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THE HISTORY OF THE BORDER TOWNS

OF

JAMAICA.

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A Dissertation

Submitted to the Board of University Studies
of the Johns Hopkins University in conformity with
the requirements for the degree of
Doctor of Philosophy;

by

WILLIAM PHILLIPS JOHNSON

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PREFACE.

The present work offers a detailed study of the pelecypods of the richest mid-tertiary, found now in the Antillean region. It is believed to represent a horizon of high importance in that interesting area and if it is possible to definitely correlate it with the tertiary section in the Coastal Plain of the United States a step of no small importance will have been taken toward the solution of the many disputed issues of West Indian stratigraphy.

The grouping of the general considerations under three headings has the disadvantage of postponing the expression of the significance of certain features, but an obvious advantage lies in the separation of elements and relations that are evident from different points of view. In the systematic discussions previously described forms are redescribed whenever it is considered necessary, not only to reveal deficiencies in the original diagnoses, but also in order to establish uniformity in the employment of different terms. In the list of occurrences under each species an attempt has been made to attach each occurrence to the proper authority, except in the case of the geographic and bathymetric ranges of the recent species, which have been obtained from a catalogue, compiled by Miss Julia A. Gardner from various sources.

ACKNOWLEDGEMENTS.

The writer wishes to express his great indebtedness, first of all, to Mr. D. A. Berry, of the Johns Hopkins University, at whose suggestion the investigation was initiated and who has been an unflinching source of inspiration, as well as of assistance in the solution of difficulties at every stage of the work; to Miss Julia A. Gardner, of the Johns Hopkins University, for the use of the unpublished results of her extensive work on the later Tertiary faunas of Virginia and the Carolinas, without which many important relations would have escaped consideration and also for her generous assistance in the determinations and in the interpretation of the broad aspects of the fauna; to Mr. W. B. Clark and the other members of the faculty of the Geological Department for the opportunity to pursue the investigation and the training that made it possible; to Mr. L. A. Vaughan, of the United States Geological Survey, whose suggestions were valuable because of his wealth of information concerning the Antillean and adjacent regions; to Mr. W. H. Dall and Mr. Paul Gartsch, of the National Museum, for assistance extended during frequent visits to the Museum; to Mr. J. A. Pilsbry, of the Philadelphia Academy of Natural Sciences, for access to type material; and to Mr. Stanley Jordan, of the Maryland Geological Survey, who prepared the material and made the preliminary determinations.

INTRODUCTION.

The border between Forest and Park Forest, near Foston, also at the south-western corner of the island of Jamaica, have long been known to contain a considerable pit and richly developed molluscan fauna. In 1866 Mr. James Barrett, then the Director of the Jamaica Survey, discovered a collection of the material in the Forest Forest. (1) A

- (1). Murphy, J. I., Quart. Jour. Geol. Soc. London, vol. 12, p. 221, 1866. See also the Geologist, v. 175, p. 175.

Later Mr. Derrick J. Moore (2) submitted a report on the molluscs. At different times Mr. J. J. Lechmere Murphy (3) has

- (2). Moore, D. J., Quart. Jour. Geol. Soc. London, vol. 19, pp. 510-517, 1867.

- (3). Murphy, J. I., loc. cit., p. 511-512, 1866; vol. 12, p. 221, 1866; vol. 13, pp. 406-501, 1867; vol. 14, pp. 404-411, 457-446, 1874; vol. 15, pp. 41-42, 1875.

published descriptions of species from the "Flora of Jamaica". Apparently most, if not all, of his collections were obtained through Mr. V. M. Hayes, of Kingston, Jamaica, who has confirmed the impression that the material came from Forest (1), and all

times are now the property of the United States National Museum.
Mr. Robert Etheridge in an appendix to the report of the Jamaican
Survey, described the fauna (5). Guppy and Bell in 1893 (6)

- (4). Hill, A. L., Bull. Mus. Comp. Zool., Harvard, vol. 34,
(Zool. Ser. 4), p. 117, 1909.
(5). Etheridge, R., Reports on the Zoology of Jamaica, Part 3,
West Indian Survey, Gen. Zool. Survey, West India,
No. 5, pp. 719-757, 1869.
(6). Guppy, C. J. E., and Bell, A. H., Proc. N. S. W. Nat. Hist.,
vol. 19, No. 1110, pp. 307-351, 1893.

issued additional descriptions, based on Guppy's material and
also on a collection made for the National Museum by Messrs.
Geffert and Simon. During the course of his reconnaissance
of Jamaica Mr. Robert A. Hill also made a collection and the
report of his investigation contains a rather lengthy review
of the mistakes of the members of the Jamaican Survey and others
in the correlation of the Jordan and other lists (7) and also a

- (7). Hill, A. L., loc. cit., pp. 9-14, 32-33, 1909.

notice of the molluscan and other elements of the fauna (8).

- (8). Idem, pp. 145-173.

In the monumental *Warner Institute Papers*, Dr. Dall (1) described many new species and noted the occurrence of previously described forms; the last species also include a brief discussion of the fauna and a check-list (2).

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- (1). Dall, J. H., *Trans. Wagner Inst. Sci., Philadelphia*,
- vol. 5, pts. 1-3, 1890-1907.
(2). Idem, pt. 6, pp. 1586-1597, 1907.
-

The material for the present study has been furnished by two collections that are the property of the Johns Hopkins University; the one is the result of several accessions to the valuable assemblage of tertiary molluscs made by Mr. J. M. Albrich, of Birmingham Alabama, the other a collection obtained by Dr. James M. Derden, now of Rhodes University College, Grahamstown, South Africa, in 1899, while he was curator of the Museum of Kingston, Jamaica. Through the kindness of the Museum authorities the writer has also had access to the collections housed at the National Museum.

ANALYSIS OF THE FAUNA.

1. Biological Analysis.

During the course of the present study, 157 species and varieties of pelecypods have been recognized; these are segregated into 61 genera and 40 families. One of the species are indeterminable and 25 are new. Perhaps no single locality of the relatively well-known northern portion of the Coastal Plain province of the United States has yielded a bivalve fauna of such extensive representation, although the Miocene world famous along the Suwannee River in Florida have furnished an equal number of species and the entire pelecypod fauna is comparable of that fauna and also of the Miocene Forttown fauna is the same. No other explored locality in the Antillean region has revealed an equally prolific fauna, but it must be remembered that, strictly speaking, the paleontologic investigation of that interesting locality has been begun. It is fortunate indeed that conditions of sedimentation during the deposition of the Jordan beds and subsequent events were of such a nature as to furnish an optimum setting for the revelation of the character of an Antillean mid-Tertiary molluscan fauna.

The Trichodonta, *Trichodonta*, is a prominent role, being represented by 79 species, more than 40 percent of the entire fauna. The taradonta, with 44 species, are second.

responsible for this large number and for their relative position in the constitution of the continental tertiary fauna is considered, it is evident that their position in the Caribbean fauna is well founded. A minor element in the taxodont assemblage is furnished by the seven species of the genus Isoxys, a number which is, however, relatively high, in accordance with the general consideration that the Antillean mid-Tertiary faunas are more populous in members of this genus than the approximately equivalent faunas of the North American continent. By far the most important taxodont is the genus Leptodus, with 27 species, distributed among 13 sections. Indeed, this remarkable diversification is one of the salient features of the fauna and is not rivaled among the continental faunas with which comparisons might be made, not even the rich Paleocene and Eocene fauna being quite equal with regard to this element. In the midst of such marked efflorescence it is surprising that the Onchoceras, which usually occupy a position of importance in the mid-Tertiary faunas of the Antillean region and its periphery, are represented by a single small form, and the Leptoceras are entirely absent. The Leptoceras are the most abundant, both individually and specifically, but only three of the nine species are unusually prolific. In addition to this numerical importance the taxodonts command attention because of the presentation of some unusual features, so that it seems advisable to discuss

new sections for three regions- Inshore, Inner and Area.

Among the brachiopods, the Pectens are subordinate only to the Area. They contribute 15 species, representing even sections, among which are included virtually all the forms that would be expected in a tropical fauna. The Aequipectens are the most prolific and include several species that are widely distributed in the Caribbean region. With regard to specific diversification Chlorophylla s. s. is almost equal to Aequipecten, but only one of the species is abundant. One of the interesting features presented by the Pectens is the occurrence of numerous valves of a small, delicate secularis form and also a single valve of a prosecution, the latter being rather rare in the fossil state.

The oysters form a puzzling assemblage, for they are few in number in all the collections available and large forms are notably absent. The small size is noteworthy when it is considered that especially in the Orto Comission Area and also in the Alam Pliff Form a species that is considered identical with one of the Bowden forms reached an imposing size. Since the same condition obtains in all the collections it may probably be assumed that the indicated relative importance of the genus is approximately correct, although it must be remembered that subsequent exploration may reveal the presence of large oyster beds. In connection with the small size of the oysters it is interesting to note that an unusually large and common Orto

Yanoria is included as a possible Yanoria sp.
small, curious form that has been referred to the genus
Yanoria, although it is clearly typical of that group.

One of the most striking features of the fauna is
the original abundance and specific diversification of the
Lucinacea. Although only five genera are included in this sub-
family, they are represented by 52 species. The genus Phac-
oides is the most important contributor to this assemblage, it
alone furnishing half of the species, distributed among eight
sections. Two other elements, Lucinacea and Milne, and the
genus Lucina, all of which might be expected to be present, are
absent. The Lucinacea and Milne are abundant and well-diver-
sified, while the Phacoides are individually numerous and
the Diplomata, though including Diplomata, Diplomata, and Diplomata,
represented by a small number of individuals.

The general representation of the Lucinacea fauna is
decidedly contrast with richness of the Lucinacea element, the
entire subfamily including only four genera, represented into
three orders of the Lucinacea. The Lucinacea and Milne
the small number of species in the Lucinacea and Milne
are represented by a total of only five species. An interesting
feature is furnished by the presence of a few Lucinacea to
section Lucinacea of the Lucinacea.

The same section, composed of eleven species, is found in the lower part of the section, but is not represented by the same number of species. The section is divided into a position of importance. The section is divided into those that are found in the tropical and subtropical and mid-tropical, American region, but Parastarte and Parastarte are not included and the Parastarte, which are similar to the mid-American and Caribbean region, are a considerable element; in fact, all of the Parastarte is the most abundant group in the section.

The most similar form is a small form that previously was described as an immature Parastarte. In the light of the additional material at hand, however, and a comparison with the material it is considered to consider this as a new form, which is questionable, but is not the Parastarte, probably under the family Parastarte.

The family Parastarte is divided into three subfamilies of genera and species. The genera are divided among the subfamilies Parastarte, Parastarte and Parastarte, the majority belonging to the first of these. The genus Parastarte is the most abundant, with regard to both the number of species and individuals. Parastarte, represented by a single valve, has heretofore not been found outside the Floridian region, either recent or fossil and Parastarte does not appear in any of the other

and other similar features. Another interesting feature is the occurrence of a form that is probably best placed in the genus Spogorella, from the typical form of which it is differentiated by differences that are of at least sectional value. Only two species of the genus have been known, a recent species from the West Coast and another from the Miocene of the Atlantic Coast.

The genus Fellina should be placed among the important genera, for it includes 15 species, distributed among six sections. Fellina has the largest number of species to its credit, but the most abundant forms are found under Perissa and Noesella. The other Fellina-a present no unusual features from a biological point of view.

The remaining Teleostomes are scattered among several groups. The so extremely dolensae is represented by a species of the genus Diaploca. A single fragmentary valve belonging to an indeterminable species of the genus Diocleis is the sole representative of the Diocleis. The Forbula are the only non-boring Diocleis present, and, although including only three species, two of them are exceedingly prolific. The unusually favorable conditions have permitted the preservation of several boring Diocleis that usually are not found in tertiary faunal lists.

2. Ecological Analysis.

The content of recent marine faunas probably would view with grave misgivings an attempt to reconstruct environmental conditions on the basis of the testimony furnished by a single element of a fauna, and it must be admitted that such an attempt is extremely hazardous, the natural tendency being to overburden the scant evidence in the desire to formulate a more or less definite conclusion. The attending dangers are accentuated by the unsatisfactory condition of the available information concerning the actual and relative importance of the factors conditioning the distribution of faunas, of which the three most important are the character of the bottom, temperature and depth; it must be remembered, however, that other factors may have a potent influence on the distribution of a certain fauna and that the several elements may be intercorrelated or may itself be subdivided into different types of faunas or less moment under different conditions. The paleontologist who desires to deduce conclusions concerning the ecological conditions that determined the character of a pre-existing fauna is at the very outset handicapped by the serious dearth of information concerning the actual constitution of existing shallow-water faunas, to say nothing of the effect of different bottom, for by far the greater number of faunas that receive this con-

sideration have flourished in either relatively, or actually, shallow water or even in the intertidal zone. Dredging operations have been conducted for the most part in the lee or off-shore water and even then the use of suction has arisen through the unfortunate practice of drilling to limit the occurrence of dead and living forms. For obvious reasons it is often impossible to determine the texture of the bottom at each haul even in shallow water, so that the knowledge concerning the influence of bottom conditions rests largely on what is known concerning the distribution in the intertidal zone.

An intensive study of a restricted shallow-water Indian area, such as the one conducted by the Fish Commission for Vineyard Sound and Buzzards Bay (11), would be of inestimable value.

(11). Coll. Mar. Fisheries, vol. 71, pp. 1 and 2, 1918.

in projecting backward the conditions that determined the assemblage of an Antillean tertiary fauna. Despite the difficulties involved, the assemblage of bottom invertebrates is such as to permit the offering of certain considerations, some of which are more or less obvious and even trite, while others are to be regarded with some reservation.

It is of course, a mere platitude to state that the fauna is tropical, since such a thing is to be expected from the

geographical position of the deposits may have been the same; yet this aspect is emphasized in a striking manner by the extreme development of certain groups and the absence of others that are prominent in the Tertiary. Several of the Atlantic coast. A more glance at the faunal list shows the most prolific genera, Urosalpinx, Pecten, Chama, Cardium, Urosalpinx are characteristically tropical or are represented by sections or species that are confined to low latitudes or there reach their maximum development. According to the latest faunal lists only two of the 18 species that are recent at the present time range north of Cape Hatteras, the oblique Anomia discolor and Urosalpinx multisulcata; eight are found from Hatteras northward to the West Indies; seven are confined to the area south of Florida and one species is restricted to the tropical portion of the West Indies. Virtually the same proportions obtain for a third number of recent species that are closely related to certain modern forms.

One of the most striking features of the fauna is the unusual development of the Urosalpinx, a group that attains its greatest importance in the warmer seas. The species are such as might be expected in tropical waters; indeed, many of them are encountered in the present-day Indian Ocean. The genus Pecten is usually a conspicuous element in the list, and Pecten fossils of almost all latitudes, but the large species that are

characteristic of higher latitudes, such as the form which usually forms entire legs in the Tortoise-like form, and occasionally segment. Although individuals of the genus Popillia are numerous, they are divided among three species; the genus is at present confined to tropical or subtropical regions and is relatively rare in the Tortoise form of the United States, all of the occurrences in the middle and later Tertiary fossils being restricted to the Floridian area.

Perhaps the most obvious indication of temperate conditions is furnished by the Libartaria. When the Libartaria Libartaria and Libartaria Libartaria include one or two distinct, but in the latter assemblage the genus is entirely absent, the superfamily being represented only by several subfamilies, including three species of the subgenus Libartaria. The condition, values of an Libartaria, a genus which at the present time is predominantly limited in distribution, and is a common element.

It has already been remarked that the Libartaria development of the Libartaria is to be considered one of the distinctive features and it is significant that the entire group is quite partial to tropical habitats, although a few species, especially of the Libartaria, are found in high latitudes. No other superfamily, except the Libartaria, presents so small number of species and from the point of view of the number of genera and sections which the numerous species are distributed this group is unique.

to Utricularia, Utricularia, Utricularia. An example in
 point is Utricularia by the Utricularia, which has species
 are present in the lake. According to available data the
 growth of Utricularia is characteristic of deeper water and yet
 several species occur in shallow water of the Gulf coast that
 are usually considered to be shallow water. The failure
 of the genus to occur in the continental shelf and later
 further, however, has been explained by a decline in the salin-
 ity of the water, but it would not be safe on this basis alone
 to conclude that the Border waters were of consistent depth.

The fauna is essentially a shallow water fauna. All
 of the recent species at the present time occur in water of
 light depth and many of them have been recorded in the inter-
 tidal zone, but the range of the fauna is extended into consid-
 erably deeper water. The presence of a variety of deeper water
 elements, such as Utricularia and Bathypneustes, may be the result of
 the action of currents or other extra-littoral factors. Since
 but a single variety of Utricularia is present it is doubtful
 whether the fauna is indigenous. Until the specimens are studied
 and the evidence of other groups of organisms considered, it
 is unwise to attempt to even roughly approximate the depth of
 the water, but it may be noted that the depth of the Gulf is
 not exceeded 35 or 40 fathoms and it is highly probable that most
 of the specimens were collected in water that was not more than 10 fathoms deep.

shallower.

Even greater uncertainties attend an effort to postulate the bottom and shore configuration. It may be rather definitely stated, however, that by far the greater majority of the bivalves are vertical to be to a somewhat of sand or fine gravel and therefore it may be assumed that in general the waters were clear and the bottom free from mud; even the bivalves are those that are usually found on sand bottom. In this connection the absence of *Pinna* and related forms that prefer a muddy bottom is not without significance. The few *Cardium* bivalves present probably had their station in estuaries, at the head of which lived the *Brachidontes* *gracilis*. The small oyster that is considered identical with the recent mangrove-oyster, *O. edulis*, may be assigned to the same habitat, if its habits were the same as those of the recent form. The meager representation or absence of the small *Leptodonta* and other forms that usually frequent muddy bottoms in sheltered near-shore positions or attach themselves to algae, seems to indicate an open coast and rather strong current action. It appears that the greater part of the coast is low and interrupted, as indicated above, by a few estuaries, and also by headlands, since the coarse texture of the sediments testified to rapid erosion in at least part of the area and the proximity of the volcanic debris from which they were derived.

3. Geologic Analysis.

The correlation of the West Indian Tertiary deposits involves a somewhat complicated history, which will be briefly considered only, in so far as it has a direct bearing on the opinion concerning the stratigraphic position of the molluscan faunas of the Jordan and approximately equivalent formations. In the earlier, and, therefore to say, even in the more recent, literature it was the unfortunate practice to carelessly avoid the assignment of collections to definite localities, and therefore such vague statements as "Jamaica", "Eocene of Jamaica" and "Oligocene of Jamaica" are frequently encountered. In the case of "Jamaica" as used by Moore, there is little, if any, uncertainty concerning the latter notation, since it is definitely known that his Jamaican specimens came from Jordan and, of course, his usage was in conformity with that adopted by his colleagues.

The molluscan faunas in question were referred with general unanimity of opinion to the Eocene by Moore (1),

(1). Moore, J. J., *Part. Amer. Geol. Soc. Bulletin*, vol. 1, pp. 72-44, 1870 (to the Jordan); vol. 2, pp. 112-1, 1871 (Santo Domingo); vol. 12, pp. 710-71, 1877 (Jamaica).

Guppy (1), Etheridge () and (2) - New Pliocene to distinguish them from the older Miocene faunas of Antioquia and

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- (1). Guppy, A. J. L., Quart. Jour. Geol. Soc. London, vol. 28, no. 311-116, 1876 (Jamaica); pp. 373-379 (General); Geol. Mag., Decade 1, vol. 1, pp. 380-391 (General); Decade 1, vol. 1, pp. 404-411, 427-440, 1874 (General, including a check-list); Quart. Jour. Geol. Soc. London, vol. 28, no. 311-312, 1876 (Santo Domingo). Guppy has expressed the same opinion in numerous other papers that have no direct relation.
- (2). Etheridge, R., reports on the geology of Jamaica, pt. 2, West Indian Survey, Trans. Geol. Soc. Britain, vol. 1, no. 311-322, 1869.
- (3). Trans. Am. Philos. Soc. New ser., vol. 15, pp. 97-104, 1877 (Santo Domingo).
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Trinidad, the latter being subsequently modified by Guppy. These early investigations were conducted before Guppy had differentiated the Pliocene or before the concept of a distinct Pliocene from previous or transgressive Miocene received general credence and it was quite natural to consider the latter's Miocene since they occupied an intermediate position with reference to Miocene and Pliocene faunas, although most of the fossils that were assigned to the latter species have been segregated from their original assemblage by the later accepted definition of specific limits. From the very inception of the early studies the close relation of the fauna of the latter to the tertiary faunas in the vicinity of Honduras in 1869-

western side was popularized.

In a brief statement by himself in 1911 that "the Oliphe
pole had been found in St. Domingo" (1) in fact the Oliphe pole
referred to the pole of Oliphe in the West Indian arch;

(1). Journal, T. A., with. Hist. Sci., vol. 7, no. 30, p.
57, 1916.

The position of the Oliphe pole in earlier records is somewhat
different from the position of the Oliphe pole (1), which

(2). Journal, T. A., with. Hist. Sci., vol. 7, no. 30, p.
57, 1916.

It is also considered that the Oliphe pole (1) is not the
Oliphe pole (2), but the Oliphe pole (3).

(3). Ibid. 1916, p. 57.

Gregory, however, in the first to see the Oliphe pole
entering the Oliphe pole (1) and the Oliphe pole (2)
which is the Oliphe pole (1) and the Oliphe pole (2)
and the Oliphe pole (1) and the Oliphe pole (2).

(4). Gregory, T. A., with. Hist. Sci., vol. 51,
p. 57, 1916.

(2). 1911, . . . , Proc. 1911. 1911. 1911, vol. 1, pt. 1, . . . , 1911 :

(2). Bull. Soc. Geol. France, 5^e ser., vol. 1, p. 712, 1902.

(7). Gen. & Anth. Anth. Sci., vol. 101, no. 11-12, 1915.

(4). Soviet. Geol. Soc. Col. Volume, No. 1, p. 150-171, 1915.

... , or between the Chisolm and the Miocene" (1). Later (2) the same was given in similar position - between the Chisolm and Oak Grove.

(1). Dall, W. H., Trans. Acad. Sci. San Francisco, vol. 2, pt. 6, p. 1782, 1907.

(2). Dall, W. H., Bull. U. S. Nat. Mus., no. 28, p. 6, 1917.

Almost 70 percent of the Bowdoin eleutherozoans are peculiar and 18 percent, 9 percent, exist to the present. The largest assemblage of forms found elsewhere is the group of 74 species that are known to occur in Santo Domingo; the largest number in common with any horizon in the Floridian succession is the 17 Chisolm species, followed by 9 with the Paleozoic and 7 with the Tampa and also the Oak Grove. The actual numbers are of little significance, since a slight change in the definition of specific limits would have a decided effect; moreover, as the distributional list indicates, much is contingent upon the species of a genus at a certain horizon, especially as to whether it is trochilid, apithecoid or trochilid, and also upon the extent to which a genus has been studied.

The Floridian succession, which must be considered the type for the determination of the age of the Antillean fauna, is undoubtedly also late. The Upper Miocene

	Oligocene	Miocene	Pliocene	Post-Pliocene
1. Nucula morantiana n.sp.	p. 42			
2. Nucula (Plasiasorepta) hilli n.sp.	p. 47			
3. Leda (Cypriteria) pettella Dall	p. 49			
4. Leda (Cypriteria) cerata Dall var. Subritenamorphia n. var.	p. 52			
5. Leda (Leda) indigena Dall	p. 57			
6. Leda (Hebelleda) bondeniana n.sp.	p. 63			
7. Leda (Hebelleda) bondeniana var. subturnida n. var.	p. 65			
8. Leda (Hebelleda) duerdeni n.sp.	p. 66			
9. Leda (?) clara Guppy	p. 68			
10. Yoldia ovalis Gabb	p. 74			
11. Tindaria callipicta n.sp.	p. 74			
12. Limopsis ovalis Gabb var. supracancellata n. var.	p. 76			
13. Limopsis jamaicensis n.sp.	p. 79			
14. Arca occidentalis Philippi	p. 81			
15. Arca umbonata Lamarck	p. 84			
16. Arca bondeniana Dall	p. 89			
17. Arca berryi n.sp.	p. 93			
18. Arca (Arca) reticulata Emelin	p. 95			
19. Arca (Arca) propectea n.sp.	p. 98			
20. Arca (Calloarca) candida Emelin	p. 100			
21. Arca (Calloarca) endomema n.sp.	p. 103			
22. Arca (Calloarca) delepida n.sp.	p. 105			
23. Arca (Calloarca) inusitata n.sp.	p. 107			
24. Arca (Stenoarca) dentera n.sp.	p. 112			
25. Arca (Stenoarca) subcandeida n.sp.	p. 113			
26. Arca (Stenoarca) modioleida n.sp.	p. 115			
27. Arca (Fossularca) adamsi Dall	p. 117			
28. Arca (Fossularca?) ovalina Dall	p. 124			
29. Arca (Scapharca) halidonata Dall	p. 123			
30. Arca (Scapharca) halidonata var. hispaniolica n. var.	p. 127			

31. *Arca (Scapharca) perpleura* n.sp. p.132
 32. *Arca (Scapharca) inaequilateralis* Guppy p.134
 33. *Arca (Scapharca) donacia* Dall p.139
 34. *Arca (Scapharca) prephaina* n.sp. p.141
 35. *Arca (Scapharca) wordeni* n.sp. p.143
 36. *Arca (Scapharca) agnatha* n.sp. p.145
 37. *Arca (Scapharca) thomasiensis* n.sp. p.147
 38. *Arca (Argina) telepia* Dall var. *microtera* p.149
 39. *Arca (Cunearca) ophthanta* n.sp. p.150
 40. *Arca (Batharca) hendersoni* Dall p.152
 41. *Arca (Anadara) daseia* n.sp. p.158
 42. *Glycymeris jamaicensis* Dall p.160
 43. *Glycymeris acuticostatus* (Sowerby) p.164
 44. *Glycymeris pennacea* (Lamarck) p.167
 45. *Pina refurca* n.sp. p.171
 46. *Atrina* sp. indet. p.174
 47. *Nelina* sp. indet. p.175
 48. *Theria prepocera* n.sp. p.176
 49. *Istrea megodon* Hanley p.178
 50. *Ostrea haitiensis* Sowerby p.183
 51. *Ostrea folium* Linnaeus p.190
 52. *Pecten (Pecten) barretti* n.sp. p.194
 53. *Pecten (Euvula) bowdenensis* Dall p.197
 54. *Pecten (Euvula) sp. indet.* p.200
 55. *Pecten (Chlamys) vaginulus* Dall p.202
 56. *Pecten (Chlamys) ameleus* n.sp. p.205
 57. *Pecten (Chlamys) neamorphus* n.sp., p.207
 58. *Pecten (Chlamys) bellipictus* n.sp. p.208
 59. *Pecten (Neopecten) inaequalis* Sowerby var. *acutipictus* n. var. p.209

Tampa beds	
Santo Domingo	
Cuba	
Antigua	
Anguilla	
Coracao	
Cumana	
Isthmus of Darien	
Gatun form.	
Costa Rica	
Mexico (Oligo?)	
Chupala mnt.	
Oak Grove sand	
Shoal River mnt.	
California (Mioc?)	
Costa Rica (Mioc?)	
Calvert form.	
St. Marys form.	
Florida	
Yeriktown form.	
Duflin form.	
California (Plioc?)	
Trinidad (Plioc?)	
Costa Rica	
Mexico	
Waccamaw form.	
Calcosahatchie form.	
Calcosahatchie	
Peru	
Pleistocene	
Recent	

Oligocene

Miocene

Pliocene

Pleistocene

Recent

	Oligocene	Miocene	Pliocene	Post-Pliocene
10. Tecten (Aequipecten) sumpleus n.sp. p218	X			
11. Tecten (Aequipecten) oxygonus Sowerby p224	X			
12. Tecten (Aequipecten) clachistos n.sp. p223				
13. Tecten (Aequipecten) concinnatus n.sp. p225				
14. Tecten (Pseudamusium) guppyi Dall p227				
15. Tecten (Amusium) papiraceus (Gabb.) ? p229	X			
16. Tecten (Trypanosium) spendulus n.sp. p232				
17. Spondylus bostyrchites Guppy p234	? X			
18. Spondylus cookii n.sp. p238	X			
19. Spondylus (echinatus var.?) inoikeilus n.sp.?				
20. Plicatula densata Conrad p242	X			
21. Lima (Lima) stenocostata n.sp. p246				
22. Lima (Mantellum) dalli n.sp. p248				
23. Limaea solida Dall p250				
24. Placunanomia lithobleta Dall p252				
25. Anomia microgramma Dall var. indecisa Dall p255				
26. Anomia simplex d'Orbigny p258	X			
27. Modiolus (Brachydontes) guppyi Dall p262				
28. Dreissena coelesta (Kicks) var. jamaicensis m. var. p263				
29. Tellina Gardnerae n.sp. p267				
30. Verticordia (Trigonotina) bowdenensis Dall p269				
31. Verticordia (Haliris) jamaicensis Dall p271				
32. Peromya jamaicensis Dall p273				
33. Cuspidaria (Cardiomya) craspedonia Dall p276				
34. Cuspidaria (Bowdenia) distira Dall p279				
35. Crassatellites (Scambula) jamaicensis Dall p282				
36. Crassatellites (Scambula) attaspissa n.sp. p285				
37. Crassatellites (Crassinella) guppyi Dall p287				
38. Crassatellites (Crassinella) bowdenensis Dall p290				
39. Crassatellites (Crassinella) xenus n.sp. p292	X			

90. *Venericardia scabricostata* (Guppy) P²²⁸
 91. *Venericardia* (*Pteromeris*) *acaris* Dall P²²⁸
 92. *Chama involuta* Guppy P³⁰⁰
 93. *Chama macerophylla* Emelin P³⁰²
 94. *Echinochama antiquata* Dall P³⁰⁷
 95. *Codakia spinulosa* Dall P³¹²
 96. *Codakia lomonea* n.sp. P³¹⁵
 97. *Codakia* (*Tagonia*) *pertenera* Dall P³¹⁶
 98. *Codakia* (*Tagonia*) *guppyi* n.nam. P³¹⁸
 99. *Codakia* (*Tagonia*) *ventryesi* Dall P³²⁴
 100. *Myrtaea limoniana* Dall P³²⁷
 101. *Myrtaea hispanola* n.sp. P³²⁷
 102. *Myrtaea* (*Eulopia*) *vermiculata* Dall P³²⁸
 103. *Myrtaea* (*Eulopia*) *forcata* Dall P³³⁰
 104. *Myrtaea* (*Eulopia*) *aranta* n.sp. P³³²
 105. *Phacoides domingensis* Dall ? P³³³
 106. *Phacoides* (Here) *podagrinus* Dall P³³⁵
 107. *Phacoides* (Here) *podagrinus* var. *alvarezi* n.sp. P³³⁹
 108. *Phacoides* (Here) *browni* n.sp. P³⁴⁰
 109. *Phacoides* (Here) *tithonis* Dall P³⁴²
 110. *Phacoides* (*Pleurolecin*) *quadriscostatus* Dall P³⁴⁴
 111. *Phacoides* (*Carilucina*) *recurrens* Dall P³⁴⁹
 112. *Phacoides* (*Pseudomitha*) *glumindus* n.sp. P³⁵¹
 113. *Phacoides* (*Callucina*) *pauperatus* (Guppy) P³⁵¹
 114. *Phacoides* (*Callucina*) *pauperatus* var. *oligocostatus* n.var. P³⁵⁴
 115. *Phacoides* (*Callucina*) *curvostatus* n.sp. P³⁵⁵
 116. *Phacoides* (*Parilucina*) *yaguensis* (Gubb) P³⁵⁶
 117. *Phacoides* (*Parilucina*) *proteludus* n.sp. P³⁵⁸
 118. *Phacoides* (*Parilucina*) *limneides* n.sp. P³⁶⁰

Tampa beds
 Santo Domingo
 Cuba
 Antigua
 Anguilla
 Curaçao
 Guiana
 Isthmus of
 Darien
 Gatun form.
 Costa Rica
 Mexico (Olig?)
 Chipola murl
 Oak Grove and
 Shoal River murl

Oligocene

California (Mioc?)
 Costa Rica (Mioc?)
 Calvert form.
 St. Marys form.
 Florida
 Yorktown form.
 Duplin form.

Miocene

California (Plioc?)
 Trinidad (Plioc?)
 Costa Rica
 Mexico
 Waccamaw form.
 Caloosahatchie form.

Pliocene

Luner
 California
 Peru

Post-Miocene?

Pleistocene
 Recent

X

X

X

X

X

X

X

X

X

X

X

X

X

X

X

X

X

X

X

X

X

X

X

X

X

X

X

X

X

119. *Phuocoides (Belluclina) actinus* Dall ^{P.361}
^{P.363}
120. *Phuocoides (Belluclina) archonterus* n.sp. ^{P.363}
121. *Divaricella previaricata* Guppy ^{P.365}
122. *Divaricella quadriscata* (D'Arbigny) ^{P.368}
123. *Diplo donta walli* n.sp. ^{P.372}
124. *Diplo donta homalostriata* n.sp. ^{P.374}
125. *Diplo donta (Telamella) minor* Dall ^{P.376}
126. *Diplo donta (Phlyctiderma) puncturella* Dall ^{P.378}
127. *Erycina quadrata* (Baldl) ^{P.380}
128. *Erycina pura* n.sp. ^{P.383}
^{P.384}
129. *Anisodonta (Basterotia) bowdeniana* Dall ^{P.387}
130. *Montacuta (?) menotreta* n.sp. ^{P.389}
131. *Cardium (Cardium) dissidipictum* n.sp. ^{P.392}
132. *Cardium (Trachycardium) inconspicuum* ^{P.394}
^{P.395}
133. *Cardium (Trachycardium) lingualearis* Guppy ^{P.397}
^{P.398}
134. *Cardium (Trachycardium) bowdenense* Dall ^{P.400}
^{P.401}
135. *Cardium (Trachycardium) vaughani* n.sp. ^{P.403}
136. *Cardium (Fragum) medium* Linnaeus ^{P.405}
^{P.406}
137. *Cardium (Fragum) elatocostatum* n.sp. ^{P.412}
^{P.413}
138. *Cardium (Trigonocardia) haitense* Sowerby ^{P.414}
^{P.415}
139. *Cardium (Trigonocardia) haitense* var. ^{P.419}
^{P.420}
^{P.421}
^{P.422}
140. *Cardium (Trigonocardia) thumaston* n.sp. ^{P.425}
^{P.426}
141. *Cardium (Laevicardium) serratum* Linnaeus ^{P.428}
^{P.429}
142. *Protocardia jamaicensis* Dall ^{P.430}
^{P.431}
143. *Protocardia* sp. indet. ^{P.432}
^{P.433}
145. *Transennella amondea* n.sp. ^{P.437}
^{P.438}
146. *Transennella elethusa* n.sp. ^{P.439}
^{P.440}
144. *Xenofacia bowdeniana* (Dall) ^{P.443}
^{P.444}
147. *Tivela jamaicensis* Dall ^{P.446}

Tampa beds
Santo Domingo
Cuba

Antigua
Anguilla

Curaçao

Comana

Isthmus of
Darren

Gatun form.

Costa Rica

Mexico (orig.?)

Chipola marl

Oak Grove sand

Shoal River
marl

California (Mioc.)

Costa Rica (Mioc.?)

Culvert form.

St. Marys form.

Florida

Yorktown form.

Duplin form.

California (Plioc.)

Trinidad (Plioc.?)

Costa Rica

Mexico

Waccamaw form.

Cuba (Satchie form.)

Lower
California

Peru

Pleistocene

Recent

Oligocene

Miocene

Pliocene

Post-
Pliocene

148. *Euforarium* (Gouldia) insulare Dall. ^{p.442} Simpson
 149. *Pitaria* (Hyphantosoma) carbasae (Guppy) ^{p.445}
 150. *Pitaria* (Lomelliconcha) planiveta (Guppy) ^{p.445}
 151. *Antigona* (Ventricola) blandiana (Guppy) ^{p.453}
 152. *Cyclinella* plasiatensis n.sp. ^{p.456}
 153. *Chione* sawkinsi n.sp. ^{p.458}
 154. *Chione* retzyida n.sp. ^{p.462}
 155. *Chione* woodwardi (Guppy) ^{p.464}
 156. *Chione* (Liraphora) hendersoni Dall. ^{p.468}
 157. *Parastarte* antillensis n.sp. ^{p.472}
 158. *Cooperella* (Tomidella) thaumasta n.sp. ^{p.475}
 159. *Tellina* (Merisca?) acrocosmia Dall. ^{p.477}
 160. *Tellina* (Merisca) sclera Dall. ^{p.479}
 161. *Tellina* (Merisca) sclera var. lerasca n.sp. ^{p.480}
 162. *Tellina* (Merisca) aequistriata Say var. ^{p.481}
 bowdenensis n.sp.
 163. *Tellina* (Phyllodina) holistrecta Dall. ^{p.483}
 164. *Tellina* (Phyllodina?) lindsayi n.sp. ^{p.485}
 165. *Tellina* (Eurytellina) sp. indet. ^{p.486}
 166. *Tellina* (Moerella) simpsoni Dall. ^{p.487}
 167. *Tellina* (Moerella) hendersoni Dall. ^{p.489}
 168. *Tellina* (Angulus) pharcida Dall. ^{p.491}
 169. *Tellina* (Angulus) gonida n.sp. ^{p.493}
 170. *Tellina* (Angulus) apomsa n.sp. ^{p.494}
 171. *Tellina* (Angulus) browni n.sp. ^{p.496}
 172. *Tellina* (Angulus) pressa Dall. ^{p.497}
 173. *Tellina* (Scissula) scitula Dall. ^{p.499}
 174. *Strigilla* pisiformis (Linnaeus) ^{p.501}
 175. *Macoma* (Thaumacoma) tracta Dall. ^{p.504}
 176. *Macoma* (Thaumacoma) olivella Dall. ^{p.506}

Tampa beds
 Santo Domingo
 Cuba
 Antigua
 Anguilla
 Curaçao
 Cumaná
 Isthmus of
 Darien
 Gatun form.
 Costa Rica
 Mexico (Olig.)
 Chipeta marl
 Oak Grove sand
 Shual River ^{marl}

Oligocene

California (Mioc.)
 Costa Rica (Mioc.)
 Calvert form.
 St. Marys form.
 Florida
 Yorktown form.
 Duplin form.

Miocene

California (Plioc.)
 Trinidad (Plioc.)
 Costa Rica
 Mexico
 Waccamaw ^{form.}
 Caloosahatchie ^{form.}

Pliocene

Lower
 California
 Peru

Post-Pliocene

Pleistocene

Recent.

X

X

X

X

X

X

X

X

X

X

X

X

X

X

177. *Macoma (Cymatocja) vendryesi* Dall p.538
 178. *Semele calliconcinnata* n.sp. p.510
 179. *Abra triangulata* Dall p.512
 180. *Abra deutera* n.sp. p.514
 181. *Donax lennoxii* n.sp. p.515
 182. *Donax cymbolia* n.sp. p.517
 183. *Psammosolen cumingianus* (Dunker) p.518
 184. *Spisula* sp. indet. p.522
 185. *Ervilia gabbi* n.sp. p.523
 186. *Corbula (Aloidis) heterogena* Dall p.525
 187. *Corbula (Coneucorbula) sericea* Dall p.530
 188. *Corbula (Bothrocorbula) viminea* Guppy p.533
 189. *Gastrophuena ovata* Soreby var. *retundata* Dall? p.534
 190. *Martesia* (?) sp. indet. p.538
 191. *Xylophaga* (?) sp. indet. p.539
 192. *Teredina bordeniana* Dall p.540
 193. *Teredo* sp. indet. p.542

Tampa beds
 Santo Domingo
 Cuba
 Artigua
 Anguilla
 Curacao
 Cumana
 Isthmus of
 Darien
 Butun form.
 Costa Rica
 Mexico (Olig.?)
 Chipola marl
 Oak Grove sand
 Shoal River
 marl

Oligocene

California (Mioc.)
 Costa Rica (Mioc.)
 Calvert form.
 St. Marys form.
 Florida
 Yorktown form.
 Duplin form.

Miocene

California (Plioc.)
 Trinidad (Plioc.)
 Costa Rica
 Mexico
 Mucarnair form.
 Caloushutchie
 form.

Pliocene

Lower
 California
 Peru

Post-
 Miocene

Pleistocene
 Recent

X

X

X

?

X

?

X

X

X

X

X

These Anelochisols occur in close proximity to the
the sand, which, as stated before, is considered to be a
terrian, being the oldest. Under the No. 11 Alvar
at the same place the Alvar, Oak Grove and the 1st River
the character and relations of the Alvar and the 1st River
are fairly well-known as the result of Hall's extensive work
which was published in the "Annals of the Entomological Society"; the Alvar
Alvar has been, however, more fully differentiated by
an (1) and the Alvar, as well as the other Alvar groups, is
being now being studied at the present time by Mr. J. A. Rehn.

(2). J. A. Rehn, U. S. G., in "Annals of the Entomological Society",
Old Ann. Report, Vol. 14-15, 1900; "Annals of the Entomological Society",
Washington, Vol. 15, p. 161, 1910.

The three groups are more or less distinct and, although the
assemblages are distinct, it is believed that they are
separated from each other by no great intervals of time (3).

(2). Partial identification of the Alvar.

The Alvar is the result of the Alvar, which are the Alvar, the
the fauna of which are fairly known, but it is not yet definitely
stated that they are more than one; the Alvar, however,
should probably be placed about at the top of the Alvar.
in the Alvar section described in "Annals of the Entomological Society".

Shoshonites of the Miocene, which is well represented by the
than our horizon, in the Pliocene Salween shales, which are
represented by the Salween shales, in fact,
it is the Salween shales and not the Salween shales in
the entire Tertiary series.

Further north in Virginia the Miocene is well represented by the Salween, St. Albans, Bartonian
and Duplin, but the oldest, Salween, is Middle Miocene, being
probably Bartonian. The Bartonian and Duplin, which were deposited
in separate basins, are virtually synchronous, although
the faunas are decidedly different, due to differences in
temperature and bottom conditions (1), the Duplin being warmer
temperate. The Pliocene is like the warm-temperate

(1). Gardner, F. H., U. S. Jour. Sci., 1911, ser. 2, vol. 32,
pp. 535-571, 1911.

and is considered to represent Pliocene,
the Salween shales being being considered as being of
these more northern faunas have been established by
Gardner, and the results, which are shown in the table, are given
place at the writer's disposal.

It is thus evident that the only post-Tertiary
subtropical or warm-temperate faunas with which the Salween
fauna can be compared, are the Upper Miocene Duplin and the
Pliocene Waccamaw and Salween shales. Although, as we have

expected from the present composition, and the recent forms are common to the Pacific and Atlantic Oceans, the latter being the nearest of the two to the former, it is significant that many of the groups have closer affinities with Duplin and even with the and Saloo-whatchin forms. The more important of these modern elements will be mentioned.

The taxonomic group, one-third of the total number of recent species included in the present group and all of these are found among the Pacific, so that that family, and especially the subfamily Arcidae, has been especially prominent. Five Recent Arcas are included in the list and several others, A. (Arcas) solida var. microdon, A. (Arcas) obtusa and

A. (Arcas) remains have very closely allied recent forms. The mere number of recent species is of minor importance since four such are found in the Pacific Ocean and three in the Atlantic. A modern element is, however, furnished by the introduction of the section Bathypora. The most abundant Bathypora, B. (Bathypora) bathypora is closely related to the Pacific B. (Bathypora) bathypora and the Atlantic B. (Bathypora) bathypora.

B. (Bathypora) bathypora is closely related to the Pacific B. (Bathypora) bathypora and the Atlantic B. (Bathypora) bathypora.

Two of the three groups are believed to be identical with recent species. If the former, for B. (Bathypora) bathypora is believed to be identical with one of the intermediate groups of a former distribution on both sides of the Atlantic of course the present restriction to the Pacific Ocean. The former

of the recent Mytilus-oyster, P. (Mytilus) edulis, in the Florida section is somewhat remarkable.

The section includes several elements that are not known to the Floridian fauna. Among these are P. (Mytilus) horridus, P. (Mytilus) edulis, and P. (Mytilus) edulis. The most notable member of the genus, P. (Mytilus) edulis in edulis var. edulis is well known and is considered a variety of the recent P. edulis. Although the section Mytilus is known from the Oyster Bank, the Mytilus species is var. edulis in the recent Mytilus section. In addition to the Mytilus section, the Pectinacea family, another more modern element in the section of Mytilus edulis, which may be the ancestor of the recent echinus. Among the remaining Mytilus species the genera Mytilus and Placynonion are represented in the Floridian section.

Almost all of the Mytilus species are known from the Floridian section, but their distribution can not be determined. The genera represented by the Mytilus section are Mytilus and Placynonion.

Of the five species of Mytilus edulis the two belong to the Mytilus edulis var. edulis, which is a recent form, but the Mytilus edulis, which is a recent form, is a recent form. Aside from the recent Mytilus edulis, the Mytilus edulis of the recent Mytilus edulis belongs to the Mytilus edulis edulis.

also, the pollen and beetle fossilization percentages being the same
to be encountered.

The insect fauna is well represented in the pollen assemblage
than in the beetle assemblage in the case of the Upper Oligocene. In
addition to the influence of several species, including
Jodalis lomanderi, Spodoprius (Jodalis) ventralis and Spodoprius
(Dallwitz) ventralis, which are the most abundant, related to Dublin
or later forms, this assemblage is characterized by the initial appearance
of the section Neurolepidus of the genus Phacelidius, which
which in Florida is not known earlier than the Pliocene. The
section Diolobus of Diolobus, which was introduced in the
fauna, reaches its first development in the Pliocene in the
Dublin fauna. It is also present in the Pliocene of the Florida
Pliocene. Besides, no other species of Phacelidius (Phacelidius)
has been recognized except in the recent fauna of the Pliocene.
Amongst the species of Spodoprius (Spodoprius) ventralis have not been
reported from earlier than the Dublin. The superfamily
which is mentioned includes Diolobus + Diolobus and a re-
cent Diolobus, the latter which is now a very interesting
horizon.

The sections include groups that have been well represented
in virtually all of the fossiliferous strata of the Pliocene. These have
been studied, the groups being modified by existing forms.
There are, however, two recent species, Spodoprius (Spodoprius) ventralis
Spodoprius (Spodoprius) ventralis from the North American Pliocene
are confined to the Pliocene and the Pliocene. Spodoprius (Spodoprius) ventralis

varian is represented by an unknown form bed, earlier than Miocene. The two species of Protoceras is closely comparable with recent West Indian forms.

The Veneridae also contain a number of interesting elements. livei galeensis is the only representative of the genus recorded from American Tertiary, and the recent Gallia (Gallia) livei has not been recognized at any other Tertiary horizon. The single Uchellina is very close to a recent species. Uchella livei is closely allied to the Dublin Uchella. The genus Prostoma, here called from the Miocene horizon, is represented by a form that can scarcely be separated from the Miocene to recent type of the genus, P. triquetra. A unique form is believed to represent a new section of the genus Cooperella, which in its typical form is a genus in the Dublin.

The Tellinidae proper are an almost entirely distinct group, only two of the fifteen species having an extra-Atlantic distribution, without any striking similarity. Three species are representatives of groups that persist from the Miocene to the recent. The other Tellinidae, however, present some unexpected features, including the initiation of the section Uchella of the genus Uchella, which is Uchella livei and Uchella livei that is surprisingly close to the Miocene and recent Uchella livei.

The Chipolan elements in the fauna are relatively numerous and not without significance. Of the bivalve species that are common to the two faunas, about one fourth are there-

are hardly serviceable for purposes of correlation, the remain-
ing belonging to the following orders, with 1 species to each
order, Parasitica, Cardium, Artiodonta, Polysiphonia and Alveolata. In
addition to the identical species, a number of the later forms
have their closest affinities with Chitonia species; these
Borden forms include Area (Geophanta) lineolata Li., A.
(Geophanta) lineolata, Pteris arenospora, Pecten (Stictopora)
bellipictus, Line stenospora, Salix arenospora, the two man-
brulae, Monticula (?) monostoma and Chitonia (Stictopora) clavicorni-
atum. There is also Chitonia . . . , but none of the other
American ones is not known to survive the Cretaceous.

Without any doubt the Chitonia elements are completely
overlapped by the large number of more modern congeneric forms,
especially those that involve the introduction of entirely new
groups of sectional or great value. It is difficult, however,
to interpret the significance of these modern elements with re-
gard to age relations since the position of fossil species is in-
volved. Many of the post-Chitonia elements in the Borden group
show the fossil more the characteristically tropical groups and
it may be contended that the later Borden, aspect of the fauna
is due to the fact that it is strictly tropical fauna, the first
American tropical fauna of any importance that has been recorded
to date. It must be remembered also that the Chitonia fauna is
the oldest of the Algonkian fauna. Whether the Chitonia fauna is

or Wolf Grove and Shoal River no longer indicate a break from the
subtropical to temperate of the climate will be known when the
recent study of these faunas is completed. In the consideration
of the correlation of the Jordan fauna the character of the
Shoal River fauna, which is now virtually unknown, is of primary
importance.

On the whole it seems that the Jordan fauna is distinct
from the other faunas and it may be tentatively
that it is a Boreo-Asian, that is, Lower Miocene, in the
sense of the American geologists. The Boreo-Asian is
suggested not so much because the fauna resembles the Boreo-Asian
faunas of Europe, as to extend its range to the west. It
will be seen that this view is in conformity with the opinion
of the American geologists that the Jordan fauna is of
Indian Tertiary origin, but the correlation has been made by
a different method of attack, and an attempt has been made to
correlate with the American geologists. The correlation of
Jordan and the American geologists in connection with the
distribution of the Jordan fauna in the United States, of which
preliminary notices have been published (1), is as follows:

- (1). Jordan, W. A., 3rd ed. 1914, 1915, 1916, 1917, 1918, 1919, 1920, 1921, 1922, 1923, 1924, 1925, 1926, 1927, 1928, 1929, 1930, 1931, 1932, 1933, 1934, 1935, 1936, 1937, 1938, 1939, 1940, 1941, 1942, 1943, 1944, 1945, 1946, 1947, 1948, 1949, 1950, 1951, 1952, 1953, 1954, 1955, 1956, 1957, 1958, 1959, 1960, 1961, 1962, 1963, 1964, 1965, 1966, 1967, 1968, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 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3572, 3573, 3574, 3575, 3576, 3577, 3578, 3579, 3580, 3581, 3582, 3583, 3584, 3585, 3586, 3587, 3588, 3589, 3590, 3591, 3592, 3593, 3594, 3595, 3596, 3597, 3598, 3599, 3600, 3601, 3602, 3603, 3604, 3605, 3606, 3607, 3608, 3609, 3610, 3611, 3612, 3613, 3614, 3615, 3616, 3617, 3618, 3619, 3620, 3621, 3622, 3623, 3624, 3625, 3626, 3627, 3628, 3629, 3630, 3631, 3632, 3633, 3634, 3635, 3636, 3637, 3638, 3639, 3640, 3641, 3642, 3643, 3644, 3645, 3646, 3647, 3648, 3649, 3650, 3651, 3652, 3653, 3654, 3655, 3656, 3657, 3658, 3659, 3660, 3661, 3662, 3663, 3664, 3665, 3666, 3667, 3668, 3669, 3670, 3671, 3672, 3673, 3674, 3675, 3676, 3677, 3678, 3679, 3680, 3681, 3682, 3683, 3684, 3685, 3686, 3687, 3688, 3689, 3690, 3691, 3692, 3693, 3694, 3695, 3696, 3697, 3698, 3699, 3700, 3701, 3702, 3703, 3704, 3705, 3706, 3707, 3708, 3709, 3710, 3711, 3712, 3713, 3714, 3715, 3716, 3717, 3718, 3719, 3720, 3721, 3722, 3723, 3724, 3725, 3726, 3727, 3728, 3729, 3730, 3731, 3732, 3733, 3734, 3735, 3736, 3737, 3738, 3739, 3740, 3741, 3742, 3743, 3744, 3745, 3746, 3747, 3748, 3749, 3750, 3751, 3752, 3753, 3754, 3755, 3756, 3757, 3758, 3759, 3760, 3761, 3762, 3763, 3764, 3765, 3766, 3767, 3768, 3769, 3770, 3771, 3772, 3773, 3774, 3775, 3776, 3777, 3778, 3779, 3780, 3781, 3782, 3783, 3784, 3785, 3786, 3787, 3788, 3789, 3790, 3791, 3792, 3793, 3794, 3795, 3796, 3797, 3798, 3799, 3800, 3801, 3802, 3803, 3804, 3805, 3806, 3807, 3808, 3809, 3810, 3811, 3812, 3813, 3814, 3815, 3816, 3817, 3818, 3819, 3820, 3821, 3822, 3823, 3824, 3825, 3826, 3827, 3828, 3829, 3830, 3831, 3832, 3833, 3834, 3835, 3836, 3837, 3838, 3839, 3840, 3841, 3842, 3843, 3844, 3845, 3846, 3847, 3848, 3849, 3850, 3851, 3852, 3853, 3854, 3855, 3856, 3857, 3858, 3859, 3860, 3861, 3862, 3863, 3864, 3865, 3866, 3867, 3868, 3869, 3870, 3871, 3872, 3873, 3874, 3875, 3876, 3877, 3878, 3879, 3880, 3881, 3882, 3883, 3884, 3885, 3886, 3887, 3888, 3889, 3890, 3891, 3892, 3893, 3894, 3895, 3896, 3897, 3898, 3899, 3900, 3901, 3902, 3903, 3904, 3905, 3906,

Order P R I M A R Y M O L L U S C A .

Superfamily NUCULACEA

Family Nuculidae

Genus NUCULA Lamarck

Subgenus Nucula s. s.

NUCULA MORANTANA n. sp.

Description.- Shell small, subtrigonal, moderately inequilateral, moderately inflated; anterior margin gently convex, rounding rapidly into the symmetrically arcuate base; posterior margin shorter, with a steeper slope and slightly more convex curve, insinuated below by the impingement of the boundary of the impressed area behind the umbo; umbones moderately prominent and opisthogyrate, placed behind the median vertical; area behind the umbo definitely impressed, relatively large, cordate; external sculpture of coarse and strong concentric rugae and less conspicuous and finer radials which on adult shells fail to override the rugae; the sculpture of the posterior impressed area similar to that of the remainder of the shell, but weaker; chondrophore narrow, oblique; hinge heavy for the size of the shell, anterior series consisting of about ten teeth, slightly arcuate; posterior series shorter, straight, including about six teeth; inner margin of the valve finely crenulated.

Dimensions.- Length, 4.8 mm.; alt. 4 mm.; semi-diam. .9 mm.

Remarks.- This small and delicately sculptured species is represented by a number of valves. The characteristic features are the weakly, but obviously, impressed pseudo-lunule, the relatively strong sculpture and the moderately inequilateral outline.

N. tenuisculpta Gabb (1), a Santo Domingo Oligocene form, is more

(1). Trans. Am. Philos. Soc., new ser., vol. 15, p. 255, 1873.

elongated and has weaker and finer concentric sculpture and stronger radial striations. Guppy has described two species, N. vieta (2) and N. baccata (3) from the Pliocene of Matura, Trinidad; vieta is

(2). Proc. Sci. Assoc. Trinidad for 1867, p. 174; Geol. Mag., Decade 2, vol. 1, p. 443 (check list); pl. 18, fig. 8, 1874. Dall, (Trans. Wagner Free Inst. Sci., Philadelphia, vol. 3, pt. 4, p. 577, 1898) has placed this species together with tenuisculpta Gabb in synonymy with crenulata Hinds, but the two fossil species, at least, are distinct from each other.

smaller, higher, more oblique, more inflated and is without the posterior impressed area, while baccata is larger, more oblique,

(3). Idem, 1867, p. 174; idem, 1874, p. 443, pl. 18, fig. 7.

more inflated and has lower umbones, no posterior area, finer sculpture and more persistent radial striae.

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Occurrence.- Lower Miocene: Bowden beds, Bowden, Jamaica.

Section *Plasiasarepta* n. sect.

Etymology.-- $\pi\lambda\eta\sigma\iota\alpha\zeta\omega$, -to approach; Sarepta, a genus of pelecypods.

Shell of medium size, well inflated, transversely subelliptical in outline; inequilateral; umbones low, opisthogyrate; areas before and behind the beak not differentiated; external sculpture consisting of numerous, regular concentric rugae; teeth forming the hinge relatively small, in two series, a longer anterior and a shorter, heavier posterior, separated by the chondrophore; ligament entirely internal, seated on a relatively large, deep-set, oblique chondrophore which is placed immediately before the umbo; internal margin of valve smooth; pallial line not known.

Type.-- N. hilli n. sp.

In some respects this section is rather far removed from the typical *Nuculas*, especially with regard to outline and sculpture. Apparently it approaches the genus Sarepta A. Adams, the type of which, S. speciosa is a recent Japanese form; the members of that genus are, however, rounded-ovate, and therefore equilateral or subequilateral, and have a narrow, elongated chondrophore, but at the same time there is at least a feeble development of an external ligament. In the case of N. hilli n. sp. there is no recognizable trace of an external ligament, the ligament being confined to the interior of the shell where it is situated on a prominent, obliquely directed chondrophore. Externally the shell somewhat resembles

certain regularly subovate or subelliptical forms of the genus Malletia, as the recent West Indian M. Smithii Dall or M. cytherea Dall, but that genus is characterized by the entirely external position of the ligament.

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NUCULA (PLASIASAREPTA) HILLI n. sp.

Description.- Shell of medium size, thin, polished, decidedly inflated, inequilateral; outline transversely subelliptical, rounded posteriorly, produced and rounded anteriorly, ventral margin gently arcuate; umbones low, opisthogyrate; external surface sculptured with well-defined, numerous, regular concentric rugae, which become crowded and less prominent on the dorsal half of the shell, the umbo being almost smooth; chondrophore relatively large, elongated, subtriangular, its axis oblique and curved, deeply set, placed immediately in front of the umbo; hinge-teeth short, in two series, decidedly discrepant in length; the anterior series longer, moderately curved, including fifteen or sixteen teeth progressively reduced in size toward the chondrophore and continuing almost to the tip of the umbo, the last few teeth being placed along the upper anterior margin of the chondrophore; posterior series short, straight or slightly concave, numbering five or six teeth of virtually the same size, the series ceasing abruptly at the chondrophore; inner margin of the valve smooth; internal surface of the shell polished; muscle scars and pallial line obscure.

Dimensions.- Length, 8.9 mm.; alt., 6.9 mm.; semidiam., 1.9 mm.

Remarks.- The subelliptical outline, inconspicuous umbones, well defined and regular concentric rugae of this species, which is represented by a number of valves, produce a facies which is

quite unmistakable. It is, in fact, unique among the Tertiary and Recent *Nuculas* of the Antillean region and is obviously so different from the majority of *Nuculas* that it might well be referred to a distinct category of more than sectional value. No forms german are known from the American Tertiaries. Of the recent Antillean species *N. cymella* Dall (1) has regular concentric sculpture and smooth internal margins, but in other features the shell is more typically nuculiform, being less inequilateral and smaller than *hilli*, rounded-trigonal in outline and having the hinge more symmetrical.

This species is named in honor of Mr. Robert T. Hill, whose reconnaissance of Jamaica was an important step in the elucidation of the stratigraphic succession of that island.

Occurrence.-- Lower Miocene: Bowden beds, Bowden, Jamaica.

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- (1). Bull. Mus. Compt. Zool., Harvard, vol. 12, pp. 246-247, 1886; Proc. U. S. Nat. Mus., vol. 12, p. 258, pl. 13, fig. 1, 1889.
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Family Lediidae
Subfamily Lelinae
Genus LEDA Schumacher
Section Jupiteria Bellardi

LEDA (JUPITERIA) PELTELLA Dall

Leda acuta Gabb, 1873, Trans. Am. Philos. Soc., new ser., vol. 15,
p. 255, (ex parte). Not L. acuta Conrad, 1832.

Leda peltella Dall, 1898, Trans. Wagner Free Inst. Sci., Philadelphia
vol. 2 pt. 4, p. 579 (name only), pl. 72, fig. 5.

Description.- "Shell elongate, convex, beaks central; anterior
end rounded, base broadly convex; posterior end acute, hinge slight-
ly concave from the beaks to the posterior end. Surface marked
by regular rounded concentric ribs. Length .35 inch." (Gabb, 1873)

Type locality.- Santo Domingo.

Shell of medium size, plump, decidedly high, slightly inequilateral;
anterior and posterior ends almost equally produced, the anterior
margin rounded and the posterior forming a rostrum, typically
short, blunt and very slightly recurved; ventral margin decidedly
arcuate; umbones low, subcentral in position; lunule narrow
but distinct, bearing relatively coarse transverse elevations not
continuous with the concentric rugae; escutcheon large, bounded
by a well-marked carina; a faint sulcus usually present adjacent
to the rostral carina, anteriorly a second sulcus may be present;

external sculpture of regular, closely-set concentric rugae, equally developed throughout and extending across the rostral carina and escutcheon, but ceasing at the edge of the narrow lunule; teeth strong, with about twenty before and fifteen behind the small chondrophore.

Dimensions.-- Length 8.8 mm.; alt. 5.8 mm.; semidiam. 2.4 mm.

Remarks.-- The typical forms of this species- the most prolific of the Ledas- are characterized by their unusual, almost rotund, shape, which, together with the features of the lunule and escutcheon, permits such forms to be readily recognized. It is not surprising to find marked variability in a group which is so well represented. The most marked variation is toward a more elongate form and the end products are notably different from the average form. A different appearance is presented by certain forms which are high, but have the posterior carina sharper than usual, the escutcheon broader and the posterior and anterior sulci more definitely developed. The presence of an area in front of the beaks which differs in sculpture from the remainder of the shell is employed as the criterion in assigning these two antipodal types to this species. The sculpture is, however, fairly constant, although on a few forms the rugae are coarser than on typical individuals. The posterior sulcus is seldom conspicuous, in fact, very few individuals display it to such a degree as the one figured by Dall, and an anterior sulcus is but rarely developed.

Among Gabb's acuta are some forms which are larger than peltella, more elongated and attenuated posteriorly and have a more concave posterior dorsal margin and more convex base; they probably should be separated from the other forms which resemble the Bowden peltella.

Occurrence.- Oligocene, Santo Domingo. (Gabb, 1873)

Lower Miocene: Bowden beds, Bowden, Jamaica. (Dall, 1898)

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LEDA (JUPITERIA) CERATA Dall var. SUBVITREORUMORPHA n. var.

?Leda perlepada Guppy, 1867, Proc. Sci. Assoc. Trinidad for 1867,
p. 173, (ex parte)

?Leda perlepada Guppy, 1874, Geol. Mag., Decade 2, vol. 1, p.
442 (check list), pl. 18, fig. 9 (ex parte)

Description.-- Shell small, polished, transversely elongate, virtually equilateral, notably convex; ventral margin broadly arcuate, anterior margin abruptly rounded, posteriorly rostrate- the rostrum being of medium length, blunt and slightly recurved; umbones tumid, strongly incurved and opisthogyrate, placed approximately at the median horizontal; escutcheon poorly defined, bounded by a low rounded carina; area in front of beaks slightly impressed, but not forming a lunule; external surface sculptured with fine rugae which are more sharply sculptured and crowded on the distal half of the shell and are continuous across the impressed areas both before and behind the beaks; chondrophore relatively narrow and elongate; about sixteen teeth in the anterior series and thirteen in the posterior; muscle scars relatively large pallial sinus obscure.

Dimensions.-- Length, 5.8 mm.; alt., 3.4 mm.; semidiam., 1.3 mm.

Remarks.- The members of this well-represented variety are sharply differentiated from the co-existent Ledas. The elongate, equilateral form, polished surface and ventral crowding of the fine rugae are characteristic features. When compared with the more abundant and highly variable peltella and indisena the characters of the variety under discussion are constant. There is, however, a slight variation in shape, a few of the valves being higher and therefore less elongate than the typical form; this difference in outline is frequently encountered among immature forms. The extreme elongated variants of peltella somewhat resemble subvitreamorpha, but the two may ~~be~~ readily be distinguished since subvitreamorpha is less inequilateral, more convex, more bluntly rostrate and has more tumid and more decidedly opisthogyrate umbones and distally crowded rugae; moreover, it does not have the lunule or sharp posterior carina of cerata.

In the National Museum collection of Bowden material this form bears the name Leda vitrea d'Orbigny, although that species does not appear in the 1903 check-list. (1) Apparently there is some confusion concerning L. vitrea d'Orbigny (2) and at the

(1). Trans. Wagner Free Inst. Sci., Philadelphia, vol. 3, pt. 6, p. 1586. Several Ledas which do not appear in any of the Bowden collections at the writer's disposal are included in this list.

(2). In de la Sagra, Hist., Phys., polit. et natur. de l'Isle de Cuba, Mollusques, vol. 2, pp. 262-263, pl. 26, figs. 27-29, 1853 (French ed.)

present time it is necessary to rely on d'Orbigny's figures, despite the fact that occasionally these figures have been found to be more artistic than accurate. When compared with the recent form which Dall(1) has described as a variety of vitrea d'Orbigny's figures indicate that his vitrea is less elongate, more sharply rostrated, more broadly rounded anteriorly and has a more prominent escutcheon and posterior carina, a slight posterior sulcation and a fairly well-defined transversely sculptured lunule. On the whole these differences appear to be of an order sufficient to raise Dall's varietal name to specific rank.

The Bowden forms are very close to the recent cerata, but cerata of the same size are constantly different in having a less concave posterior dorsal margin, slightly more convex anterior margin, less convex base, less upturned rostrum and lower umbones. Apparently the recent form is quite variable, for a valve which is larger than any of the Bowden forms has a more concave posterior dorsal margin than subvitreamorpha, the base and rostrum are similar, but the umbo is proportionately lower. Until the recent species is better understood it seems advisable to consider the Bowden form as a variety.

Among Guppy's four cotypes of perlepada, from the Pliocene

(1). Bull. Mus. Compt. Zool., Harvard, vol. 9, p. 126, 1881;
idem, vol. 12, pp. 250-251, pl. 8, figs. 12, 12a, 1886.

of Matura, Trinidad, are three small valves which can scarcely be distinguished from young, high Bowden specimens; the other, apparently adult, shell appears to be abnormal. Further exploration of the Trinidad locality may demonstrate the identity of the two forms, in which case Guppy's name would be prior. No adequate conception of perlepada can be obtained from Guppy's figure.

Dall (1) has placed in synonymy with vitrea, L. milleri Gabb (2) from the Miocene of Sapote, Costa Rica, but that species is more like the large, elongated forms which Gabb included under his Santo Domingian L. acuta. (3) No definite statements can be made concerning Toulou's Catun "Leda sp. (vielleicht eine neue Art, aff. Leda vitrea var. cerata Dall u. Leda sublaevis Bell.)" (4) since the figure is poor and the discussion inadequate. It is,

(1). Trans. Warner Free Inst. Sci., Philadelphia, vol. 3, pt. 4, p. 579, 1898.

(2). Jour. Acad. Nat. Sci. Philadelphia, 2d ser., vol. 8, p. 346, pl. 44, figs. 22, 22a, 1881. (As Mucularia milleri)

(3). See under discussion of L. peltella.

(4). Jahrb. K.-k. geol. Reichsanstalt, vol. 58, p. 719, pl. 27, fig. 2, 1908.

however, larger and more inequilateral than subvitreamorpha and in all probability is distinct.

Occurrence.- Lower Miocene: Bowden beds, Bowden, Jamaica.
? Pliocene (?) - Matura, Trinidad (Guppy 1867, 1874)

Section *Leda* s. s.

LEDA (*LEDA*) *INDIGENA* Dall.

Leda bisulcata Guppy, 1867, Geol. Mag., Decade 1, vol. 4, pp.
500-501, fig. 2.

Leda bisulcata Guppy, 1874, Geol. Mag. Decade 2, vol. 1, p. 442
(check list)

Leda bisulcata Guppy, 1882, Proc. Sci. Assoc. Trinidad, p. 173,
pl. 7, fig. 7.

Not *L. bisulcata* Meek and Warden, 1861.

Leda indigena Dall, 1898, Trans. Wagner Free Inst. Sci., Phila-
delphia, vol. 3, pt. 4, p. 579 (name only).

Description.- "Shell ovately trigonal, with numerous concentric ribs narrower than their interstices; with a somewhat sinuous elevated ridge running from the umbo to the pointed rostrum behind; rounded anteriorly with a round groove running from the umbo to the ventral margin near the anterior angle. Umbones close; posterior dorsal area flat, sloping, striate continuously with the ribs of the disc; no very distinct anterior area. Teeth very prominent." (Guppy, 1867)

Type locality.- Jamaica.

Shell small, moderately inequilateral; posterior dorsal margin slightly excavated; rounded anteriorly, sharply rostrate

posteriorly, the rostrum being slightly recurved; ventral margin gently arcuate; umbones low, tumid, proximate, slightly orthogyrate; lunule not differentiated, represented by a slightly depressed narrow zone; escutcheon sharply differentiated, broad, extending to the tip of the rostrum, bounded by a strong, sharp carina, which becomes slightly broader and flat distally, the exterior edge being sharp throughout while the edge facing the escutcheon is lower and less sharp; immediately anterior to the rostral carina is a shallow sulcus which is best defined in the umbonal region and scarcely affects the ventral margin; anteriorly a shallow, but sharply limited, sulcus runs from the umbo to the ventral margin, the outline of which it rarely affects; external surface sculptured with closely-set, regular, continuous concentric rugae, equally strong throughout and persisting across the rostral carina and escutcheon; teeth strong, about fifteen behind and sixteen before the deeply-set, small triangular chondrophore.

Dimensions.- Length, 6.5 mm.; alt. 3.8 mm.; semidiam. 1.5 mm.

Remarks.- Although the forms referable to this species are quite variable, they may usually be recognized by the pointed, slightly recurved rostrum, the sharp posterior carina and the broad, long escutcheon which is conspicuously sculptured by the persistent concentric rugae. Variations occur principally with regard to shape and the size and spacing of the concentric rugae. The typical indigena is rather elongated, but some forms tend to

approach peltella by being higher; such forms are distinguished from even the unusually strongly carinated and sulcated variants of the peltella group by the more decided emphasizing of the carina and accompanying sulcus, the more conspicuous development of an anterior sulcus, the presence of a more attenuated rostrum and the absence of a lunule. On the other hand, the elongated variants of peltella also approach indigena, - in this case the less sharply rostrated and sulcated forms of indigena - but such members of the peltella group may invariably be recognized by their weaker carina, blunter rostrum and differentiated lunule.

The young of indigena are proportionately higher than adults. On either side of the anterior sulcation a few faint radiating lines, subparallel to the sulcation, are occasionally present in the interspaces between the rugae. This species is a conspicuous element among the Leds of the fauna, being surpassed numerically only by peltella.

L. indigena is very closely related to L. acuta (Conrad) (1) which ranges from the Upper Oligocene Chipola and Oak Grove beds of Florida to the Recent and also has a wide geographical range. The Bowden species is, however, in general terms smaller, less

(1). Am. Mar. Conch., p. 32, pl. 6, fig. 1, 1832. For synonymy see Dall, Trans. Wagner Free Inst. Sci., Philadelphia, vol. 3, pt. 4, pp. 592-593, 1898.

elongate, and has a more recurved rostrum and a more constantly fine concentric sculpture than acuta, as that species is accented; in addition the rostral carina is sharper and the sulci more pronounced than in the case of most acuta. None of the forms at hand have a sculpture as coarse as that which is commonly seen in any collection of acuta. The Bowden species varies principally with regard to shape; while the most notable variation of acuta concerns the sculpture. The tendency of indigena toward a less elongate, higher shape is very noticeable and therein lies, perhaps, the principal distinction between the two.

L. dodona Dall (1), of the Chipola marl of Florida, belongs to the same general group. It may be distinguished by its very coarse concentric rugae and also by its almost smooth esutcheon. A species from the Oak Grove sand of Florida, L. trochilia Dall (2) is also closely related, but is recognized by the wide spaces between the often discontinuous and irregular rugae and by the absence of rugae on the rostral carina. The Eocene (Wilcox) L. robusta Aldrich (3) has coarse concentric sculpture which is evenly

(1). Trans. Wagner Free Inst. Sci., Philadelphia, vol. 3, pt. 4, pp. 589-590, pl. 32, fig. 6, 1898.

(2). Idem, p. 590, pl. 32, figs. 4, 12, 1898.

(3). Bull. Amer. Pal., vol. 1, no. 2, p. 17, pl. 5, figs. 1, 1a, 1895.

spaced only on the umbo and is almost obsolete in the region anterior to the anterior sulcation; in addition the chondrophore is placed well under the umbo so that it is almost concealed when the interior of the shell is viewed in normal position.

The "Leda cf. acuta" which Toulia (1) described in his account of the "Pliocene" fauna of Tehuantepec differ from both acuta and indigena in having the posterior portion of the ventral margin less convex and a straighter and blunter rostrum.

It may be added that Guppy's figure of bisulcata is poor and probably represents a young, high individual.

(1). Jahrb. K.-k. geol. Reichsanstalt, vol. 61, p. 478, pl. 29, fig. 6, 1911.

Occurrence.-- Lower Miocene: Bowden beds, Bowden, Jamaica (Guppy, 1867, 1874; Dall, 1898).

Sèction Hebeleda n. sect.

Etymology.-- Hebes,- blunt; Leda.

Shell small, decidedly inflated, subequilateral, bluntly rostrated; posterior carina subrounded; area behind the umbo flattened, but not impressed; external surface sculptured with concentric lines usually obscure and irregularly developed; hinge-teeth in two subequal series, separated by a relatively wide triangular chondrophore; ligament apparently entirely internal.

Type.-- L. bowdeniana n. sp.

This section is proposed for the reception of two species and a variety - all new - which form a homogeneous group, sharply differentiated from the associated Ledas. The group is characterized by its strongly inflated, bluntly rostrated form. L. duerdeni n. sp., the shortest of the three forms constituting this section, externally bears some resemblance to certain rostrated forms of the genus Tindaria, such as T. smirna Dall, a deep-water species from the Gulf of Panama, but aside from other considerations, Tindaria has an external ligament. L. pontonia Dall, dredged near the Galápagos Islands, appears to belong to the group under consideration. Through forms which are more sharply rostrated, less convex and more obviously sculptured Hebeleda grades into Jupiteria.

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LEDA (HEBELEDA) BOWDINIANA n. sp.

Description.- Shell small, decidedly convex, transversely elongate, outline sub-trigonal posteriorly rostrate, subequilateral, dorsal margins with steep slopes, the anterior being convex and the posterior concave; produced and abruptly rounded anteriorly; posterior margin forming a short blunt rostrum; broadly and symmetrically arcuate ventrally; umbones approximately central in position, high, very tumid, strongly incurved and opisthogyrate; area behind the umbo flattened; posterior carina low, broad and very feeble distally; external sculpture of irregularly spaced, poorly developed, fine impressed lines, obsolete on the umbones and in the area within the posterior carina, and coinciding with the irregularly spaced lines of growth in the distal half of the shell; chondrophore triangular, relatively broad; teeth in two series, with about nineteen in the slightly convex anterior series and about thirteen in the concave posterior series, the median teeth being small and obscure; muscle scars faint, relatively large; pallial line obscure.

Dimensions.- Length, 6.2 mm.; alt., 4.5 mm.; semidiam., 1.9 mm.

Remarks.- This species, the type of the section, is described from several valves which display constant characters.

The Galapagos form mentioned above, L. pontonia Dall (1) is larger and has a more excavated postero-dorsal margin and more

(1). Proc. U. S. Nat. Mus., vol. 12, p. 257, pl. 13, figs. 5, 5b, 1889.

convex base.

Occurrence.-- Lower Miocene: Bowden beds, Bowden, Jamaica.

LEDA (HEBELEDA) BOWDENIANA var. SUBTUMIDA n. var.

Description.- Shell resembling the typical bowdeniana, but more elongate, slightly less convex; umbones lower and less tumid; ventral margin less curved; sculpture coarser and more irregular; chondrophore broader; hinge with about sixteen teeth in each series, the anterior series more convex and the posterior less concave than in the typical bowdeniana.

Dimensions.- Length, 6.5 mm.; alt., 4 mm.; semidiam., 1.7 mm.

Remarks.- A number of valves are included under this variety. When compared with bowdeniana they show the above differences, which, though slight, involve many characters and are constant. Since the variety is more elongate and has lower umbones, it follows that the slope of the dorsal margins is less steep and the postero-dorsal margin less excavated.

A poorly preserved shell which is higher than the typical bowdeniana and has a shorter rostrum and obscure concentric sculpture which is obsolete on the posterior half of the shell, probably indicates a tendency to variation in a direction antipodal to subtumida.

Occurrence.- Lower Miocene: Bowden beds, Bowden, Jamaica.

LEDA (HEPELEDA) DUERDENI n. sp.

Description.- Shell small, polished, rounded-triangular with a short posterior rostrum, decidedly convex, subequilateral; posterior dorsal margin slightly concave; bluntly rounded anteriorly; ventral margin asymmetrically arcuate, being slightly more convex posteriorly; umbones high, tumid, strongly opisthogyrate; area behind the umbo distinctly flattened; rostral carina low, broad, but strong throughout; external surface sculptured with fine, evenly spaced, concentric lines except on top of the umbones and in the area bounded by the rostral carina- the sculpture at times obsolete on the posterior half or entire surface of the shell; chondrophore large, triangular, situated below and just anterior to the tip of the umbo; teeth strong, the anterior series numbering about thirteen and the posterior sixteen.

Dimensions.- Length 4.9 mm.; alt., 3.4 mm.; semidiam., .9 mm.

Remarks.- L. duerdeni has a facies totally different from bowdeniana; it is smaller, higher, and has a shorter, but more acute, rostrum, stronger ventral carina, more regular and more delicate external sculpture, larger chondrophore and heavier hinge. In outline it stands in decided contrast with the average Leda and without the testimony of the ligament would probably be placed

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among the rostrated Tindarias, for which Verril and Bush (1) proposed the subgenus Tindariopsis.

(1). Am. Jour. Sci., 4th ser., vol. 7, p. 59, 1897.

The name is given in recognition of the services of Dr. James E. Duerden, now of Rhodes University College, Grahamstown, South Africa, who while Curator of the Museum at Kingston, Jamaica, collected the Bowden material which constitutes the Duerden Collection of the Johns Hopkins University.

Occurrence.-- Lower Miocene: Bowden beds, Bowden Jamaica.

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LEDA (?) CLARA Guppy.

Leda clara Guppy, 1874, Geol. Mag., Decade 2, vol. 1, p. 442,
(check list) pl. 17, figs. 1, 1a.

Leda clara Guppy, 1875, Geol. Mag., Decade 2, vol. 2, p. 42.

Leda clara Guppy, 1882, Proc. Sci. Assoc. Trinidad, p. 172, pl. V,
fig. 4.

Description.- "Subelliptical, lanceolate, nearly equilateral, somewhat but not extremely rostrated. Disk smooth, shining; valves with a few fine close regular concentric riblets perceptible near the anterior angle, where an indistinct sulcus runs upwards towards the umbo. No distinct escutcheon. Lunule narrow, indistinctly defined. Umbones prominent. Ventral margin slightly angulated at about a third of its length from the posterior point, where an obscure carina runs to the margin from the umbo. Length 12 mill., height 6, thickness about 4 mm." (Guppy 1875)

Type locality.- Jamaica.

Shell large, heavy, moderately convex, subequilateral; anterior dorsal margin convex, posterior dorsal margin excavated; abruptly rounded anteriorly; posterior margin bluntly rostrate above and obliquely truncated below, the slope of the truncation abruptly joining the direct, median portion of the ventral margin; umbones low, approximately central in position, strongly

opisthogyrate; lunule not differentiated, represented by a very narrow, slightly flattened area; area behind the umbo wider, flattened; rostral carina situated near the dorsal margin, low, relatively broad, subrounded; distal third of the shell bearing a very shallow sulcus immediately anterior to the rostral ray, the sulcus very slightly emarginating the truncated posterior margin; external surface sculptured with fine, impressed lines, feebly developed on the umbones and accentuated by irregularly spaced incrementals in the distal half of the shell; chondrophore large; teeth strong, becoming finer toward the point of divergence, the anterior series numbering about nineteen and the posterior series fifteen; muscle scars and pallial sinus obscure.

Dimensions.— Length, 17.5 mm.; alt., 7.5 mm.; semidiam.,

Remarks.— This species is conspicuous as being easily the largest of the Bowden Lediidae. Young shells display only a feeble posterior truncation below the blunt rostrum, but on mature individuals this feature is especially prominent. Since the pallial sinus is obscure the proper position of this form is doubtful; the shape, character of the external sculpture and absence of a well-defined lunule and sharp rostral carina suggest that it may find its proper place in the section Portlandica of the genus Yoldia— a section which has been considered of generic value, intermediate between Leda and Yoldia.

Occurrence.- Lower Miocene: Bowden beds, Bowden, Jamaica.
(Guppy 1974, 1975; Dall, 1903 (1)).

(1). This note refers to the check-list on pp. 1532-1538 of
vol. 3, pt. 6 of the Wagner Institute papers. References
will be given to this list only when the species is not
designated as a member of the Bowden fauna in the text.

Genus VOIDIA Müller.

VOIDIA OVALIS Gabb.

Yoldia ovalis Gabb, 1873, Trans. Am. Philos. Soc., new ser.,
vol. 15, pp. 255-256.

Description.- "Shell small, compressed, sub-elliptical;
beaks slightly in advance of the middle; hinge line sloping vent-
ly, base and ends rounded; surface smooth or bearing a few faint
impressed concentric lines on the anterior part near the base.
Length .35 inch, width .15 inch." (Gabb, 1873)

Type locality.- Santo Domingo.

Shell of medium size, thin, polished, transversely subellip-
tical, moderately convex, decidedly compressed posteriorly; ant-
erior dorsal margin shorter and more oblique than the posterior,
the distal ends of both abruptly joining the lateral margins;
anterior lateral margin rounded; upper portion of the posterior
lateral margin almost at right angles to the dorsal margin, low-
er portion rounding evenly into the gently and symmetrically arcuate
ventral margin; umbones very low, situated anterior to the median
horizontal; behind the umbo lies a very narrow, slightly impress-
ed area, sculptured with fine lines and containing in its proximal

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half a raised line parallel to and scarcely separated from the outer edge of the area; anterior to the umbo is a similar, but shorter area; external sculpture of very fine, inconspicuous, impressed lines, obsolete in the umbonal and posterior regions and at times over the entire shell; chondrophore relatively large; teeth fine, the two series diverging at a very obtuse angle; about eighteen teeth in the anterior and twenty in the posterior series; anterior teeth larger, in both series the size reduced gradually toward the point of divergence; muscle scars obscure; pallial line sharply, but not deeply, sinuated.

Dimensions.- Length, 10.7 mm.; alt., 6 mm.; semidiam., 1.8 mm.

Remarks.- The feebly impressed areas before and behind the umbones are very narrow and inconspicuous. In the case of young forms it may be better to describe the shell as having before and behind the umbones a very narrow and shallow sulcus which impinges on the dorsal margins at approximately the distal extremities of the hinge, since on such forms the ridge just inside what is described as the impressed areas in the adult is prominent enough to cause such an appearance. The anterior and posterior margins are similarly rounded, but the curve of the posterior margin is more complete since the posterior dorsal margin is less oblique than the anterior.

The single Santo Domingian specimen is slightly more elongated than the Bowden forms and has very feeble concentric sculp-

ture which is developed only near the antero-ventral margin.

Y. solenoides Dall (1), a recent species from the Gulf of Mexico,

(1). Bull. Mus. Compt. Zool., Harvard, vol. 9, p. 127, 1881;
idem, vol. 12, p. 248, pl. 9, figs. 2, 2a, 1886.

has the same general facies, but is more elongate, the length being slightly more than twice the altitude, the slope of the anterior dorsal margin is less steep, the posterior dorsal margin joins the lateral margin by a gentle curve, instead of a sharp angle, the posterior end is more symmetrically arcuate and the ventral margin less curved.

Occurrence.- Upper Oligocene: Santo Domingo (Cobb, 1873);

Lower Miocene: Bowden beds, Bowden, Jamaica (Dall, 1903).

Subfamily Tindarinae.

Genus TINDARIA Bellardi.

TINDARIA CALLIPICTA n. sp.

Description.- Shell small, polished, veneriform, transversely subovate, moderately inequilateral, well inflated; rounded anteriorly and posteriorly, the anterior dorsal margin slightly below the level of the posterior and rounding more convexly into the symmetrically arcuate base; umbo tumid, relatively prominent, prosogyrate, situated before the median horizontal; external surface sculptured with regular relatively coarse concentric rugae, obsolete on the umbo and near the dorsal margins; ligament external, opisthodetic, the area very narrow and shallow, obscurely truncating the proximal portion of the posterior series of teeth; chondrophore absent; teeth in two series, separated by a short, transversely elongated, subumbonal lamella; the convex posterior series numbering fifteen teeth, reduced in size toward the umbo and the dorsal portions of the seven proximal teeth obscured by the immersion of the ligament; anterior series slightly concave, including seven teeth, the distal five heavy and the proximal two abruptly reduced in size; interior of the shell polished; anterior muscle scar placed under the distal extremity of the hinge; relatively large; posterior scar and pallial line obscure.

Dimensions.- Length, 3.5 mm.; alt., 2.5 mm.; semidiam., 1.2 mm.

Remarks.- The single valve on which this species is based is the first member of the genus to be described from the Tertiaries of the Antillean region. The ligament is assumed to be opisthodetic and therefore the umbo is described as prosogyrate. T. callipicta is smaller and less elongate³ than T. cytherea Dall (1)

(1). Bull. Mus. Compt. Zool., Harvard, vol. 12, pp. 254-255, pl. 8, figs. 1, 1a, 1886.

and T. amabilis Dall (2) of the recent Antillean fauna, and differs also in hinge characters. The Bowden form appears to resemble

(2). idem, vol. 18, p. 438, pl. 40, fig. 9, 1889.

more closely T. panamensis Dall (3) from the Gulf of Panama, but is less produced posteriorly and is without the slight posterior

(3). idem, vol. 43, no. 6, p. 388, pl. 17, fig. 10, 12.

compression.

Occurrence.- Lower Miocene: Bowden beds, Bowden, Jamaica.

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Superfamily A R C A C E A

Family Limopsidae

Genus LIMOPSIS Sasso.

LIMOPSIS OVALIS Cabb var. SUPRACANCELLATA n. var.

Description.- Shell small, longitudinally subovate, moderately convex, subequilateral, posteriorly slightly produced obliquely; anterior and posterior dorsal margins straight, the posterior usually longer; rounded anteriorly and posteriorly, the curve of the posterior margin less full; umbones prominent, tumid, strongly incurved and slightly opisthogyrate, subcentral in position; external surface covered with almost equally developed radial and concentric riblets, producing a cancellated sculpture, the concentric riblets showing a tendency toward irregular width, the radials more constant; cardinal area relatively wide, amphidetic, interrupted by the small triangular, subumbonal chondrophore; before the chondrophore five or six almost vertical teeth, the proximal tooth placed under the chondrophore, a short edentulous interval separating the anterior series from the four or five more horizontal teeth that constitute the posterior series; muscle scars obscure; inner edge of the interior margin of the valve finely crenulated, the crenulations tending to become obsolete on the posterior margin.

Dimensions.- Length, 5.8 mm.; alt., 6.2 mm.; semidiam., 1.5 mm.

Remarks.- This form is considered, after some hesitation, a variety of L. ovalis Cabb (1), described from the Oligocene of

(1). Trans. Am. Philos. Soc., new ser., vol. 15, p. 255, 1873.

Santo Domingo. The typical ovalis reaches a larger size and is slightly less oblique. Adult shells do not display the obliquity for which "this shell is remarkable", according to the original description: on the contrary, they are but slightly oblique.

On the largest of his specimens the concentric sculpture is exaggerated, while the others have a sculpture closely resembling that of supracancellata. Guppy (2) has described a very closely related

(2). Proc. U. S. Nat. Mus., vol. 19, p. 525, pl. 30, fig. 2, 1896.

form, L. subangularis, from the Oligocene Ditrupa bed at Point-apier, Trinidad; in fact, it is so close to the previously described ovalis that it, too, should probably be considered a variety. The Trinidad variety differs from supracancellata by being smaller, slightly more oblique, less convex and by having the concentric sculpture usually more accentuated than the radial, so that the cancellated effect- so conspicuous on supracancellata- is

often negligible. On the whole, the three forms in the order ovalis, ovalis subracancellata, ovalis subangularis constitute a series from large and slightly oblique to small and more decidedly oblique; the differences are, however, slight and the forms apparently variable, so that they might well be considered identical. Dall (1) considered the Bowden and Trinidad specimens identical

(1). Trans. Wagner Free Inst. Sci., Philadelphia, vol. 3, pt. 4, p. 607, 1898.

and stated that they may be the same as ovalis.

The recent North Atlantic and West Indian L. minuta Phillipi (1) is typically more oblique, more convex and more finely sculptured.

(2). En. Moll. Sci., vol. 1, p. 63, pl. 5, fig. 3; vol. 2, p. 45.

Occurrence.-- Lower Miocene: Bowden beds, Bowden, Jamaica.
(Dall, 1898)

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LIMOPSIS JAMAICENSIS n. sp.

Description.- Shell minute, heavy for the size, suborbicular, convex, slightly compressed in the distal postero-dorsal region; anterior dorsal margin short and direct, posterior dorsal margin longer and sloping gently downward; dorsal portion of anterior lateral margin slightly excavated, the remainder curving broadly and evenly into the ventral margin; posterior lateral margin less broadly curved and passing more abruptly into the ventral margin, producing a slight posterior obliquity; umbones relatively prominent, decidedly inflated; external sculpture of fine, widely separated concentric raised lines, the interspaces being broadest in the central portion of the shell, and less prominent, but more frequent, radial riblets; at the points of intersection of the two sets of sculpture conspicuous irregular blisters, absent in the umbonal region; posterior portion of the narrow cardinal area longer; chondrophore small, triangular; teeth in two discrete series separated by a relatively wide edentulous area, the three teeth of the anterior series heavy, vertical and placed near the dorsal margin; the three posterior teeth weaker, almost horizontal, situated further from the dorsal margin and placed one below the other in a gently curved series; inner margin of the valve faintly crenulated, the crenulations coarsest on the ventral por-

tion of the postero-lateral margin.

Dimensions.- Length, 2 mm; alt. 2.2 mm.; semidiam., .8 mm.

Remarks.- This species is represented by a single left valve. The "blisters" at the points of intersection of the radial and concentric sculpture are unusual and give the shell a peculiar appearance. The specimen is very small and is probably an immature individual.

Occurrence.- Lower Miocene: Bowden beds, Bowden, Jamaica.

Family Arcidae

Subfamily Arcinae

Genus ARCA (Linnaeus) Lamarck.

Subgenus Arca s. s.

ARCA OCCIDENTALIS Philippi.

Arca barbadensis d'Orbigny, 1845 (?), in de la Sagra, Hist., fis.,
polit. y natur. de la Isla de Cuba, Moluscos, p. 245,
(Spanish ed.).

Arca occidentalis Philippi, 1847, Abbild. u. Beschreib., vol. 3,
p. 29, pl. 4, fig. 4.

Arca barbadensis d'Orbigny, 1857, in de la Sagra, Hist. phys.,
polit. et natur. de l'Ile de Cuba, Mollusques, vol.
2, pp. 321, 322, (French ed.).

Arca noae Guppy, 1866, Quart. Jour. Geol. Soc. London, vol. 22,
p. 298 (non Linnaeus, 1758).

Arca occidentalis Philippi, Guppy, 1874, Geol. Mag., Decade 2,
vol. 1, p. 443 (Check list).

Arca occidentalis Philippi, Guppy, 1876, Quart. Jour. Geol. Soc.
London, vol. 32, p. 531.

Arca occidentalis Philippi, Dall, 1898, Trans. Wagner Free Inst.
Sci., Philadelphia, vol. 7, pt. 4, p. 620.

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Area occidentalis Philippi, Dall & Simpson, 1901, Bull. U. S.

Comm., vol. 50, pt. 1, pp. 459-460.

Description.— "A. testa elongato-oblonga, subquadrangula; latere antico breviusculum, angulo fere recto terminato; postice emarginato; carina obtusa ab apice decurrentei; costis regularibus, prominentibus, interstitiis longitudinaliter striata subaequantibus; medianis parum minoribus; area dorsali mediocri; ligamento illam maxima ex parte occupante. Long. 22", alt. 10", crass. 11" (Philippi, 1847)

The specimens at hand are large, transversely elongate, very inequilateral, decidedly convex anteriorly, higher and compressed posteriorly; dorsal margin straight, equaling the maximum length of the shell; antero-lateral margin with an oblique posteriorly directed slope; anterior portion of the ventral margin emarginated by a long, narrow byssal space, posterior portion convex; postero-lateral margin insinuated medially, the portion dorsal to the insinuation more produced; umbones situated at about the anterior fourth of the length, broad, inflated, slightly prosogyrate, with a slight median sulcus, the sulcus broadening toward the ventral margin and forming a wide, shallow depression, the limits of which on the ventral margin coincide with the limits of the byssal space; posterior beel broad, but well-marked; external surface covered with radial ribs of unequal size and sculpturing in different

portions of the shell (anterior to the umbonal depression high, broad, sharply sculptured and separated by narrower interspaces; in the wide depression very narrow, low, and the wider interspaces with from one to four fine secondary ribs that disappear in the dorsal half of the shell; posterior to the depression the ribs higher and broader, with one or two furrows, the equally wide interspaces containing from two to five secondary ribs; the ribs on the posterior keel very low and divided distally by furrows into portions of irregular width; dorsal to the posterior keel the first three ribs broad and usually furrowed, but the remainder narrow), concentric sculpture of irregular growth lines on both the ribs and interspaces; cardinal area broad and long, the subumbonal portion with discontinuous ligament grooves that diverge at an acute angle; hinge long and straight; teeth numerous, becoming longer and slightly oblique distally; anterior and posterior inner margins strongly crenulated, the ventral margin posterior to the byssal gape weakly crenulated.

Dimensions.- Length, 68 mm.; maximum alt., 28 mm.; semidiam., 15 mm.

Remarks.- The Bowden specimens, which are numerous, agree in every detail with the recent form of wide distribution in the Antillean region. As is to be expected, from the habits of this species, the shape is variable with regard to details, but the

general proportions and sculpturing are constant. The length of the two posterior "wings" and the depth of the emargination between them are especially inconstant. From the other *Arca*s of the fauna occidentalis may be differentiated by its elongate form and the character of the radial ribbing. The small *A. paratina* Dall (1), of the Florida Shipola and Tampa silex beds, very much

(1). Dall, W. C., Trans. Wagner Free Inst. Sci., Philadelphia, vol. 4, pt. 4, pp. 621-628, pl. 55, fig. 14, 1908.

resembles *A. occidentalis* in many characters, but when compared with occidentalis of the same size, is usually less alate posteriorly, proportionately longer, with a more uniform outline, more delicate and more numerous ribs.

This species apparently is the form which Petiver (2) designated "*Mytilus Barbadosis, vulgaris, striatus, striis fuscis*" - cited

(2). Mem. nat. cur., p. 267, no. 62, 1708.

by Sloane in his "Natural History of Jamaica". (7) This name was

(3). Voyage to the islands Madeira, 1703, 1704, St. Christophers and Jamaica; with the Natural History of the last of these Islands, vol. 2, p. 257, no. 9, 1725.

given binomial standing by d'Orbigny in his work on the molluscs of Cuba. Since there is some confusion concerning the date of publication of the two editions of that work it is uncertain whether d'Orbigny's or Philippi's name has the right of priority. The date given on the title-page of the Spanish edition is 1845, but in the text the author refers to publications that did not appear until 1846. If this edition was published in fascicles, like the French edition, the Arcas probably were included in the last fascicle. Although the date of the French edition is usually given as 1853, the fascicles appeared at different times and the one containing the Arcas was probably published about 1847. Although d'Orbigny did not figure barbadensis there is no doubt concerning its identity since he stated that it was the form that had been confused with the Mediterranean A. noae Linnaeus. Until more definite information is available it is advisable to retain Philippi's long-established name.

Occurrence.- Upper Oligocene.- Santo Domingo (Guppy, 1874, 1876). Turacao (Dall, 1898). Lower Miocene: Bowden beds, Bowden, Jamaica (Guppy, 1874, Dall, 1898). Pliocene.- Caloosahatchie formation, Florida (Dall, 1898); ^{Trinidad (Guppy 1874)} Pleistocene.- Florida Keys, Yucatan, and most of the West Indian Islands (Dall, 1898). Panama (Brown and Pilsbry, 1913). Recent.- Hatteras to Santo Marta and Carthagena, east to Bermuda and off the west coast of North America in 1 to 20 fathoms.

ARCA UMBONATA Lamarck.

Arca umbonata Lamarck, 1819, Anim. sans vert. vol. 6, p. 37;

idem, 2d ed., 1835, p. 462.

Arca umbonata Lamarck, Philippi, 1847, Abbild. u. Beschreib.,

- vol. 3, p. 13, pl. 17b, figs. 3a-c.

Arca nose Stimpson, 1860, Smithsonian Inst., Checklist, Am. Mar.

Shells, p. 2. (non Linnaeus, 1758)

Arca imbricata Gabb, 1873, Trans. Amer. Philos. Soc., new ser.,

vol. 15, p. 254 (as of Bruguière, 1789)

Arca imbricata Gabb, 1881, Jour. Acad. Nat. Sci., Philadelphia,

2nd ser., vol. 3, p. 378 (as of Bruguière) ex parte. (synexcl.)

Arca imbricata Heilprin, 1887, Trans. Wagner Free Inst. Sci.,

Philadelphia, vol. 1, p. 118, (as of Bruguière, 1789)

Arca listeri ? Heilprin, 1887, idem, p. 118, (as of Philippi,

1847)

Arca imbricata Dall, 1889, Bull. U. S. Nat. Mus., No. 57, p.

40 (as of Bruguière, 1789)

Arca umbonata Lamarck, Dall, 1898, Trans. Wagner Free Inst.,

Sci., Philadelphia, vol. 3, pt. 4, pp. 620-621, pl. 53,
figs. 4, 4a.

Arca umbonata Lamarck, Dall & Simpson, 1901, Bull. U. S. Fish

Comm., vol. 20, pt. 1, p. 460.

Arca umbonata Lamarck, Dall, 1915, Bull. U. S. Nat. Mus., no. 90, p. 118, pl. 17, figs. 6, 8.

Description.- "A. testa transversim oblonga, ventricosa, angulato-sinuata, decussatim substriata; umbonibus magnis, arcuatis; latere postico brevissimo." (Lamarck, 1835)

The Bowden specimens are small, subrhomboidal, much inflated, very inequilateral; anterior margin almost at right angles to the long, straight dorsal margin, short, curving below into the ventral margin, which is very slightly arcuate and feebly emarginated anterior to the middle by the small byssal gape; obliquely truncated posteriorly; umbones very tumid, prominent, strongly incurved, opisthogyrate, placed at about the anterior third of the length of the hinge; posterior keel strong, but not excessively sharp or high; region dorsal to the keel slightly excavated; exterior surface anterior to the posterior keel covered with radial ribs, relatively coarse except in the region of the byssal gape; in the anterior half of the shell one or two fine radiating ribs often present in the interstices; the radial ribs crossed by weaker, low, irregular concentric ridges, producing a subimbricated sculpture; dorsal to the posterior keel three or four coarse, subnodulous ribs, succeeded by several finer ones; cardinal area very wide, the anterior portion marked by several oblique ligament grooves;

teeth small, numerous, uninterrupted; inner margin smooth except for a few, inconspicuous crenulations on the posterior end.

This species, which comes up to the Recent virtually unchanged is represented by several small valves. The largest has the following dimensions, - length, 18 mm.; maximum altitude, 8.5 mm.; semi-diameter, 5.8 mm.

Gabb's Santo Domingian specimens labelled A. imbricata Brug. are typical umbonata, but among his Costa Rican Pliocene imbricata are some A. (Calloarca) candida Gmelin.

Occurrence. - Upper Oligocene. - Tampa silex beds, Florida (Dall, 1898, 1915). Chipola marl, Florida (Dall, 1898). Oak Grove sand, Florida (Dall, 1898). Santo Domingo (Gabb, 1873). Lower Miocene: Bowden beds, Bowden, Jamaica.

Pliocene. - Limon, Costa Rica (Gabb, 1881).

Pleistocene. - Florida Keys and Antilles (Dall, 1898).

Recent. - Hatteras to southern Brazil, throughout the Antilles and east to Bermuda in less than 50 fathoms.

ARCA BOWDENIANA Dall.

Arca bowdeniana Dall, 1898, Trans. Wagner Free Inst. Sci., Philadelphia, vol. 3, pt. 4, pp. 622-623, pl. 33, fig. 12.

Description.- "Shell small, inflated, somewhat irregular, very inequilateral, the beaks almost posterior; dorsal slope conspicuous; its outer border with a stout keel and its surface somewhat excavated; beaks small pointed, prosogyrate; cardinal area wide lozenge-shaped, flattish, with a few grooves for the resilium forming a small lozenge near the beaks; sculpture as in A. umbonata, the imbrications close and subnodulous; shell not alate in front and with the anterior margin nearly vertical from the hinge-line; posterior end obliquely truncate, the basal angle most extended, the dorsal one forming nearly a right angle; anterior teeth ten, posterior twenty-seven, with no noticeable hiatus in the line, the teeth resembling those of A. paratina but proportionately larger; interior smooth, the posterior end with a few flutings, the rest of the margin entire; the byssal foramen narrow and its margins encroaching only moderately on the valves. Lon. 15, alt. of hinge-line 6, of beaks 8, diam. (greatest posteriorly) 9 m."

"This odd little shell is peculiar in being narrower near

the very anterior beaks and widest about the middle of the posterior slope. It appears to be easily discriminated from the other species of this variable group known to the region." (Dall, 1898)

Type locality.-- Bowden, Jamaica.

The statement, in the body of the description, that the "beaks are almost posterior" involves a typographical error; the beaks are anterior in position, being situated at about the anterior third of the length of the hinge. The posterior keel is very strong and sharp and the region dorsal to it is sharply excavated. The sculpture is very delicate. Anterior to the posterior keel the imbricated or cancellated effect is produced by the superposition of strong, somewhat irregular concentric ridges on weaker, but prominent, close-set radiating ribs of fairly constant width, except in the extreme anterior region where they are wider; dorsal to the posterior keel there are about three strong radial ribs, on which the concentric ridges are but feebly developed, followed by two or three narrow ribs.

A number of detached valves of A. bowdeniana are present in the collections, of these the largest is 17 mm. long, 8.5 mm. high and 4.5 mm. in semidiameter. Although there is the usual variation in regularity and proportions of shape, certain features are constant, such, as the sharpness of the posterior keel, the depth of excavation of the region dorsal to the keel and the fine,

subimbricated sculpture. Typically the posterior margin is conspicuously produced below.

Remarks.- A. bowdeniana is very closely related to the associated A. umbonata. There appears, however, to be constant differences between them. A. bowdeniana is smaller and usually less inflated, has slightly more prosogyrate beaks, finer sculpturing, larger teeth, a somewhat narrower cardinal area, a stronger posterior keel- which forms at the lower end of the posterior margin a usually prominent "wing"- and the region dorsal to the posterior keel is more excavated. But perhaps the most notable distinction lies in the differences in diameter of the various regions of the shell. In the case of bowdeniana the maximum diameter is at about the middle, i. e., posterior to the beaks, the diameter rapidly decreasing anteriorly across the beaks to the anterior margin; while umbonata has the greatest diameter at, or just posterior to, the beaks and from that point the decrease anteriorly to the margin is even more rapid.

A. grammatodonta Dall (1), of the Tampa silex beds fauna, is much larger, less inflated, the slope from the umbo to the anterior margin is less steep and the posterior slope is not as

(1). Dall, W. H., Bull. U. S. Nat. Mus., no. 90, p. 118, pl. 20, figs. 1, 2, pl. 22, fig. 3, 1915.

deeply excavated.

Occurrence.- Lower Miocene: Bowden beds, Bowden, Jamaica.
(Dall, 1898, 1907). Pliocene.- Limon, Costa Rica (Dall, 1898).

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ARCA BERRYI n. sp.

Description.- Shell very small, elongate, moderately inflated, trapezoidal in outline; both extremities of the dorsal margin angular; asymmetrically rounded anteriorly, truncated posteriorly; dorsal and ventral margins parallel; the ventral margin slightly contracted medially by the short, narrow byssal sate; umbones relatively high and prominent, inflated, placed at about the anterior third of the length; posterior ridge low and inconspicuous; sculpture typically of many clear-cut, rounded radial ribs, very narrow in the median portion of the shell and widest in the extreme anterior and posterior portions; the ribs may be finely and faintly nodulated by numerous low, concentric raised lines; cardinal area very wide, with usually a single set of fine ligament grooves that diverge from the umbones at an acute angle; hinge almost as long as the shell, straight; teeth uninterrupted medially, fine, numerous; inner margin of the shell with relatively deep crenulations except in the median ventral portion.

Dimensions.- Length, 10 mm.; alt., 5 mm.; semidiam., 3 mm.; length of hinge 7 mm.

Remarks.- The members of this species- the most abundant of the true Arcas- constitute a highly variable group. Although the typical trapezoidal outline is never lost, some specimens are

low and elongate, while others are higher and shorter. There is also considerable variation in the amount of inflation- some of the largest individuals being much more inflated than the typical form. Relative excess of inflation is concomitant with excessive height and a less flattened posterior slope. The radial ribs may be flat and feebly sculptured, instead of rounded and sharply chiseled. Occasionally the ribs are dichotomous and in the region in line with the narrow byssal gape, where the ribs are very narrow, secondary even narrower ribs are often present. There is such a profusion of individuals that it seems necessary to assume that the largest specimens are actually adult.

A. berryi is much smaller than any associated true *Arca*s. From the young of bowdeniana, occidentalis and umbonata it differs by the absence of a sharp, well-defined posterior ridge, as well as in shape and sculpture. A. (Scapharca) donacia is of about the same size or slightly smaller, but, besides the obvious differences that place the two in separate subgenera, the one is donaciform and the other trapezoidal.

This species is named for Prof. E. W. Berry, of the Johns Hopkins University, whose work has added greatly to the knowledge of the Atlantic and Gulf Coastal Plains.

Occurrence.- Lower Miocene: Bowden beds, Bowden, Jamaica.

Subgenus *Barbatia* (Gray) Adams.

Section *Acar* (Gray) Adams.

ARCA (*ACAR*) *RETICULATA* Gmelin.

Arca reticulata etc., Chemnitz, 1784, *Conch. Cab.*, vol. 7, p. 193,
pl. 54, fig. 540.

Arca reticulata Gmelin, 1791, *Syst. Nat.*, vol. 6, p. 3311.

Arca squamosa Lamarck, 1819, *Anim. sans Vert.*, vol. 6, p. 35,

Arca domingensis Lamarck, 1819, *idem*, p. 40.

Arca clathrata Lamarck, 1819, *idem*, p. 46.

?*Arca gradata* Broderip and Sowerby, 1829, *Zool. Journ.*, vol. 4,
p. 365.

Arca divaricata Sowerby, 1833, *Proc. Zool. Soc.*, London, for 1833,
p. 18.

Arca divaricata Sowerby, Reeve, 1844, *Conch. Icon.*, *Arca*, pl. 16,
fig. 108.

Arca reticulata Chemnitz, Lamarck, 1835, *Anim. sans Vert.*, 2nd ed.,
pp. 475-476.

Arca squamosa Lamarck, Cuppy, 1874, *Geol. Mag.*, Decade 2, vol. 1,
p. 443 (check list).

Barbatia (*Acar*)*reticulata* Gmelin, Dall, 1898, *Trans. Wagner Free*
Inst., Sci., Philadelphia, vol. 7, pt. 4, p. 629.

Arca reticulata Gmelin, Dall & Simpson, 1901, *Bull. U. S. Fish*
Comm., vol. 20, pt. 1, p. 460/

Barbatia (Acar) reticulata Gmelin, Dall, 1915, Bull. U. S. Nat.,
Mus., no. 90, p. 120/

Description.- "A. testa subrhomboidea decussatim striata
alba; natibus approximatis, valva cordata." (Gmelin, 1791)

The Bowden specimens are small, thick-shelled, subrhomboidal, moderately inflated; rounded anteriorly, obliquely truncated posteriorly; umbones low, broad, strongly incurved, prosogyrate, placed at about the anterior third of the length; posterior ridge well defined, subangular; external surface sculptured with strong, somewhat irregular concentric ridges, separated by deeply-channelled narrow grooves, and less prominent, but more numerous, radiating ribs; the concentric ridges often giving an imbricated effect, especially on the posterior ridge and occasionally showing superimposed fine concentric striae; posterior slope usually feebly sculptured; cardinal area narrow, excavated, becoming slightly wider in front of the umbo, transversely striated; hinge relatively short, gently arched; median teeth short and irregular or absent, posterior teeth more numerous than the anterior and more oblique; muscle scars prominent, the edges being raised above the surface of the shell; inner margin of the valves finely and irregularly crenulated.

Dimensions.- Length, 19 mm.; alt. 11 mm.; semidiam, 5 mm.;
length of hinge, 10 mm.

Remarks.- This characteristic species, which as an extended geological range in the Antillean region and its perimeters, is well represented in the Bowden fauna, The shape, and the peculiar half-imbricated and reticulated character of the sculpturing alone serve to distinguish this species from the other members of the genus.

Occurrence.- Upper Eocene.- Jackson group, Jackson, Mississippi (Dall, 1898). Oligocene.- Tampa silex beds, Tampa, Florida (Dall, 1898, 1915). Chipola marl, Florida (Dall, 1898). Matura, Trinidad (Guppy, 1874, "Pliocene"; Dall, 1898). Lower Miocene: Bowden beds, Bowden, Jamaica. (Dall, 1898). Pliocene.- Limon, Costa Rica (Dall, 1898). Caloosahatchie marl, Florida (Dall, 1898); ^{Trinidad (Guppy 1874)} Pleistocene.- Antilles generally (Dall, 1898). Recent.- Hatteras to Gulf of Campeche and east to Bermuda in 0 to 287 F. Occurs in both deep and shallow water off Hatteras; elsewhere in shallow water only.

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ARCA (ACAR) PROPENTUA n. sp.

Description.- Shell small, heavy, moderately elongated, well inflated; rounded anteriorly, the curve decidedly convex; posterior end produced below, subrounded above; base gently arcuate, descending toward the posterior end; umbones tumid, high and broad; posterior ridge prominent, rounded; ventral half of the shell with a slight median depression; external surface sculptured with numerous fine radial ribs separated by narrow interspaces except on the posterior slope where the ribs are wider and the interspaces of about the same width; the ribs occasionally dichotomous: concentric sculpture developed throughout by nodulations on the ribs; cardinal area narrow, excavated, widening slightly in front of the umbo, transversely striated; hinge with a continuous series of teeth, the teeth oblique at the extremities, small and vertical medially; inner margin of the valve without definite crenulations.

Dimensions.- Max. length, 8 mm.; max. alt. 5.8 mm.; semidiam. 1.8 mm.; length of hinge, 4.5 mm.

This species is described from a single valve. It is immediately distinguished from A. reticulata by its less elongate form, more rounded posterior ridge and decidedly finer sculpture. The Calcosahatchie A. millifila Dall(1) is larger, proportionately

(1). Trans. Wagner Free Inst. Sci., Philadelphia, vol. 7, pt. 6, p/ 1629, pl. 56, figs. 21, 24, 1907.

higher and has a straighter base, fewer and less conspicuously
modulated radials and wider interspaces.

Occurrence.- Lower Miocene: Bowden beds, Borden, Jamaica.

Section Calloarca Gray.

ARCA (CALLOARCA) CANDIDA Gmelin.

Arca candida Helblingi Chemnitz, 1874, Conch. Cab., vol. 7, p.
195, pl. 55, fig. 542.

Arca candida Gmelin, 1791, Syst. Nat., vol. 6, p. 3311.

Arca jamaicensis Gmelin, 1791, idem, p. 3312.

Arca Helblingii Bruguière, 1797, Encycl. Meth., p. 195.

Arca candida Chemnitz, d'Orbigny, 1845, in de la Sagra, Hist.
fis., polit. y natur. de la Isla de Cuba, Molluscos,
p. , (Spanish ed.); 1853, idem, vol. 2, pp. 519-520,
(French ed.).

Barbatia Bonaczi Gabb, 1873, Trans. Am. Philos. Soc., new ser.,
vol. 15, pp. 254-255.

Arca imbricata Gabb, 1881, Jour. Acad. Nat. Sci., Philadelphia,
2nd ser., vol. 8, p. 378, (as of Bruguière) ex parte. (syn excl.)

Barbatia (Calloarca) candida Gmelin, Dall, 1908, Trans. Wagner
Fr e Inst. Sci., Philadelphia, vol. 3, pt. 4, pp.
626-627.

Arca candida Gmelin, Dall & Simpson, 1901, Bull. U. S. Fish Comm.,
vol. 20, pt. 1, p. 460.

Description.- "A. testa pellucida rhombidali anterius producta posterius truncata decussatim striata; natibus remotis, marginem posterius hians; hiata ovato ciliato." (Gmelin, 1791)

The Bowden specimens are of medium size, subtrapezoidal in outline, somewhat compressed; asymmetrically rounded anteriorly, posterior end truncated above, acutely produced below; posterior ridge low and broad; umbones low, situated at about the anterior fourth of the length; external sculpture of numerous, sharply cut closely spaced radial ribs of different width, being narrowest in the central portion of the shell; the ribs occasionally dichotomous or the interspaces with secondary, intercalate radials; ribs nodulated at irregular intervals, the ribs being widest and strongest, the intercostal spaces widest and the nodules most prominent on and behind the posterior ridge; cardinal area of medium width, crossed by several diverging ligament grooves; teeth in an uninterrupted series; but the median teeth very short; inner margins with irregular, inconspicuous crenulations.

Dimensions.- Length, 26.5 mm.; alt., 17 mm.; semidiam., 5.8 mm.; length of hinge, 15 mm.

Remarks.- Numerically this species is well represented, but the majority of the specimens are much smaller than the one measured. Some irregularity in shape and proportions is noticeable. A. candida may be recognized by its somewhat compressed valves and

beaded radial ribs, which are especially prominent on the posterior slope.

The Santo Domingian form which Gabb described as Barbatia bonaczyi apparently is candida, although one of his two types has sculpture that is finer than usual and both have a less sharp posterior ridge and therefore a less excavated posterior slope than the average candida. As mentioned above in the discussion of A. umbonata, Gabb's Costa Rican Pliocene material under the name of imbricata includes some forms which should be referred to candida.

Occurrence.-- Oligocene.-- Chipola marl, Florida (Dall, 1898) Santo Domingo (Gabb, 1873). Lower Miocene: -- Bowden beds, Bowden, Jamaica (Dall, 1898). Pliocene.-- Limon, Costa Rica (Gabb, 1881). Trinidad (Dall, 1898). Pleistocene.-- The Antilles generally (Dall, 1898). Recent.-- Hatteras to southern Brazil in less than 50 fathoms.

ARCA (CALLOARCA) ENDOMENA n. sp.

Description.- Shell small, elongated, subtrapezoidal, decidedly inflated; dorsal and ventral margins subparallel, the ventral margin slightly arcuate, with a broad, feeble insinuation toward the posterior end; rounded anteriorly; posteriorly truncated, produced below; umbones tumid, broad, situated at about the anterior third of the length; posterior ridge rounded, but prominent; external surface sculptured with numerous radial ribs; the extreme anterior ribs separated by interspaces of virtually the same width, the succeeding ribs narrower, with the interspaces wider than the ribs and often bearing a fine secondary radial; toward the posterior ridge the ribs become wider and are separated by narrow impressed lines; on the posterior slope ribs few and broad, interspaces of about the same width; the radials bearing obscure elevations along concentric lines, except in the anterior portion of the shell where the concentric sculpture forms definite nodules; cardinal area moderately wide, the posterior portion with obliquely directed ligament grooves; hinge bearing about twenty-five teeth, the posterior ones notably oblique, the anterior less oblique, the series uninterrupted medially; posterior and anterior inner margins obscurely crenulated.

Dimensions.- Max. length, 10 mm.; alt., 5.5 mm.; semidiam., 2.5 mm.; length of hinge, 6.5 mm.

Remarks.- A. endorana is represented by one valve. Some of the characters suggest that its proper place is in the section Acar, but the cardinal area is too wide. It differs from the young of A. candida of the same size by being more elongate, but less produced at the postero-ventral angle, more inflated, with higher umbones and less conspicuously developed concentric sculpture.

Occurrence.- Lower Miocene: Bowden, beds, Bowden, Jamaica.

ARCA (CALLOARCA) DELSPIDA n. sp.

Description.- Shell small, moderately elongated, well inflated; anterior end rounding rapidly into the base; base almost straight very feebly emarginated medially, flexed upward at the posterior end; posterior margin produced below, obliquely truncated above; umbones conspicuous, broad; posterior ridge rounded; external sculpture consisting of numerous, fine radial ribs, ornamented with conspicuous, delicately sculptured, square or slightly elongated, nodules throughout; as usual, anteriorly and posteriorly the ribs and interspaces wider, especially on the posterior slope; cardinal area wide for the size of the shell, with obscure transverse striations in the anterior and median regions and deeper oblique grooves posteriorly; hinge-teeth forming a continuous series, the teeth relatively heavy, normal in position; anterior and posterior inner margins obscurely crenulated.

Dimensions.- Max. length, 6.5 mm.; alt. 4.2 mm.; semidiam., 1.8 mm.; length of hinge, 5 mm.

Remarks.- The distinguishing feature of this species, which also is represented by only a single valve, is the delicate, reticulated sculpture, by which feature alone it may be separated from the associated Calloarcas. Because of the character of the

sculpture it externally bears a closer resemblance to A. (Acar)
- proptus than to either canifia or endomena, but it differs from
but it differs from that species by being more regular in outline,
more elongated, with a more delicate and more regular sculpture; more-
over, there is the difference in the cardinal areas which places
the two- perhaps unnaturally- in different sections.

Occurrence.- Lower Miocene: Bowden beds, Bowden, Jamaica.

ARCA (CALIOARCA) INUSITATA n. sp.

Description.- Shell of medium size, high, somewhat compressed, irregular; posteriorly obliquely truncated above and produced below; irregularly rounded anteriorly; anterior portion of the ventral margin distorted by the long, wide byssal gape; umbones relatively low, broad, decidedly prosogyrate, at about the anterior third of the length; posterior ridge prominent, the region behind the ridge being excavated; external surface sculptured with numerous, very narrow, irregular radial ribs, occasionally dichotomous and the interspaces occasionally bearing intercalated narrower secondary ribs; interspaces usually narrower than the ribs; the posterior slope sculptured with four ribs much coarser than the others; concentric sculpture of irregular growth lines and occasional raised lines, the two producing in certain portions of the shell a feeble semi-reticulated sculpture; cardinal area relatively short and wide, conspicuously marked by six or seven concentric ligament grooves; hinge gently arched; anterior teeth irregular, median teeth very short, almost obsolete, posterior teeth large, oblique; inner margin of the shell smooth or with faint crenulations.

Dimensions.- Length, 31.5 mm.; alt. 22 mm.; semidiam., 7.8 mm.; length of hinge 12 mm.

Remarks.- Several valves are referred to this species, among them one which is not typical since it is more produced posteriorly and the cardinal margin is longer behind the umbo. It is to be expected, however, that so irregular a form should be variable.

A. inusitata may be recognized by its irregular, distorted shape, prominent byssal gape, excavated posterior slope and numerous, fine radials. Several closely related species have been described from various localities. A. irregularis Dall (1), a Tampa silex and Caloosahatchie form, is larger, with umbones that are

(1). Trans. Warner Free Inst. Sci., Philadelphia, vol. 3, pt. 4, pp. 623-624, pl. 73, fig. 5, 1898.

more posterior in position and coarser ribs. A. marylandica Conrad (2), from the Oligocene of Florida and the Miocene of Mary-

(2). Fos. Med. Ter. U. S., p. 54, pl. 29, fig. 1, 1840/

land, is larger, with lower, less inflated umbones, a broad, low posterior ridge and an unexcavated posterior slope. The Tampa silex A. arcuata Heilprin (5) is higher, more inflated, less regular

(5). Trans. Wagner Free Inst. Sci., Philadelphia, vol. 1, p. 118, pl. 16, fig. 65, 1887.

in outline, with a less prominent posterior ridge and less excavated posterior slope.

Occurrence.- Lower Miocene: Bowden beds, Bowden, Jamaica.

Section Stenoarca n. sect.

Etymology.-- στενός - narrow; arca.

Shell small, reticulately sculptured; umbones almost terminal, strongly prosogyrate; cardinal area narrow, impressed, long, entirely or almost entirely opisthodetic; hinge-teeth in two series, the anterior series short, thickened, more or less irregular, subumbonal in position, the upper thickened margin ceasing abruptly behind the umbo: posterior series longer and normal; the two series continuous or interrupted by the evanescence of the teeth at the anterior end of the posterior series.

Type.-- A. dentera n. sp.

Three new species are referred to this section; of these dentera and subcandeida have an uninterrupted series of teeth, with the anterior series notably thickened, while adult individuals of modioleida usually have a medial, wide elephantous area. A. subcandeida has a very small portion of the cardinal area before the umbones and in the case of the other two species the cardinal area is entirely opisthodetic. From the above statements it is evident that this section is not sharply differentiated, but forms an intergrading series with other sections. The shape of dentera and subcandeida suggests halloarca; in shape and in the possession of an interrupted dental series modioleida resembles halloarca and also lucullaria, but the cardinal area does not extend in front

of the umbo. The cardinal area of A. subcandeilla reaches in front of the umbo for a very short distance and in that respect it bears a resemblance to some Dalloarces, but this species has the peculiar hinge of dentera, the type of the section. The division of the teeth into a short, more or less irregular anterior series and longer, normal posterior series is somewhat similar to that found in the section Argina of the subgenus Scapharca, but the general facies precludes the possibility of finding a place for these forms among the Arginas. With regard to hinge elements Stenoarca appears to have much the position among the Barbetias that Argina has among the Scapharces.

ARCA (STENOARCA) DENTERA n. sp.

Description.- Shell small, well inflated, decidedly inequilateral; almost vertically subtruncated anteriorly, produced and abruptly rounded posteriorly, base gently arcuate; umbones full, broad, relatively prominent, strongly prosogyrate, placed almost at the anterior fifth of the length; posterior ridge broad and low; external sculpture of numerous, narrow, weakly sculptured radial ribs of varying width, being widest posteriorly; concentric sculpture of irregularly spaced incremental lines and striae, slightly affecting the radial ribs; cardinal area entirely opisthodetic, narrow, impressed, crossed by three oblique, slightly raised lines; anterior series of teeth consisting of six thickened, irregular teeth placed under the umbo, the thickened area ceasing abruptly behind the umbo and succeeded immediately by the posterior series, the latter numbering twenty-three teeth which increase in size toward the distal end and at the end of the series become oblique in position; inner margin of the valve smooth.

Dimensions.- Length, 16 mm.; alt., 10.5 mm.; semidiam., 4.1 mm.; length of hinge, 9 mm.

Remarks.- Only a single valve of this interesting form is present. The shape and sculpture suggest *Galloarca*; the hinge *Argina*; but the cardinal area is unique.

Occurrence.- Lower Miocene: Bowden beds, Bowden, Jamaica.

ARCA (SEMIOARCA) SUBLANDEIDA n. sp.

Description.— Shell small, transversely subelliptical, higher and more produced posteriorly, slightly inflated; posterior dorsal margin direct; rounded posteriorly, the curve of the upper portion being less convex; subtruncated anteriorly; ventral margin sloping gently downward toward the posterior end; umbones very low and flat, strongly prosogyrate, situated at about the anterior fifth of the length; posterior ridge low and very broad in the umbonal region, becoming obsolete toward the margin; external surface sculptured with numerous fine radial ribs, narrowest in the region below the umbo and widest posteriorly; the ribs separated by fine impressed lines except on the posterior slope where between some of the ribs are interspaces as wide as the ribs themselves; concentric sculpture of regular, closely spaced concentric impressed lines, overriding the radials, thus producing a conspicuous reticulated sculpture and causing the ribs on the posterior slope to be nodulated; cardinal area narrow, impressed, almost entirely opisthodetic, the very short portion in front of the umbo being widest; hinge as in A. dentera n. sp., but with five teeth in the anterior series and eighteen in the posterior; inner margin of the valve smooth.

Dimensions.— Length, 13 mm.; umbonal alt. 7.6 mm.; max. alt., 8.2 mm.; semidiam., 2.8 mm.; length of hinge, 7 mm.

Remarks.- This species, also represented by a single valve, is closely related to A. dentera and undoubtedly belongs in the same genetic series. Differences between them involve factors of proportions, outline and sculpture. Aside from the difference in size, which may be of no significance, subcandeida is lower, more compressed, especially posteriorly, the base has a decided slope; the umbo is lower, less inflated, more anterior in position; the sculpture sharper and more obviously reticulated and the cardinal area extends in front of the umbo.

Occurrence.- Lower Miocene: Bowden beds, Bowden, Jamaica.

ARCA (SIBENARCA) MODIOLLEIDA n. sp.

Description.- Shell small, thin, modioliform, somewhat compressed, very inequilateral, produced and higher posteriorly; posterior dorsal margin direct, long, anterior end rounded below, subtruncate above; rounded posteriorly, the curve being less convex above; ventral margin sloping downward posteriorly, slightly contracted medially; umbones very low, almost terminal; posterior ridge not well defined distally, but high and broad in the umbonal region; sculpture of low radials, fine and separated by impressed lines in the region before the posterior ridge, coarser, swollen and separated by as wide or wider interspaces behind the posterior ridge; concentric sculpture of fine concentric impressed lines, as well as irregular incremental lines, producing a reticulated sculpture on unworn portion of the shell; cardinal area very narrow, entirely opisthodontic, deeply impressed, with a low median ridge extending from the anterior end of the area to its ventral margin at about the middle of the posterior series of teeth; anterior teeth numbering four to six, slightly oblique, more or less irregular, subumbonal in position, medial teeth very short and weak, or obsolete, producing a long edentulous gap; about eight oblique teeth at the distal end of the posterior series; inner margin of the valve smooth or minutely crenulated.

Dimensions.- Length, 10 mm.; alt. in umbonal region, 4.1 mm.; alt. in posterior region, 6 mm.; semidiam., 1.9 mm.

Remarks.- The peculiar modiolus-like form of this small species at once distinguishes it from the co-existing Arcas. It is represented by a number of valves; several being slightly larger than the type. The shape suggests Balloarca and the hinge Cucularia, but the peculiarities of the cardinal area connect it most closely with the section Stenoarca. In the case of this species the remarkable features of the cardinal area are even more strongly emphasized than in the other two species of the section. The cardinal area is entirely opisthodetic, exceedingly narrow and so deeply impressed as to be almost internal; indeed, if any portion of the ligament occupied the area below the median ridge it may very well have been entirely internal. The teeth are typical of the section in that they are divided into two series, but the teeth in the middle of the hinge are very weak or entirely obsolete, leaving only the irregular anterior teeth and the oblique, regular teeth at the distal end of the posterior series.

All of the valves are more or less worn, so that the sculpture, which is never prominent, is often faint. Several individuals are less inflated throughout and more compressed in the posterior dorsal region than the typical form. A. subcandeida is larger, the posterior ridge is less prominent proximally, the slope of the ventral margin less steep, the anterior margin not produced below and the sculpture coarser.

Occurrence.- Lower Miocene: Bowden beds, Bowden, Jamaica.

Section Fossularca Gossmann.

ARCA (FOSSULARCA) ADAMSI Dall.

Arca coelata Conrad, 1845, Fos. Med. Ter. U. S., p. 61, pl. 32,
fig. 2.

Arca coelata Conrad, Tuomey and Holmes, 1857, Pleioc. Fos. South
Carolina, p. 22, pl. 4, figs. 6, 6a.

Not A. coelata Reeve, 1844.

Arca Adamsi Shuttleworth, Guppy, 1874, Geol. Mag. Decade 2, vol.
1, p. 443 (check list).

Arca Adamsi Shuttleworth, Dall, 1886, Bull. Mus. Compt. Zool.,
Harvard, vol. 12, p. 243,

Arca Adamsi (Shuttleworth Mss.) Smith, 1888, Jour. Lin. Soc.,
London, Zool., vol. 20, p. 499, pl. 30, figs. 6, 6a.

Barbatia (Fossularca) Adamsi (Shuttleworth) Smith, Dall, 1898,
Trans. Wagner Free Inst. Sci., Philadelphia, vol. 3,
pt. 4, pp. 629-630.

Arca adamsi Smith, Dall & Simpson, 1901, Bull. U. S. Fish Comm.,
vol. 20, pt. 1, p. 461.

Barbatia (Fossularca) Adamsi Smith, Dall, 1915, Bull. U. S. Nat.
Mus., no. 30, p. 121.

Description.- "Trapezoidal, disk widely and not profound-
ly contracted; ribs numerous, alternated towards the base, tuber-

culated, achleated anteriorly and posteriorly; posterior slope depressed; umbo acutely angulated behind; basal margin slightly arched; posterior margin obliquely truncated; beaks approximate." (Conrad, 1845)

".....Its simulated ribs of trailing blisters give it a remarkable similar appearance to Arca lactea, which however has real ribs." (Dall, 1886)

The Bowden specimens are small, moderately inflated, subtrapezoidal in outline, slightly inequilateral; rounded anteriorly, obliquely truncated posteriorly, ventral and dorsal margins parallel, the ventral margin very slightly contracted medially; posterior ridge low and broad; umbones relatively low, broad, placed slightly anterior to the median horizontal; external sculpture of "blisters" more or less connected radially and concentrically, forming a delicate cancellated sculpture; beneath the blisters, which are invariably partially or even entirely removed, are faint, slightly elevated radial and concentric lines, as well as irregularly spaced concentric lines of growth; cardinal area narrow, excavated, the ligament seated on a subumbonal triangular area; teeth in two series separated by a narrow subumbonal edentulous space; about fifteen teeth in the posterior series and eight in the anterior; muscular impressions well-defined, bounded by raised ridges which converge toward the umbones; inner margin of the valve usually entire.

Dimensions.-- Length, 8.5 mm.; alt., 6 mm.; semidiam., 2.2 mm.; length of hinge, 5 mm.

Remarks.-- When compared with other specimens of this widely ranging species, it is apparent that the Bowden representatives are smaller; the posterior ridge lower; the ventral margin less contracted and the edentulous gap in the hinge shorter. The delicate cancellated sculpture formed by the "trailing blisters", as Dall has happily described them, is very characteristic. The blisters, however, are easily worn off and all of the specimens have only a few of them remaining, the surfaces from which the blisters have been removed being almost smooth. The elevated ridges that bound the muscle scars appear to better advantage on the posterior scar.

Recent specimens of this species apparently were early distributed under the manuscript name of A. adamsi Shuttleworth and Dall was the first, as Miss Gardner has shown, (1) to define it.

(1). Mss.

Smith, to whom the species is usually assigned, did not publish his description until two years later.

Occurrence.-- Cliocene.-- Tampa silex beds, Florida (Dall, 1898, 1915). Chipola marl, Florida (Dall, 1898). Oak Grove

sand, Florida (Dall, 1898). Lower Miocene: Bowden beds, Bowden, Jamaica (Dall, 1898). Miocene.- Yorktown formation, Virginia (Gardner, Mss.) Duplin formation, North Carolina (Conrad, 1845, Dall, 1898, Gardner Mss.). Brunswick River bed, Georgia (Gardner, Mss.). Pliocene.- Caloosahatchie Marl, Florida (Dall, 1898). Paccamaw formation, North Carolina (Dall, 1898, Gardner, Mss.); South Carolina, (Gardner, Mss.). Croatan formation, North Carolina (Gardner, Mss.); ^{Trinidad (Guppy 1874)} Pleistocene.- Simon's Bluff, South Carolina (Gardner, Mss.). Labelle, Florida. Recent.- Hatteras to Fernando Noronha, Brazil and east to Bermuda in 10 to 55 fathoms.

ARCA (FOSSULARCA ?) OVALINA Dall.

Barbatia (Fossularca ?) ovalina Dall, 1898, Trans. Wagner Free
Inst. Sci., Philadelphia, vol. 3, pt. 4, p. 670, pl. 72,
fig. 18.

Description.- "Shell minute, solid, ovate, with rather inflated valves; beaks low in the anterior fourth, prosogyrate; cardinal area short, narrow, smooth, or longitudinally striate, the part occupied by the ligament forming a small excavate triangle with the apex at the beak in each valve; surface nearly smooth, sculpture of faint, irregular, concentric lines, crossed by still fainter sparse radiations which are not pronounced enough to modify the surface; inner margin of the valves smooth; muscular impressions large; hinge short with about three crowded anterior and four oblique posterior teeth, the two series separated by a wide gap below the ligament. Lon. 3.2, alt. 2.5, diam. 2 mm."

"A single specimen of this curious little shell, with the form of a Nucula, the cardinal margin of a Littopsis, and the teeth of an Arca; was found in the marl. It should, perhaps be referred to Lissarca Smith." (Dall, 1898).

Type locality.- Bowden, Jamaica.

Remarks.- Two valves, one from each collection, of this

puzzling form are present. It certainly is not a typical *Toscul-
arca* and probably should be referred to a new section. The umbo
is almost anterior in position, so that the shell is very inequi-
lateral. Four anterior and five posterior teeth are present, and
in both series the teeth are more closely spaced than in the spec-
imen figured by Dall.

Occurrence.- Lower Miocene: Bowden beds, Bowden, Jamaica.

Subgenus Scapharca Gray.

Section Scapharca s. s.

ARCA (SCAPHARCA) HALIDONATA Dall.

Arca consobrina Guppy, 1866, Quart. Jour. Geol. Soc. London, vol. 22, p. 293 (non Sowerby, 1850).

Arca consobrina Guppy, 1874, Geol. Mag., Decade 2, vol. 1, p. 443, /4.
(check list) ex parte, non Sowerby, 1850.

Not A. consobrina d'Orbigny, 1844.

Scapharca (Scapharca) halidonata Dall, 1898, Trans. Warner Free
Inst. Sci., Philadelphia, vol. 8, pt. 4, pp. 646-647,
pl. 33, fig. 24.

Description.- "Shell subequivalve, ovate, oblique, inflated; beaks rather high, strongly bent forward, almost reaching the anterior fourth of the length; left valve larger, with about thirty-four clear-cut, elegantly sculptured radial ribs; the anterior dozen ribs are usually dichotomous or deeply sulcate; the ribs on the middle of the shell are grooved with one or two shallow, sharp, incised lines; the more posterior ribs are wider and flatter with three or more grooves; those on the posterior dorsal slope are angular, narrower, and usually have not more than one groove, which is nearly obsolete; the concentric sculpture is of evenly spaced, fine, elevated lines arched in the interspaces and finely nodulat-

ing the anterior ribs; the sculpture is similar on both valves; the anterior end of the shell is rounded, the base arcuate, the posterior end oblique above and produced below; the ends of the hinge-line are angulate^d; the cardinal area is moderately wide with about three concentric lozenges outlined by the grooving; the hinge-line is straight, the teeth numerous and mostly vertical, the two series not interrupted^d, the posterior distal teeth tending to become irregular in the adult. Long. of shell 55, of hinge-line 41, alt. 40, diam. 40 mm.; large specimens reach a length of 68 mm." (Dall, 1898).

Type locality.- Bowden, Jamaica.

Angle between the antero-dorsal margin and the antero-lateral margin almost 90° , that between the postero-dorsal and postero-lateral about 125° ; anterior radial ribs about equal to the interspaces, but the posterior ones broader; in the anterior portion of the shell the ribs have a relatively broad and deep sulcus which extends half of the distance from the margin to the umbo; toward the central portion of the shell the sulcus occupies only the distal third or fourth of the ribs and becomes progressively shallower and narrower until in the central portion of the shell it is merely a sharp line (one or two of which may be present); ribs immediately anterior to the posterior slope broader and having three or four inconspicuous lines; those on the posterior

slope low, flat, relatively broad, and with one or two, usually faint, lines; closely and evenly spaced concentric lines present, producing nodules on the ribs, except on those on the posterior slope and a few immediately anterior to it, the nodulations being most conspicuous on the proximal half of the ribs; inner margin of the shell deeply crenulate.

Dimensions.- Length, 59 mm.; alt., 45.5 mm.; semidiam., 20 mm.; length of hinge-line, 40 mm.

Remarks.- Individuals of this species are very abundant, in fact, it is the most abundant area, and all stages of growth are represented. Young forms have a shape that is noticeably different from that of the adults; the upper part of the posterior lateral margin is not obliquely truncated or the truncation is not pronounced and the lower part of the same margin is not as much produced, so that the angle between the postero-dorsal and postero-lateral margins is less obtuse, and the entire posterior lateral margin straighter. Other differences between young and adult are apparent when details of sculpture are considered. On adolescent shells the sulcus appears on only a few of the anterior ribs and the lines on the posterior ribs disappear; while on young shells the ribs in even the extreme anterior portion of the shell are not sulcated, in other words, there is a progressive diminution in the number of anterior ribs that display sulcation. Some immature

forms, left valves in particular, are more inflated than the typical form and have more deeply channeled interspaces.

This is the species which Guppy identified as A. consobrina Sowerby (not A. consobrina d'Orbigny), which was described from Santo Domingo. The relations between halidonata and Sowerby's consobrina and the question of nomenclature is discussed under the following variety.

Occurrence.- Upper Oligocene.- Curacao (Dall, 1898) Cumana, Venezuela (Guppy, 1874). Lower Miocene: Bowden beds, Bowden, Jamaica. (Guppy 1866, 1874; Dall 1898).

ARCA (SCAPHARCA) HALIDONATA var. HISPANICOLA n. nom.

Arca consobrina Sowerby, 1850, Quart. Jour. Geol. Soc. London,
vol. 6, p. 52, pl. 10, fig. 12.

Arca (Anadara) consobrina Sowerby, Gabb, 1873, Trans. Am. Philos.
Soc., new ser., vol. 15, p. 253. (syn. excl.)

Arca consobrina Sowerby, Guppy, 1875, Geol. Mag., Decade 2, vol. 14
1, p. 443 (check list), ex parte.

Arca consobrina Sowerby, Guppy, 1876, Quart. Jour. Geol. Soc.,
London, vol. 32, p. 531.

Not A. consobrina d'Orbigny, 1844.

? Arca cf. consobrina Moore, Toulou, 1908, Jahrb. K.-k. geol. Reich-
sanstalt, vol. 58, pp. 717-718, pl. 27, fig. 1.

Not A. consobrina Sowerby of Guppy, 1866 (= A. halidonata Dall)
or Gabb, 1881.

Description.- "Testa oblonga, obliqua, aequivalvis, radia-
tim costata, lateribus superne angulatis, antico infra rotundata,
postico rotundato-angulato; costis anastomosis, numerosis, plerum-
que quadratis, et decussatis, ad basin sulcotenae divisae, postic-
is fere laevibus, planulatis; area cardinali latiusculca." (Sow-
erby, 1850).

Type locality.- Santo Domingo.

Shell large, subtrapezoidal, the length more than one and one-half times the height, inflated; umbones relatively low and flat, strongly bent forward, situated at almost the anterior third of the length; angle between antero-dorsal and antero-lateral margins about 90° , that between postero-dorsal and postero-lateral margins about 130° ; anterior lateral margin rounded; posterior lateral margin obliquely truncated above and produce below; posterior half of ventral margin subparallel to the dorsal margin, anterior half gently arcuate; external sculpture the same as on the typical halidonata; cardinal area, hinge and interior margin as in halidonata.

Dimensions.-- Length, 70 mm.; alt., 44 mm.; semidiam., 21 mm.; length of hinge-line, 52 mm.

Remarks.-- It is here proposed to consider Arca consobrina Sowerby a variety of A. halidonata Dall. Although Sowerby's description is brief and inadequate, the accompanying figure is satisfactory so that there is little doubt as to the salient features of his consobrina. Unfortunately, however, as Dall has pointed out (1), consobrina had been used in 1844 by d'Orbigny (2) for a

(1). Trans. Wagner Free Inst., Sci., Philadelphia, vol. 3, pt. 4, p. 647, 1898.

(2). Pal. Francaise, (Terraine Bret.) vol. 7, pp. 209-210, pl. 211, figs. 4-7, 1844.

form from the Neocomian of the Paris Basin. Thus Sowerby's name is preoccupied, although d'Orbigny's area consobrina is a Lusulacea.

In the collections at hand some adults of halidonata vary somewhat with regard to shape and the height of the umbones. The typical halidonata is relatively high and has high, prominent umbones, but there are variants in the direction of greater elongation and lower beaks. The end product of such variation is the form described by Sowerby as area consobrina, which differs from A. halidonata in being more elongated, in having a straighter base line and lower and flatter umbones as Dall has shown. (1)

(1). loc. cit.

In addition, the umbones of Sowerby's consobrina are placed slightly farther toward the middle of the shell and the upper portion of the posterior lateral margin is more oblique, in other words, the angle between the postero-dorsal and postero-lateral margins is more obtuse. Since these differences are scarcely of specific grade, and since, moreover, the end products are almost completely connected, it seems better to consider the more elongate form as merely a variety of halidonata. In the collections at hand there are only three large right valves that can with certainty be referred to the variety, although, as stated above, some of the halidonata forms vary in that direction. The absence of any small-

er specimens of hispaniolia may be due to the uncertainties of collection, but it is possible that the young forms differ so little from halidonata that they cannot be separated.

The Santo Domingian forms that Gabb determined as A. consobrina Sowerby are typical, but to place A. floridana Conrad in synonymy was an error. It is probably safe to suspect that the citation of Guppy for the occurrence of consobrina in "Haiti" refers to hispaniolia, but it is uncertain whether the Jumaná specimens are halidonata or its variety; Gabb's Costa Rican Pliocene consobrina (1) is scarcely the same as the Santo Domingian form, being higher and

(1). Jour. Acad. Nat. Sci., Philadelphia, 2nd ser., vol. 8, p. 378, 1881.

more convex.

Toula is mistaken in assigning consobrina to Moore, whose description of "Some Tertiary Beds in the Island of San Domingo" immediately preceeds Sowerby's description of the shells. The single Gatun specimen is so poorly preserved that it is difficult to determine what it actually is. Toula comments on the marked dichotomy of the posterior ribs, a feature which is most characteristic of hispaniolia.

The Miocene (Duplin) and Pliocene (Waccamaw and Caloosahatchie)

A. lienosa Say (1) of the same size has a similar appearance, but is more evenly rounded anteriorly and has a slightly more arcuate base, more numerous and flatter ribs which have a more definite median sulcus and also a secondary sulcus on either side and are more obviously and finely nodulated. The recent West Indian A. secticostata Reeve (2) also is more completely rounded anteriorly

(1). Am. Conch., pl. 36, fig. 1, 1830.

(2). Conch. Icon., Arca, fig. 38, 1844. (= A. foridana Conrad, 1869)

and has wider interspaces.

Occurrence.- Upper Oligocene.- Santo Domingo (Sowerby, 1850; Gabb, 1873; Guppy, 1874, 1876) ?Cumana, Venezuela (Guppy, 1874) ?Gatun formation, Panama (Toula, 1908). Lower Miocene: Bowden beds, Bowden, Jamaica.

ARCA (SCAPHARCA) PERPLEURA n. sp.

Description.- Shell of medium size, heavy, decidedly inflated, moderately inequilateral; base gently and evenly rounded, subtruncated posteriorly, rounded anteriorly; umbones moderately high, full, prominent, with an inconspicuous median sulcation, situated at about the anterior third of the length; external surface sculptured with thirty-three high, flat-topped radial ribs of uniform width, separated by narrower deeply-channelled interspaces; on the posterior slope the ribs lower and the interspaces wider than in the other portions of the shell; concentric sculpture of fine, usually evenly spaced raised lines, producing low nodules on the ribs, except on those on the posterior slope; cardinal area moderately wide with two ligament grooves behind the umbo; teeth numerous, vertical, except at the posterior end, the series continuous; inner margin with deep crenulations.

Dimensions.- Length, 23.5 mm.; alt., 17.5 mm.; semidiam., 9.6 mm.; length of hinge, 17 mm.

Remarks.- *A. perpleura* is represented by two detached left valves. It resembles most closely individuals of the same size belonging to the species *halidonata*, but differs by being proportionately more elongate, heavier, less compressed in the posterior dorsal region, more inflated and by having fuller, more prominent beaks,

higher ribs and more deeply channeled interspaces.

Occurrence.- Low Miocene: Bowden beds, Bowden, Jamaica.

ARCA (SCAPHARCA) INAEQUILATERALIS Guppy.

Arca inaequilateralis Guppy, 1866, Quart. Jour. Geol. Soc. London,
vol. 22, pp. 293-294, pl. 23, fig. 2.

Arca inaequilateralis Guppy, 1874, Geol. Mag., decade 2, vol. 1,
p. 447, (check list).

Scapharca (Scapharca) inaequilateralis Guppy, Dall, 1898, Trans.
Wagner Free Inst. Sci., Philadelphia, vol. 7, pt. 4,
p. 647.

Description.- "Shell transverse, slightly oblique, very inequilateral, produced posteriorly; valves with about 30 crenate radiating ribs, single on the disk, where they are not broader than one-third of their interstices; double anteriorly and posteriorly, where they are equal in width to the interstices; hinge-line long straight, forming an abrupt angle with the rounded anterior margin; posterior margin with an oblique slope." (Guppy, 1866)

Type locality.- Jamaica.

Shell small, thin, elongate, subovate, moderately inflated; umbones low, situated at about the anterior third of the length; the straight dorsal margin forming sharp angles with both lateral margins; angle between the dorsal and anterior lateral margin being slightly more than 90° , the one between the dorsal and posterior lateral margins about 135° ; extreme upper portions of ant-

erior and posterior lateral margins feebly incised on adult shells; anterior margin rounded; upper portion of posterior margin obliquely truncated, lower portion produced; ventral margin sloping toward the posterior end; sculpture of the two valves similar, consisting of about thirty, clear-cut radiating ribs, the one adjacent to the antero-dorsal margin usually small and narrow; the next eight to twelve broad, being wider than the interspaces, and having a shallow, broad median sulcus; ribs in the central portion of the shell narrow, usually less than half as wide as the interspaces, and usually square; the posterior ribs, nine to eleven in number, much wider than the interspaces, flat and with a narrow groove (rarely two), almost or entirely obsolete on those ribs in the extreme postero-dorsal region; concentric sculpture of fine, closely set raised lines, producing on the sulcated anterior ribs a double row of nodules and a single row on the undivided medial ribs, the nodulation of the median ribs usually more conspicuous on the left valve; posterior ribs not affected by the concentric sculpture; cardinal area very narrow, with one to three ligament grooves behind or under the umbones; teeth fine, closely set, short, vertical (except in the posterior region), uninterrupted, but the median teeth very short, inner margin of the valves deeply crenulated and from the crenulations faint lines, most noticeable in the posterior region, run up toward the umbo.

Dimensions.- Length, 31 mm.; alt., 16.7 mm.; semidiam., 7 mm.; length of hinge, 19 mm.; length, 28 mm.; alt., 15.8 mm.; semidiam., 6.5 mm.; length of hinge, 11 mm.

Remarks.- Compared with the average *Scapharca* the shell of this species is decidedly thin and the sculpturing is elegant. Individuals belonging to this species are numerous and they may be immediately recognized by their small size, thin shells and internal radiating lines. The differences in the size and sculpturing of the radial ribs in different areas of the shell are enhanced by the delicate chiseling which characterizes the sculpture throughout. The anterior ribs are nodulated and sulcated; the median ribs are narrow and usually not prominently nodulated; the posterior ribs are broad, low and smooth, except for a shallow groove. A few forms show a very faint and shallow sulcus on the umbo. Some young shells have the dorsal postero-lateral margin more deeply incised than in the case of the average adult. *A. inaequilateralis* is closely related, as Dall (1) has pointed out, to *A. latidentata*

(1). loc. cit.

Dall (2) of the Chipola marl and Tampa siliceous, but may be dis-

(2). loc. cit., p. 638, pl. 72, fig. 15, 1898.

tinguished by its more produced posterior margin, the varying character of the ribs in different portions of the shell, thinner shell, and finer, shorter and more numerous teeth. Another species from the same horizons, A. (Scapharca) hypomela Dall (1) is readily distinguished when adult since the Floridian form is much larger, more

(1). loc. cit., p. 637, pl. 33, fig. 1, 1898; Bull. U. S. Nat. Mus., no. 90, p. 121, pl. 17, fig. 7, pl. 21, figs. 17, 18, 1915

inflated, truncated posteriorly rather than acutely rounded and the ribs, except those on the posterior slope are deeply channelled; young individuals of the same size as inaequilatoralis are similar in appearance, especially those from the silex beds, because of their thin shells, but they always have sulcated ribs and are not quite as much produced and rounded posteriorly. A. caturgensis Pons (2), described from Catur, Panama is larger, however, more

(2). Jahrb. K. K. Geol. Reichsanstalt, vol. 61, p. 497, pl. 70, fig. 4, 1911.

convex, less produced posteriorly, the anterior ribs are more deeply sulcate, the median ribs narrower and sharper and the ribs immediately anterior to the posterior slope are sulcated. Brown and Pilsbry have described another more closely related Catur form -

A. dariensis; (1) it is larger, less produced posteriorly, the curve of the anterior margin is fuller, so that the ventral margin

(1). Proc. Acad. Nat. Sci., Philadelphia, vol. 5, p. 362-363, pl. 82, fig. 10, 1911.

does not descend posteriorly; the type of sculpture is the same, but neither the nodules or the concentric lines in the interspaces are as prominent on right valves, on left valves the median ribs are wider and the posterior ribs occasionally have two rows of fine nodules.

Guppy's description, though brief, considered most of the diagnostic features. His figure, however, was drawn from an imperfect valve; the incision of the uppermost portion of the antero- and postero- lateral margins is deeper than normal and the shell should be more produced posteriorly.

Occurrence.- Lower Miocene: Bowden beds, Bowden, Jamaica.
(Guppy, 1866, 1874; Dall, 1898)

ARCA (SCAPHARCA) DONACIA Dall.

Scapharca (Scapharca) donacia Dall, 1898, Trans. Wagner Free Inst.
Sci., Philadelphia, vol. 5, pt. 4, p. 649, pl. 33, fig. 13.

Description.- "Shell small, donaciform, moderately plump, with rather elevated prosocoelous beaks at about the anterior third; valves almost similarly sculptured; left valve with about twenty-four low, strap-like, narrow radial ribs with somewhat wider interspaces; the ribs are plain, smooth, and entire on both valves; on the left valve the interspaces are crossed by numerous equidistant elevated lines which do not appear on the ribs; on the right valve the interspaces are only marked by lines of growth; hinge-line short, cardinal area very narrow, smooth; anterior end larger, rounded; posterior end produced and attenuated; hinge teeth small, similar, slightly divergent; internal margin of the valves with deep short flutings. Lon. 6.8, alt. 4.5, diam. 3 mm." (Dall, 1898)

Type locality.- Bowden, Jamaica.

The umbones are relatively high and conspicuous. On the umbo of the right valve a very shallow and narrow sulcus is usually present. Toward the ventral margin this sulcus broadens, but although slightly emarginating the median ventral margin; it is never prominent; on the left valve the sulcus is absent or very poorly

defined. The ribs - four to six in number - in the sulcus are narrower and flatter than the others; this is true also of the ribs that have a corresponding position on the left valve. On unworn valves fine, evenly and closely spaced concentric lines, usually more prominent in left valves, appear in the intercostal spaces; the median teeth are short and vertical, while the anterior and posterior ones are longer and slightly oblique. The deep, short crenulations of the internal margin are obsolete in the median ventral region, i. e., in the region of the external median sulcus.

Dimensions.- Right valve: Length, 9 mm.; alt. 6 mm.; semidiam., 2.5 mm.; length of hinge 5 mm. Left valve: Length, 9 mm.; alt., 5.2 mm.; semidiam., 2.6 mm.; length of hinge, 4.8 mm.

Remarks.- This is a small form, but there is no doubt that it actually is adult, since it is well represented by an amazing number of individuals of various stages of growth. Because of its shape and relatively high umbones it is sharply set off from the young of associated Scapharceas.

Occurrence.- Lower Miocene: Bowden beds, Bowden, Jamaica. (Dall, 1898).

ARCA (SCAPHARCA) PLEURALIA n. sp.

Arca (Scapharca) auriculata Lamarck ?, Dall, 1898: Trans. Wagner
Free Inst. Sci., Philadelphia, vol. 7, pt. 4, p. 649.

Description.- Shell of medium size, decidedly inflated; posteriorly the angle broadly produced and the margin slightly insinuated near the dorsal angle; anterior margin rounding by a broad curve into the gently and asymmetrically arcuate base; both extremities of the straight dorsal margin angular; umbones medium height, full, prominent, at about the anterior third of the length; posterior ridge strong, rounded, the posterior slope excavated; left valve slightly larger, with thirty-two, sharply chiseled, square radial ribs separated by interspaces wider than the ribs in the anterior and median portions of the shell, but narrower in the posterior portion; in the anterior half of the shell the ribs dichotomous distally, on the posterior slope flatter and broader; all the ribs except those on the posterior slope nodulated by numerous, sharp concentric raised lines that persist across the intercostal spaces; right valve with thirty lower and broader radial ribs, the interspaces being of about the same width in the anterior half of the shell and narrower in the posterior half; only the anterior six or seven ribs dichotomous, the nodulation limited to the anterior ribs, the nodules not as sharp as on the left valve; cardinal margin of medium

width, crossed by three to five concentric ligament grooves; teeth numerous, strong, vertical, the series being straight and continuous; inner margin of the valve with short crenulations.

Dimensions.-- Right valve (type): Length, 35 mm.; alt., 24 mm.; semidiam., 10 mm.; length of hinge, 22 mm. Left valve: Length, 38 mm.; alt. 25 mm.; semidiam., 12.5 mm.; length of hinge 24 mm.

Remarks.-- *A. brephaina* is very close to the recent *A. auriculata* Lamarck (1) and undoubtedly is in the same direct genetic

(1). Anim. sans Vert., vol. 6, p. 42, 1819; Reeve, Conch. Icon., Arca, pl. 6, fig. 35, 1844.

series. The Bowden form is smaller, has more numerous, usually finer, lower and more conspicuously nodulated radial ribs and much narrower interspaces. It may be distinguished from the associated *Scapharcas* by its "auriculate" outline.

The single poorly preserved valve in the National Museum Collection, which was doubtfully referred to auriculata by Dall, appears to belong to this species.

Occurrence.-- Lower Miocene: Bowden beds, Bowden, Jamaica.

ARCA (SCAPHARCA) WORDENI n. sp.

Description.- Shell medium-sized, moderately inflated, heavy, elongate; dorsal margin long, straight, angular at both extremities; unevenly rounded anteriorly, subtruncated posteriorly; ventral margin asymmetrically arcuate; umbones inflated, low, with a very faint median sulcus; left valve sculptured with thirty-two clear-cut, square radial ribs of almost constant width throughout, except in the extreme anterior and posterior regions, flattened on the posterior slope; interspaces narrower than the ribs; except on the posterior slope the ribs and interspaces crossed by concentric raised lines, sharp in the interspaces and nodulating the ribs; right valve with thirty or thirty-one lower and usually narrower radial ribs, separated by interspaces of about the same width; concentric lines prominent in the interspaces, but nodulating only a few anterior ribs; cardinal area narrow, with one or two ligament grooves; teeth small and straight apically, longer at both ends and slightly oblique at the posterior end of the series; inner earvin with short, deep crenulations.

Dimensions.- Length, 25.5 mm.; alt., 17 mm.; semidiam., 8.2 mm.; length of hinge, 18 mm.

Remarks.- A. wordeni is characterized by its rather elongate

and inflated form, thick shell and relatively high, undivided ribs separated by deeply channeled interspaces. Young individuals are proportionately less inflated than adults and the umbonal sulcus is often more prominent. A. inaequilateralis is of about the same size but is much thinner, more produced posteriorly, less inflated and has finer ribs; A. peroleura is higher, heavier, has fuller, more prominent beaks, wider ribs and narrower interspaces. The Chipola A. hypomela Dall (1) has the same general form, but is much

(1). Trans. Warner Free Inst. Sci., Philadelphia, vol. 7, pt. 4, pp. 637-638, pl. 57, fig. 1, 1898.

larger and has lower, deeply sulcate ribs and a wider cardinal area.

This species is named for Mr. Stanley Jordan, of the Maryland Geological Survey, who gave efficient assistance in the preparation and preliminary determination of the material.

Occurrence.— Lower Miocene: Bowden bells, Bowden, Jamaica.

ARCA (SCAPHARCA) AGNASTIA n. sp.

Description.- Shell small, thin, moderately inflated, higher posteriorly, compressed in the posterior dorsal region; posterior margin truncated; ventral margin curving gently in the posterior half and more rapidly in the anterior half, anterior margin curving abruptly upward; both lateral margin joining the dorsal margin by sharp angles, the posterior angle being slightly more than 90°; umbones low, relatively broad, placed at about the anterior third of the length, with a very slight median sulcus; external surface sculptured with forty low, narrow, flat radial ribs, broader and flatter on the posterior slope, separated by narrower interspaces; in the interspaces faint concentric lines, persistent across the ribs, except those on the posterior slope, producing slight undulations; cardinal area of medium width, with faint longitudinal striations; hinge long, straight, with numerous fine teeth; inner margin with numerous, short crenulations.

Dimensions.- Length, 21.3 mm.; alt., 12.8 mm.; semidiam., 5 mm.; length of hinge, 16 mm.

Remarks.- The compressed posterior dorsal region produces an auriculate effect which is more pronounced on young individuals. The ventral margin ascends rapidly toward the anterior end. These features, together with the numerous narrow, flattened radial ribs and small size of the shell, are distinguishing characteristics.

Young individuals, both sides being more auriculate, have a greater difference in altitude between the posterior and anterior ends, i. e., the ventral margin ascends more rapidly anteriorly, and the umbonal sulcation often persists to the ventral margin, thus producing an almost bilobed appearance. Considerable difficulty was experienced in distinguishing between the young of agnastha and wordeni, those belonging to agnastha are usually more elongate, more auriculate and have more numerous and finer ribs. The adults are readily separable, since the shell of wordeni is heavier, larger, higher, more inflated and its ribs are coarser and higher. From the auriculate perphaina, agnastha differs by being smaller, thinner, more elongate, less inflated and by having more numerous and finer ribs. A. acomosa Dall (1), of the Shipola fauna,

(1). Trans. Wagner Free Inst. Sci., Philadelphia, vol. 7, pt. 4, p. 648, pl. 33, fig. 15, 1898.

is more produced anteriorly, has a straighter base, wider ribs and the anterior ribs are divided.

Occurrence.— Lower Miocene: Bowden beds, Bowden, Jamaica.

ARCA (SCAPHARCA) THOMASIANA n. sp.

Description.- Shell, small, well inflated, moderately inequilateral, slightly produced posteriorly; anterior end of the dorsal margin rounded; ventral margin almost symmetrically arcuate; rounded anteriorly and posteriorly; umbones moderately high, placed anterior to the median horizontal, the tip very slightly impressed medially; external surface sculptured with thirty-six narrow, square-topped, closely set radial ribs separated by narrower interspaces; the anterior seven or eight ribs and the accompanying interspaces relatively wide; the next eight narrow and the succeeding ones progressively slightly broader, those on the posterior slope broadest and flattest; concentric sculpture of irregular, inconspicuous lines which faintly and unevenly nodulate the anterior and median ribs; cardinal area moderately wide, with a single ligament groove behind the umbo; teeth numerous, vertical, except at the posterior end of the series; inner margin of the shell ornamented with numerous, deep, long crenulations; interior of the shell marked with fine, inconspicuous radiating lines.

Dimensions.- Length, 19.5 mm.; alt., 12 mm.; semidiam., 5.1 mm.; length of hinge, 14 mm.

Remarks.- This species is represented by a left valve. It may seem unfortunate to add another species to the already long list of Bowden Scapharcas, especially the species rests on a single

valve which may be immature. The curved outline at the juncture of the anterior and dorsal margins, the almost symmetrical curve of the base, the numerous narrow radial ribs, the long, narrow crenulations of the inner margin are all distinctive. These features, together with the rather high, inflated form, distinguish A. thomasensis. It should be added that the posterior end of the dorsal margin of the specimen is broken off.

A. agnatha has about the same number of ribs, but they are wider and the shell is more elongate and auriculate. A. wordeni is almost the same shape, but its ribs are much coarser and the anterior end of the dorsal margin is sharply angulated.

Occurrence.- Lower Miocene: Bowden beds, Bowden, Jamaica.

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Section Argina Gray.

ARCA (ARGINA) TOLEPIA Dall var. MICROTERA n. var.

Scapharca (Arcina) tolepia Dall, 1898, Trans. Wagner Free Inst.
Sci., Philadelphia, vol. 3, pt. 4, pp. 649-650, pl. 33,
figs. 7, 8. (ex parte).

Description.— Shell small, well inflated, the greatest inflation and greatest height of the shell behind the median horizontal, compressed in the distal postero-dorsal region; right valve smaller, more rounded, lower posteriorly than the left; antero-dorsal margin very short; rounded anteriorly; base sloping toward the posterior end; posterior lateral margin scarcely rounded below, but curving to meet the dorsal margin; umbones tumid, broad; medially sulcate^d, placed at about the anterior third of the length; left valve sculptured with thirty-six to thirty-eight strong radial ribs; anterior and median ribs subrounded, separated by narrower interspaces, and nodulated, the nodules being connected across the interspaces by raised lines; posterior ribs lower, flatter, separated by interspaces of almost the same width, and smooth or inconspicuously nodulated; right valve with twenty-eight to thirty sharply sculptured, obscurely nodulate^d ribs separated by deeply channelled interspaces of the same width or slightly wider; card-

inal area as in the typical *Argina*; hinge with about fifteen posterior and nine anterior teeth, the two series uninterrupted; inner margin of the valve deeply crenulated.

Dimensions.-- Length, 6.1 mm.; max. alt. 5.9 mm.; semidiam., 1.8 mm.; length of hinge, 4 mm.

Remarks.-- The description of the right valve may be incorrect since the only right valves at hand are very small forms which are doubtfully referred to this variety. It seems improbable that only left valves of one species and right valves of another should appear and therefore these right valves are considered microtera, although they display characters different from those that would be expected. Right valves of the section *Argina* are smaller than left ones and usually have fewer and lower ribs, but in this case the disparity in the number of ribs is inordinate and the ribs are more sharply sculptured on the right valves, even projecting beyond the margin in the anterior and median regions of the shell. In addition the right valves are more rounded and have umbones that are only obscurely sulcated.

This form has previously been referred to as A. tolepis, a name which Dall proposed for a species from Santo Domingo and Juanana which Guppy (1) erroneously identified with the recent A.

(1). Geol. Mag., Decade 2, vol. 1, p. 443 (check list).

pexata Say (= A. campechensis Dillwyn). The Bowden specimens are however, much smaller than the typical tolepis, proportionately less inflated, slightly more rounded posteriorly and have sulcated umbones, a few more ribs and narrower interspaces. In view of these differences it seems advisable at the present time to consider the Bowden form a depauperate variety.

The young of A. campechensis Dillwyn(1) of the same size have

(1). Descr. Cat. Rec. Shells, vol. 1, p. 238, 1817.

a longer postero-dorsal margin which meets the lateral margin at a sharper angle, a straighter base, sharper and more conspicuously nodulated sculpture and unsulcate^d umbones. A. brightonensis Maury (2) and A. billingsiana Maury (3), both from an Upper Oligo-

(2). Jour. Acad. Nat. Sci., Philadelphia, 2nd ser., vol. 15, pp. 46-47, pl. 8, figs. 4-6, 1912.

(3). Idem, pp. 45-46, pl. 8, figs. 2, 3.

cene horizon at Brighton, Trinidad, are more elongate, less inflated and differ also in sculpture.

Occurrence.-- Lower Miocene: Bowden bells, Bowden, Jamaica (Dall, 1938)/

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Section Cunearca Dall.

ARCA (CUNEARCA) OPPOSITA n. sp.

Description.- Shell small, cardiform, height exceeding the length, decidedly inflated, higher posteriorly, moderately inequilateral; left valve larger, higher posteriorly, more inflated than the right and having higher umbones; dorsal margins short; rounded anteriorly and posteriorly, the curve of the anterior margin shorter and more convex than the posterior, passing without interruption into the slightly curved base; base descending toward the posterior end; umbones high, tumid, subcentral in position, prosograte; external surface sculptured with twenty-six to twenty-eight radial ribs, conspicuously nodulated throughout on the left valve, except on the umbo, but the right valve having only a few anterior ribs nodulated; cardinal area narrow behind the umbones, shorter and wider before; anterior series of teeth numbering eight or nine, vertical, forming an uninterrupted series, with the twelve to fourteen teeth of the posterior series; inner margin of the valve with short, deep crenulations.

Dimensions.- Length, 7.5 mm.; alt. 7.0 mm.; semidiam., 3.5 mm.; length of hinge, 4.5 mm.

Remarks.- It is not unreasonable to assume that the small valves that are the only representatives of this form are immature.

Such a conclusion is natural from a consideration of the characters of the cardinal area which is more like that of the section Argina than would be expected in a Lunearca. The hinge and outline, however, are not arginoid, and it is probable that adult shells would have a more equilateral cardinal area.

This is the only representative of the numerous races of high * Arcas that have a rather inde-Tertiary distribution in the Caribbean region. Its cardium-like form and extreme inflation are noteworthy.

Urbina (1) has described A. chavezii from the Miocene of Lu-

(1). Bol. Soc. geol. mexicana, vol. 6, pt. 2, pp. 151-152, pl. 60, figs. 56-60, 62-65, 1910.

- 2 - -----
luzum, Chiapas, Mexico; it reaches a much larger size and is less rounded, being more produced posteriorly and with a straighter base. Apparently this species is decidedly variable, a form such as the one represented by fig. 67 closely resembling opthanta in outline; the Caloosahatchie A. alcina Dall (2) differs in a simi-

(2). Trans. Wagner Free Inst. Sci., Philadelphia, vol. 7, pt. 4, pp. 635-650, pl. 31, fig. 5, 7, 1896.

lar manner. The young of the recent West Indian A. chernitzi

Philippi (1) of the same size are more elongated, much less in-

(1). Zeitschr. für Mal., vol. 8, p. 50, 1851, (= A. bisops
d'Orbigny = A. orbis y Nobelt).

flated, with lower and broader umbones.

Occurrence.- Lower Miocene: Bowden beds, Bowden, Jamaica.

Section Bathyarea Nobelt.

AREA (BATHYAREA) HENDERSONI Dall.

Scapharca (Bathyarca) Hendersoni Dall, 1898, Trans. Wagler Free
Inst. Sci., Philadelphia, vol. 7, pt. 1, p. 657, pl.
32, fig. 9.

Description.- "Shell very small, much inflated, the hinge-line
as long as the shell, which is of a rounded triangular form, with
rather prominent prosocoelous beaks; left valve with fine, elevated
rounded concentric lines, crossed by closer, less prominent, and
finer radial lines; in the right valve, as usual in this section
of the genus, the radial sculpture predominates over the concentric,
the latter though present being inconspicuous; cardinal area mod-
erately wide, the beaks being nearly medial, the surface of the
area longitudinally striated; hinge with about five nearly verti-
cal anterior teeth separated by a wide unarmed gap from six or seven
smaller, more oblique posterior teeth; margin of the valves thin,
entire, or microscopically crenulate; the inner edges of the ad-
ductor scars slightly raised above the inner surface of the valve.
Lon. 2, alt. 2, diam. 2 mm."

"This minute little species is obviously adult, and about ten

valves were obtained. It resembles A. pectunculoides Scacchi (1)

- (1). Notizie, etc., p. 25, Tab. 1, fig. 12, 1877. The West Indian form has been separated as the variety orbiculata Dall. (Bull. Mus. Compt. Zool., vol. 9, p. 121, 1881; idem, vol. 12, pp. 240-241, pl. 8, fig. 5, 1886.
-

and A. clomerula Dall² of the recent fauna, but is smaller, more

- (2). loc. cit., pp. 121-122, 1881; loc. cit., p. 241, pl. , figs. 9, 9a, 1886.
-

inflated, and more triangular than either of them." (Dall, 1898)

Type locality.-- Bowden, Jamaica.

Remarks.-- In the Duerden collection there are only a few valves of this small, interesting species, but, strange enough, a surprisingly large number is present in the Aldrich Collection. The shell is much higher posteriorly so that the anterior margin descends steeply, while the posterior margin is only gently curved. The greatest inflation is in the median posterior region. For the size of the shell the umbones are very broad; they are placed slightly anterior to the median horizontal. Occasionally there is visible a very faint sulcus on the umbo, which when continued is on the anterior side of the median line of the shell and in rare cases it slightly insinuates the margin. As usual in the section, the

left valve is larger. Left valves in particular display a certain range of variation in convexity, the less convex forms having a narrower cardinal area and more oblique anterior teeth.

Among the specimens was a left valve which was quite distinct from the remainder in being more convex, in having a shorter posterior dorsal margin and therefore a more convex posterior lateral margin, much higher and more incurved umbo and a wider cardinal area. Unfortunately the shell was not complete and in handling was irreparably broken. It is mentioned in the hope that future exploration will reveal its presence.

The most closely related forms are, as noted above, recent species.

Occurrence.-Lower Miocene: Bowden beds, Bowden, Jamaica.
(Dall, 1908).

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Section Anadara Gray.

ARCA (ANADARA) DASEIA . sp.

Description.- Shell of medium size, heavy, subrhomboidal, elongate, much inflated, slightly higher in the posterior region, the anterior margin curving broadly into the gently arched ventral margin; obliquely truncated posteriorly; umbones high, decidedly inflated, the tip slightly impressed medially, situated at about the anterior third of the length; left valve sculptured with twenty-six high, square radial ribs, separated by wider deeply channelled interspaces; on the posterior slope the ribs lower and flatter, the anterior ribs about as wide as the interspaces; concentric sculpture of incrementals, elevated at intervals, producing faint nodulations on the tops of the ribs and inconspicuous raised lines on the sides of the ribs and in the interspaces; cardinal area impressed, of moderate width, wider in front of the umbo, with five ligament grooves behind the umbo and five longitudinal striations before; hinge long, straight, with fine numerous teeth, larger and slightly oblique distally; inner margin of the valve with short, broad, deep crenulations.

Dimensions.- Length, 31.5 mm.; alt., 19 mm.; semidiam., 16 mm.; length of hinge, 23 mm.

Remarks.- This species, the only representative of the section *Anadara*, is founded on a single left valve. The elongate form, thick, heavy shell, high beaks and deeply sculptured radial ribs distinguish it from the other *Anas* of the Bowden fauna. *A. daseia* is smaller than *A. rampsa* Dall (1) of the Choctawhatchie Miocene, more elongate, more produced posteriorly, with a more

(1). Trans. Wagner Free Inst. Sci., Philadelphia, vol. 7, pt. 4, pp. 656-657, pl. 52, fig. 21, 1898.

typical *Anadara* hinge. The Caloosahatchie *A. catasarca* Dall (2) is larger, more produced posteriorly, with umbones that are more

(2). Idem, pp. 654-655, pl. 52, fig. 20, 1898.

anterior in position and sharply sulcated anterior ribs.

Occurrence.- Lower Miocene: Bowden beds, Bowden, Jamaica.

Subfamily Glycymerinae.

Genus GLYCYMERIS De Costa.

GLYCYMERIS JAMAICENSIS Dall.

Pectunculus pennacea Guppy, 1866, Quart. Jour. Geol. Soc. London,
vol. 22, p. 297 (non Lamarck, 1801.).

Axinea pennacea Gabb, 1877, Trans. Am. Philos. Soc., new ser., vol.
15, p. 255 (non Lamarck, 1801) ex parte.

Pectunculus decussatus Guppy, 1874, Geol. Mag., Decade 2, vol. 1,
p. 443 (check list), ex parte. (non Linnaeus, 1758).

Pectunculus decussatus Guppy, 1876, Quart. Jour. Geol. Soc. London,
vol. 32, p. 522, (ex parte, non Linnaeus, 1758).

Glycymeris Jamaicensis Dall, 1898, Trans. Wagner Free Inst. Sci.,
Philadelphia, vol. 3, pt. 4, p. 608.

Description.- ".....Moderate size, nearly circular, quite
convex, externally sculptured with fine, even, radiating striae,
impressed at intervals so as to give the effect of obsolete ribs,
which are more apparent on the middle of the shell; on the beaks
some of the threads are stronger; umbones low and blunt; cardinal
area impressed, narrow, short, and smooth; teeth small, uninter-
rupted, about twenty-four in all, the line gently arcuate; inner mar-
gin fluted, with a slight insinuation near the base in front.

Long. 35, alt. 53, diam. 22 mm." (Dall, 1898).

Type locality.-- Bowden, Jamaica.

Shell decidedly convex; umbones low, decidedly inflated; adults with the distal two-thirds of the posterior slope gently keeled, the point of impingement of the keel on the posterior lateral margin being the dorsal termination of a truncation extending obliquely downward to the postero-ventral margin, then joining the even curve of the anterior half of the ventral margin; anteriorly the straight dorsal margin passing rapidly into the broad curve of the antero-lateral margin; the slope between the postero-dorsal and postero-lateral margins less abrupt; external sculpture of many very low, inconspicuous radiating ribs, narrowing into more prominent elevated lines on the umbones and absent in the extreme antero- and postero-dorsal regions; fine, equally spaced radiating striae and equally fine, but less prominent, concentric striae superimposed on the ribs and narrower interspaces, the two producing distinctly cancellated sculpture visible only on uncin valves; cardinal area very narrow; hinge-plate gently and uniformly arched; teeth relatively small, usually 12 before and 13 behind the umbo; buttresses of the muscle-scars not prominent,

Dimensions.-- Length, 35 m. ; alt., 54 m. ; semilim., 11.5 m. .

Remarks.-- This species is most abundant of the members of the genus. Individuals that have assumed adult features are character-

ized by the unique posterior keel, which, though slight, is noteworthy, and the concomitant oblique truncation of the postero-lateral margin. Immature forms do not display these features, but they may readily be distinguished from the young of the other species by their external sculpture. Compared with adults, the primary radials of young shells are prominent and the secondaries suppressed.

Guppy referred this form to G. pennacea (Lamarck) or G. decussatus (Linnaeus), but it obviously differs from the recent, which has been given either of those names, being more convex, with a more irregular contour and weaker concentric sculpture. Most of Gabb's Santo Dominican pennacea are neither that species or jamaicensis; they differ from the latter by being less inflated, more elongated transversely, without the posterior keel and truncation, the posterior margin being rounded more convexly than the anterior, with the primary radials slightly more prominent. In addition to this form, typical specimens of jamaicensis are present. G. carbasina Brown and Pilobry (1) of the Gatun fauna, is smaller,

(1). Proc. Acad. Nat. Sci., Philadelphia, vol. 63, pp. 563-564, pl. 28, fig. 9, 1911.

without the posterior keel and truncation, with lower, broader umbones, more prominent primary radials, more conspicuous concentric

sculpture, fewer and coarser teeth, deeper and sharper internal marginal crenulations.

Occurrence:- Upper Oligocene.- Santo Domingo (Gabb, 1875; Guppy, 1874, 1876). Cumana, Venezuela (Guppy, 1874). Lower Miocene: Bowden beds, Bowden, Jamaica (Guppy, 1866, 1874; Dall, 1908)

GLYCYMERIS ACUTICOSTATA (Sowerby)

Pectunculus acuticostatus Sowerby, 1850, Quart. Jour. Geol. Soc.

London, vol. 6, p. 53, pl. 10, fig. 13.

Pectunculus acuticostatus Sowerby, Guppy, 1866, Quart. Jour. Geol.

Soc. London, vol. 22, p. 207, 1866.

Axinea acuticostata (Sowerby) Gabb, 1873, Trans. Am. Philos. Soc.,

new ser., vol. 15, p. 255.

Pectunculus acuticostatus Sowerby, Guppy, 1874, Geol. Mag., Decade

2, vol. 1, p. 443 (check list).

Pectunculus acuticostus Sowerby, Guppy, 1876, Quart. Jour. Geol.

Soc. London, vol. 32, p. 532.

Glycymeris acuticostata (Sowerby) Brown and Pilsbry, 1911, Proc.

Acad. Nat. Sci., Philadelphia, vol. 63, p. 364.

Description.- "Testa suborbicularis, subobliqua, postice subangulata, radiatim multicastrata, costis tenuibus, sulcisque angulatis, area cardinali bifariam tenuiter sulcata, antibus cardinalibus ad utrumque latus numerosis, confertis." (Sowerby, 1850).

Type locality.- Santo Domingo.

Shell of medium size, the height about equaling the length, moderately convex, outline ovate-trigonal; dorsal carinae scarcely differentiated; posteriorly produced, subangular; broadly rounded

anteriorly and ventrally; umbones very low; external sculpture consisting of about twenty-six low, radiating ribs, sharply angular on unworn shells except in the extreme antero- and postero-dorsal regions, the flanks of the ribs sloping gently from the angular summit, forming angular interspaces; concentric sculpture of fine, equally spaced striae, usually not overriding the summits of the radials, but conspicuous on their flanks; cardinal area narrow, very short, not affecting the angular outline of the dorsal margin, conspicuously marked by ligament grooves diverging from a median vertical line; hinge plate decidedly arcuate; teeth small, numerous, the series interrupted by the subsidence of the cardinal area, with twelve or thirteen teeth on either side; inner margin of the valve coarsely and weakly crenulated.

Dimensions.-- Length, 24 mm.; alt. 23.8 mm.; semidiam., 6.5 mm.

Remarks.-- The beautifully sculptured shells of this widely distributed species are almost as numerous as jamaicensis. The low, sharply angular ribs and subangular posterior production are the salient characters. Among immature forms the irregular outline of the posterior margin is poorly defined or entirely lost. Young shells apparently belonging to this species, present puzzling features. Some have the typical, somewhat compressed form and characteristic angular sculpture; others are more inflated, with higher umbones, angular or subangular ribs, separated by definite interspaces; another group, including most of the smallest shells,

are inflated, with more or less rounded ribs separated by narrower interspaces. Numbers of the last group somewhat resemble G. pectinata (Gmelin) (1), but differ by their higher umbones, narrower

(1). Syst. Nat., p. 1313, 1792.

ribs and interspaces.

G. canalis Brown and Pilsbry (2), described from Catun,

(2). Proc. Acad. Nat. Sci., Philadelphia, vol. 63, p. 304, pl. 28, fig. 10, 1911.

Panama, is more inflated, with rounded ribs, which may, however, be subangular.

Occurrence.- Upper Oligocene.- Santo Domingo (Sowerby, 1850; Tabb, 1873; Guppy, 1874, 1876). Cumana, Venezuela (Guppy, 1871). Catun formation, Panama (Brown and Pilsbry, 1911). Lower Miocene: Bowden beds, Bowden, Jamaica. (Guppy, 1874; 1876; Dall, 1899).

GLYCYMERIS PENNAEA (Lamarck)

Pectunculus pennaceus Lamarck, 1819, Anim. sans Vert., vol. 6,
p. 51; 1835, idem, 2nd ed., p. 490.

Pectunculus carolinianus Conrad, 1875, Fos. Med. Per. United
States, no. 1, inside of back cover.

Pectunculus carolinensis Conrad, 1840, idem, p. 63, pl. 55, fig. 2.

Pectunculus carolinensis Conrad, 1841, Am. Jour. Sci., 1st ser.,
vol. 41, p. 346.

Pectunculus pennaceus Lamarck, Reeve, 1843, Conch. Icon., vol. 1,
Pectunculus, pl. 5, fig. 24.

Not P. carolinensis Holmes, 1860, Post-Pleioc. Fos. South Carolina,
p. 15, pl. 3, fig. 4.

Axinea carolinensis Conrad, 1863, Proc. Acad. Nat. Sci., Phila-
delphia, vol. 14, p. 580.

Axinea carolinensis Conrad, Maek, 1864, Misc. Check List, Smiths.
Misc. Coll., no. 183, p. 5.

Pectunculus lineatus Heilprin, 1887, Trans. Wagner Free Inst. Sci.,
Philadelphia, vol. 1, p. 103. (non Lamarck, 1819, non
Reeve, 1843).

Glycymeris pennaceus (Lamarck) Dall and Simpson, 1901, Bull. U. S.
Fish Comm., vol. 20, pt. 1, p. 459.

Not P. pennacea Guppy, 1866, Cabb, 1875 (ex parte) = G. ianadensis
Dall.

Description.- "P. testa orbiculari, tumida, decussatim striata, alba; maculis spadiceis longitudinalibus fasciculatis; natibus limamenti extremitate antica inflexis." (Lamarck, 1819).

The Bowden specimens are of medium size, subcircular, the height virtually equaling the length, decidedly convex; umbones low, much inflated, opisthogyrate, placed slightly behind the median horizontal, almost in contact: anterior dorsal margin longer than the posterior, with a more gentle slope to the lateral margin; slightly produced posteriorly, but rounded; evenly rounded anteriorly and ventrally; external surface sculptured with twenty-four to thirty almost equally spaced primary radiating ribs, on young shells sharply defined and narrow throughout, on adults most conspicuous on the umbonal slopes, becoming very low and relatively broad distally, broader than the interspaces, with a median or submedian groove on the distal two-thirds; Secondary radials, extending about four-fifths of the distance from the margin to the umbo, occasionally present; concentric sculpture of fine striae impressed on the radials, producing a cancellated effect; cardinal area narrow, deeply impressed, confined to the area immediately under and before the umbo; hinge plate gently arched; teeth in two series, the anterior convex, including fifteen teeth, the five nearest the umbo vertical and small, the remainder coarser and typically slymeroid; posterior series shorter and less convex, with nine rela-

tively coarse teeth, the first three (from the umbo) angular, the remainder straight and almost horizontal; muscle scars relatively large, weakly buttressed; inner margin of the valve with fine crenulations.

Dimensions.- Length, 26 mm.; alt., 25.8 mm.; cardinalian., 9 mm.

This interesting *Glycymeris* is represented by three right valves. The smallest form has radial sculpture which differs somewhat from that of the largest, the ribs being very sharply defined and subangular, becoming slightly broader distally, with faint secondaries in the distal portion of some of the interspaces. On the shell of intermediate size the primary ribs are relatively broad and angular distally, with secondaries of almost the same order of magnitude. Finally, on the largest individual, the ribs are flat, broad and grooved. From the above it is quite obvious that young shells display to better advantage the characteristic cancellation.

The deeply immersed, almost internal ligament, pronounced backward twisting of the umbo, the strikingly different anterior and posterior teeth are unusual for the genus. The largest Bowden valve bears a remarkably close resemblance to a larger West Indian valve in the National Museum collection. It should be remembered that Lamarck (1835) stated that this species is "remarquable surtout par les crochets qui ont leur pointe dirigée

tout-à-fait à l'extrémité antérieure (posterior) du ligament, la manière que le ligament est entièrement bas de l'intervalle qui les sépare." Apparently it is not known whether such forms actually belong to the group which usually receives the name pennacea, members of which do not have the above hinge and ligament characters; and besides have a more angular posterior margin, but the same sculpture. Conrad reported one of these from the Duplin of North Carolina, although it has not appeared in subsequent collections. Because of this uncertainty it is doubtful whether all of the above citations belong in the synonymy.

G. jamaicensis is more inflated, more angularly produced and keeled posteriorly, with less prominent concentric sculpture, a different cardinal area and hinge.

Occurrence.- Lower Miocene: Bowden beds, Bowden, Jamaica. Miocene.- Duplin formation, North Carolina (Conrad, 1875, etc.). Pliocene.- Dominica, West Indies (Hall, 1898); Calooshatchie marl, Florida (Hall, 1898). Recent.- North Carolina to the West Indies and east to Bermuda.

Superfamily Pterioacea.

Family Pinnidae.

Genus PINNA (Linnaeus) Lamarck.

PINNA RETURJA n. sp.

Description.- Shell small, slender, moderately thick, strongly convex; summit of the shell subangular to rounded, situated nearer the dorsal margin; dorsal surface almost flat, the ventral gently arcuate; apex rounded; dorsal and ventral margins straight, diverging at an angle of about 25° ; external surface with a well-defined, relatively deep sulcus, beginning near the anterior end and extending posteriorly along the summit of the shell; dorsal region of the shell sculptured with five well-defined longitudinal ridges, enclosing the ridge adjacent to the sulcus; upper half or more of the ventral portion sculptured with three more irregular, broader, lower ridges, followed (toward the ventral margin) by oblique, obscure undulations, diverging slightly from the margin and terminating abruptly at the longitudinal ridges; inner surface with a low, narrow ridge corresponding to the external sulcus.

Dimensions.- Length, about 65 mm.; max. alt., 17.5 mm.; max. semidiam., 7.8 mm.

Remarks..- This species is described from two fragments, the median portion of a right valve and an immature, almost complete left valve with the extreme posterior region lacking. On the larger fragment most of the posterior muscle scar is visible, showing that it is large, longitudinally elongate, convexly rounded posteriorly, ventral in position. The principal features are the strong, asymmetrical convexity, prominent external sulcus and the character of the sculpture.

The Caloosahatchie P. caloosahatchensis Dall (1) is heavier, more

(1). Trans. Wagner Free Inst. Sci., Philadelphia, vol. 3, pt. 4, p. 660, pl. 26, fig. 4, 1890.

symmetrical, with a broader, higher internal ridge and different sculpture. P. rudis (Linnaeus) Dillwyn (2), a recent West Indian

(2). Linnaeus, Syst. Nat., ed. 12, no. 1159, 1766, ex parte; Dillwyn, Cat. Rec. Shells, p. 322, 1817; Reeve, Conch. Icon., Pinna, pl. 10, fig. 19, 1858.

species, is thinner, with a less conspicuous external sulcus and internal ridge and differs also in sculpture; the other recent West Indian form, P. carnea Smelin (3), differs in a simi-

(3). Syst. Nat., p. 3255, 1792; Reeve, Conch. Icon., Pinna, pl. 20, fig. 18, 1858 (as P. flabellum).

lar manner. All of the above species reach a larger size than the Bowden form.

Occurrence.- Lower Miocene: Bowden beds, Borden, Jamaica.

Genus *ATRINA* Gra.

ATRINA sp. indet.

The genus *Atrina* is represented by a single fragmentary right valve. The ventral margin, apical and extreme posterior portions are missing, so that the outline is uncertain, although it appears to be elongated and slender with the dorsal margin straight and slightly reflexed. Most of the external surface is sculpture with relatively coarse oblique undulations upon which are superimposed finer oblique markings; but along the ventral edge, which may be some distance from the ventral margin, there are indications of at least one longitudinal ridge. Because of the character of the sculpture and the feeble convexity, this fragment is believed to represent a distinct species.

Occurrence.- Lower Miocene; Bowden beds, Bowden, Alaska.

Family Velinidae.

Genus *ILLIRA* Retzius.

ILLIRA sp. indet.

A small fragment of an apparently adult valve and an almost perfect, but very young, valve are present. The latter is very thick-shelled in the umbonal region; the byssal notch long, narrow, sharply indented; the ligament grooves long, diverging at a slight angle from the byssal notch, the raised intervals between the grooves narrower than the grooves; external sculpture feeble, consisting of numerous fine concentric striations, reinforced at intervals by incrementals. Because of the decidedly narrow byssal notch this fragment has an unusual appearance. The other extremely small valve is subquadrate in outline; anterior lateral margin flexed inward, but without a definite byssal notch; ligament grooves relatively wide, four in number, separated by much narrower ridges.

Occurrence.- Lower Miocene: Bowden beds, Bowden, Jamaica.

Family Etridae.

Genus PTERIA Scopoli.

PTERIA PREPOCERA n. sp.

Description.- Shell small, moderately and broadly inflates along a diagonal from the umbo to the postero-ventral margin, the greatest convexity medial and rising abruptly from the anterior lateral margin, descending more gently posteriorly and ventrally; dorsal margin moderately long, straight; umbones low, scarcely rising above the dorsal margin; anterior auricle small, triangular, depressed, set off from the rest of the shell by a ledge along the line of the narrow bisal sinus; surface of the shell smooth except for obscure sinuous incrementals on the anterior auricle; cardinal area very narrow, long, extending almost to the extremities of the dorsal margin; hinge of right valve with a socket placed slightly before the umbo and a lateral lamella near the posterior end of the dorsal margin.

Dimensions.- Length, about 9 mm.; ht., 11 mm.; apical diam., 3.5 mm.

Remarks.- *P. prepofera* is represented by two somewhat symmetrically right valves. The incomplete loss of the posterior portion of both valves leaves some doubt as to the outline, but it may be judged that the shell is not much produced along either the post-

ero-dorsal or postero-ventral war ins.

Dall (1) referred to this form as Pteris inornata Sabb (2)

(1). Trans. Warner Free Inst. Sci., Philadelphia, vol. 7, pt. 4, p. 333, 1898.

from Santo Domingo. That is evidently intended to be the type of that species is a mould impressed on a hard argillaceous matrix,

(2). Trans. Am. Philos. Soc., new ser., vol. 15, p. 357, 1875.

altogether different in lithological character from the remaining Santo Domingo material, with little of the shell remaining; it is more convex, more produced posteriorly, with the anterior auricle narrower and more acuminate. The Chipola material which has been described as P. (arvanta var.) chipolana Dall (3) is very fragmentary; apparently the form is less produced posteriorly and more abruptly inflated.

(3). loc. cit., p. 669, 1902.

Occurrence.--Lower Miocene: Borden beds, Borden, Texas (Dall, 1902).

Superfamily Ostracea.

Family Ostreidae.

Genus OSTREA (Linnaeus) Lamarck.

OSTREA MEGODON Hanley.

Ostrea megodon Hanley, 1845, Proc. Zool. Soc. London for 1845,
p. 106.

Ostrea callus Valenciennes, 1846, Voy. Venus, Joquille, pl. 21.

Ostrea cerrosensis Gabb, 1869, Pal. California, vol. 2, pp. 35,
106, pl. 11, fig. 61.

Ostrea callus Valenciennes, Gabb, 1869, Jour. Conch., vol. 5,
p. 32.

Ostrea megodon, Hanley, Reeve, 1871, Conch., Icon., Ostrea, pl.
12, figs. 24a-b.

Ostrea callus Valenciennes, Heilprin, in White, 1884, Fourth
Ann. Rept. U. S. Geol. Survey, p. 713.

Ostrea megodon Hanley, Dall, 1893, Trans. Wagner Free Inst. Sci.,
Philadelphia, vol. 7, pt. 2, pp. 685-686.

Description.- "Ost. testa calcata, elabre, solida, subaequi-
valvi, pallide livido-purpurascete, marginis versus plicata; pli-
cis anticis 5 aut 6, maximis, subangulatis; posticis minimis, ang-

ulatis, paucis, subobsoletis: margine valde plicato, intusque
marginis minusve scabro; natibus incurvatis; superficie interna albo-
virescente, numquam margaritacea; cicatrice satis magna, reniformi.
Long. 5 poll."

"A rare and extraordinary species, which bears not the slightest resemblance to any of the recent *Ostraea*. The narrow sickle-shaped contour and gigantic marginal tooth-like fold form its most distinctive character. The adult specimens are attached by their apices only." (Hanley, 1845).

Shell small, thin, subequivalve; both valves compressed or slightly convex; outline variable elongate and longitudinally subovate to subfalcate; left valve bearing three to five broad, irregular, subangular to rounded plications, most prominent at the ventral margin and extend only a short distance from the margin; depressions between the plications broader, thinner and less angular than the plications; right valve with similar, but less prominent, plications or more frequently irregularly warped; both valves without definite concentric sculpture except inconspicuous, usually non-laminated incremental lines; ligament area wide, oblique in position, with, on the left valve, a broad, shallow median depression; submargins finely, but conspicuously corrugated; muscle scar relatively large, posterior in position, longitudinally subelliptical to broadly subovate in outline, with the anterior dorsal ear in deeply emarginated.

Dimensions.- A longitudinally subovate right valve: lat. 26.5 mm.; lt., 40.5 mm. A subfalcate right valve: dorsal lat., 17 mm.; ventral lat. 27.5 mm.; alt., 31.5 mm.

Remarks.- The proverbial difficulties involved in the differentiation of the members of this genus are augmented in the case of the Bowden oysters by the almost complete absence of large individuals. The specimens referred to O. megodon are by far the most numerous. Typically this species is subfalcate, but most of the individuals are only slightly curved while many of them have an o tline which varies from longitudinally elongate to longitudinally subovate with the umbo placed at or near the posterior end. The most characteristic features are the small number of broad, subrounded, short plications on the left valve, the similar sculpture or irregular warping of the right valve, and the absence of laminate concentric sculpture. The somewhat falcate O. pauciplicata Dell (1), described from the Oak Grove sand, has a larger

(1). Trans. Wagner Free Inst. Sci., Philadelphia, vol. 7, pt. 1, p. 678, 1898. (As O. sellaeformis Conrad var. pauciplicata.).

number of radials (seven to fifteen) and regular concentric laminae. Non-falcate forms of megodon somewhat resemble the widespread

O. trisoralis Conrad (1) of the same size, but trisoralis is thicker, with more definite concentric laminae and a wider ligament

(1). Conrad, W. A., Proc. Acad. Nat. Sci., Philadelphia, vol. 7, p. 259, 1865.

area.

Cabb (2) suggested the identity of his O. cerrosensis, from

(2). loc. cit., p. 106.

the Miocene (?) of Cerros Island, off Lower California, with the undescribed, but figured, recent O. callus Valenciennes, but stated that cerrosensis is not more than half as large as the recent form. He also noted the occurrence of an oyster in the late Tertiary of Payta, Peru, which he considered identical with callus; in fact, later in the same year in the Journal of Conchology he called the Peruvian form callus. Reeve apparently was the first to recognize the identity of callus with the previously described merodon. If the above synonymy is accepted, this species is, as Dall has stated, one of those forms which formerly was common to the Antillean and Pacific regions, but after the separation of the two provinces persisted only on the Pacific side. Examples of such distribution are frequently encountered, not only among

the molluscs, but also among other groups, especially the corals.

Occurrence.- Oligocene.- Santo Domingo (Dall, 1928).

Lower Miocene: Bowden beds, Bowden, Jamaica. (Dall, 1928). Pliocene(?).- Jerros Island, off Lower California (Gabb, 1869; Dall, 1928). Post Pliocene(?).- Paito, Peru (Gabb, 1869). Post Pliocene (?).- San Bruno, east side of peninsula of Lower California (Gabb, 1869). Recent.- Gulf of California at Acapulco and southward (Dall, 1928).

OSTREA HAITENSIS Sowerby.

- Ostrea Haitensis Sowerby, 1850, Quart. Jour. Geol. Soc. London,
vol. 6, p. 57.
- Ostrea Heermanni Conrad, 1855, Proc. Acad. Nat. Sci., Philadelphia,
vol. 7, p. 267.
- Ostrea vespertina Conrad, 1856, Pacific R. R. Rept., vol. 5, p.
325, pl. 5, figs. 76-78.
- Ostrea Heermanni Conrad, 1856, idem, p. 326.
- Ostrea vespertina Conrad, 1857, U. S. and Mex. Bound. Surv. Rept.,
pt. 2, p. 160, pl. 17, figs. 1a-3.
- Ostrea virginica Guppy, 1866, Quart. Jour. Geol. Soc. London,
vol. 22, p. 577 (non Gmelin, 1792) in text.
- Ostrea Yeatchii Gabb, 1869, Pal. California, vol. 2, pp. 74-75,
60-61, 106, pls. 11, fig. 59; 17, figs. 21, 21a.
- Ostrea vespertina Conrad, Gabb, 1869, idem, p. 107.
- Ostrea haitensis Sowerby, Gabb, 1877, Trans. Am. Philos. Soc.,
new ser., vol. 15, pp. 257-258.
- Ostrea virginica Guppy, 1874, Geol. Mag. decade 2, vol. 1, no. 45,
(check list), ex parte, non Gmelin, 1792.
- Ostrea Haitensis Sowerby, Guppy, 1876, Quart. Jour. Geol. Soc.
London, vol. 32, p. 572.

Ostrea neermanni Conrad, Heilprin in White, 1884, Fourth Ann.

Rept. U. S. Geol. Survey, p. 314.

Ostrea vespertina Conrad, Heilprin in White, 1884, idem, p. 315,
pl. 71, figs. 2-4.

Ostrea vesatchii Tabb, Heilprin in White, 1884, idem, p. 316, pl.
72, fig. 1.

Ostrea Haitensis Sowarby, Dall, 1908, Trans. Wagner Free Inst.
Sci., Philadelphia, vol. 7, pt. 1, p. 665.

?Ostrea aff. vespertina Conrad, Toulou, 1908, Jahrb. K.-k. Geol.
Reichsanstalt, vol. 53, pp. 710-711, pls. 26, fig. 1;
27, figs. 14a-c.

?Ostrea aff. vespertina Conrad, Toulou, 1911, idem, vol. 67, pp.
474-475, pl. 20, figs. 1a-b.

?Ostrea gatunensis Brown and Pilsbr., 1911, Proc. Acad. Nat. Sci.,
Philadelphia, vol. 67, p. 706, pl. 20, figs. 1, 2.

Description.- "Testa oblonga, crassa, elicata, plicis paucis
(senis ad septenis), magnis, undulatis, subsquamosis, squamis non-
nunquam subtubulosis; limbo interno omnino glabro." (Sowarby, 1953)

Type locality.- Santo Domingo.

The Bowden specimens are small (not exceeding 50 mm. across),
thin or slightly thickened, compressed to slightly convex; outline

varying from longitudinally ovate to broadly ovate or even sub-circular; left valve with five to seven strong, narrow, usually sharply angular plications, some arising near the umbo and becoming progressively prominent toward the margin; secondary plications occasionally intercalated between the primaries at the margin and extending a short distance from the margin; interspaces between the plications deep and sharply angular; concentric sculpture of laminae, superimposed on the plications and most prominent near the ventral margin; right valve almost smooth or bearing plications similar to those on the left; submargins usually corrugated; muscle scar large for the size of the shell, subelliptical to sub-circular in outline, posterior in position; inner margin of the valve at times bearing minute pustules.

Dimensions.— Lat. 28 mm.; alt. 75 mm.

Remarks.— O. haitensis is represented by only a few small valves. This meager representation is probably not a certain indication of its role in the composition of the fauna, but, since no large oysters of any species are present, it may be explained by the fortuitous circumstances of collection. It must be remembered, however, that conditions may have been unfavorable for the prolific growth of oysters, since in none of the collections to which the writer has had access, are the members of this genus prominent, either in size or in number. The adult Santo Dominican

specimens are of enormous size. In the Chipola and Oak Grove faunas of Florida O. haitensis is the most widely distributed of the oysters and is also present in the Shoal River fauna. (1) Here it attains a large size, reaching 10 or 12 cm. across.

(1). Gardner, J. A., Mss.

compared with specimens from either Santo Domingo or Florida the Bowden forms are very small indeed. In the case of the large Florida forms the outline is more subcircular, the plications more persistent toward the umbo and the concentric lamellae often sub-spinose on the crests of the plications.

This species is characterized by its subcircular or broadly ovate outline and strong, relatively regular, sharply angular plications. These features readily distinguish it from the associated O. megodon, which is more elongate, typically subfalcate, with broader, fewer, weaker and less angular plications and without prominent concentric laminae. The Oligocene Antiquan O. antiquensis Brown (2) is heavier than the typical haitensis; the plications,

(2). Proc. Acad. Nat. Sci., Philadelphia, vol. 65, pp. 603, 614, pls. 19, fig. 17; 20, figs. 1, 5, 6, 1917.

when present, although of almost the same number, are divided into

two groups, one of five and the other of two, by a posterior broad depression and, since the shell is heavy, the plications scarcely affect the margins; besides, the margin of the left valve is strongly upturned and the right valve correspondingly reflected. The small, thin, elegantly sculptured Borden forms are scarcely comparable with this massive species, but the typical large haitensis approaches it more closely. Brown states that "at Millers Bay [Antigua] a much larger species of oyster was observed, perhaps O. haitensis Sowerby." (1) O. rugifera Dall (2) from the

(1). idem, n. 603.

(2). loc. cit., p. 687, 1898, (as O. sellaeformis Conrad, var. rugifera).

Tampa silyer and Chipola horizons never attains the size of haitensis and may be distinguished from the young of haitensis by the coarser ribbing in the right valve and the more exfoliate lamellae in the left. The Oak Grove O. pauciplicata Dall (3) has a

(3). idem, (as O. sellaeformis Conrad, var. pauciplicata).

more falcate outline and more regular concentric lamellae. When Cabb described the California faunas he was not acquainted as he

later stated, with Sowerby's brief description (1), but when he

(1). loc. cit., p. 258, 1873.

prepared the Santo Domingo memoir he recognized the identity of his O. veatchii (type locality, Cerros Island, off Lower California and occurring also at San Bruno on the east side of the Peninsula of Lower California) and O. haitensis. The California form, apparently is comparable in size and in other features to the large Floridian and Santo Dominican specimens. Dall has added to the synonymy the unfigured O. heermanni Conrad and O. vespertina Conrad, both originally described from "Carrizo Creek", California. According to the excellent figures in the Mexican Boundary Report, the plications of vespertina are not as high or as sharp as on the typical haitensis and the outline is not as rounded, but these features are probably due to immaturity. It appears that the California paleontologists still consider vespertina, veatchii and heermanni distinct species.

Suway (1866) stated that he could not consider O. haitensis distinct from O. virginica Smelin, but later (1876) he recognized the fact that they are sharply differentiated. Soula's "Ostrea aff. vespertina Conr." 1900, Gatun, Panama, appears to be the young of haitensis; his 1911 citation (Tehuantepec, Mexico) refers to two small, rather elongate right valves, with strong concentric ribs.

ings which probably also are lower haitiensis. Brown and Pilsbry (1911) described a form in the synonymy of a new species, O. guatemalensis, of which young specimens resemble haitiensis, but with the plications less sharp, while the adult type has low, rounded, somewhat irregular plications that produce an appearance different from the typical haitiensis.

Occurrence.-- Upper Oligocene.-- Santo Domingo (Sowerby, 1850; Gabb, 1872; Gabb, 1874, 1875); Chipola marl, Florida (Dall, 1892, Gardner, Mss.); Oak Grove sand, Florida (Dall, 1896; Gardner, Mss.); Shoal River marl, Florida (Gardner, Mss.); ?Taton Formation, Panama (Toula, 1908; Brown and Pilsbry, 1911); Lower Miocene: Bowden beds, Bowden, Jamaica (Guppy, 1846; Dall, 1898). ? Oligocene (?).-- Tehuantepec, Mexico (Toula, 1911). Miocene (?).-- Cerros Island, off Lower California (Gabb, 1869); Carrizo Creek, California (Conrad, 1855, 1857); other localities in California (anastomoses). Pliocene (?).-- Foker Canyon, near Merhall, California, (English, 1914 (1)). Post Pliocene (?).-- San Bruno, east side

(1). Univ. California Pub., Bull. Dept. Geol., vol. , . 205-218, 1914 (as O. yeatchii Gabb)

of the peninsula of Lower California (Gabb, 1869).

Ostrea folium Linnaeus:

- Ostrea folium Linnaeus, 1758, Syst. Nat., ed. 12, p. 620.
- Ostrea folium Linnaeus, Born, 1782, Mus. Gess. Hist. Nat., p. 114, vignette, p. 121.
- Ostrea folium etc., Chemnitz, 1785, Iconh. Ich., vol. 8, p. 31, pl. 71, figs. 662-663.
- Ostrea limacella etc., Chemnitz, 1785, idem, p. 31, pl. 71, fig. 664.
- Ostrea folium Linnaeus, Gmelin, 1791, Syst. Nat., vol. 6, p. 5734.
- Ostrea folium Linnaeus, Lamarck, 1819, Anim. sans Vert., vol. 4, p. 211.
- Ostrea limacella Lamarck, 1819, idem, p. 211.
- Ostrea rubell Lamarck, 1819, idem, p. 210.
- Ostrea erucella Lamarck, 1819, idem, p. 211.
- Ostrea folium Linnaeus, L'Orbigny, 1845 (?) in de la Mure, Hist. phys., polit. et natur. de l'île de Cuba, Mollusques, p. (Spanish ed.); 1857, idem, (French ed.), vol. 8, pp. 505-506.
- Ostrea folium Linnaeus, Reeve, 1871, Conch. Icon., vol. 10, Pl. 10, figs. 41a-c.
- Ostrea frons Reeve, 1871, idem., pl. 10, figs. 41a-c. (as Ostrea c)
- Ostrea cristata Wall and Silliman, 1891, Bull. U. S. Fish Comm., vol. 20, pt. 1, p. 464, (non Born, 1780).

Description.- "Shell rather thin, brown or brownish purple, adhering to mangroves by elongated lobes of the lower valve; upper valve in the middle elevated into a tube-shaped rib, all the sides divergently ribbed; ribs, rounded, smooth." (Reeve, 1871).

The Bowden form referred to this species are small and thin-shelled; outline variable, longitudinally subovate to elongate and narrow; left valve usually more convex than the right; longitudinally swollen medially; margins of the valves sculptured with fifteen to twenty sharp, usually sub-rounded clefts or beads, smaller dorsally and extending only a short distance from the center, the central portion of the shell almost smooth or bearing curved clasping spines; concentric sculpture of inconspicuous incremental lines; ligament area small, flattened; muscle scars small, subelliptical to subcircular in outline, usually posterior in position; inner margin of the shell, or only portions of the margin, often bearing small pustules.

Dimensions.- Lat. 11 mm.; alt., 54 mm.

Remarks.- These forms are the most puzzling of this unsatisfactory assemblage of oysters. They cannot be separated from the recent West Indian group which has been reported under various names, - O. folium Linnaeus, O. cristata Borné and O. gracilis Gmelin. Since this species has not been recorded in the Caribbean

and since the Borden forms so closely resemble the recent ones it is natural to accept with some hesitancy this sudden, pronounced extension of range. The suggestion has been made that these specimens are recent shells which have been washed up on the beach where the Borden beds are exposed, but such a view can hardly be entertained since in color and texture these bryozoa are similar to the other Borden shells.

It is extremely doubtful whether this species is genetically valid, since it may merely include forms which are abnormal because of situs. The Borden forms, however, are constant in the possession of numerous, small, but sharp, marginal plications. The plications of haitiensis are larger, however, fewer in number and extend further toward the umbos. Like the folia on merodon the form and broader; besides, folium is more elongate than haitiensis, of the same size but narrower and more convex than the 10-12 fold form of merodon. The clasping processes were developed only when the shell was attached, presumably to a rock or some other object, like the recent forms. In regard to the elements, usually smaller forms and numerous marginal plications characterize this species as here considered.

C. frons is small in strobilus, although the plications are acutely angled and the shell is usually attached apically. Large, thin, and somewhat flattened, and somewhat flattened shells.

O. serrulatus, Thellin (1), an African form, is less elongated, with

(1). Syst. Nat., vol. 3, p. 7333, 1793; Reeve, Icon. Ich.,
Plutea, pl. 6, fig. 4, 1850.

fewer plications that extend further toward the umbo. Thellin's

O. cristatus (2) is much broader, with fewer and broader marginal

(2). loc. cit., p. 113, pl. 7, fig. 7, 1850.

plications.

Amo. Gabb's Santo Domingoan oysters are so small for which probably should be referred to this species, although they are less elongate, with fewer plications that extend further toward the umbo and poorly developed clusters. It can be assumed that Gabb had these forms in mind when he noted the occurrence of "two or perhaps three other species of small oysters, among which one appears to be the common mangrove oyster, O. frons L. (limacella Lam.)" (3).

(3). Trans. Am. Philos. Soc., new ser., vol. 17, p. 232.

Occurrence.-- Lower Pliocene: Jordan's hole, Pechin, Jamaica.
Recent: West Indies in shallow water.

Superfamily: Pectinacea.

Family: Pectinidae.

Genus PECTEN Miller.

Subgenus Pecten s. s.

Section Pecten s. s.

PECTEN (PECTEN) BARRETTI n. sp.

Pecten (Pecten) soror Call, 1898, Trans. Wagner Free Inst. Sci., Philadelphia, vol. 5, pt. 4, p. 712 (ex parte, non Gabb, 1873).

Description.- Shell large, subequilateral; dorsal margin long, slightly concave, diverging at an angle of about 95°; right valve decidedly convex, sculptured with nineteen to twenty-two strong, high, almost square, radial ribs, their edges and tops being slightly rounded, separated by narrower, deeply channelled interspaces; in the interspaces and on the flanks of the ribs obscure, fine slightly raised concentric lines present; left valve slightly concave, with the same number of narrower, strong, square radial ribs, with deep, flat interspaces of the same width or slightly wider; concentric lines more prominent than on the right valve and occasionally extending across the ribs, but less conspicuous on the ribs than in the interspaces; submargin without radial

sculpture, relatively wide and forming a steep ledge on the left valve; auricles subequal, with weak radial ribs and fine concentric lines; interior ventral margin deeply crenulated.

Dimensions.- Left valve.- Lat. 50mm.; alt., 45 mm.; length of hinge, 25 mm.; Immature right valve.- Lat., 32 mm.; alt., 29.5 mm.; diam. 7 mm.; length of hinge about 15 mm.

Remarks.- On the left valve the strong radial ribbing does not terminate abruptly dorsally, the large ribs being followed by a few, weaker, closer radials, which gradually become obsolete leaving the submargins without radial sculpture. The dorsal margins on the single mature left valve are proportionately shorter than on the younger ones and more concave, while the fine concentric lines on the disk are not as prominent. Young right valves are proportionately less convex, with lower and narrower ribs and stronger concentric sculpture which overrides the ribs.

P. barretti is recognized by its very convex right valve, with strong, almost square radial ribs and slightly concave left valve, with equally strong, but narrower and square radials. It has been confused with P. soror (Gabb) (1), described from Santo Domingo

(1). Trans. Amer. Philos. Soc., new ser., vol. 15, p. 257, 1875,
(as Janira soror).

and later reported from Gatun (1). That species is, however, more concave dorsal margins and wider auricles; left valve with

(1). Gabb, W. M., Jour. Acad. Nat. Sci., Philadelphia, 2nd ser., vol. 7, p. 747, 1881, (as Janira soror).

slightly broader and rounded ribs, narrower interspaces and coarser concentric sculpture which overrides the ribs, the elevations on the inner margin wider and the edges of the elevations more sharply raised; right valve with ribs more rounded and auricles without radials. The Gatun P. reliquus Brown and Pilsbry (2) has more angular ribs, with the concentric lines on the left valve slightly

(2). Proc. Acad. Nat. Sci., Philadelphia, vol. 64, pp. 510-511, pl. 23, fig. 3, 1912. (= Pecten sp. (vielleicht n. sp.) Paula, 1903.)

weaker, but on the right stronger.

This species is named in memory of Mr. Lucius Barrett, the Director of the early Jamaican Survey, whose premature death was largely responsible for the hopeless incoordination of the published results of that organization's investigation.

Occurrence.— Lower Miocene: Bowden beds, Bowden Jamaica (Dall, 1898).

Section Euvola Dall.

PECTEN (EUVOLA) BOWDENI Dall.

Pecten (Euvola) bowdenensis Dall, 1893, Trans. Acad. Nat. Sci. Philad., vol. 5, pt. 1, p. 717, pl. 29, fig. 1.

Sci., Philadelphia, vol. 5, pt. 1, p. 717, pl. 29, fig. 1.

? Pecten (Euvola) bowdenensis Dall, 1893, 1905, Bol. Soc. Geol.

mexicana, vol. 1, p. 143, (check list).

? Pecten (Euvola) bowdenensis Dall, 1893, 1906, Bol. Inst. Geol.

Mexico, no. 22, p. 27, pl. 1, figs. 9, 10.

Description.- "Shell resembling P. ziczac L. in the right valve, with about twenty-three obsolete smooth ribs separated by impressed lines; right valve very convex; ears subequal, smooth, notch narrow, deep; left valve with seventeen low, rounded ribs separated by wider, squarely impressed interspaces; submargins wide, smooth; disk moderately concave; ears subequal, smooth, concavely arched; interior margin of the base with paired lines, the pairs separated by deeper channels; cardinal area obvious. Alt. 47, lat., 44.5 mm."

"The sculpture of the left valve definitely separates this species from the young of P. ziczac, P. medius and allied forms known from this region." (Dall, 1893).

Type locality.- Bowden, Jamaica.

Shell thin, width and length almost equal, hinge line approximately equal to half the width of the shell; dorsal margin low, slightly concave, diverging at an angle of about 105° ; ventral half of the outline forming an evenly semicircular; on the very convex right valve the radial lines between the obsolete "ribs" but feebly impressed, the surface more or less polished, with very faint, irregularly spaced incremental lines, usually slightly more conspicuous and more regularly disposed on the subearrins and on certain irregular, somewhat worn areas on the disk; the concave left valve with the umbonal portion almost smooth, the interspaces between the low ribs usually slightly raised apically; the concentric fine lines more conspicuous than on the right, though still faint, and more regularly spaced; auricles on both valves subequal and smooth, except for fine incremental lines, the lines decidedly imbricate on the right anterior auricle; on the interior of the left valve the paired lirae visible for only a short distance from the margin, the interval between the two members of a pair more deeply channelled than the interval between two pairs, the opposite of the condition on the right valve, with lirae extending farther up toward the umbo.

Dimensions.- A right valve.- Lat., 44 mm.; alt., 45 mm.; diam., 16 mm.; length of hinge, 21 mm. A left valve.- Lat., 47 mm.; alt., 46.5 mm.; diam., 16 mm.; length of hinge, 22.5 mm.

Remarks.- The almost smooth, very convex right valves and moderately concave, relatively strongly sculptured left valves of this species are conspicuous among the Tuxtepec scallops. The ribs on young left valves are weaker and narrower than on adults.

P. bordenensis is closely related to the recent P. ziczac Linnaeus (1), but the right valve of the recent form is not quite as convex and the left valve is sculptured with more numerous ribs, separated by narrow impressed lines. P. melius Lamarch (2) is

- (1). Syst. Nat., ed. 10, p. 606, 1759; Reeve, Conch. Icon., vol. 6, Pecten, pl. 6, fig. 29, 1852.
-

more strongly ribbed. The Costa Rican Pliocene P. limonensis Dall (3) is smaller, with less poorly defined ribs on both valves.

- (2). Anim. sans Vert., vol. 6, p. 163, 1819; Thernitz, Conch. Cab., vol. 7, pl. 60, figs. 586, 587, 589, 1784.
- (3). loc. cit., p. 715, 1908, (= Janira laevigata Cabb, Jour. Acad. Nat. Sci., Philadelphia, 2nd ser., vol. 6, p. 579, pl. 47, fig. 84, 1881, not P. laevigatus Goldfuss, 1875).
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The left valves which were described from the Pliocene of Tuxtepec, Mexico as bordenensis, but the intercostals seem to be too flat and deep for that species.

Occurrence.- Lower Miocene: Borden beds, Borden, Jamaica (Dall, 1908). Pliocene.- Tuxtepec, Mexico (Banc, 1905, 1906).

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PLESTEN (LUVOLA) sp. indet.

The presence of a second species of the section Luvola is indicated by fragments of a small right valve. The shell is very thin, feebly convex; exterior surface sculptured with about twenty-five very weak, rounded radials, obsolete toward the umbo, separated by flattened interspaces about half as wide; concentric incrementals fairly prominent; interior of the valve with weak radials of about the same order of magnitude as the external ones.

Externally this form is very close to P. gatumensis Toulal (1), but comparison with material in the Philadelphia Academy collection

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(1). Jahrb. K.-k. geol. Reichsanstalt, vol. 58, pp. 711-712, pl. 26, fig. 2, 1908 (Not P. (Amusium) gatumensis Toulal, idem, pp. 716-717, pl. 26, fig. 10).

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from the Gatun beds shows that the Gatun species has external radials that are slightly higher toward the ventral margin and internally the interspaces between the radials are narrower until near the margin where they suddenly become wider and deeper, the ribs therefore becoming narrower and higher. It is possible, however, that these differences are due to the difference in characters of various growth periods, only fragments of large valves of gatumensis being available.

The Bowden form is separated from the associated bowdenensis by its less convex contour, the presence of flattened interspaces

between the external radials and of internal radial ribs instead of paired lirae.

Occurrence. - Lower Miocene: Bowden beds, Bowden, Jamaica.

Subgenus *Chlamys* Bolten.

Section *Chlamys* s. s.

PECTEN (CHIAMYS) VAGINULUS Dall.

Pecten (*Chlamys*) ornatus Lamarck ? var. vaginulus Dall, 1898,
Trans. Warner Free Inst. Sci., Philadelphia, vol. 3,
pt. 1, pp. 715-716.

? Pecten sp. (aff. P. gracilis Sow. Toulon, 1908, Jahrb. d. k.
geol. Reichs., vol. 58, p. 711, pl. 23, fig. 7.

Description.- "Seven small valves of a species closely resembling *P. ornatus* were obtained at Bowden; the form and sculpture are practically the same, but the ribs (twenty-one to twenty-five) are single, subequal, and not fasciculated, and are separated by simple narrower interspaces not radially threaded. The young of ornatus, as far as observed, seem to always have one or more interstitial riblets. I therefore propose for the present form the varietal name of vaginulus, which may be raised to specific rank if the difference is confirmed by the characters of adult specimens." (Dall, 1898).

Type locality.- Bowden, Jamaica.

Shell small, thin, subequivalve, suborbicular, the height slightly exceeding the width, equilateral, excepting the auricles,

moderately inflated; right valve usually less inflated than the left; dorsal margins diverging at an angle of 90° or less; both valves sculptured with twenty to twenty-five slender, square to subrounded radial ribs, separated by narrower interspaces; in the interspaces and occasionally overriding the ribs fine, inconspicuous, slightly raised concentric lines present, rarely causing a few anterior and posterior ribs to be scabrous; submargins without radial sculpture or with fine radials, forming a continuous series with those on the disk; hinge long, auricles decidedly unequal, especially on the right valve; byssal notch deep and sharply sinuate; both auricles sculptured with irregular radial ribs and concentric lines, the sculpture of the anterior auricle coarser and more decidedly imbricated.

Dimensions.-- A right valve: lat. 11.8 mm.; alt., 1° mm.; diam., 1.9 mm.; length of hinge, 7.5 mm. A left valve: lat. 12 mm.; alt., 15 mm.; diam. 2.1 mm.; length of hinge, 7.2 mm.

Remarks.-- The small, thin, delicately sculptured valves of this species are very abundant and the individuals range in stages of growth from mature to very young. This abundance and the constancy of the above noted, marked differences between it and the recent P. ornatus Lamarck (1) testify to the advisability of re-

(1). Anim. sans Vert., vol. 6, p. 176, 1810; Bruguière, Enc. Méthod., pl. 214, fig. 5, 1739.

ing Dall's varietal name to specific rank. The outline of the shell is somewhat variable, some of the shells being more orbicular than the typical slightly elongate form. On some valves the anterior submargin is narrower than the posterior and is without radial sculpture, while on the posterior one radial sculpture may or may not be present. In general, this species is characterized by its small, thin shell, suborbicular and moderately inflated outline and numerous, finely sculptured ribs. Immature right valves are especially conspicuous because of their compression and unusually long anterior auricles. The few individuals with rounded ribs and slightly scabrous anterior and posterior ribs differ from the young of the associated P. (Aeg. inecten) sumplous n. sp. of the same size by having more numerous and more slender ribs, narrower interspaces, with at no time all the ribs scabrous.

Toula's figure reproduces an incomplete right valve which agrees, as far as the figure is concerned, with varinulus. He notes, however, that the ribs display a tendency to become dichotomous on the middle of the disk. Since his material furnished only two fragmentary valves it is difficult to determine whether his form is identical.

Occurrence.-- Upper Oligocene: ? Catun, Panama (Toula, 1908).

Lower Oligocene: Bowden beds, Bowden, Jamaica, (Dall, 1898).

PELLEW (CHILANYS) ANILINUS n. sp.

Description.- Shell small, subequivalve, suborbicular, the height and width virtually equal, well inflated, the two valves equally inflated; the dorsal half, excluding the auricles, forming a sector of about 95° , the ventral half evenly subcircular; both valves sculptured with twenty-one to twenty-three strong, subrounded radial ribs, separated by narrower interspaces; concentric sculpture of fine raised lines usually appearing in the interspaces and occasionally on the ribs; subauricles without radial sculpture; auricles unequal, both bearing inconspicuous radials, on the posterior auricle more prominent ventrally, but on the anterior broader and stronger dorsally, overridden by fine concentric lines, coarser and more irregular on the anterior auricle.

Dimensions.- Right valve: lat., 15 mm.; alt., 14.8 mm.; diam., 7.8 mm.; length of hinge, 3 mm. Left valve: lat., 17.5 mm.; alt., 17.2 mm.; diam., 7.5 mm.; length of hinge, 4.2 mm.

Remarks.- P. anilinus is well characterized, although individuals are not as numerous as those of the other member of this section. The characters are constant except for a slight variation in outline which causes some specimens to be slightly less rounded than the typical form. Occasionally a slight selen appears on the extreme distal portion of the ribs, but this is a min-

or feature, never affecting all the ribs. This species is recognized by its well inflated, suborbicular outline and numerous strong, subrounded radials. It is closely related to P. varinulus but is slightly larger, more inflated, with the right valve inflated to the same degree as the left, more rounded, its ribs are broader and never as flat as those of many specimens of varinulus. Although end members of the two series approach each other in outline or in the degree of inflation, they may be separated by one or more of the above differences. Immature individuals of the two species resemble each other very closely, but usually the ensemble of the characters is sufficient to differentiate them.

Occurrence. - Lower Miocene: Bowden beds, Bowden, Jamaica.

PECTEN (JULIATIS) NEA-SCHWABII n. sp.

Description.-- Shell small, thin, moderately inflated, higher than wide, the dorsal margins sloping steeply; external surface sculptured with about twenty-three narrow, prominent, rounded, unequally spaced radial ribs of inconstant width, some extending only a little more than half of the distance to the umbo and all becoming obsolete before the umbo is reached; the ribs finely nodulated along irregularly spaced concentric lines; auricles unequal, with relatively prominent radials roughened by overriding concentric lines; byssal notch prominent.

Dimensions.-- lat. 4 mm.; alt., 5 mm.; diam., .5 mm.

Remarks.-- Although the single right valve on which this species is based is doubtless very young, the narrow, irregularly spaced and nodulated radials definitely distinguish it from the other members of the section.

Occurrence.-- Lower Miocene: Borden beds, Borden, Jamaica.

PECEN (CHLAMY) BILIPICTUS n. sp.

Description.- Shell small, thin, compressed, the height slightly exceeding the width; dorsal margin long; external sculpture of eleven feeble, rounded ribs, separated by wider interspaces, becoming obsolete on the dorsal half of the shell; concentric sculpture of fine, microscopic concentric striae over the entire surface; auricles subequal, the right anterior sculptured with radials, with superimposed concentric lines, scabrous along the hinge; byssal notch prominent; interior of the valve with broad radial undulations corresponding to the external intercostal spaces.

Dimensions.- lat. 7 mm.; alt., 7.5 mm.

Remarks.- This species also is represented by a small right valve. It is distinguished by its few, feeble radials and fine concentric striae. Dall (1) has described a closely related form, P. aluminensis, from the Chipola; it has more numerous and more prominent radials.

(1). Trans. Wagner Free Inst. Sci., Philadelphia, vol. 3, pt. 4, p. 740, pl. 34, figs. 10, 11, 1898.

Occurrence.- Lower Miocene: Bowden beds, Bowden, Jamaica.

Section *Aequipecten* Fischer.

PECTEN (*Aequipecten*) *INEQUALIS* Sowerby var. *Aequipecten* n. var.

Pecten inaequalis Guppy, 1856, Quart. Jour. Geol. Soc. London,
vol. 22, p. 294, pl. 12, fig. 6 (non Sowerby, 1850).

Pecten inaequalis Guppy, 1874, Geol. Mag., Series 2, vol. 1, p.
445 (check list), ex parte, non Sowerby, 1850.

Pecten (*Aequipecten*) *inaequalis* Dall, 1891, Trans. Wagner Free
Inst. Sci., Philadelphia, vol. 3, pt. 1, p. 714, (ex
parte, non Sowerby, 1850).

Description.— Shell of medium size, the height and width
almost equal, subequilateral, with the posterior side more produced;
right valve decidedly inflated, left valve moderately or slight-
ly inflated, compressed toward the ventral margin; dorsal margins
straight or slightly concave, the posterior margin lower and with
steeper slope than the anterior, the two margins diverging at an
angle of 90°; exterior surface of right valve sculptured with seven-
teen or eighteen high, broad, more or less polished radial ribs,
their tops slightly rounded and their flanks excavated; intervening
intercostal spaces narrower, deeply and coarsely striate; in the
interspaces fine, but distinct raised concentric lines present,

the umbones inflated, but at their distal ends more lar-ly, rounded, arched incremental lines usually visible; left valve with the same number of ribs, but lower, more rounded and with sloping sides distally, the interspaces wider; the concentric lines in the interspaces and the growth lines on the ribs more prominent than on the right valve; submargins on both valves smooth, except for very fine concentric lines; auricles subequal, the posterior with two to five small radial ribs, decreasing in prominence from the margin of the disk or absent on the dorsal portion, the entire surface covered with fine concentric lines; anterior auricle sculptured with three to five usually slightly coarser ribs of irregular width, slightly roughened by the over-riding, inconspicuous concentric lines; cardinal crura prominent; interior ventral margin deeply crenulated, with lirations extending toward the umbo.

Dimensions.— A right valve: lat., 25.6 mm.; alt., 27.5 mm.; diam., 8 mm.; length of hinge, 13 mm. A left valve: lat., 24.5 mm.; alt., 27.8 mm.; diam., 5.7 mm.; length of hinge, 14 mm.

Remarks.— This form is by far the most abundant of the *Borden* *Pecten*. The right valve is much inflated, while the left is less convex or even compressed, especially among young individuals. The degree of inflation of both valves is subject to slight variation; the most inflated forms are also less orbicular, being higher than wide. The difference in the character of the radial sculp-

ture on the two valves is marked. On the left valve, since the interspaces are wider than on the right, the concentric sculpture is more prominent and the arched, crowded growth lines on the ribs are more constantly present. Left valves are usually more inequilateral than right ones. The ribs of immature left valves are less rounded, almost square, distally, than on adults; while young right valves differ from adults in having the ribs lower and the interspaces wider.

The strongly inflated right valves, with high, broad, sharply chiseled ribs and the decidedly less convex left valves, with lower, more rounded ribs are readily distinguishable from the associated *Pecten*. The Gaton *P. levicostatus* Gould (1) reaches a large size, is less convex, with more numerous (twenty-one), slightly

(1). Jahrb. K.-k. geol. Reichsanstalt, vol. 58, p. 715, pl. 24, figs. 1-3, 1908.

narrower and lower radials. Right valves may be confused with the young of *P. operculariformis* Gould (2), from the same locality, but

(2). Idem, pp. 712-717, pl. 24, fig. 3.

the Gaton form is less inflated, with more numerous (twenty-five) narrower radials, narrower and shallower interspaces; since the

left valve is about as much inflated as the right it is decidedly different from the left valve of the Jordan form. The recent E. sayanensis Bell and Simpson (1) closely resembles the Jordan form

(1). Bull. U. S. Fish Comm., vol. 23, pt. 1, p. 487, pl. 55, fig. 7-9, 1901.

restricted in outline and sculpture, but the ribs are lower and not quite so square.

It was surprising to discover that the Santo Domingo form differs from the insensibilis form Jordan and other Antillean localities. Apparently the long-established concept of insensibilis was based on Cuvier's figure, which, it must be remembered, represents a Jordanian, presumably Jordan, form, and on Cuvier's description. In the case of this species, as with Cuvier's other Antillean species, it is assumed that Cuvier's Santo Domingo forms are the same as those which Cuvier described unless they obviously differ from Cuvier's diagnosis, although that assumption may be incorrect; at least, it seems advisable to limit Cuvier's names to Santo Domingo forms whenever closely related, but different, species occur elsewhere. The typical insensibilis, as here restricted, reaches a larger size than its Jordan variety, and although its valves are virtually identical in appearance, the ribs of right valves are lower, more rounded, without the first two or three excavated flanks

that are so characteristic of the variety. In this connection it is well to remember that Sowerby described (1) both sides of the interspaces of what certainly was a right valve of "Pectyolites".

(1). Quart. Jour. Geol. Soc. Lond., vol. 6, p. 12, 1850.

Occurrence.- Upper Glipocene: Gracaeo (Dall, 1904); Isthmus of Darien (Dall, 1908); Lower Miocene: Borden belt, Oregon, Pacific Supply, 1898, 1874; Dall, 1908).

PECTEN (AECUIPECTEN) SIMPLIX n. sp.

Pecten exasperatus Guppy, 1876, Quart. Jour. Geol. Soc. London, vol. 22, p. 294 (non Sowerby, 1843).

Pecten oxygonum Gabb, 1877, Trans. Am. Philos. Soc., new ser., vol. 15, p. 256, (non Sowerby, 1850).

Pecten exasperatus Guppy, 1874, Geol. Mag. Decade 8, vol. 1, p. 447 (check list), ex parte, non Sowerby, 1847.

Pecten oxygonus Guppy, 1874, idem, (non Sowerby, 1850).

Pecten oxygonum Guppy, 1876, Quart. Jour. Geol. Soc. London, vol. 32, p. 572, (non Sowerby, 1850).

Pecten (Aecuipecten) thetidis Dall, 1898, Trans. Wagner Free Inst. Sci., Philadelphia, vol. 3, pt. 4, pp. 714-715, (non Sowerby, 1850).

Not P. oxygonum Sowerby, Dall, 1898, idem, pp. 714-715.

Pecten (Aecuipecten) oxygonum Brown, 1917, Proc. Acad. Nat. Sci., Philadelphia, vol. 65, p. 601.

Description.- Shell of medium size, equilateral, except for the auricles, subequivalve, both valves moderately convex, suborbicular, with the height and width virtually equal; outline, exclusive of the auricles, forming a sector of approximately 90° ; hinge straight, about two-thirds of the width of the shell; dorsal mar-

gins straight, their distal ends more rounded on the left valve than on the right; external sculpture similar on both valves, with eighteen to twenty prominent radial ribs, more or less square on the dorsal half of the shell, broader and more rounded on the ventral half, separated by narrower interspaces; the ribs and interspaces in the ventral half of the shell ornamented with radial rows of short, blunt scales, smaller in the interspaces, inconspicuous on the dorsal half, reduced to a single row and often absent in the interspaces; submargins sculptured with fine, narrow, irregularly spaced, squamose radial ribs; auricles broad, the anterior longer, with a deep byssal notch, both sculptured with squamose radial ribs of irregular width, wider and higher than those on the submargins, on the anterior auricle the ribs wider and the scales more prominent than on the posterior; interior of the shell with paired lirae separated by excavated intervals.

Dimensions.-- A right valve: lat., 74.5 mm.; alt., 54.4 mm.; diam., 9 mm.; length of hinge, 23.5 mm. A left valve: lat., 73.2 mm.; alt., 74 mm.; diam., 8.8 mm.; length of hinge, 24.5 mm.

Remarks.-- P. sumplens is a common form in the Borden fauna and is one of the most wide-spread of the mid-Tertiary Pectens in the Caribbean region, having been reported under various names from almost all localities where deposits of that age have been explored. The characters are fairly constant, although the degree

of inflation is subject to slight variability. The scales show a tendency to alternate on adjacent rows and except near the ventral margin of adult shells the rows are not separated by definite grooves. The majority of the specimens have nineteen ribs. The internal lirations usually extend over more than half of the distance to the umbo, although on thick shells the distance is less. Young shells are less orbicular than adults, being higher than wide, the sculpture on the interspaces is reduced to radial, raised scaly lines, the ribs are merely roughened and their distal ends squarer.

This species is recognized by the scabrous character of the sculpture and the almost constant number (nineteen) of distally subrounded ribs. It is closely related to the Eocene and Recent P. exasperatus Sowerby (1), with which Cuppy first confused it,

(1). Thesaur. Conch., vol. 1, p. 54, pl. 18, figs. 137, 138, 139,
("P. fuscopurpureus Conrad, 1849).

but the recent form is larger and individuals of the same size are usually less orbicular, more inflated, with steeper dorsal margins, the scales arranged in more definite radial series and more prominent in the interspaces. Brown and Pilsbry have described two varieties of this species; as oxyzonus canalis (2) from

(2). Proc. Acad. Nat. Sci., Philadelphia, vol. 64, p. 511, pl.
94, fig. 7, 1912.

Gatun, which is larger, with subequal radial striae on the ribs and interspaces and the surface less oblique, scabrous; and oxygonus optimum (1), from the Costa Rican Miocene and Antiquo (2),

- (1). idem, pp. 511-512, pl. 24, fig. 2 (= P. paremensis Gabb, Jour. Acad. Nat. Sci., Philadelphia, 1st ser., vol. 3, p. 347, pl. 45, fig. 21, 1881, non d'Orbigny). The Antiquo form which Gabb (loc. cit., pp. 717-718, pl. 33, fig. 7, 1881) described as P. gabbii, as a new name for Gabb's P. paremensis, is distinct; Gabb's specimen came from Sapote, Costa Rica, not Santo Domingo.
- (2). Brown, A. P., Proc. Acad. Nat. Sci., Philadelphia, vol. 65, pp. 601-602, 1913.
-

which also is larger, more inequilateral, with the dorsal half of the ribs subrounded, the ventral half beveled, radial striae on the ribs and interspaces crossed by irregular incrementals, the surface roughened, but not scabrous, the submargins forming a high, steep ledge.

Bowerby's failure to provide figures for his three briefly described Santo Dominican Pectens (3) has caused some confusion.

- (3). Bowerby, C. B., Quart. Jour. Geol. Soc. London, vol. 6, p. 52, 1850.
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It is surprising that Gabb should have identified the present form as oxygonus Bowerby since it obviously conflicts with Bowerby's

diagnosis and it is unfortunate that later workers have accepted Gabb's determination. There is no warrant for assigning the thetidis Sowerby to this common Pecten, as Dall has done, since Santo Domingian specimens are known that agree with Sowerby's description and probably with one of the valves under that name in the Heniker collection at the British Museum (1), Guppy's early con-

- (1). Information from Mr. Reid, discourse by Dall, loc. cit., pp. 714-715, 1908. In addition to this valve there are others which certainly are distinct.
-

fusion of a "Jamaican" Pecten with the recent exasperatus, an error which he later corrected and followed Gabb's example in calling it oxyronus, indicated that he had the present form in mind. In this connection it is surprising that Dall used thetidis in a manner "which would agree with usage as seen in the Guppy and other collections". (?) Apparently Guppy had this common seaboard form labeled-

- (2). Dall, W. H., loc. cit., p. 715, 1908.
-

ed "thetidis" when his collection was acquired by the National Museum.

The Santo Domingian specimens of sumolans reach a slightly larger size than the Porden ones, with the scales arranged more

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p. 532

Definitely in linear series toward the ventral margin, the series separated by shallow grooves, an arrangement which is concomitant with the increase in size, as is shown by the Bowden specimens. The largest Antigua valve, larger than any from Bowden, has a narrow, scabrous medial rib in the interspaces near the margin.

No Pecten resembling thetidis is known from the Bowden beds; it differs from sumplensis by its more inequilateral outline, higher, sharper ribs, their summits with a shallow sulcus, bounded by a narrow radial on either side, with another radial near the base, the surface of the radial roughened by irregular, low elevations, but not definite scales, along unequally spaced concentric lines.

Occurrence.- Upper Oligocene: Santo Domingo (~~Schuchert~~, 1910; Gabb, 1873; Guppy, 1874, 1876; Dall, 1898); Antigua (Brown, 1917); Curacao (Dall, 1898); Lower Miocene: Bowden beds, Bowden, Jamaica (Guppy, 1866, 1874; Dall, 1898).

PECTEN (~~ACQUINECTEN~~) OXYCONUS Sowerby.

Pecten oxyconum Sowerby, 1850, Quart. Jour. Geol. Soc. London, vol. 6, p. 52.

Pecten augusticostatus Cabb, 1873, Trans. Am. Philos. Soc. (new ser.) vol. 15, p. 256.

Pecten (Acquincten) oxyconum Sowerby, Dall, 1898, Trans. Wagner Free Inst. Sci., Philadelphia, vol. 7, pt. 4, pp. 713-714.

Not P. oxyconum Cabb, 1873, Cuppy, 1874, 1876, Brown, 1913, (= P. sumpleus n. sp.).

Description.- "Testa suborbicularis, subobliqua, tumida, costellis radiantibus 19, superne acutangulis, interstitiis aequalibus lineis incrementi concinne decussatis; auribus inaequalibus, laevibus, radiatim costellatis, costellis tenuissimis." (Sowerby, 1850).

Type locality.- Santo Domingo.

"Shell small, suborbicular, with nineteen to twenty-one sharply keeled ribs separated by V-shaped interspaces, with little-elevated, sharp, thin, concentric linear imbrication; form, tumid, cardinal crura well marked; left valve less convex than the other. Alt. and lat. about 15 mm." (Dall, 1898, from type of P. augusticostatus Cabb).

Shell small, well inflated, subequivalve, suborbicular, slightly more produced and unevenly rounded posteriorly; posterior dorsal margin longer than the anterior; right valve sculptured with twenty-two or twenty-three angular radial ribs, the summit being slightly rounded and on adult shells the ribs rounded at the ventral margin, separated by angular interspaces, with the apices of the angles rounded; on the slopes of the ribs and in the bottoms of the interspaces fine, closely spaced, sharply raised concentric lines present, usually not rising above the summits of the ribs; left valve sculptured with eighteen or nineteen similar, but broader and more sharply angular, ribs and similar concentric lines; submargins of both valves smooth except for very fine, inconspicuous concentric striae; auricles subequal, with four or five narrow, unequally spaced radial ribs, crossed by concentric imbrications; cardinal crura conspicuous, finely striated.

Dimensions.- A left valve: lat., 14 mm.; alt., 11.1 mm.; diam., 7.8 mm.; length of hinge, 5.2 mm. A right valve: lat., 12.5 mm.; alt., 12.2 mm.; diam., 8 mm.; length of hinge, 6 mm.

Remarks.- The two valves are of almost equal convexity, but the left displays a tendency to be slightly less convex and more inequilateral. The radial sculpture on the two valves is quite different; on the left valve the ribs are fewer, broader and more sharply angular, but still very slightly rounded, especially at

the ventral margin and in the umbonal region. The concentric lines override the ribs but rarely and then are very faint. Two large right valves, larger than the one measured, that apparently belong to this species, have ribs which are notably rounded and even flattened at the ventral margin. As usual, young shells are more rounded than adults. The angular ribs are the distinguishing feature of this species, which numerically is not a conspicuous element of the Pecten fauna.

As Dall pointed out, Cabb's Santo Dominican augusticostatus agrees with Sowerby's description of oxygnus. The fact that this form is not similar to any of those under the name oxygnus in the Fenner collection, as Dr. Dall learned from Mr. Reid, should not have much weight since it is evident that labels and shells in that collection are improperly associated, a confusion which in all probability occurred after the completion of Sowerby's work. The type of augusticostatus is larger than the Bowden specimens, with the median and posterior ribs sharply angular, the summits of the anterior six or seven slightly rounded, the posterior submargin bearing weak radials.

Occurrence.- Upper Oligocene: Santo Domingo (Sowerby, 1850; Cabb, 1873; Dall, 1898); Lower Miocene: Bowden beds, Bowden, Jamaica (Dall, 1898).

PECELEN (ADQUIPELEN) ELACHISTUS n. sp.

Description.- Shell small, moderately inflated, suborbicular, subequilateral; right valve more inflated than the left; exterior surface of right valve sculptured with twenty-one rounded or subrounded radial ribs, separated by slightly narrower, rounded interspaces; concentric sculpture of fine, but conspicuous, concentric raised lines, occasionally overriding the ribs in the distal third of the shell and in the same region rarely extended sufficiently to form continuous concentric lines of slightly projecting, inconspicuous, thin, scales; left valve sculpture with seventeen or eighteen strong, square radials separated by deeply impressed interspaces of the same width, with the concentric lines usually prominent in the interspaces and occasionally appearing on the ribs; submargins, auricles and crura as in P. oxygonus.

Dimensions.- 1 right valve: lat., 10 mm.; alt., 10 mm.; diam., 1.8 mm.; length of hinge, 5.5 mm.; 1 left valve: lat., 8.7 mm.; alt., .5 mm.; diam., 1.4 mm.; length of hinge, 5.9 mm.

Remarks.- P. elachistus, represented by several valves, all of which probably are not mature, closely resembles P. oxygonus in general features, but the sculpture is decidedly different. Right valves of elachistu have fewer, (one or two less) broader, more rounded ribs, with correspondingly narrower interspaces, than

the young of oxygonus of the same size; on left valves the differences are even sharper, since on elachistus the radials are square and the interspaces almost squarely impressed, while on oxygonus both radials and interspaces are angular. Left valves of the new species are less tumid than those of oxygonus.

Occurrence.- Lower Miocene: Bowden beds, Bowden, Jamaica.

PLATE (ADDITION) TO JOURNAL n. 30.

Description.- Shell of medium size, slightly inequilateral; left valve moderately convex; dorsal margins converging at an angle of slightly more than 90°, the posterior dorsal margin being longer than the anterior, causing a slight production posteriorly; exterior surface sculptured with seventeen strong, almost flat-topped, but rounded, radial ribs, separated by interspaces of virtually the same width; concentric sculpture of relatively conspicuous, fine, sharply raised concentric lines, overriding the ribs except in the distal half of the shell, the lines being arched in the interspaces with the convex side toward the ventral margin; submargin sculptured with concentric lines, finer than those on the disk; auricles subequal, with radial and concentric sculpture; cardinal crura prominent; right valve not known.

Dimensions.- Left valve: lat., 14.5 mm.; alt., 14.7 mm.; diam., 2.3 mm.; length of hinge, 7.5 mm(?).

Remarks.- This sharply defined species is represented in the material at hand by a single left valve. The strong, subparallel radial ribs and, above all, the conspicuous, raised concentric lines over the entire surface of the disk, except on the distal portions of the ribs, serve to distinguish this form from the more related *trapezoides*. The concentric lines are actually closely

sized, but the interval between them is wider than in the case of most species.

Occurrence. - Lower Miocene: Bowden beds, Bowden, Jamaica.

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Subgenus *Pseudanomia* W. & A. 1861.

Section *Pseudanomia* A. A.

PECTEN (*PSEUDONOMIA*) *PECTEN* Dall.

Pecten (*Pseudonomia*) *pecten* Dall, 1891, *Waggoner Inst.*
Sci., Philadelphia, vol. 5, pt. 4, pp. 711, 715, pl. 74,
figs. 12, 13.

Description.- "Shell small, suborbicular, moderately convex,
smooth, with the surface covered with microscopic lamptonectes
striation; ears small, the anterior slightly larger, all with
very minute radiation and concentric lines; notch narrow, small,
with no ctenolium; interior smooth, without lirae or developed
crura; traces of the auricular crura alone perceptible; cardinal
margin bearing a sharply cross-striated, very distinct pro-
vinculum; basal margins flattened, posterior margin slightly compressed.
Alt. 6, lat. 6 mm.

"The abundance and uniformity of this little shell testify to
its abult character. Occasional individuals show a thickened line
internally on each side, on the lower edges of the submargin,
like some recent species, and also traces of coloration in blotches."
(Dall, 1891).

Type locality.- Bowden, Jamaica.

Remarks.- Numerous individuals of this small species are present in both collections. On all except the most opaque shells, faint, microscopic concentric markings, due to differences in the texture of the shell rather than to sculpture, are visible, and on a few more or less translucent, polished valves these markings are quite distinct. Radiating lines on the auricles are seldom observed and when present they are subordinate to the inconspicuous concentric lines. In the anterior auricle of the right valve the concentric lines are most prominent and are slightly roughened.

Typical individuals are of the following dimensions:

A right valve: lat. 5.9 mm.; alt., 5.7 mm.; length of hinge, 2.3 mm.

A left valve: lat. 5.5 mm.; alt., 5.3 mm.; length of hinge, 2.5 mm.

The small, thin, smooth valves of this species, with the marked provinculum cannot be confused with any of the co-existent Pecten. Pecten (Cyclopecten) oligolepis Brown and Pilsbry (1) from Gatun is smaller, with a more rounded outline and faint sculpture.

(1). Proc. Acad. Nat. Sci., Philadelphia, vol. 64, pp. 512, 513, text fig. 5, 1912.

Occurrence.- Upper Oligocene: Oak Grove sand, Florida (Dall, 1892); Lower Miocene: Bowden beds, Bowden, Jamaica (Dall, 1898). Pliocene: Limon, Costa Rica (Dall, 1894).

Cubrensis Amusium (Bolten) Schumacher.

Section *Amusium* s. s.

PECTEN (AMUSIUM) PAPYRACEUS (Gabb) ?

Pleuronectia papyracea Gabb, 1873, Trans. Am. Philos. Soc., New
ser., vol. 15, p. 257.

Amusium papyraceum (Gabb) Dall, 1898, Trans. Wagner Free Inst. Sci.,
Philadelphia, vol. 3, pt. 4, p. 718.

Pecten (Amusium) papyraceus Dall, 1898, idem, p. 757.

Description.- "Shell discoidal, sub-circular, very slightly
longer than wide; slightly inequivalve; ears nearly equal; sur-
face perfectly smooth, or marked only by faint lines of growth; in-
ternal surface marked with small double radiating rib. Length
from beak to base 2.2 inch, width 2 inches." (Gabb, 1873).

Type locality.- Santo Domingo.

Remarks.- The collections at hand contain a small fragment
of a large *Amusium* and two fragmentary immature valves. The
fragment shows that the ventral portion of the external surface is
smooth except for faint, closely spaced concentric lines; while
the interior is sculptured with paired radials. Both the distance
between the radials that form a pair and that between adjoining

pairs is greater than on the type of pyrreus, described from Santo Domingo. The immature valves are higher than wide; auricles large, subequal; exterior smooth except for faint, microscopic emptionectes striation. Since the ventral third of both valves has been broken off it is difficult to determine the character of the internal sculpture; if paired radials were present near the ventral margin, they are obsolete before reaching the portion which is preserved.

The distinguishing features of pyrreus are its somewhat ovate form, smooth exterior and paired internal radials. A recent Antillean and Gulf form is referred to this species. The validity of its separation from the Miocene and Pliocene P. bartoni Ravenel (1), is doubtful, but that species is, however, usually larger

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- (1). Proc. Acad. Nat. Sci., Philadelphia, vol. 9, p. 96, 1844;
Shomey and Holmes, Pleioc. Fos. South Carolina, p. 27,
pl. 10, figs. 1, 2, 1855.

er and more orbicular; P. line Brown and Pilsbry (2), from Tatum, /o /n has the auricles depressed below the plane of the disk. The re-

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- (2). Proc. Acad. Nat. Sci., Philadelphia, vol. 14, p. 314, pl.
24, fig. 1, 1912 (= Pecten (Amusium) cf. bartoni Ravenel,
Toula, Jahrb. K.-k. geol. Reichsanstalt, vol. 58, pp. 714-
716, pl. 26, figs. 8, 9, 1908.
-

remaining testlar, Anusium of the Caribbean region have none
form of external sculpture or marking.

Occurrence.- Upper Oligocene: Santo Domingo (Abb, 1975).
Lower Miocene: ?Borden beds, Borden, Jamaica (Dall, 1938).
Recent: Gulf of Mexico to Haiti in 20 to 0 fathoms, occurring
in both shallow and deep water off West Florida and in deep
water only in the West Indies.

Section Propeanadium de Gregorio.

PROPEAN (PROPEANADIUM) SPINOLUS n. sp.

Description.— Shell small, thin, compressed, suborbicular, higher than wide; dorsal margins with a steep slope; external surface of left valve sculptured with very fine concentric striae, obsolete toward the ventral margin, with faint suggestions of a far coarser, more widely spaced concentric lines near the ventral margin; dorsal half of the shell bearing exceedingly fine radial striae, barely visible under the microscope; the entire surface covered with camptonectes striations; internal lirae faintly visible from the exterior; auricles small, with a median broad ridge, separated from the disk by a scarcely impressed line; interior with ten prominent, relatively heavy lirae, extending about half the distance to the umbo, thickened toward the ventral margin, but terminating before the margin is reached; distal extremities of the lirae acute, except the two nearest the dorsal margin, which are rounded; right valve not known.

Dimensions.— lat., 5.6 mm.; alt., 3.1 mm.

Remarks.— It is somewhat surprising to find this delicate shell in the Borden marl. It bears a remarkable close resemblance to P. pourtalesiana Coll. 1), one of the most common of the deep-

er water species in the Gulf and Antillean waters and also, re-

(1). Bull. Mus. Compt. Zool., Harvard, vol. 12, pp. 211-212,
pl. 4, fig. 7; pl. 5, fig. 12, 1885.

ported from the Pliocene of the Isthmus of Tehuantepec (2).

The recent form is larger, more orbicular, with larger auricles,
less conspicuous external sculpture, the internal lines not quite

(2). Buse, G., Bol. Inst. Zool. Mexico, no. 22, pp. 52-53, 1900.

as heavy, less swollen and pointed at their distal end, and extend-
ing farther toward the umbo.

Occurrence.-- Lower Miocene: Bowden beds, Bowden, Jamaica.

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Family Spondyliidae.

Genus SPONDYLUS Linnæus.

SPONDYLUS BOSTRYCHITES n. sp.

Spondylus bifrons Sowerby, 1850, Quart. Jour. Geol. Soc. London,
vol. 6, p. 57.

Not S. bifrons Goldfuss, 1855.

Spondylus bostrychites Guppy, 1867, Proc. Sci. Assoc. Trinidad
for 1867, p. 176.

Spondylus bostrychites Guppy, Gabb, 1875, Trans. Am. Philos. Soc.
new ser., vol. 15, p. 257.

Spondylus bostrychites Guppy, 1874, Geol. Mag., decade 2, vol. 1,
p. 443 (check list).

Spondylus bostrychites Guppy, Dall, 1903, Trans. Wagner Free Inst.
Sci., Philadelphia, vol. 3, pt. 1, pp. 748-750.

? Spondylus bostrychites Guppy, Dall, 1917, Bull. U. S. Nat. Mus.,
no. 90, p. 124, pl. 19, fig. 4.

Description.— "Testa subregularis, rotundata, ventricosa,
marginem latiusculum, valde denticulato; extus rarissime costato,
costis 5 ad 6 spiniferis; area cardinali alterius valvæ angustis-
sima, alterius latiori." (Sowerby, 1850).

Type locality.— Santo Domingo.

"The type form of this species has a relatively small number

of spinose ribs, the later ventral ones being free from spines, longitudinally finely striate, and brown with very perfect minute scales. The adult shell is rather short and rounded and less inflated than usual in the genus. The species is remarkable for its small hinge-area." (Dall, 1893).

Two immature left valves apparently should be assigned to this species. They are thin, slightly auriculate, slightly inflated, moderately inequilateral, the posterior side being more produced; umbones very low, weakly inflated; external surface sculptured with a varying number (ten to fifteen) of low, primary radial ribs, bearing at irregular intervals short, relatively stout spines; secondary radial ribs and striae of irregular width interscalated between the primaries, transversely roughened or slightly spinose; in the interval between two primary ribs one secondary rib usually more prominent and more obviously spinose than the others; auricles poorly developed, their surface ornamented with a few small spines or scales; cardinal area very narrow; inner margin of the valve irregularly and feebly crenulated. The dimensions of the larger are: lat., 15.5 mm.; alt., 12.1 mm.; diam., 2.5 mm.; length of hinge, 6.5 mm.;

A very small, proportionately more convex left valve is doubtfully referred to this species; it has the secondary radial ribs suppressed and the few spines near the ventral margin are dorso-ventrally compressed.

Remarks.- Santo Domingian specimens of this species reach an enormous size, being as much as 115 mm. high or 100 mm. wide, with the primary ribs not prominent and bearing a few spines, the whole surface slightly scabrous. Forms from other localities, including Bowden, are never of such an imposing size and perhaps should be considered a distinct variety. The Bowden form referred to this species is characterized by its moderately inflated, rounded form, relatively few, low, narrow, spinose primary ribs with intervening non-spinose secondaries and longitudinal striae on and between the secondaries. Specimens from the type locality have the primaries narrower and less spinose, but apparently these characters are susceptible to variation, for specimens from other Antillean localities that are comparable in other features to those from Bowden have the sculpture of the Santo Domingian form, the ribs being as narrow or even narrower. The advisability of including the Tampa cilex form is doubtful since it is narrower, more inflated, with a wider and shorter cardinal area.

A very closely related form, S. chipolensis Coll, (1) occurs

(1). loc. cit., pp. 751-759, 1908; loc. cit., p. 125, pl. 10, fig. 1, 1915.

in the Chipola and Oak Grove faunas; it is more oval and inflated, with more numerous spinose ribs and concentric striations on the

secondaries. The smaller of the two immature left valves at hand displays some of the characters of chilolans; it has more numerous spinose ribs than the larger, without radial striations on the secondaries, but, on the other hand, the outline is that of postryphites and there is no trace of concentric striation.

Occurrence.- Upper Oligocene: Tampa city beds, Florida (Dall, 1898, 1915); Limestone of White Beach, Florida (Dall, 1898, 1915); Santo Domingo (Sowerby, 1859; Guppy, 1874, 1874; Cabb, 1873; Dall, 1898, 1915); Antigua (Cooke,); Anguilla (Guppy, 1874; Dall, 1898, 1915); Lower Miocene: Borden beds, Borden, Jamaica (Guppy, 1874; Dall, 1898, 1915).

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POLIDIA COOKII n. sp.

Description.- Shell of medium size, pectiniform, suborbicular, subequilateral, conspicuously auriculate for the genus; right valve decidedly inflated in the umbonal region; exterior surface sculptured with five to seven primary radial ribs, in the form of very broad, low, angular, primary radials occupying the entire area of the shell and separated by longitudinal depressions, or only their crests elevated as distinct ribs; the crests of the primaries bearing stout, blunt spines at irregular and widely spaced intervals; on the gently sloping sides of the primaries or on the flat areas that would form the sides of the primaries if they were elevated, appear secondaries, of irregular width, faintly striated longitudinally and faintly scabrous, with exceedingly fine scales arranged in very narrow, longitudinal series; auricles sharply differentiated from the disk, subequal, slightly roughened or scabrous; concentric sculpture represented only by faint lines on the auricles; left valve only moderately uniformly convex; primary ribs never as broad as on the right valve, spinose, as on the right; secondaries more prominent and more sharply sculptured, occasionally bearing very short spines; inner margin of the valves irregularly crenulated; interior of right valve with inconspicuous broad, undulations corresponding to the external intercostal depressions.

Dimensions.- Right valve: lat. 24.6 mm.; alt., 24.7 mm.;

diam., 9 mm.; length of hinge, 12 mm.

Remarks.— A fragment of an apparently mature left valve, two immature right valves and a younger left constitute the representation of this sharply-defined species, the fragment presents only the umbonal and posterior dorsal portion of the shell and therefore some uncertainty attends its position; but in so far as can be determined, the outline, sculpture and auricles testify to its place in this species. The left valve is decidedly pecteniform since it is only moderately and uniformly inflated, while the right valve is strongly inflated in the umbonal region. In sculpture the two valves are notably different.

S. cookii is recognized by its suborbicular outline, prominent auricles, strongly inflated right valve, sculptured with spinose, broad primary radials and finely scabrous, longitudinally striated secondaries, and moderately inflated left valve with more equally developed primaries and secondaries. S. bostrychites is less inflated, less orbicular, more inequilateral, less auriculate, with less pronounced sculpture, the ribs being much smaller and the spines shorter.

This species is named for Dr. J. Mythe Cooke, of the U. S. Geological Survey, who is making valuable contributions to the Tertiary molluscan paleontology of the West Indies.

Occurrence.— Lower Miocene: Borden, beds, Borden, Jamaica.

SPORDYRUS (DUMYANUS var?) INDIENSIS n. sp.?

Description.- Shell small, equilateral, well inflated, higher than wide; umbo inconspicuous; right valve sculptured with eleven or twelve radials, bearing closely-spaced spines, the spines very long for the size of the shell and slightly curved, occasionally giving place to broad, irregularly curled, transverse scales, extending across one or more of the primary radials; between the primary radials poorly defined radial rows of small irregularly spaced scales present, the rows interrupted by the transgression of the broad scales; auricles not prominent, their surface roughened or bearing a few spines; creura prominent for the size of the shell; inner surface of the valve with irregular crenulations of two orders, the primary ones, corresponding to the external intercostal spaces, extending up toward the umbo as inconspicuous crenulations; left valve not known.

Dimensions.- Lat., 10 mm.; alt., 11.3 mm.; diam., 7 mm.; length of hinge, 5.5 mm.

Remarks.- One of the surprising features of the fauna is the presence of this small, beautifully sculptured valve among the many ponderous shells. Although very small, it is remarkably close to the recent Antillean S. echinatus (Lertyn) (1), which

has not been recorded from any horizon lower than the Pleistocene(2).

(1). Univ. Zoonch., vol. 2, fig. 154, 1734 (= L. americana Leveche, Anim. sans Vert., vol. 6, p. 138, 1819; Leveche, Zoonch. Icon., Spondylus, pl. 14, fig. 17, 185; L. spathuliferus Leveche, etc.

(2). Gabb's Santo Domingo L. americana (Trans. Acad. Nat. Sci. Phila. ser. 4 vol. 13, p. 237, 1877) is L. curanorodon Brown and Pilsbry (Proc. Acad. Nat. Sci., Philadelphia, vol. 64, p. 514 (foot-note) 1912); while his Costa Rican Eocene americana (Jour. Acad. Nat. Sci., Philadelphia, 2nd ser., vol. 3, p. 272, 1881) probably is distinct.

No recent forms, comparable in size, have been available for comparison. The spines of the form which has generally been called spathuliferus are more compressed dorso-ventrally, with their extremities irregularly crenulate, but apparently the character of the spinose sculpture is decidedly constant, an indication of the variability being furnished by the elaborate synonymy given by Dall (3).

(3). Trans. Amer. Mus. Nat. Hist., Philadelphia, vol. 7, pt. 4, pp. 752-760, 1896.

The single Jordan specimen is characterized by the low, broad or irregular, transverse scutes on the primary scutes and internally scabrous secondarys; these features serve to differ it sharply from the associated species.

Occurrence.-- Lower Miocene: Sweden, etc., etc.

Genus Plicatula Leach.

Plicatula sensata Conrad.

Plicatula sensata Conrad, 1847, Proc. Acad. Nat. Sci., Philadelphia, vol. 1, p. 11.

Plicatula sensata Conrad, 1847, Trans. Med. Soc., U. S., p. 77, pl. 43, fig. 3.

Plicatula sensata Conrad, 1847, Proc. Acad. Nat. Sci., Philadelphia, vol. 14, p. 502.

Plicatula sensata Conrad, Leach, 1848, Proc. Zool. List, Smiths. Misc. Coll., no. 183, p. 4.

Plicatula virillata Conrad, 1874, Geol. Mag., decade 2, vol. 1, p. 436, pl. 17, fig. 7; ^{p443 (check list)} (ex parte).

Plicatula sensata Conrad, Whitfield, 1895, Mon. U. S. Geol. Survey, no. 24, pp. 75-76, pl. 5, figs. 7-8.

Plicatula sensata Conrad, Dall, 1878, Trans. Wagner Inst. Sci., Philadelphia, vol. 7, pt. 4, p. 767.

Plicatula sensata Conrad, Glenn, 1904, Maryland Geol. Survey, Miscell. vol. p. 571, pl. 98, figs. 7-9.

Plicatula sensata Conrad, Dall, 1913, Bull. U. S. Nat. Mus., no. 30, p. 125.

Description.- "Ovate, thick, commonly and irregularly

pliate; inferior valve ventricose, its ribs acute, with arching spiniform scales; cardinal teeth large, curved, laterally striated, crenulate on the margins; large cardinal teeth in each valve slightly bifid, broad; muscular impressions prominent. Length one inch and an eighth."

"The valves have about 10 folds, and the lower valve closely resembles a variety of Ostrea virginica." (Conrad, 1842).

Type locality.- Cumberland Co., New Jersey.

The Bowden specimens are small, of varying thickness, subequilateral to decidedly inequilateral, moderately or slightly inflated; outline irregular, usually more or less rounded-triangular or subovate; umbones low, inconspicuous; external surface sculptured with five to nine strong radial plications, most pronounced at the ventral margin and not extending to the umbones; concentric sculpture of irregular, more or less overlapping lamellae, stronger on the plications and at times producing on them short, broad scales; when the attachment is not by the umbones, irregular, faint, closely spaced concentric growth lines visible on the umbones; inner margin of the valves coarsely crenulate by the plications and usually finely denticulated; interior surface of the valve irregular.

Dimensions.-- Right valve: lat., 18 mm.; alt., 15.5 mm.; diam., 8.8 mm.

Remarks.-- The valves of a small Plicatula are quite abund-

ant. In shape and thickness the usual variation that characterizes attached bivalves is encountered; but, on the whole, the valves are of medium thickness and more or less rounded in outline. The absence of plications on either a portion of the surface of the entire surface of the shell depends upon the size of the area of attachment and since the right or left valve may be attached, either valve may be partly or entirely smooth. The average number of plications is six or seven. None of the specimens have short, marginal plications intercalated between the primary ones. This feature, together with the small size, and thinness of the shell, suggests that the Bowden forms may be a distinct variety. Their salient features are the small size, rather broad, subrounded outline and the relatively numerous, somewhat foliaceous plications. The Miocene (Virginia, North Carolina) and Pliocene (North and South Carolina, Florida) P. marginata Say (1),

(1). Jour. Acad. Nat. Sci., Philadelphia, vol. 4, pp. 156-157, pl. 9, fig. 4, 1824.

is more triangular in outline, with fewer but more prominent plications, the same differences distinguish consata from the recent Antillean P. gibbosa Lamarck (2), and the recent form is, in affi-

(2). Syst. Ani. sans Vert., p. 172, 1801.

tion, characterized by dark lines on the exterior.

Of Guppy's two types of P. maxillata one, which does not have the appearance of a Bowden shell, is a typical gibbosa, as Dall has already pointed out; the other is without the dark lines and probably is a thickened of the form here called loata. The latter has the appearance of a shell from the Bowden beds. Webb (1) has reported gibbosa from Santo Domingo, but specimens under that name apparently are no longer in the collection.

Occurrence.- Oligocene: Peninsular limestone, Florida (Dall, 1898, 1915); Tampa giller beds, Florida (Dall, 1898, 1915); Chipola marl, Florida (Dall, 1898, 1915); Oak Grove sand, Florida (Dall, 1898, 1915); Cuba (Jooke,); Guallave beds, Costa Rica (Dall, 1898, 1915); Lower Miocene: Bowden beds, Bowden, Jamaica (Guppy, 1874; Dall, 1898, 1915); Miocene: Palvert- New Jersey (Conrad, 1845; Dall, 1898, 1915), Maryland (Lenn, 1904). St. Mary's- North Carolina (Gardner, Mss.), Norltown- Virginia, North Carolina (Gardner, Mss.).

Family Limidae.

Genus LIMA (Bruguière) Juvier.

Subgenus Lima s. s.

Section Lima s. s.

LIMA (LIMA) BELFLORELLA n. sp.

Description.- Shell small, thin, moderately inflated, decidedly inequilateral and oblique; gently rounded anteriorly, posteriorly obliquely produced below, emarginated above; exterior surface sculptured with twenty-four very low and narrow radials, separated by much broader interspaces; the radials relatively widest and most prominent in the umbonal region, toward the ventral margin becoming sharper and occasionally bearing short, narrow, scales at irregular intervals or roughened by irregular concentric lines on the distal third of the shell; posterior submargin relatively wide, long and very deeply impressed; anterior submargin much smaller and less deeply impressed; auricles small, subequal, not differentiated from the submargins; both auricles and submargins sculptured with irregular concentric lines and indistinct radials; cardinal area wide; nuchal pit large, deep, subumbonal and vertical in position, extending into the cavity of the shell; internal ventral margin scarcely affected by the external radials.

Dimensions.- Max. lat., 10.5 mm.; max. alt., 12 mm.; semi-

Diam., 3.8 mm.; length of hinge, 5 mm.

Remarks.— This species is based upon a single left valve. The radial sculpture is rather weak, weaker than in most species of the section Line s. s. The posterior submargin is unusually long and so deeply impressed that it has a decided influence on the outline; on the other hand, the anterior submargin is scarcely differentiated from the disk.

The weak, narrow, slightly scabrous radials and deeply impressed, long posterior submargin characterize this species. I. tampaensis Dill (1), from the whirle of Hillsborough Bay, Florida, is larger, with stronger radials and a serrated base.

(1). Trans. Garner Free Inst. Sci., Philadelphia, vol. 5, pt. 4, p. 766, pl. 75, fig. 18, 1908.

Occurrence.— Lower Miocene: Bowdin bells, Bowdin, Florida.

Section Mantellum (bottom) W. and A. 1903.

II-A (MANTELLUM) DANIEL R. 1903.

Description.- Shell small, fragile, obliquely elongated, well inflated; closing slightly at the postero-ventral and antero-dorsal angles; dorsal margin short, straight, the posterior longer; anterior end rounded above, slightly incised at the dorsal margin by the gap, obliquely truncated below; truncate posteriorly subparallel to the anterior truncation; base rounded; external surface without radial sculpture except for a few, feeble, barely visible narrow radials near the ventral margin, extending over almost half the length of the shell in the postero-ventral region; a few weak, fine, thin, raised concentric lines present on the ventral half of the shell; the entire surface covered with microscopic verrucular markings, resembling carinotectes striation, most prominent on the umbo; cardinal area narrow, the ligament pit wide, shallow, not projecting into the cavity of the shell; interior of the valve with faint radial markings in the postero-ventral region.

Dimensions.- Median lat. (measured along a line perpendicular to the oblique axis) 5 mm.; max. alt., 7 mm.; diameter, 1.3 mm.; length of hinge, 1.5 mm.

Remarks.- The decidedly oblique outline and virtually smooth surface of this species, which is described from a single right valve, are diagnostic.

The name is given in honor of Dr. William H. Dall, without whose monumental Warner Institute Papers this study could not have been attempted.

Occurrence.- Lower Miocene: Borden beds, Borden, Jamaica.

Genus LIMNAE Brown.

/n

LIMNAE SOLIDA Dall.

Limnaea solida Dall, 1896, Trans. Wagner Free Inst. Sci., Philadel-
phia, vol. 7, pt. 1, p. 709, pl. 75, figs. 4, 5.

Description.- "Shell minute, solid, rounded triangular,
with about twelve rounded, strong, slightly granular radial ribs,
separated by narrower interspaces crossed by lines of growth;
submargin without radial sculpture; hinge-line short, with a
small central pit, on each side of which are about eight teeth;
interior radially feebly grooved, the basal margin crenulated by
the ribs; shell moderately inflated. Alt. 3.5, lat. 3.7, diam.
2.5 mm."

"This little shell is related to the L. Browniana Dall (1) of
recent fauna, but is distinguished from it by its narrower and

(1). Bull. Mus. Compt. Zool., Harvard, vol. 18, pp. 226-227, 1896;
Proc. U. S. Nat. Mus., vol. 18, p. 251, pl. 12, fig. 9,
1890.

more solid hinge, with a distinctly smaller regular pit and
heavier and more solid shell." (Dall, 1896).

Type locality.- Bowden, Jamaica.

Shell very small, subovate-triangular, beakless, inflated in the umbonal region, subumbilical; the curve of the lower portion of the posterior margin slightly more convex than the corresponding part of the anterior margin; broadly arcuate; umbones relatively prominent; exterior surface of the shell sculptured with fourteen to sixteen strong radial ribs, on immature shells rounded throughout, but on adults becoming angular in the distal third of their length and at the same time bearing minute nodulations on their sides; ribs separated by interspaces of virtually the same width; throughout almost the entire length of each interspace a small, median, rounded, minutely nodulated ridge present; submargin sculpture with ten to fifteen concentric ridges, the posterior submargin longer and usually having the concentric ridges more prominent and more numerous; ligament pit small, shallow, subumbonal with six to eight teeth on either side; inner margin of the portion of the shell with radial sculpture deeply crenulate; interior of the shell with inconspicuous radial nodulations corresponding to the external radial sculpture.

Dimensions.- Lgt., 7 mm.; alt., 5.5 mm.; condition., .9 mm.

Remarks.- This interesting species is well represented in the collections at hand. Despite the small size of the shell the sculpture is very sharply chisel-like. One of the valves shows traces of dark coloration.

Occurrence.- Lower Miocene: Sweden (bells, Borden, Maine).

Superfamily ANOMIIDA

Family Anomiidae.

Genus PLASURANOMIA Broderip.

PLASURANOMIA LITHOBLETA Dall.

Plasuranomia lithobleta Dall, 1882, Proc. Acad. Nat. Sci.,
Philad. Acad., vol. 5, pt. 4, pp. 776-777.

Description.-- "Shell resembling P. plicata [Broderip and
Holmes (1)], but flatter; not plicate, but minutely pavel like (1);

(1). Pleioc. Fos. South Carolina, p. 19, pl. 1, figs. 1-3, 1835.

surface radially sculptured with minute, almost microscopic,
threads, which are frequently interrupted, when the termination
of the proximal part of the thread is swollen, resembling a min-
ute head or pustule; interior resembling P. plicata, but the hinge
weaker, the amorphous irregularities confined to a very small
space near the umbo, and inconspicuous; crura of the lower valve
small, forming an acute angle, well elevated, the socket for their
reception on the opposite valve shallow. Alt. about 50, lat. 50,
diam about 3 mm."

"This form is distinguishable at once by its peculiar sur-

face sculpture." (Dall, 1908).

Type locality.-- Bowden, Jamaica.

Shell large, thin, compressed, irregularly suborbicular; irregularly warped and folded, the broad undulation being most pronounced at the ventral margin, but not definitely plicated; umbonal region occasionally swollen; exterior surface sculptured with fine, discontinuous, swollen radial striae, broken up into longer or shorter portions or interrupted so frequently that they produce a finely pustulose appearance; byssal plug on right valve elongated, triangular, almost extending to the cardinal margin; internal cardinal "rugosities" very feebly developed or obsolete; right valve with strong cardinal crura, diverging at an acute angle; left valve with a sharply defined, large, triangular umbonal depression into which the crura of the right valve are received, the anterior and posterior distal portions of the depression separated by a triangular elevated area corresponding to the depressed area between the crura on the right valve.

Remarks.-- Several more or less incomplete valves of this species, of which the largest is about 40 mm. in latitude and altitude, are at hand. It is the only member of the genus Flammina so far recorded in the West Indian Tertiaries. The genus at the present time occurs on the Pacific coast of Central Ameri-

ca, but evidently did not exist on the Atlantic side, although
Turney and Holmes (1) notes its presence in the harbor of Charleston,
South Carolina, an occurrence which is discredited (2).

(1). idem.

(2). Dall, A. H., loc. cit., p. 778, 1902.

The radial sculpture of the Borden species is irregularly developed.
Some portions of the shell, especially the umbonal region,
may be smooth or the fine, swollen radial lines may cover the
entire surface. When present they are always more or less interrupted.
On one left valve these radials are especially well developed,
being more prominent than on any of the types. Another
left valve, of which only the dorsal half is preserved, has only
very faint concentric markings and the hinge "socket" is, strangely
enough, without the median distal raised triangular area.

As stated in the quoted description, Lithoblete can be recognized
by its radial sculpture. P. plicata Turney and Holmes
is a smooth, marginally plicated form occurring in the Duplin
formation of the Carolines.

Occurrence.- Lower Miocene: Borden, beds, Borden, Jamaica
(Dall, 1902).

Anomia microgramma (Linnaeus) Miller.

ANOMIA MICROGRAMMA Dall var. *INDECISA* Dall.

Anomia microgramma var. *indecisa* (Quoy & Gess.) Dall, 1898,

Trans. Wagner Free Inst. Sci., Philadelphia, vol. 5,

pt. 4, p. 737.

Anomia microgramma var. *indecisa* Dall, Bull. U. S. Nat. Mus.,

no. 90, p. 126.

Description.- *A. microgramma* "Shell small, irregular, characterized by a fine, almost microscopic, close-set radial striation covering the whole surface and flaring away from the medial line of the valve in a somewhat wavy manner; the two lower scars on the left valve are subequal and side by side, the major byssal scar larger, opposite the radial line between them; the beak of the left valve is some distance within the margin, and the surface where worn appears smooth; the striation is only visible under a lens in most cases. Alt. 17, lat. 25 mm."

"This species is recognizable by its fine, almost divaricate striation, which does not break into nodes as near the beak, as in the larger and more coarsely sculptured *A. schioppioides*.

"The specimens from Borden have a still finer and often partially obsolete striation. They form the variety *indecisa* (Quoy, Gess)" (Dall, 1898).

Type locality.-- Bowden, Jamaica.

Remarks.-- Only a few of the Bowden Anomias can be referred to this variety and they are somewhat doubtful. All of them are small, none exceeding 16 mm. in latitude or altitude. A. microgrammata is a well-defined species which occurs in the same siliceous beds and Chippel Marl. The variety indecisus is, however, of doubtful validity. The radial striations, which constitute the characteristic feature, are very fine indeed on the specimens at hand and occur only on very limited portions of the shell. They are visible only under the microscope. Most of the Anomias in the Bowden fauna are here referred to A. simplex d'Orbigny since they are smooth except for occasional exaggerated incrementals. Apparently simplex itself may have suggestions of radial striae and for that reason the advisability of establishing a variety for the Bowden forms with mere suggestions of radial striation is questioned. At the present time, however, it seems advisable to retain the varietal name.

A. floridana Dall (1), of the Oak Grove fauna, is larger and

(1). loc. cit., p. 705, pl. 75, fig. 7, 1902.

has, in addition to obsolete faint radial striations, weak concentric and obsolete, feeble radial striations. A. umbonata Turb., an

Oligocene species from Trinidad (1), is ringed, but conspicuous-

(1). 1906, Proc. U. S. Nat. Mus., vol. 19, p. 325, pl. 30, fig. 6, 1896.

ly postular and without radial striation.

Occurrence.-- Lower Miocene: Bowden Beck, Bowden, Jamaica
(Dall, 1898, 1915).

ANOMIA SIMPLEX d'Orbigny.

Anomia electrica Gould, 1841, Invert. Mass., p. 140 (non Linnaeus)

Anomia squamella Gould, 1841, id., p. 140 (non Linnaeus)

Anomia ephippium Linnaeus var., Conrad, 1845, Mos. Ned. Ind. U.
S., p. 75, pl. 45, fig. 4.

Anomia simplex d'Orbigny, 1845, in de la Sagra, Hist. Nat., polit.
y natur. de la Isla de Cuba, Moluscos, p. 371, pl. 33,
figs. 51-53. (Spanish ed.).

Anomia acortea Gray, 1849, Proc. Zool. Soc. London, p. 116.

Anomia Conradi d'Orbigny, 1850, Prodr. Pal. Strat., vol. 7, p. 174.

Anomia simplex d'Orbigny, 1857, in de la Sagra, Hist. phys., polit.
et natur. de l'Isle de Cuba, Mollusques, vol. 2, p. 377,
pl. 33, figs. 51-53. (French ed.).

Anomia ephippium DuRoi and Holmes,¹⁸⁵⁵ Pleioc. Mos. South Carolina,
p. 11, pl. 5, fig. 4. (non Linnaeus).

Anomia ephippium DuRoi and Holmes,¹⁸⁵⁸ Post-Pleioc. Mos. South Carolina,
p. 11, pl. 2, fig. 11. (non Linnaeus).

Anomia Conradi d'Orbigny, Conrad, 1847, Proc. Acad. Nat. Sci.,
Philadelphia, for 1842, vol. 14, p. 582.

Anomia Conradi d'Orbigny, Beck, 1864, Misc. Check list, Smiths.
Misc. Coll., no. 137, p. 1.

Anomia alba Verrill, 1877, Am. Jour. Sci., 3rd ser., vol. 7,
p. 317.

Anomia ephippium Labb, 1877, Trans. Amer. Phil. Soc. (n. s.) vol. 15, p. 257. (non Linnaeus).

Anomia glabra Verrill, 1877, Am. Jour. Sci., 3rd ser., vol. 10, p. 372.

Anomia ephippium Labb, 1881, Jour. Acad. Nat. Sci., Philadelphia, 2nd ser., vol. 3, p. 380 (non Linnaeus).

Anomia Ruffini Heilprin, 1887, Trans. Wagner Free Inst. Sci., Philadelphia, vol. 1, p. 162 (non Journal).

Anomia simplex d'Orbigny, Dall, 1889, Bull. U. S. Nat. Mus., no. 57, p. 72, pl. 57, figs. 1, 2.

Anomia simplex d'Orbigny, Slosser and Dall, 1896, Proc. U. S. Nat. Mus., vol. 19, p. 526.

Anomia simplex d'Orbigny, Dall, 1898, Trans. Wagner Free Inst. Sci., Philadelphia, vol. 3, pt. 4, p. 714.

Anomia simplex d'Orbigny, Glenn, 1904, Maryland Geol. Survey, Misc. vol., p. 769, pl. 98, fig. 1.

Anomia simplex d'Orbigny, Dall and Simpson, 1901, Bull. U. S. Fish Comm., vol. 20, pt. 1, p. 468.

Anomia simplex d'Orbigny, Buse, 1906, Bol. Inst. Geol. Mexico, no. 22, no. 55, 56, pl. 2, figs. 13-17; pl. 7, fig. 5.

? Anomia sp. indt., Coule, 1908, Jahrb. N.-k. Geol. Reichsanstalt, vol. 58, p. 711.

Description.-- "Shell of medium size, suborbicular, thin, of-

ten translucent; the left valve inflated, the right flattened; umbones central, almost but not quite terminal; exterior surface usually smooth, with a few e asperate growth lines, sometimes delicately wrinkled; interior of valves possess the characters of the genus." (Gould, 1841).

Remarks.- Most of the Boulder representatives of this genus are, as stated above, referred to simplex. They possess the abbreviated diagnostic feature of this protean form - the smooth exterior surface. None of them exceed 17 mm. in latitude or altitude. As would be expected among small forms, the growth lines are not conspicuously emphasized.

Guppy and Dall reported this species from the "Oligocene of Jamaica" in 1896, but it does not appear in the 1905 check list. At least some of Tabb's Santo Domingan ephiolium appear referable to this species. Doula has merely mentioned the presence of a "kleinen dünnschaligen blüthigen Anomia" in the Gatun fauna.

Occurrence.- Oligocene: Santo Domingo (Tabb, 1895);

Lower Miocene: Boulder beds, Boulder, Jamaica (Guppy and Dall, 1896);

Miocene: Belvert formation, Virginia (Gardner, Mss.), St. Mary's formation, Maryland (Glenn, 1904), Virginia (Gardner, Mss.), Yorktown formation, Virginia (Gardner, Mss.), Duplin formation, North Carolina (Peterson), Pootachetobie Marl, Florida (Gardner, Mss.) Pliocene: Ichauway Marl, North Carolina, (Gardner, 1904),

Oroatan formation, North Carolina (Lawler, 1931), and formation, North and South Carolina (Lawler, 1931), also at the end of Florida (Dall, 1932, Timon, Costa Rica (Abb, 1931), Santa Maria and Santa Maria Tototila, Mexico (Pace, 1936). Pleistocene: Atlantic and Gulf coasts from North Carolina southward (Dall, 1938). Recent: as far as Martinique in less than 10 fathoms.

Subgenus *Modiolus* 1898, p. 333

Family *Modiolidae*

Genus *MODIOLUS* Lamarck.

Section *Brachydontes* Swainson.

MODIOLUS (*BRACHYDONTES*) *GUPPYI* Dall.

Modiolus (*Brachydontes*) *Guppyi* Dall, 1898, Trans. Wagner Free
Inst. Sci., Philadelphia, vol. 3, pt. 4, p. 794, pl. 25,
fig. 16.

Description.- "Shell small, thin, delicate, radiately num-
erously ribbed, the ribs but seldom dichotomous, general form as
in *M. grammatus*, [Dall (1)], but shorter and more rounded, the
surface frequently concentrically faintly undulated, inner dorsal
margin sharply crenulate, the rest of the shell margin almost
smooth, basal end of the valve rounded, dorsal angle obsolete.

Alt. 8.5, max. lat., 4.7, diam., 2.5 mm."

"This differs from the last [*M. grammatus* Dall] in its more
delicate and less dichotomous ribbing, its more rounded, thinner,
and less angular shell, and in the absence of crenulations over
most of the margin, due to feebleness of the sculpture." (Dall,
1898).

(1). *Idem*, p. 794, pl. 20, fig. 2.

Type locality.- Bowden, Jamaica.

- - -

Shell small, thin, transversely elongate, widest at about the middle of the shell; umbones inflated, almost terminal; umbonal ridge strong, but rounded, becoming lower and broader posteriorly; proximal third or more of the dorsal margin straight, forming a subrounded angle of about 140° with the distal portion, which is gently curve or slightly emarginated; ventral margin usually slightly concave; posterior margin narrow, abruptly rounded; external surface sculptured with numerous, inconspicuous, rounded radial ribs, separated by interspaces of the same width or narrower; radials usually obsolete on the most convex portion of the umbonal ridge; concentric sculpture of usually faint incremental lines, occasionally exaggerated; hinge often with suggestion of denticulation, with two or three projections on the left valve and obscure sockets on the left; proximal portion of the inner dorsal margin conspicuously crenulated, the distal portion weakly crenulated and the remainder of the margin usually smooth or very feebly crenulated.

Dimensions.-- Max. lat. (dorso-ventral) 5.5 mm.; alt. (anteroposterior) 10.5 mm.; semidiam., 1.8 mm.

Remarks.-- This solitary member of the genus is well represented in the material at hand. The width varies considerably, the valve measured being the widest. The angle between the two portions of the posterior margin is not sharp, but rounded or subrounded. A rather surprising feature is the indication of hinge denticulation

on apparently adult shells. One of the left valves shows three small, but distinct, projections, while most of the others have suggestions of two or three similar processes. Right valves have corresponding, but obscure, depressions.

M. cubayi may be recognized by its numerous weak radials and by the presence of definite crenulations on only the dorsal portion of the inner margin. The differences between this species and the Tampa cilex grammatus Dall are stated in the above description. In the case of M. grammatus var. curtulus Dall (1), of the

(1). idem.

Chipola marl, these differences are even more pronounced. The recent Antillean M. citrinus Bolten (2) is larger, wider, more

(2). Mus. Bolt., 1st ed., p. 157, 1798 (= M. sulcatus Lamarck).

rounded anteriorly and the entire inner margin is crenulated.

Occurrence.-- Lower Miocene: Bowden beds, Bowden, Jamaica.
(Dall, 1903).

Family Trepostomidae

Genus *Alibon* Van Beneden.

Alibon *Alibon* (Vick) var. *Alibon* *Alibon* var.

Description.— Shell of medium size and thickness, outline varying from lanceolately elongate to subovate, greatest width slightly behind the middle of the shell; dorsally and unequally convex, the differential convexity caused by the ventral position of the umbo, high, but not high, umbonal ridge, its axis being almost close to the ventral margin throughout; umbo acute, terminal, bent forward; dorsal margin convex, subangular to broadly curved throughout; ventral margin concave throughout or flexed outward before joining the abruptly rounded posterior margin; external surface sculptured with irregularly disposed, occasionally exasperated, concentric lines, usually most conspicuous near the margin, and often, obscure, irregular, concentric striations; umbonal region high and wide for the size of the shell; left valve with a relatively large, shallow, ventrally situated socket, corresponding tooth in the right valve small, developed or obsolete; li- mental groove prominent, occupying more than a third of the proximal portion of the dorsal margin.

Dimensions.— Max. lat. (dorso-ventral) 0.7 mm.; alt., (antero-postero) 1.2 mm.; con. lat., 0.5 mm.

Remarks.-- The outline and width are quite variable; the dorsal margin may be subangular, as in the case of the large (with the angulation situated at about a third of the distance from theumbo to the posterior margin) or strictly convex, in which case the shell is wider. In a similar manner the ventral margin varied from decidedly concave throughout to subconvex, the latter outline being caused by the reflection of the posterior portion. The socket on the hinge of the left valve is pronounced, but none of the right valves have a well-developed corresponding tooth. Dorsio-ventrally the shell is not convex near the ventral margin, while in an antero-posterior line the greatest convexity is at about the middle of the shell.

The Pleistocene (1) and Recent D. coxleyana Nickl (2), from the east coast of the Panama region, is so close that

(1). Brown, A.P. and Pilbry, F.A., Proc. Acad. Nat. Sci. Philadelphia, vol. 35, p. 107, 1911.

(2).

the two forms can hardly be separated; the former form, is, however, smaller, more slender and in general more strongly convex.

Occurrence.-- Lower Miocene: Borden beds, Borden, Indiana.

Family Juliidae.

Genus JULIA Gould.

JULIA SACCHARINA n. sp.

Description.— Shell small, transversely elongated, well-inflated; dorsal margin arcuate; rounded posteriorly, base sloping toward the posterior end; umbo prominent, placed at the anterior end, strongly bent downward over the narrow, deeply incised lunule the margin below the lunule sloping downward to the prominently produced antero-ventral angle; anteriorly with a sub-rectangular ridge curving from the umbo to the produced angle, the area between the ridge and the margin flattened; exterior surface smooth, except for irregular incrementals; hinge edentulous; on the right valve the inner edge of the lunule flattened and extended, the margin below the lunule produced outward by the thickened ventral edge of the lunule; on the left valve the inner edge of the lunule thickened.

Dimensions.— Lat., 8 mm.; alt., 6.5 mm.; width, 3.2 mm.

Remarks.— A number of valves, of which two are adult, of this interesting species are at hand. The genus is at the present time confined to the Indo-Pacific region. One species has been described from the American Lanthian, *Lanthian*, the Chipole J. Florida Dall (1); it is less elongate, smaller, with more flattened

less strongly carved umbones, smaller and shallower lophes, and more pronounced anterior carina.

(1). Trans. Wagner Free Inst. Sci., Philadelphia, vol. 7, pt. 1, p. 811, pl. 35, figs. 1-7, 1908.

This species is named for Miss J. A. Gardner of the Johns Hopkins University, who is making noteworthy contribution to the Tertiary paleontology of the Atlantic Coastal province.

Occurrence.-- Lower Miocene: Borden beds, Borden, Jamaica.

Order A P O L Y A I C O S A B A S

Superfamily P O L Y A S E A .

Family Verticordiidae.

Genus VERTICORDIA Wood.

Subgenus Trigonulina d'Orbigny.

VERTICORDIA (TRIGONULINA) BOWDENLISIS Dall.

Verticordia (Trigonulina) bowdenlisis Dall, 1907, Trans. Warner
Free Inst. Sci., Philadelphia, vol. 3, pt. 6, p. 1512.

Description.- "Shell small, rotund, rather convex, with eight
or nine anterior radial ribs with deep, subequal interspaces, then
a wide space followed by two adjacent ribs, then a much wider space
with another adjacent pair beyond it separated by a smooth area,
larger in the left than in the right valve, from the posterior
margin; the surface when intact is covered with minute granules
arranged in rows harmonizing with the ribs; lunule very deeply im-
pressed in the left valve, less so in the right; tooth of the right
valve large and strong, the posterior margin of the left valve mod-
ified to form a lamina or lateral tooth received in a groove of
the opposite valves. Lon. 2.7, alt. 2.6, diam. 2.0 mm."

"Very similar to V. Gossmani [Dall (1), Jackson and Hibola]

(1). idem.

but more globose and orbic lat." (Dall, 1903).

Type locality.-- Bowden, Jamaica.

Remarks.-- The small valves of this species are abundant in the Aldrich collection but much less numerous in the Bowden collection. The largest valve has the following dimensions: lat. 3.5 mm.; alt. 3.5 mm.; diam. 1.5 mm. Dall has noted that this form was labelled "V. ornata d'Orbigny" (1) in Cuppy's collection;

(1). In de la Sagra, Hist. Phys. polit. et natur. de l'Ile de Cuba, Mollusques, vol. 1, p. 292, pl. 27, Figs. 30-33, 1853 (French ed.).

that recent species has fewer, broader ribs and broader interspaces. Aldrich (2) has described V. dalliana from the Oligocene of Red Bluff, Mississippi; it is smaller, more compressed and with sharper ribs.

Occurrence.-- Lower Miocene: Bowden beds, Bowden, Jamaica.

(Dall, 1903).

(2). Nautilus, vol. 12, no. 2, p. 100, pl. 11, fig. 12, 1903.

Subgenus Haliris Dall.

VERTICORDIA (HALIRIS) JAMAICENSIS Dall.

Verticordia (Haliris) jamaicensis Dall, 1907, Trans. Wagner Free
Inst. Sci., Philadelphia, vol. 3, pt. 6, p. 1511.

Description.- "Shell small, thin, subquadrate, inflated, with
strongly prosocoelus beaks; sculptured with about twenty-seven
radial close-set ribs with narrower interspaces; a smooth, deep
lunar impression in front of, and a narrow, escutcheon-like smooth
area behind them, the whole surface minutely granulose; basal mar-
gin angularly produced near the middle, internally minutely fluted
in harmony with ribs; hinge normal; Alt. 4.75, low. 4.5, diam.
4.6 mm."

"This has a general resemblance to V. mississippiensis Dall,
(1) Eocene, but is smaller, thinner, proportionately shorter,

(1). Idem, op. 1510-1511, pl. 42, fig. 1.

and more inflated." (Dall, 1907).

Type locality.- Bowden, Jamaica.

Remarks.- Some of the valves at hand are larger than the
National Museum specimens, one being especially large, with the

Following dimensions: lat., 12.5 mm.; alt., 12 mm.; diam., 5.5 mm. Some small right valves are decidedly more convex and higher than the average form. Adult shells are heavier, with the internal flutings inconspicuous and the basal angle more or less straightened. In view of the large size of some of the valves in the collections which have furnished the material for this study, it is evident that jamaicensis is larger than mississippiensis. The Bowden form is closer to V. quadrangularis Aldrich (1), from the

(1). Nautilus, vol. 16, no. 9, p. 101, Pl. 1, figs. 22, 23, 1907.

Reef Bluff Oligocene, but that species is heavier, with a more decided ventral angle on adult valves, fewer and wider ribs and narrower interspaces.

Occurrence.- Lower Miocene: Bowden beds, Bowden, Jamaica (Dall, 1903).

Genus POROMYA Forbes.

POROMYA JAMAICENSIS Dall.

Poromya jamaicensis Dall, 1907, Trans. Warner Free Inst. Sci., Philadelphia, vol. 7, pt. , p. 1503, pl. 56, fig. 27.

Description.-- "Shell small; hinge, interior and surface sculpture like those of P. granulata Nyst [and Westendorp (1)], but differing from it by the absence of rostration at the posterior end, which is evenly rounded though more attenuated than the anterior end. Length 5.7, height 4.7, diameter 3.0 mm."

"All of the specimens found agree in small size, absence of rostration, and closeness of the granular surface sculpture, which

(1). Nouvelles Res. des Joq. Foss. d'Avvers, p. 7, pl. 7, fig. 3, 1870. (as Corbula granulata); H. and A. Adams, Gen. Rec. Holl., vol. 2, p. 337, pl. 97, figs. 3a, b (as Stetia granulata).

is disposed in radial lines." (Dall, 1907).

Type locality.-- Gordon, Jamaica.

Shell small, subequilateral, being more produced posteriorly, decidedly inflated, compressed toward the posterior end; antero-dorsal margin excavated, rounding into the broadly convex anterior

end; postero-lateral margin longer, straight or slightly convex, with a steeper slope; posterior end more attenuated than the anterior, rounded to subtruncated; base with a slight posterior emargination on valves with a decided posterior production; umbones tumid, high, prosogyrate, area in front of the umbo slightly excavated; external surface with conspicuous granules, obscurely arranged in radial series, the granules finer toward the posterior end; ligament area opisthodeltic, narrow, flattened, extending throughout the length of the posterior dorsal margin, poorly defined on the left valve; chondrophore conspicuous, placed behind the umbo, directed toward the posterior end, almost external on the left valve; hinge with an obtuse right cardinal before the chondrophore, a corresponding left deep, triangular socket and long left posterior lateral, formed by the compression of the margin; interior of the valve subnacreous, with obscure radii, the ventral margin finely crenulated and the margin at the posterior end compressed.

Dimensions.-- Lat. 7.5 mm.; alt., 4.5 mm.; semidiam., 8.5 mm.

Remarks.-- This species, which is well represented, is recognized by its outline and granulation. Variation in outline is apparent, some of the valves being slightly produced and rounded posteriorly and others decidedly produced and subtruncated. The valves that are most decidedly rounded posteriorly are usually right valves and a concomitant feature is the lower end broader

outline of the trabeculae. The trabeculae may be obviously arranged along radial lines, but such arrangement is often obscure or even absent.

Occurrence.- Lower Miocene: Borden beds, Borden, Jamaica.
(Dall, 1907).

Family Cuspidariidae.

Genus CUSPIDARIA Nardo.

Subgenus Cardiomys A. Adams.

CUSPIDARIA (CARDIOMYS) CRASPEDONIA Ball.

Cuspidaria (Cardiomys) craspedonia Ball, 1907, Trans. Amer. Phil. Soc., Philadelphia, vol. 5, pt. 3, p. 1706, pl. 57, fig. 17.

Description..- "Shell small, blunt, rostrate, the disk sculptured with numerous elevated, simple, radial threads, with, in the interspaces, from one to three much finer subradial threads, the whole crossed by fine concentric lines of growth; the major radials increase somewhat in prominence near the posterior end; beaks low, submedian, inconspicuous; rostrum small, short, slightly recurved, subtruncate terminally, sculptured concentrically with a single feeble thread extending from the beaks to the lower posterior extremity; hinge normal, pectate very small; interior basal margin fringed by small projections corresponding to the major radial sculpture. Length 4.0, height 3.5, diam. 2.0 mm."

"This species is probably the one referred by Juppy to C. alt-

ermata Orbigny (1), a recent form which it resembles, but which

(1). In de la Sagra, Hist. phys., polit. et nat. de la Ile de Cuba, Mollusques, vol. 3, p. 290, pl. 47, figs. 17-20, 1857 (French ed.).

is larger and has the rostrum radially sculptured with numerous threads." (Dall, 1907).

Type locality.-- Borden, Jamaica.

Remarks.-- This species is represented by only a few valves. The Santo Domingian form which Cabb (2) designated C. alternata

(2). Trans. Am. Philos. Soc., ser. 2, vol. 17, p. 145, 1875, (as Neaera alternata).

is larger, more elongated, with a higher rostrum and no secondary radials on the anterior half of the shell; his (3) C. ornaticornis

(3). Idem.

is also larger, with fewer radials, as in the recent ornaticornis of Orbigny (5).

(5). loc. cit., p. 290, pl. 47, figs. 17-20, 1857.

The suggestion made by Dell concerning *G. p.* presumably refers to Cuvier's (1) 1874 check-list where "Neaera costellata Desh." is reported from "Jamaica."

(1). Geol. Mag., decade 2, vol. 1, p. 441.

Occurrence.-- Lower Miocene: Borden hills, Borden, Jamaica (Dell, 1907).

Subgenus Distia Dall.

Distia (Borlenia) Distia Dall.

Distia (Borlenia) Distia Dall, 1907, Trans. Amer. Mus. Nat. Sci., Philadelphia, vol. 5, pt. 3, p. 156, pl. 17, fig. 10.

Description.-- "Shell small, plump, with elevated beaks nearly centrally situated, attenuated, rostrate, and compressed behind; sculptured with two strong threads, one on the anterior basal slope and the other near the posterior border of the disk, which by its projection angulates the basal margin; between these two the surface is finely, radially striate, and a few nearly obsolete striations occur behind the posterior thread; rostrum moderately straight or a little decurved, nearly smooth, a few faint radial striae on its basal aspect, rounded terminally; hinge as described in the diagnosis of the subgenus; basal margin entire except where the radial thread forms a small projection. Length 5, Height 3, Diameter 2 mm."

"This little shell recalls Woznia subopposita [all (1)] of the

(1). Proc. U. S. Nat. Mus., vol. 13, p. 11, pl. 3, fig. 7, 1880.

recent fauna, but has a different history."

Type locality.-- Bouldon, Jamaica.

Remarks.-- The valves of this species, like those of the subgenus, are abundant, but, as with the other *Leptodonta*, all of the specimens are from the Albrit collection. Wall (1) gave the following diagnosis of the subgenus: "*Leptodonta* like *Leptodonta*; bivalve

(1). *Proc. Zool.*, 4. 1504, 1907.

with a posterior left and anterior right cardinal, the sillinium between them, but no laterals; the margin of the right valve grooved to receive the edge of the valve opposite." On the right valves at least, however, there is a very prominent posterior cardinal and the edge of the margin immediately behind the sillinium is produced and thickened for a short distance so as to produce an incipient anterior cardinal; on the left valve the hinge line is abruptly pushed posteriorly to receive the posterior right cardinal, while behind this emargination the margin is thickened and produced to form a weak posterior cardinal. The lower margin of the right valve is grooved, the posterior more deeply than the anterior. The largest valve has the following dimensions; length, 4 mm.; alt., 3.3 mm.; diam., 2 mm.

E. (Juxtonia) monostear, occurring off Bouldon, is without laterals or left cardinals, the right valve having an anterior

Cardinal 1 is without the feeble external radial, all the cost-
rum brought, truncated.

Geography.- Lower Miocene: Jordan 600, Jordan, Jordan
(1911, 1907).

Figure 1.- Several valves below 100 to this species are in the collections at hand, the largest having the following dimensions: length 47.5 mm.; ht., 78 mm.; semilength, 11.5 mm. The shell is slightly depressed in front of the posterior carina, but not enough to affect the margin. Between the carina and the escutcheon is another fainter carina; midway between the two carinae is a faint, shallow sulcus on the ventral half of the shell. The relative width of the lunule and escutcheon is inconsistent, but in length they are subequal and the lunule is usually more deeply impressed. On the largest valve the concentric undulations are somewhat irregular on the ventral half of the anterior slope.

C. jamaicensis is distinguished by its subequilateral outline and the presence of concentric undulations in the subanal region and on the anterior slope. Dall has described a very closely related species from the Chipola Marl- *C. chinolensis* (1). The typi-

(1). loc. cit., p. 1472, pl. 49, fig. 12, 1907.

cal Chipola form differs in having fine concentric undulations on the entire surface, except on the posterior slope. This concentric sculpture may be absolute or may be present on only the anterior third or less of the shell. Such forms are distinguished from *jamaicensis* by having from two to four very coarse undula-

tion a short distance from the tip of the umbos, which may be smooth or finely undulate, while the undulations down the anterior slope, if present, are finer than those on the Borden species; in addition the umbones are slightly lower, the low ledge narrower and the hinge not as heavy.

Specimens of this species in Sapo's collections were labelled as "C. marlandiana Conrad" (1), but that form is obviously different.

(1). Dall, W. H., in "Proc. and Trans. U. S. Nat. Mus.", vol. 19, p. 589, 1896.

ent.

Occurrence.-- Lower Miocene: Borden beds, Borden Jamaica (Dall, 1907).

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MASSILLIUS (55-60) *MASSILLUS* n. sp.

Description.- Shell of medium size, heavy, decidedly convex, transversely elongate, moderately inequilateral; posterior dorsal margin excavated, abruptly rounded anteriorly, obliquely truncate posteriorly, base slightly emarginate before the carina; umbones high, decidedly incurved, the outer flattened; es-
cutcheon slightly wider and longer than the ligule, both moderately impressed; posterior carina weak; running from the umbo to the upper edge of the posterior truncation a second, lower and broader carina present; sculpture of fine concentric undulations in the umbonal region, the ventral few slightly crowded; on the anterior slope finer concentric undulations continuous almost half of the distance from the umbo to the ventral margin, the remainder of the shell smooth except for incremental lines; hinge high, massive, the right posterior cardinal relatively conspicuous; inner margin of the valve smooth.

Dimensions.- Length 61 mm.; alt., 45 mm.; semidiam., 18 mm.

Remarks.- This species, which is based on a single adult right valve and a very young right valve, is very closely related to the Oak Grove *C. densa* Dall (1), but differs by being proper-

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(1). Trans. Amer. Ent. Soc., Philadelphia, Vol. 7, pt. 5, pl. 39, figs. 9-12, 1900; idem, pt. 3, p. 172, 1905.

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thinately higher, more convex with higher and more incurved umbones, more excavated posterior dorsal margin, longer anterior truncation, steeper posterior slope, more numerous and finer umbonal concentric undulations, while the undulations on the anterior slope are coarser, there being no abrupt change from one series to the other, such as is very prominent on densus. The present form is readily distinguished from the associated jamaicensis by its greater thickness, more elongate outline, greater convexity, more excavated posterior dorsal margin, more incurved umbos, the presence of concentric undulations on only the upper half or less of the anterior slope and the greater prominence of the right posterior cardinal.

Occurrence.- Lower Miocene: Borden beds, Borden, Jamaica.

Subgenus *Crassinella* Guppy.

CRASSATELLITES (CRASSINELLA) GUPPI Dall.

Crassinella Martinicensis Guppy, 1874, Zool. Anz. decade 2, vol.

1, p. 442, (check list), ex parte, non d'Orbigny, 1845.

Crassatellites (Crassinella) Guppyi Dall, in Guppy and Dall, 1896,

Proc. U. S. Nat. Mus., vol. 19, p. 526, pl. 73, fig. 5.

Crassatellites (Crassinella) Guppyi Dall, 1907, Trans. Wagner Free

Inst. Sci., Philadelphia, vol. 3, pt. 3, p. 1476.

Description.- "Triangle trigonal, flattish, concentrically costate, with 10 to 12 lamellar ribs, much narrower than the interstices. H. 1.6, lon. 1.6 mm." (Dall, 1896).

Type locality.- Jamaica.

Shell small, compressed or slightly inflated, outline irregularly rounded-triangular, moderately inequilateral; posterior dorsal margin usually slightly longer than the anterior and slightly excavate, especially on the right valve, meeting the ventral margin at a sharp or subrounded angle; anterior dorsal margin straighter or slightly convex, rounding into the usually asymmetrically arcuate base; umbones relatively high, apically acute and compressed, slightly opisthogyrate; esutcheon usually wider and more deeply impressed than the lunule; external surface of the adult valve sculptured with eight to sixteen sharp concentric lam-

ellae, near the ventral margin are crowded and occasionally interrupted; below the sharp edge of the lamella a low rounded undulation usually developed; hinge normal.

Dimensions.- Length, 4.0 mm.; alt., 4.5 mm.; semidiam., 1 mm.

Remarks.- In right valves the greater length and excavation of the posterior dorsal margin is decided; some left valves are almost equilateral, but on the majority of them also the anterior dorsal margin is longer and more angular at its distal end. The edge of the concentric lamellae on the ventral half of the shell is usually more or less "roled", so that the lamellae have an irregular outline and may even be discontinuous. Near the ventral margin fortuitous smaller lamellae are not infrequently intercalated between the larger ones. A slight depression is sometimes present in front of the posterior margin, rarely causing the ventral margin to be feebly insinuated. The largest valve has the following dimensions: length, 6 mm.; alt., 5.5 mm.; semidiam., 1.8 mm.

The recent West Indian L. guadelupensis d'Orbigny (1) is very

(1). In de la Sagra, Hist. phys., polit. et natur. de l'Ile de Cuba, Mollusques, vol. 6, P. 200, pl. 27, figs. 24-26, 1835 (French ed.).

close, having the same outline and the same type of sculpture; the only differences seem to lie in the tendency for the right

form to be larger, more compressed and to have higher umbones,
fewer and more regularly spaced concentric lamellae. D'Orbigny's
species may be the same as A. lunulatus (Conrad) (1), which occurs

(1). Jour. Acad. Nat. Sci., Philadelphia, vol. 7, p. 157, 1874;
Fos. Medial Terr., U. S., p. 44, pl. 21, fig. 6, 1840 (as
Astarte lunulata).

in the Miocene and Pliocene as well as in the recent series. The
differences between guyanae and madagascariensis hold for lunulatus.
The dorsal margins of the Ballooschtrie A. agassizii Dall (2) meet

(2). loc. cit., p. 1479, pl. 52, figs. 3, 4, 1907.

at a more acute angle and therefore the umbo is more acute; be-
sides the shell is more compressed and the concentric lamellae
more rounded. According to Dall (1907), Guyana's A. martinicensis
d'Orbigny from the "Pliocene" of Nataru, Trinidad (3) is guyanae.

(3). loc. cit., 1874: Geol. Mag., Ser. 2, vol. 1, p. 48, 1877.

Occurrence.-- Lower Miocene: Powder Mill, Borden, Jamaica
(Conrad and Dall, 1896; Dall, 1907). Pliocene (4). Nataru, Trini-
dad (Guyana, 1874, 1875; Dall, 1907).

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BRASSINELLIDS (BRASSINELLA) BOULENENSIS Dall.

Brassinellites (Brassinella) boulenensis Dall, 1907, Trans. Amer. Microsc. Soc., Philadelphia, vol. 7, pt. 6, p. 1476, pl. 50, figs. 2, 3.

Description.- "Shell small, thick and solid, lam., subequi-lateral, the anterior side a little shorter, beak small, acute, recurved; lunule and pseudocardium lanceolate, subequal, all impress-ed, smooth; valves with subequal dorsal slopes and prominently arcu-ate base, sculptured with concentric, close-set, flattened threads, which on the umbones are less crowded and slightly sharper; ligam-ent solid, strong, normal. Height, 7.5, length 7.7, diameter 2.0 mm."

This is readily distinguished from B. cupressi by its more con-vent form, heavy set smaller shell, and finer sculpture." (Dall, 1907)

Type locality.- Boulen, Jamaica.

Remarks.- The character of this species implies a limited range of variability. The typical form is almost equilateral, the dorsal margins slope directly from the beak and the sculpture consists of rather fine concentric threads. However, since the post-erior dorsal margin shows a tendency to be slightly convex and at the same time the umbos are not so full. The sculpture may resolve itself into rather distant, sharp ridges, thus approaching the sculpture of cupressi, but it is never as coarse as in that species. There is also slight variation with regard to the degree of infla-tion.

U. harrisi is characterized by its small size, compressed, and slightly inflated shell, and its sculpture.

It differs from the associated U. harrisi. The Shiplei U. taylori shell (1) is more inflated, higher, and its sculpture

(1). loc. cit., pp. 1476-1477, pl. 12, fig. 10, 1907.

ture is weaker and more irregular, while on U. taylori shell (2) of the Salt Grove fauna, the low costate sculpture is obsolete.

(2). Ibid., p. 1477, pl. 19, fig. 11.

on the ventral half of the shell. Typical forms of the recent West Indian U. martinicensis d'Orbigny (3) are smaller, more

(3). loc. cit., p. 1479, pl. 27, figs. 21-23, 1857.

compressed and the sculpture more uniform.

Occurrence.--Lower Miocene: Borden beds, Borden, Jamaica (Dall, 1907).

STANISLAWSKA (S.A. CHIMIA) - WARSZAWA

Gouldia martinicensis Lebb, 1873, Trans. Am. Philos. Soc., ser.
ser., vol. 13, p. 338 (non Goulding, 1845).

James M. Buchanan Aug. 1970.

Dimensions.- Length 2.5 mm.; alt., 2.0 mm.; semicirc., .3 mm.

(1). *Trans. Amer. Microsc. Soc.*, Philadelphia, vol. 7, pt. 1, pp. 1473-1479, pl. 50, figs. 1, 2, 1907.

ed, probably slightly larger and has more teeth.

Cobb's Santo Domingo verticillensis appears to belong to this species.

Occurrence.- Upper Eocene: Santo Domingo (Cobb, 1875),
Lower Miocene: Borden beds, Borden, Jamaica.

Superfamily: C A R D I T A C E A E .

Family: Carditidae.

Genus: VENERICARDIA Lamarek.

Subgenus: Venericardia s. s.

VENERICARDIA SCABRICOSTATA (Guppy)

Cardita scabricostata Guppy, 1906, Quart. Jour. Geol. Soc. London,
vol. 62, p. 325, pl. 18, fig. 10.

Cardita scabricostata Guppy, 1906, 1907, Trans. Am. Philol. Soc.,
new ser., vol. 15, p. 352.

Cardita scabricostata Guppy, 1907, Zool. Anz., Decad. 2, vol. 1,
p. 142 (check list).

Cardita scabricostata Guppy, 1876, Quart. Jour. Geol. Soc. London,
vol. 32, p. 571.

Venericardia scabricostata (Guppy), Dill, 1907, Trans. Amer.
Inst. Sci., Philadelphia, vol. 5, pt. 6, p. 1424.

Description.-- "Shell suborbicular, nearly as high as wide,
with about 18 regularly nodosely variate impressed ribs; post-
erior margin nearly straight, forming an angle with the ventral
margin, which is rounded; anterior margin rounded; umbones promi-
nent; beaks strongly crenate, bifid with two teeth, of which the
posterior one is long and narrow." (Guppy, 1906).

Type locality.-- Jamaica.

Shell small, moderately inflated, levigate, unilobate, subglobose; anterior margin rounding broadly into the base, base slightly curved and subparallel to the gently curved posterior dorsal margin; posterior lateral margin scarcely rounded to obliquely subtruncate, joining the dorsal margin by a broad curve and meeting the ventral margin more abruptly; umbones almost anterior in position, well inflated, moderately wide and high; lunule small, deeply impressed; external surface sculptured with nineteen to twenty-two ribs bearing strong rounded transverse nodules; the first few anterior ribs separated by wider interspaces; the succeeding ribs up to the posterior slope terraced on either side, the nodulated portion forming a rounded keel, the interspaces being slightly narrower, beyond the posterior slope the lower, terraced portion of the rib becoming obsolete, the ribs reduced in width and the interspaces correspondingly wider; the last three posterior ribs suddenly wider and bear nodules that are more compressed at their ends or even spinose and directed toward the posterior margin; on the terrace ribs the nodules continuing across the terraces as obscure undulations; very fine concentric striae and coarser, irregular concentric elevations also present on the terraces and in the interspaces; inner margin of the valve with very short, coarse crenulations.

Dimensions.— Lat. 19 mm.; ht. 12.2 mm.; scutella ., 3.2 mm.

Remarks.-- The small valves of this strongly sub-lanceolate form are numerous. Quoy probably did not include the first anterior and the last posterior ribs in his enumeration, for none of the valves at hand have less than nineteen ribs and the common number is twenty or twenty-one. Occasionally a much smaller ribs is intercalated in one of the interspaces near the posterior margin. Young valves are more orbicular than adults, the terrace on the median ribs is obsolete and the nodules on the ventral portions of the posterior ribs display a tendency to be more scabrous. Among adult shells the characters are decidedly constant, except for a slight shift in either direction with regard to the number of ribs.

This species is characterized by its small size, subquadrate outline, with strong sculpture of the V. vitticostata type, the terraces being prominent on the median portion of the shell and the nodulations strong. Dall has described a Chipola form, V. hadra (1), which is larger, less quadrate, with more prominent
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(1). loc. cit., pp. 1429-1470, pl. 53, figs. 11, 12, 1907.
- - - - -
umbones, wider and less strongly nodulated ribs and the terraces, if present, weak. The Tampa siles and Oak Grove V. liberta Dall (2)
- - - - -
(2). Idem, p. 1472, pl. 57, fig. 12.
- - - - -

is larger, with fewer, less continuously isolated ribs and wider interspaces. The Santo Domingo specimens reach a size larger than any of the Borden ones.

Gabb has criticized Dugby's figure because of the position of the valve and because the number of ribs is not shown. It should be added that the dorsal exterior margin is typically not as angular as is indicated on the figure, and also, on the inside, the terraces of the ribs are not differentiated from the isolated keel, the ribs are wider than they should be.

Occurrence.- Upper Oligocene: Santo Domingo (Gabb, 1873; Dugby, 1874, 1876; Dall, 1907), Lower Miocene: Borden beds, Borden, Jamaica (Guppy, 1866, 1874; Dall, 1907).

Subgenus *Pt. romeris* Conrad.

VALVULICARINA (PILLOLIDIS) AGRIS Bell.

Valvulicaris (Pteromeris) agris Bell, 1907, Trans. Amer. Phil. Sci., Philadelphia, vol. 6, pt. 1, p. 154, pl. 50, fig. 4.

Description.— "Shell small, plump, subcylindrical, the shell but rather low beak situated near the posterior third; anterior end lower, obliquely produced, to 30°, posterior dorsal border descending much more steeply, subangular at the lower posterior termination; sculpture of about eighteen broad, flattened spiral ribs separated by narrow sulci and crossed by small, acute, raised threads, convex dorsally, the ends of these threads sometimes gives a punctate effect to the sulci; there is a small, narrow lunule and escauchen a narrow slit with smooth; hinge normal, the lateral distinct; the inner margin sharply angled to, the ligament and resilium wholly external. Length 2.5, height 2.5, diameter 2.0 mm."

"This little shell is hardly a typical *Pteromeris*, but it possesses all the essential characters and may be regarded as the precursor of the group. The posterior beak and very characteristic features as well as the distinct lateral. It is the earliest known and smallest of the species." (Bell, 1907).

Type locality.— Bowden, Jamaica.

Remarks.— V. acaris is represented by a rather large number of individuals. The sculpture consists of sixteen to twenty well-defined ribs, ornamented with low nodules, the ribs separated by narrow impressed lines. In addition to these ribs there is adjacent to the margin of the lunule a short row of regular, oblique rugae that represent the nodules of the adjoining ribs. At the margin of the escautcheon a similar but shorter series is usually developed and first few posterior ribs are weak with the nodules somewhat rounded. The lunule is sharply set off from the sculptured portion, but the escautcheon, which is longer and narrower than the lunule, is usually less distinctly defined; both are elevated toward the hinge in consequence of the decided thickening of the margins, especially on the right valve. The hinge is strong, the right valve with an elongated anterior and shorter posterior cardinal and a posterior lateral; the left with a broad, obtuse, median cardinal and anterior lateral. The height of the shell usually equals the width. This small, somewhat form is quite distinct.

Occurrence.— Lower Miocene: Bowden beds, Bowden, Jamaica.

Subfamily STERNAE :

Family Chamidae.

Genus STERNA (Linnaeus) Brachidre.

STERNA INVOLUTA Guppy.

Sterna maculosa Lea, 1877, Trans. Am. Philos. Soc. New Ser.,
vol. 15, p. 371 (a of Gleditsch) ex parte, non Gleditsch.

Sterna involuta Guppy, 1874, Col. Mag. Decade 5, vol. 1, p. 153,
pl. 17, figs. 5a-c; p. 442 (check list).

?Sterna involuta Guppy, 1878, Quart. Jour. Geol. Soc. London, vol.
32, p. 571.

Sterna involuta Guppy, 1881, 1882, Trans. Amer. Mus. Nat. Hist.,
Philadelphia, vol. 5, pt. 1, p. 1502.

Description.-- "Left (attached) valve deep internally, very
convex externally, often spiral, completing a turn and a half,
covered externally with distant large foliaceous scales more or
less erect, between which are small irregular intervening granular
ridges. Right valve patulous, ornamented with numerous close
concentric sinuous foliaceous laminae. Ambones large, prominent,
spiral. Larva and farther cardinal tooth eroded." (Guppy, 1874)

Type locality.-- Jamaica.

"This is a small species, attached by the right valve, with the relative of valves different. The attached valve is relatively verrucose, and covered with a row of low, radial spines, sometimes obsolete; the free valve is low, flat, concentric lamellar." (Dall, 1907).

Shell small, thin to moderately heavy, outline variable, usually suborbicular to elongate-subovate; left valve attached, irregular, decidually convex, with prominent, strongly imbricated surface sculpture with relatively coarse, slightly imbricating concentric lamellae, at intervals granulated and elevated into short scales arranged in rows or lines, obscure radial striae; irregular, interrupted swollen radial lines also present; right valve compressed or suborbital, attached in the middle region; sculptured with usually closely-set, projecting, somewhat lamellar; inner margin of right valve with fine, short striations; on the left valve the row of striae is usually removed from the margin, except on the inner anterior margin, and faint radial lines sometimes visible on the interior surface.

Dimensions.— A left valve: lat., 7 mm.; alt., 1 mm.; diam., 5 mm. A right valve: lat., 11.5 mm.; alt., 2.5 mm.; diam., 4.5 mm.

Remarks.— Among the numerous valves of this species there are some that are larger than the typical, sculptured somewhat more

measured, the largest left valve having the following dimensions:
lgt., 14 mm., wdt., 12.5 mm.; hgt., 11 mm. The sculpture of the
attached, in this case, the left, valve is, as usual, very irregular.
The radial series, which rarely extend to the umbo, may be
be termed striae, are often partially or completely obsolete, but
the peculiar, irregularly radial, interrupted, costular sculpture
is usually persistent. On right valves, although the ornamentation
is relatively constant, the number of concentric lamellae, and there-
fore the spacing, varies, as well as the relative coarseness of
the crenulations, which in a few exceptional cases are arranged in
regular radial series.

The nuchonic shell is preserved on a few of the valves; it is
minute, subquadrate, with the umbo at the anterior end, and ornamented
with six or seven distinct, regularly spaced, sharply defined
and slightly curved concentric lamellae with intervening obscure,
fine concentric striae.

The small size, "variegular" and radially asymmetric sculpture
of the attached left valve and the numerous finely crenu-
lated lamellae of the right valve are characteristic of this species. The Chipolan S. imbecilis Hall (1) is larger and

(1). lgt. 14 mm., wdt. 12.5 mm., hgt. 11 mm., 1897.

attached by the right valve; the sculpture of the left valve, con-

pared with that found on the right valve of invalata, it is less lamellar and there is a tendency for two or three radial series of foliations to be developed beyond the anterior margin; the attached valves have an obviously different shape and sculpture. The attached valve, usually the left, of S. alveolata (1), from the Tampa pillar, which is well above the zone of invalata, has more radial and lower radial ribs, while on the free valve the concentric

(1). Idem, p. 1297, pl. 71, figs. 11, 12.

sculpture is concentric. Tanna pilex (2), S. alveolata (1) (2)

(2). Idem, pp. 1298-1299, pl. 71, fig. 6.

is also attached by the left valve, on which the lateral concentric lamellae, while on the right valve the lamellae are regular, as in invalata, but, except for the occasional presence of a few obsolete crenulations on the marginal lamellae, they are not ornamented.

The Santo Domingo Massachusetts is a very distinct and recognizable; quite apparently, or, at least, to the eye, it is very different from invalata that they probably should be considered as two distinct species.

How, noted in a collection of "Pisces" forms the structure of "Some ... of ...", which is through ... of this ...

Occurrence. - Upper Cretaceous: ... (Babb, 1975; 1976, 1978); Lower Cretaceous: ... (Gunn, 1974; D 11, 1987).

CHAMA MACROPHALLA Melin.

Chama macrophalla, Melin, 1898, Journ. Ichth.,
vol. 7, pp. 101, 110, pl. 52, figs. 521, 525.

Chama macrophalla Melin, 1898, Syst. Art., vol. 6, p. 5501.

Chama citrea Melin, 1898, idem, p. 5507.

Chama macrophalla Melin, Hanley, 1842, Descrip. Nat. Hist.
Shells, p. 326.

Chama macrophalla Melin, d'Orbigny, 1845 (?), in De la Faune,
Nat. Hist., polit. y natur. de la Isla de Cuba, Molluscos,
p. , (Spanish ed.).

Chama macrophalla Melin, Reeve, 1846-1847, Journ. Ichth., vol. 1,
Chama, pl. 2, fig. 6, pl. 2, fig. 6b.

Chama macrophalla Melin, d'Orbigny, 1855, in De la Faune, Nat.
Hist., polit. et natur. de l'Ile de Cuba, Molluscos,
vol. 1, p. 537. (French ed.).

Chama macrophalla Sherrin, 1875, Trans. Am. Phil. Soc.,
New Ser., vol. 11, p. 377 (ex parte).

Chama macrophalla Sherrin, 1875, Journ. Acad. Nat. Sci.,
Philadelphia, New Ser., vol. 1, p. 375.

Chama macrophalla Melin, 1898, Trans. Amer. Mus. Nat.
Sci., Philadelphia, vol. 5, pt. 1, pp. 110-111.

Description.-- UOL. testa rotundata, levissim lamellata;

marginate into irregularities." (Gabb, 1873, p. 5234).

Shell of medium size, irregularly transversely subovate; attached by left valve; right valve moderately convex anteriorly, compressed toward the anterior margin; umbones large for the size of the shell, prosogyrate, forming about one and a half turns; external sculpture consisting of irregular, more or less overlapping concentric lamellae, crenulated and produced at irregular intervals, sculptured with fine obsolete radial striae.

Dimensions.-- Right valve: lat., 27 mm.; alt., 27 mm.; diam., 15 mm.

Remarks.-- The collections at hand have furnished a single right valve that has the characteristic features of the recent forms assigned to this species. Its occurrence in the Bowden beds would be received with suspicion if the shell did not have the characteristic appearance of other Bowden specimens. Because of its much larger size, larger umbos, more foliaceous and crenulated lamellae bearing fine radial striae, this valve is sharply differentiated from right valves of the associated involutes.

As noted above, at least some of Gabb's Santo Domingo shells are similar to this Bowden form.

Occurrence.-- Lower Oligocene: Santo Domingo (Gabb, 1873). Lower Miocene: Bowden beds, Bowden, Jamaica. Pliocene: Limon, Costa Rica (Gabb, 1881). Pleistocene: The Antilles and Suracao (Dall, 1907). Recent: Tampa to Cape Hatteras, North Carolina, to Brazil (Dall, 1907, 1908).

Genus *CHIRODIA* Fischer.

CHIRODIA *ELLIOTI* Hall.

Chirodia arcinella Guppy, 1876, Quart. Jour. Geol. Soc. London, vol. 32, p. 224. (non Linnaeus, 1757).

Chirodia arcinella Babb, 1877, Trans. Am. Philos. Soc., 1877, vol. 17, p. 371 (non Linnaeus, 1757).

Chirodia arcinella Guppy, 1874, Geol. Mag., decade 8, vol. 1, p. 142 (check list), in parte, non Linnaeus, 1757.

Chirodia arcinella Guppy, 1876, Quart. Jour. Geol. Soc. London, vol. 32, p. 331 (non Linnaeus, 1757).

Echinochama arcinella Hall, 1827, Trans. Amer. Free Inst. Sci., Philadelphia, vol. 8, pt. 1, pp. 1404-1407, pl. 74, fig. 9.

Description.— Shell large, subovate, with no almost absolute, rectilinear base, slightly arched posteriorly, rounded edges, and exserted anterior end; valves large, convex, thin, *arcinella* and with teeth prominent and slightly curved, the upper of improved teeth; the number of ribs varied from twenty to thirty-one, low with subequal inter-rib spaces, the apices very short and scale-like except on a single spiral rib; where they are spi-

coral and somewhat longer than the rest; the first two were smaller and less regular than the third. Length 10, height 4, diameter about 40 mm. exclusive of the umbilicus.

"This species when compared is seen to be more like the type of the genus with which it was associated by Dall and is really more like the Pacific species, [E. californica Dall] and has nearly as many ribs but different shape. The ribs are small, low and long, cylindrical spines."

"All the species have occasional individuals which have the spines and even the ribs nearly obsolete. Grunig's Triton specimen, and a valve collected in the Pliocene of Mexico, Costa Rica, by Cobb, are of this character, but as it is more an individual mutation than a true variety I shall not call any distinctive name to it." (Dall, 1907).

Type locality.-- Bowden, Jamaica.

Shell large, massive, equivalve, beakless, the lateral outline subquadrate; dorsal margin broadly convex, passing into the gently curved anterior margin, which passes down abruptly into the truncated base; anterior margin slightly above the level, indented at the base of the beak and then abruptly straight outward; umbones anterior in position, subequal, inflated and moderate, high; lunule large, deeply imbedded, the entire portion raised toward the margin; external surface sculptured with

about to thirty low, rounded ribs, decreasing in interval toward the base width; on the posterior half of the shell the ribs are all, but increasing in width toward the center of the shell where there is a single prominent rib; on the anterior half the ribs fewer but wider and higher and somewhat in size anteriorly, but near the margin of the lunule again becoming larger; on the dorsal margin of the right valve one or two more or less irregular ribs, much more prominent than those immediately succeeding, present; ribs ornamented with short, thick, most prominent on the large central rib and on the posterior ribs often taking the form of small irregular nodules; lunule and lunule irregularly pitted; concentric sculpture of irregularly disposed, slightly imbricating lamellae near the margin, the lamellae continuing across the lunule; inner ventral margin of the shell slightly undulate by the anterior ribs.

Dimensions.- Lat., 50.5 mm.; alt., 55 mm.; thickness, 31 mm.

Remarks.- The large, massive shells of this species are a very conspicuous element in the fauna, being equalled in size only by some of the larger specimens of Area validiorata, but in massiveness unsurpassed. The prominent irregularly sinuous rib, or ribs, adjacent to the dorsal margin is a constant feature on right valves, but is not present on the other valve. Some distance from the dorsal margin there is often present a shallow, but well-defined, groove. The portion of the shell between this

groove and the prominent radial rib is slightly raised. Traces of reddish brown coloration are visible on the interior surface of one of the valves.

E. arcinella Linnaeus (1) occurs in the West Indian region.

(1). Linnaeus, Syst. Nat., ed. 12, p. 1159, 1767; DeCoeq, Munch. Icon., vol. 1, pl. 5, fig. 21a, b.

in depths up to twenty-six fathoms and is also found in the Calceohatchie and Sacramento Pliocene. In addition to the differences discussed above, arcinella has fewer, broader ribs and much larger spines and the ventral margin is decidedly affected by the ribs. The young of antiquata have fewer ribs than the adult and relatively longer spines, so that they more closely resemble the recent species. It is an interesting fact that, as mentioned above, the Bowden form is more closely related to the Lower Californian E. californica Dall (2) than to the recent West Indian

(2).

in form.

The Santo Domingo specimens have in general less prominent radial ribs and the entire surface more deeply pitted.

It should be stated that Dall's figure does not present the shell in its proper position.

Ocellurella.-- Upper Oligocene: Santo Domingo (Guppy, 1876, 1874, 1873; Gubb, 1877, Dall, 1907). Lower Miocene: Powden beds, Borden, Jamaica (Guppy, 1876, 1874; Dall, 1907).

Superfamily: Iridopoda.

Family: Iridopodidae.

Genus: *STANIA* Sars.

Section: *STANIA* Sars.

STANIA SPINULOSA Sars.

Stania spinulosa Sars, 1907, *Rept. Norges Vidensk. Selsk.*,
Philadelphia, vol. 7, pt. 2, pp. 154-157, pl. 2, fig.
19.

Description.:- "Shell nearly spherical, moderately
ly convex, solid, with pointed, low, subparallel beaks; lunule
small, deep, coriiform; sculpture of shell, low, striate, indis-
tinct radial with slightly elevated, narrower lateral areas; these
are crossed by indistinct concentric threads, incremental lines,
and occasional ridges due to testing strands; at what would be the
intersections, if the concentric sculpture were better developed,
the shell shows small, granular modulation, which towards the ends
and dorsal margin become minutely spinulose; the right valve has
the lines well developed, the anterior lateral line most distinct,
the posterior obsolete; the posterior cardinal slightly raised
margin with traces of crenulation anteriorly; height 1.5, width
27.0, length 20.0, diameter 11.0" (Sars, 1907).

Localities. - Jamaica, Jamaica.

Description. - This species is characterized in the material at hand. The general appearance is more rounded and more, more from both of the surface of the type, and the color is more uniform, and toward the margin of the body, the color is more uniform. The radii are small, and all radii are present on the figure.

The characteristic features are the small size and the small size. There is no possibility of comparison with the recent West Indian I. tigrina (Linnaeus) (1), which ranges from the Atlantic, and the small size.

1. Tigrina, p. 10, p. 10, 1758, (as I. tigrina);
Tigrina tigrina (Linn.), Conch. Icon., vol. 1, Plate,
pl. 1, fig. 6, 1850 (non Linnaeus).

size, more rounded and thin and more rounded and thin. Dall (2)
has suggested that the citation of I. tigrina from the "Museum"

(3). loc. cit.,

of Jamaica may refer to a label of I. tigrina from a collection
at St. Ann's Parish, Jamaica, and it is not known whether
have recorded tigrina from Jamaica, 17 and in 1871 (1871 cited)

that were found from Haiti Santo Domingo and ... in
1876 (4) from the ... locality; ... from
Santo Domingo.(5).

- (7). Geol. Mag., Decade 3, vol. 1, p. 442.
(4). Quart. Jour. Geol. Soc. London, vol. 52, p. 750.
(5). Trans. Am. Philos. Soc., New Ser., vol. 12, p. 251, 1877.
-

Occurrence.-- Lower Miocene: Borden beds, Borden, Jamaica.
(Hall, 1907).

CODAXIA LUTHERI P. S.

Description.- Shell small, globular, weakly inflated; more prolated and more convexly rounded anteriorly; umbo low, acute; lunule narrow, moderately impressed; external surface sculptured with about thirty-two strong radial ribs of inconstant width, separated by narrower interrib spaces; the ribs with relatively coarse nodules arranged along usually equally spaced concentric lines, the nodules becoming compressed or flattened toward either end; right valve with two cardinals, the posterior larger and obscurely bifid, and an anterior and posterior lateral, the posterior somewhat obscured by the ligament; inner margin of the valve feebly crenulated; the interior with obscure radial markings.

Dimensions.- Lst., 14 mm.; hgt., 17 mm.; depth, 6.5 mm.

Remarks.- C. lutheri is known from a single right valve. It is characterized by its strong sculpture, both the radial ribs and the concentric nodules being sharply outlined. The radial ribs are slightly inconstant in width, especially toward either end. The sculpture is unusually strong for the section Codaxia P. S., but the shell is larger and more compressed than the average Jagonia.

Occurrence.- Lower Miocene: Border beds, Border, Jamaica.

Section *Jasania* Röckz.

CODAKIA (*JASANIA*) *PERTENERA* Dall.

Codakia (*Jasania*) per tenera Dall, 1907, *Proc. Acad. Nat. Sci. Phila.*, vol. 5, p. 1547, pl. 51, fig. 1.

Description.-- "Shell rather large, very thin, with the surface more or less irregularly indented, as if from nestling; anterior end larval, attenuated, posterior end more blunt, obscurely vertically truncate, beaks low; lunule long and very narrow, not deeply impressed; surface finely, closely, concentrically, and radially striated, but so feebly that no obvious cancellation results; hinge-margin narrow, hinge-teeth feeble, the laterals in the left valve obsolete or absent; beaks locoid; margins sometimes absolutely fluted. Height 32.5, length 55.0, diameter 17.5 mm."

"This species is not a characteristic *Jasania*, but is nearer to this group than to any other." (Dall, 1907).

Type locality.-- Bowden, Jamaica.

Remarks.-- *J. pertenera* is represented by a pair of valves, the largest being more or less subtriangular. It is characterized by its somewhat elongate outline, feeble inflation and irregular surface with weak sculpture.

Occurrence. - Toward Wisconsin: Sandston Sand, 3 mi. N. of Sandston, 3 mi. S. of Sandston (Hall, 1937).

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JODARIA (JASPERIA) JEFFII n. nov.

Lucina textilis Guppy, in Guppy and Dall, 1906, Proc. U. S.

Nat. Mus., vol. 13, p. 526, pl. 70, fig. 1.

Colakia (Jasperia) textilis Guppy, Dall, 1907, Trans. Wagner Free

Inst. Sci., Philadelphia, vol. 7, pt. 6, p. 124.

Not Lucina textilis Philippi (= Colakia (Jasperia) textilis), 1870.

Description.-- "Orbicular, occasionally a little irregular in outline; decorated by somewhat irregular fine radiating and concentric lines; margins dentate. Diameter, 11 mm." (Guppy, 1906).

Type locality.-- Bowden, Jamaica.

Shell small, thin, surface usually irregular, well inflated, width exceeding the height, slightly inequilateral, being more produced anteriorly; anterior dorsal margin short, direct or slightly concave, posterior dorsal margin longer, straight or slightly convex; broadly rounded anteriorly, vertically subtruncated posteriorly; umbones tumid, moderately high; lunule small, narrow, moderately impressed; anterior dorsal area poorly defined, posterior dorsal area depressed, sometimes causing a slight sinuation of the margin of the valve; external sculpture of numerous weak radials of irregular width, crossed by low, concentric lines of various width and irregularly spaced incrementals; on the dorsal area the radials absent or poorly developed; cardinal teeth

weak; on the left valve the posterior lateral or both posterior and anterior sometimes absent; right laterals usually present, but sometimes weak; inner margin of the valve finely arcuated.

Dimensions.-- lat., 14.2 mm.; alt., 12.5 mm.; semidiag., 5.8 mm.

Remarks.-- The concentric sculpture as preserved is irregularly developed since most of the valves are worn; there are present however, irregularly spaced concentric lines of varying width and sharpness, usually absent on the median dorsal region, as well as incremental lines. The fine radials are usually present over the entire disk, except in the umbonal region; they too are of varying width and prominence. Both sets of sculpture are usually conspicuous enough to produce a reticulated effect. Some variation is noticeable with regard to convexity, but in general the characters are quite constant.

This is an abundant form and various growth stages are represented, the valve measured being one of the largest. The small size, slightly elongate outline and fine radial sculpture are characteristic features. Dall noted the fact that Lundy Island was pre-occupied, but hesitated to propose a specific name since he doubted whether the form could be specifically differentiated from bertenera. The present form is, however, much more abundant than bertenera and presents constant differences in lateral development, shell, more inflated, less elongate, with more conspicuous

se 1pt. to and definitely over the small grain.

The above is given in honor of Mr. A. J. Hoffmann, Capt.,
of Fort - of - Smith, Arkansas, then from 1890 to 1895
more prolific contributor to the literature of the West Indian
territory, Florida.

Occurrence. - Lower Miocene: Boulders, Florida, Florida
(Girty and Hall, 1898; Hall, 1907).

JOLANIA (JOLANIA) VANDRILEI Ball.

Jolania (Jolania) Vandrilei Ball, 1907, Trans. Wagner Inst. Sci., Philadelphia, Vol. 7, Pt. 3, p. 1382, Pl. 52, fig. 1. (syn. excl.)

Description.— "This is the slightly enlarged form of Jolania antillarum Coere (= J. costata Schöen., not Schöen., 1850), from which it differs in its more inflated shell, deeper and more distinctly reticulate sculpture, with similar more thread-like radial, slender and small, slender shell. It is abundant in the Florida Gulf, from which it was collected by Henry Vandriles, Esq., who sent it to Mr. Cressy and subsequently by Messrs. Henderson and Simpson." (Ball, 1907).

Type locality.— Florida, Jamaica.

Shell small, well inflated, inequilateral, the lower portion of the anterior margin obliquely rounded; umbilical rim, moderately prominent; low to small, deep; lateral areas poorly defined except for the difference in sculpture; external sculpture of numerous, fine, sharply beveled striae; apically several fascicles, including usually two, but sometimes three fascicles, running from the umbilicus to the margin, with slender, low striae intercalated between the fascicles; the most prominent radials forming

the fascicles occasionally toward the umbilical region, but prominent and oblique to the axis; sometimes no fascicles present, with some radial lines, more prominent than others or all sub-equal; the radials forming continuous rows of lines, sometimes nodules, continuing across the intermuscular space and raised concentric lines; anterior dorsal area bearing a few weak radials; anterior portion of posterior dorsal area with radial, the remainder with a few radials becoming weaker toward the margin, a very narrow area adjacent to the margin being almost or entirely smooth, but not leathered; hinge strong; inner margin of the valve finely excavated.

Dimensions.-- Lat., 0.2 mm.; alt., 0 mm.; semilength, 7 mm.

Remarks.-- This species is the most abundant of the lenticular form, and it is micromerous, despite its small size, because of its sharply reticulated, striate sculpture. The sculpture is, however, very variable, with almost all gradations from fascicles of prominent radials, separated by finer ones, to subequal radials. In young shells that have fascicles, the individual radials constituting them are spaced at a considerable distance toward the umbo and the finer intervening radials are very often absent than in adults. There is much variation in the degree of inflation and in the convexity of the anterior margin. The largest valve at hand has the following dimensions: lat., 2 mm.,

alt., 0.1 mm., diam. 2.9 mm.

Young valves on which the radial and sutural are possibly
be confused with certain forms of the accompanying Alveolites
(Bellerophon) actinus Dall, but that species is less subcircular, with
fuller umbones, coarser and more regular radial sculpture consisting
of sharp, thin lamellae, a wider interval, an as-
certainable, weaker cardinals and more elongate laterals, especially
the posterior.

Dall notes that this species in the Cuddy collection bore the
label "Lucina actina var. antillarum."

Gabb's (1) Santo Domingian Lucina antillarum Reeve, which

1). Trans. Am. Philos. Soc., New Ser., vol. 17, p. 351, 1877.

Dall placed in synonymy, is more like the recent antillarum,
being more rounded, more uniformly coarser, with broader umbones
and weaker sculpture.

Occurrence.-- Lower Eocene: Bowden beds, Bowden, Jamaica
(Dall, 1907).

Genus MYRTAEA Murton.

Section Myrtaea s. s.

MYRTAEA LI ONIAE Call.

Myrtaea li oniae Call, 1907, Trans. Amer. Ent. Soc.,
Philadelphia, vol. 5, pt. 6, p. 135, pl. 52, fig. 13.

Description.-- "Shell small, thin, subequilateral, somewhat
longer than high, only moderately convex, though hardly com-
pressed; beaks small and low; suture deep, narrow, sublan-
ceolate, small; surface covered with fine, sharp, thin, elevated,
concentric lamellae, separated by wider interspaces and more
elevated near the dorsal margin, especially behind the beaks,
where in perfect specimens five or six of them are produced as
small leaflets, which, however, are usually broken off; hinge
with a single right and two left cardinal teeth, the laterals
obsolete; scar normal; the margin of the valves entire. Alt.
8, lon. 9, diam. 4 mm."

"This species, though very similar, is more elongated, less
elevated, and more densely lamellate than M. arcta [Cresson (1)]--

(1). Am. Jour. Conch., vol. 1, pp. 6, 132, 218, pl. 20, fig. 11,
1867.

Eschscholtz and Vicsmann], From the L. cristophora Dall and Cline-son (1), the recent representative of the group in the West

(1). Dall. U. S. Fish Comm., vol. 80, pt. 1, p. 405, pl. 35, figs. 1, 6, 1901.

Indies, it differs by its more moderate-elongate form, thicker shell, and more delicate and sparser concentric lamellae."

(Dall, 1903).

Type locality.-- Forden, Jamaica.

The anterior dorsal margin is short, straight or slightly excavated, direct or with a gentle slope and abruptly joining the obliquely subtruncated upper anterior lateral margin; while the posterior dorsal margin is longer, direct or slightly convex and passes abruptly into the vertically truncated posterior end.

Remarks.-- This species is quite abundant in the material at hand, the largest valve measuring 11.9 mm. in latitude, 11 mm. in altitude and 3.2 mm. in diameter. Variation in inflation is slight, one of the valves being more than moderately convex. There are also contrasts in the concentric sculpture, which range from but slightly elevated lamellae to much more pronounced lamellar fringes; much of this is, however, due to erosion. The lamellae are always sharp and closely spaced. Some valves from

which the lamellae have been removed show microscopic reticulations, like the ornamented striation of certain bryozoa, which reflect light brilliantly.

The specimens from Ticon, Costa Rica, are not quite as large as those from Portland and the sculpture is slightly finer than on the average Portland form.

Occurrence.- Lower Miocene: Owen's hills, Oregon, U. S. (Dall, 1903). Pliocene: Ticon, Costa Rica (Dall, 1903).

Platystrophia h. sp.

Description.- Shell of medium size, thin, well inflated, suborbicular; anterior dorsal margin short, slightly notched, upper portion of the anterior lateral margin slightly truncated; posterior dorsal margin higher than the anterior, longer and slightly convex, posterior lateral margin subtruncated in the region of the dorsal area; umbones broad, low; muscle lines, moderately impressed; anterior dorsal area poorly defined, posterior area more prominent; external surface sculptured with numerous, fine, unequally spaced and rather obsolete, weakly elevated concentric lines, becoming more prominent and subparallel in the posterior area, between the concentric lines over the entire surface of the shell obscure vertical radial markings present; hinge of left valve edentulous except for a faint suggestion of a single cardinal; right valve not known.

Dimensions.- Lat., 24.5 mm.; alt., 23.2 mm.; width at base, 1.5 mm.

Remarks.- This species is described from a single left valve. It is readily distinguished from *P. hirsuta* by its much larger size, greater convexity and less regular concentric sculpture.

Occurrence.- Lower Miocene: Torden beds, Torden, Kansas.

Section Eulopia Dall.

EULOPIA (EULOPIA) EULOPICA Dall.

Myrtaea (Eulopia) varicostata Dall, 1907, Trans. Amer. Mus. Nat. Hist., Philadelphia, vol. 7, pt. 2, p. 157, pl. 52, fig. 5.

Myrtaea (Eulopia) varicostata Dall, 1913, Bull. U. S. Nat. Mus., vol. 30, pp. 176-177, pl. 27, fig. 14.

Description.-- "Shell small; E. varicostata Dall, but shorter and more rounded; moderately convex, subequilateral, the anterior end slightly longer; beaks low and inconspicuous; lamellae narrow, concave, excavated; the eseatheon lower, longer; both beaks external, by a separate carina; ligament, groove about half as long as the eseatheon; surface with slightly elevated, thin, concentric lamellae, the interspaces radially sculptured with close-set varicostate threads; hinge with the normal cardinal dentition and distinct right lateral; allanto-cardinal rather small, the interpallial area obsolete. Alt. 1.5, length 7.5, diam. 3.5 mm." (Dall, 1907).

Type locality.-- Bering, Arctic.

The anterior and posterior dorsal carinae are of about equal length; but the anterior is moderately to distinctly concave, while the posterior is slightly convex and steeper.

Weight.-- The distinct difference of this species, and its relative position, to the relatively distinct, slightly raised concentric lamellae and the somewhat irregular, well defined in the interstices. Some of the valves are somewhat wider than the others (figured by Dall). The species is very close between this form and the related M. (M.) (1), a small inhabitant of the last Indian nation, is pointed out above.

(1). Dall. Mus. Script. Zool., vol. 1, pp. 247-48, 1897; Proc. U. S. Nat. Mus., vol. 1, p. 247, pl. 14, fig. 11, 1902, (as M. (M.)).

The single female silver specimen that was referred to this species is no longer in the National Museum and therefore no material is available for comparison.

Occurrence.-- Upper Cretaceous: Tampa Bay, Fla. (Dall, 1907, 1917); Lower Miocene: Cowden beds, Scotland, (Dall, 1907, 1917).

MARZALLA (LULOFIA) VENTRATA DALL.

Marzalla (Lulofia) ventrata Dall, 1907, Trans. Amer. Mus. Nat. Hist.
Sci., Philadelphia, vol. 7, pt. 3, p. 177, pl. 3,
fig. 15.

Description..- "Shell thin, oval, somewhat subequilateral; base low, inconspicuous; lunule low and narrow, moderately impressed, excavation almost linear, bordered outwardly by a carina; surface of the shell with delicate, minute, striations. Dorsal edge of the li. becomes almost obsolete over the middle and basal portions of the li. disk; small nodules of li. along the edge, rather flattened threads, which tend to be arranged in discrete nodules rather thick; lineations are somewhat irregular in pattern; li. is delicate, the li. at the base is feeble, li. solitary, coarse distinct, rather short; the li. at the base is large, normal; the surface of the valve with c. 12.5, lon. 17, diam. 7 mm."

"This is larger, more delicate, and thinner than most of the group." (Dall, 1907).

Locality..- Bowen, Florida.

The shell is broader than high; the anterior-dorsal margin concave, the postero-dorsal margin slightly longer, and with a steeper slope, so that the anterior lateral margin is more con-

ve from the posterior.

Remarks.- A few valves of this newly described form are present. It is characterized by its elliptical, flattened eccentric sculpture and by the fact that the valves abruptly change their direction anteriorly and posteriorly, being directed inward. Some of the valves are more elongated than the one represented by Dall's figure.

Occurrence.- Lower Miocene: Boulder beds, Boulder, Colorado (Dall, 1907).

LYRIALIA (STROPHIA) CROOKA n. sp.

Description.- Shell of medium size, thin, subovate, well inflated; antero-lateral margin excavated, postero-lateral almost straight, sloping gently, meeting the ventricall, forming a postero-lateral margin at an angle of about 120°; rounded ventrally and anteriorly; umbones low; lateral shell, feebly impressed, cordate; posterior area poorly defined; external surface sculptured with fine, thin, elevated concentric lines, eroded from much of the surface, and faint suggestion of fine radials of varying width; hinge weak; lower third of the valve entire.

Dimensions.- Int., 7 mm.; alt., 7.5 mm.; median, 5 mm.

Remarks.- This species is described from the right valve. The radial sculpture is very feeble and toward the apex is scarcely divergent in a manner somewhat similar to L. fuscata. That species differs by its greater convexity, closer concentric lines, weaker and finer radially, wider but shorter lenticles and the absence of an apertecture. Because of the feebleness of the radial sculpture crooka may be compared with L. lineata, but the latter species is more inflated, with a wider and shallower lenticle and with less conspicuous concentric sculpture.

Occurrence.- Lower Liocene: Boulder beds, Utah, America.

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Genus PHACIDES Blainville.

Subgenus Phacoides n. n.

PHACIDES DOMINGENSIS Dall ?

Lucina jamaicensis Abb, 1877, Trans. Amer. Philom. Soc., New
- ser., vol. 15, p. 351 (non ^{Lamarck} ~~Lucina~~, 1801).

Phacoides domingensis Dall, 1907, Trans. Wistar Inst. Sci.,
Philadelphia, vol. 7, pt. 6, p. 1707, Pl. 50, Fig. 11.
Not Phacoides domingensis Dall, 1915, Bull. U. S. Nat. Mus.,
No. 30, p. 137.

Description.-- "Shell closely resembling P. pectinata (for
which it has been taken by Sargoy), but smaller, more inflate,
with the notch in front of the anterior dorsal area more indent-
ed and angular, the concentric lamellation more distant and more
evenly spaced, and the posterior dorsal area shorter in propor-
tion and more triangular. Alt. 51, lon. 51, diam. 19 mm."

"This is with little doubt the Miocene precursor of P.
pectinata [Gmelin (1)], and was regarded as identical with it

(1). Syst. Nat., vol. 8, p. 3876, 1793, (as Uellina pectinata)
= Lucina jamaicensis Lamarck, 1801.

by Abb and Sargoy." (Dall, 1907).

Type locality.- Found in Lake San Dimas, Santo Domingo.

Remarks.- This species is not represented in the collections at hand. The type is silicified and has sculpture consisting of rather distant more or less lamellar concentric rugae with finer, somewhat irregular intercalated secondary rugae. The single, badly worn fragment from Bowden in the National Museum collection that has been referred to this species has no indication of secondary concentric sculpture and the primary rugae are closer and not as lamellose, probably due to erosion. The primary concentric rugae are further apart than on the associated P. browni n. sp.

The Tampa siliceous form is hardly identical with one from Santo Domingo; being smaller with a less prominent posterior dorsal area, more numerous concentric rugae, without secondary concentric sculpture except near the umbo, with obsolete radial sculpture and finely crenulated inner margins.

Occurrence.- Upper Oligocene: Santo Domingo (Abbott, 1877; Dall, 1907); Lower Miocene: ?Bowden beds, Bowden, Jamaica (Dall, 1907).

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Subgenus Here Gabb.

Section Here s. s.

PHACIDUS (HERE) POLAGRINUS Dall.

Lucina Pennsylvanica Guppy, 1866, Quart. Jour. Geol. Soc. London, vol. 22, p. 332 (non Linnaeus, 1758).

Lucina Pennsylvanica Guppy, 1874, Geol. Mag., decade 9, vol. 1, p. 442, (check list), ex parte, non Linnaeus, 1758.

Lucina pennsylvanica Guppy, 1876, Quart. Jour. Geol. Soc. London, vol. 32, p. 750 (non Linnaeus, 1758).

Phacoides (Here) polagrinus Dall, 1907, Trans. Warner Free Inst. Sci., Philadelphia, vol. 5, pt. 6, p. 1765-1766, pl. 50, figs. 16, 17.

Description.- "Shell when young moderately convex, when adult having an exaggerated thickness and almost spherical convexity. It belongs to the group of P. pennsylvanicus L., of which species it is doubtless a variation, and the mention of that species by Gabb and Guppy in the "Miocene" (=Oligocene) of St. Domingo and similar localities refers to the present Phacoides. For this reason it is best described by comparison with P. pennsylvanicus, from which it differs by its smaller size and greater inflation at maturity, its finer and closer concentric sculpture

ture, its surface and border distinct and raised, the low elevated border, its slightly yellow and more distinctly bluish of anterior dorsal area, and its more usually vitreous surface. Alt. 28, lon. 32, high. 75 mm. The largest specimen observed has a length of 48 and a diameter of 55 mm., while a specimen of P. mangelianus of the same size has a diameter of only 35 mm."

"The cardinal teeth of the fossil are 75 much more abundant than in the recent shell, in which the small cardinal teeth are usually very obscure or even wanting in adult specimens." (Bell, 1917)

Type locality.-- Bolder, Jamaica.

Shell of moderate size, outline nearly circular; immature valves strongly convex, small shell thickened, especially convex and sub-spherical; umbones of adult shells relatively broad and low, on young shells higher and narrower; posterior area broad; well-defined, anterior dorsal area broad and broad; ventral surface sculptured with regular, closely-spaced concentric rugae, continuous across the posterior and anterior margins; on the largest shells crowded toward the ventral margin; hinge strong; inner margin of the valve often bearing minute, minute serrations.

Remarks.-- Although this species is recorded by a large number of individuals, there is a rather strong tendency to the same but even the few exceptionally convex, largest forms of the

Grove found as well as in the English, is also less convex, lower and with lower rounded than the normal Bowden form, broader and longer anterior dorsal margin and a longer posterior axis.

No statement is made in Fabb's Santo Domingo memoir concerning the Miocene occurrence of Lucina pennsylvanica and there are ~~no~~ specimens in his collection that might have been referred to that species. Guppy, however, listed it from that island and also from Jamaica; if these forms are identical with the Bowden one, cofragrinus has a wide distribution.

Occurrence.- Upper Oligocene: Caracas (Dall, 1907); Jamaica (Guppy, 1874); Santo Domingo (Guppy, 1871, 1876); Lower Miocene: Bowden beds, Bowden, Jamaica (Guppy, 1866, 1874; Dall, 1907).

PHASCOLIDUS (PALL) PODAGRINUS n. sp. Animal 13 n. var.

Description.-- Shell resembling the typical normal podagrins, but smaller and less inflated; umbones wider; and slightly less tumid; posterior area longer and narrower; anterior dorsal area slightly wider.

Dimensions.-- lat., 26.5 mm.; alt., 27.5 mm.; umboniam., 3 mm.

Remarks.-- To P. podagrinus is referred a group of specimens that are readily recognized since the characters of individuals of the same stage of growth are constant. The present variety is established for certain forms that are immediately recognizable, although the individual differences that separate them from podagrinus n. sp. are not very pronounced, except for the disparity in inflation. The variety resembles more closely the forms discussed under podagrins than the typical form, since it is smaller and less inflated; but the other differences pointed out obtain also for the variety.

Occurrence.-- Lower Miocene: Bowden beds, Bowden, Jamaica.

PELAGIDAE (GASTROPODA) *PELAGIA* n. sp.

Description.- Shell of medium size, moderately inflated, suborbicular, the posterior dorsal margin being long and only slightly curved and the posterior lateral ear in obscurely sub-truncated; anterior dorsal margin with a very gentle slope; umbones low; posterior area wide, not deeply impressed; anterior dorsal area sharply impressed; external sculpture of prominent, evenly spaced concentric rugae over the entire surface of the shell.

Dimensions.- Lat., 37 mm.; alt., 35.5 mm.; semidiam., 9.5 mm.

Remarks.- Two valves, one of which is adult, form the as-is of this species. It is characterized by its gently curved postero-dorsal margin, low umbones and prominent, regular concentric sculpture; these features separate it from podagrinus and the forms with which podagrinus is compared. Superficially it resembles more closely the recent West Indian P. pennsylvanicus (Linnaeus), (1)

(1). Syst. Nat., ed. 10, p. 384, 1758; Reeve, Conch. Icon., vol. 6, Lucina, pl. 6, fig. 29, 1850.

which ranges back to the Eocene, than the other known forms, but it is less inflated, less orbicular and has a shorter antero-

lateral margin and finer sculpture.

There is a possibility that this is the form which Murray designated pennsylvanicum; the uncertain occurrence, however, militates against the supposition. Here, as elsewhere in the placing of Guppy's erroneously determined species, Miller's statements are followed since he had access to original labels in Guppy's collection.

This species is named for Dr. Amos E. Brown, of the University of Pennsylvania, who has made several contributions to the paleontology of tropical America.

Occurrence. - Lower Miocene: Bowden bank, Bowden, Jamaica.

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PILICIDAE (PILICIDAE) PILL. 1911.

Pilicidæ (Pill.) tithonis Pill., 1907, Trans. Wagner Free Inst. Sci., Philadelphia, vol. 7, pt. 6, pp. 1563-1568, pl. 50, fig. 10.

Description.-- "Shell small, rotund, with rather prominent beaks, the dorsal areas not distinguished by sculpture but indicated only by faint, broad, radial sulci; lunule small and deep, no esutcheon visible; surface with profuse, elevated, rather unevenly space, concentric lamellae; hinge well developed; margins minutely crenulate. Alt. 4.0, lon. 4.5, diam. 3.5 mm."

"This little shell, represented only by a single valve, is apparently the precursor of P. sombrarenis Pill (1), a recent species from Antillean waters, which is, however, larger, with

(1). Bull. Mus. Comp. Zool. Harvard, vol. 12, p. 264, 1906;
Proc. U. S. Nat. Mus., vol. 12, pt. 268, pl. 14, fig. 17,
1909.

more regular concentric sculpture, more delicate hinge, and nearly obsolete lunule. An obscure radial impression, which was at first taken to be pathological, extends on the fossil towards the anterior beak. The recent form shows faint traces of a similar

sulcation. In them the anterior dorsal area is not visible, limited and the crenulation of the surface is more feeble." (Dall, 1903).

Type locality.-- Borden, Jamaica.

Remarks.-- Two valves of this small form are present. It is at once distinguished from the young of associated species by its prominent, lamellose concentric sculpture.

Occurrence.-- Lower Miocene: Bowden beds, Borden, Jamaica (Dall, 1903).

Section Pleurolocinae.

PL. 10.3 (Pleurolocina)

Macoides (Pleurolocina) quadricostatus Coll, 1905, Trans. Academy
Nat. Sci., Philadelphia, vol. 5, pt. 2, p. 150,
pl. 50, fig. 7.

Description.- "Shell small, globose, oblique, short,
with strongly increased large dorsal area; beaks small, trochogy-
rate, overhanging a very small aversous lunate; line out short;
surface densely covered with high, concentric lamellae with
slightly wider interspaces, the distal edges of the lamellae
wider and reflected dorsally; radial sculpture of four small, dis-
tally widening broad ribs separated by narrow sulci, the two
inner ribs wider than the outer pair; hinge normal, strong;
seams normal; inner margins of the valves crenate. Alt. 2, diam.
6, diam. 7 mm."

"This is doubtless the precursor of the following species
[P. senilis Coll] and of the recent P. lauscornei Coll." (Coll,
1905).

Type locality.- Gordon, Jamaica.

Remarks.- The valves, one of either collection, are the
only representatives of this interesting species. It is

single form. The Jordanian form. P. quadrangula,
Pliocene. P. quadrangula Hall (1871) fig. 4, p. 15. P. quadrangula
Hall (1871) fig. 4, p. 15. P. quadrangula form 1.

- (1). Trans. Amer. Tree Inst. Sci., Phil. Acad. Nat. Sci., vol. 7, pt. 1, pl. 25, figs. 2, 3e, 1880; idem, pt. 2, pl. 17, fig. 1760, 1885.
- (2). Bull. U. S. Geol. Survey, vol. 15, pt. 1, p. 225, 1894; Proc. U. S. Nat. Inst., vol. 15, p. 225, pt. 1, p. 225, 1894.

Larger than quadrangula with a more rounded and less flattened form; while in quadrangula the outline of the shell is more rounded and the sculpture is also less flattened.

Occurrence.-- Lower Pliocene: Quadrangula, Quadrangula, Quadrangula (Hall, 1885).

Quadrangula quadrangula

Section Cavilucina Fischer.

PRACOIDES (CAVILUCINA) RECURRENTS Dall.

Pracoides (Cavilucina) recurrents Dall, 1907, Trans. Wagn. Proc. Inst. Sci., Philadelphia, vol. 3, pt. 6, p. 1219, pl. 50, fig. 11.

Pracoides (Cavilucina) recurrents Dall, 1917, Bull. U. S. Nat. Mus., no. 30, p. 173, pl. 34, fig. 5.

Description.- Shell small, tuffid or only slightly convex, oblique, deep ribbed, the dorsal side well polished; basal small, low, prominent; very small, moderately impressed rather narrow line; anterior dorsal margin evenly arched, as high as the back; surface finely, concentrically rather closely grooved, with, toward the base, two or three deep, concentric spiral indentation resting stages; hinge-teeth small but distinct; inner margins of the valves minutely serrulated. Alt. 1.5, lon. 5.7, diam. 4.0 mm."

"This little species is more like the recent West Indian P. blanda Dall than the intervening old water Miocene forms." (Dall, 1907).

Type locality.- Boston, Jamaica.

Remarks.- This species, which is not very abundant, is conspicuous for its small size, broadly low lateral outline and

prominent umbones. The fine concentric sculpture is complete or entirely absent on most of the specimens at hand, the surface being smooth except for the often deep, irregularly disposed plicæ, which may be present on any portion of the surface or altogether absent.

The Recent P. trisulcatus (Conrad) var. blanchi Dall (1) is narrower, with prominent, fine regular concentric sculpture; the

(1). In Dall and Simpson, Bull. U. S. Fish Comm., vol. 70, pt. 1, pp. 427-434, pl. 16, fig. 17, 1901.

Chippewa P. trisulcatus (Conrad) (?) and its varieties multisulcatus (Conrad) (?) (Duglin) and whitfieldi Dall (1) (Oak Grove, Miocene and Pliocene) are distinguished by their narrower umbones,

(2). Trans. Am. Assoc. Nat. and Geol., vol. 1, p. 115, 1847; Pos. Nat. Ser. U. S., n. 71, p. 40, fig. 5, 1845 (as Duglin trisulcatus).

(3). Proc. Acad. Nat. Sci., Philadelphia, vol. 1, p. 707, 1845; Pos. Nat. Ser. U. S., n. 71, pl. 40, fig. 5, 1845.

(4). loc. cit., p. 1570, 1902 (= Tricincta trisulcata Whitfield, Mon. U. S. Geol. Survey, no. 54, p. 4, pl. 10, figs. 1-4, 1905).

deeper lenticle and coarse concentric sculpture. Many of the large plicæ are narrower than the average Border form, while the Chippewa specimens reach a larger size.

See reference.- Upper Oligocene: Silver Bell, Miami, Florida
(Hall, 1907, 1915); Chipola Marl, Florida (idem); Lower Mio-
cene: Borden beds, Borden, Georgia (idem).

Subgenus *Strophodonta* Fisher.

P. viridis (Parker, 1911) *Strophodonta* sp.

Description.-- Shell large, relatively thin, suborbicular, well-inflated; dorsal margins subequal, diverging at an angle of about 120°, rounding into the lateral margins; umbilical, flat; external surface sculptured with concentric wrinkles and irregular striae, internally emphasized and irregularly disposed; hinge crenulate; ligament short, deeply inset.

Dimensions.-- Lat., 42.5 mm.; alt., 18 mm.; semilam., 11 mm.

Remarks.-- *P. viridis* is described from several more or less fragmentary valves, on most of which the interior is inaccessible. That it reaches a large size is indicated by a specimen which, if complete, would have a pericardial, the following dimensions:-- lat., 45 mm.; alt., 20 mm.; semilam., 15 mm. The characteristic features are the thickness and convexity of the shell and the large size.

Toulou's Catalogue "*Lucina* (*Lucina*) *viridis* (Parker, 1911) *Strophodonta* *viridis* (Parker, 1911) is perhaps identical, but the name is not used.

1). Jahrb. F.-u. Zool. Reichsanstalt, vol. 33, p. 110, pl. IV, fig. 7, 1908.

higher umbones and short and less developed, similar to the lower-

gint. The Miocene E. forchmani (J. Forchm., 1911)

(1). Jour. Acad. Nat. Sci., Philadelphia, vol. 1, p. 1, 1911;
Proc. Acad. Nat. Sci., Phila., vol. 1, p. 1, 1911 (as E. forchmani)

rounded and levier and E. forchmani (J. Forchm.) (1) is much smaller,

(2). Jour. Acad. Nat. Sci., Philadelphia, vol. 1, p. 1, 1911,
pl. 10, fig. 1, 1911, (as E. forchmani).

more compressed and less orbicular.

Occurrence.-- Lower Miocene: Bellerophon, London, Jamaica.

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PHASIDUS (GALLUSIA) PHASIDUS (Guppy)

Phasidus phasidus Guppy, in Guppy and Dall, 1900, Proc. U. S.

Nat. Mus., vol. 19? p. 326, pl. 10, fig. 5.

Phasidus (Gallusia) phasidus (Guppy) Dall, 1907, Trans.

Wagner Free Inst. Sci., Philadelphia, vol. 7, pt. 2,
p. 230.

Description.-- "Suborbicular, not very convex, with faint,
broad radiating (ray-like) grooves and sublamellar concentric
ridges. Diameter, 11.5 mm. The radiating argument looks like
color, but it is really faint, shallow flutings." (Guppy, 1900)

Shell of medium size, well inflated, suborbicular, being slightly
more produced anteriorly; antero-dorsal margin very short,
slightly excavated, upper portion of the antero-lateral margin ob-
liquely subtruncated; posteriorly almost vertically subtruncated;
umbo's tumid, but low; anterior and posterior dorsal areas poorly
defined; lamellae narrow, shallow, of variable length, often
absent or poorly developed on the left valve; external sculpture
of fine, often unequally emphasized, closely spaced concentric
ridges, becoming sharp and sublamellose toward the margins and on
adult shells not infrequently obsolete on the dorsal apical portion
of the shell, in which case the concentric sculpture consists of

only irregular, rounded increment 12; radiations from the umbilicus over the disk numerous very obscure radial elevations and wider depressions of varying width, occasionally entirely absent; lines with one right and two left ventral; inner margin of the valve finely crenulated.

Dimensions.-- Lat., 18.5 mm.; Alt., 18.5 mm.; semidisk., 5.5 mm.

Remarks.-- This is one of the most abundant of the *Lucinidae*. The largest individual had the following dimensions: Lat., 18.5 mm.; alt., 18 mm.; semidisk., 4.6 mm. The diagnostic features are the obscure radials, the fine concentric rugae, which become slightly raised and sharp toward the margins, both ventrally and on the dorsal areas, and the crenulations on the inner margin. The radials are always weak, but occasionally they are sufficiently emphasized to cause the edge of the ventral concentric wave to be slightly undulated. In addition to these relatively coarse radials, very fine and obscure radial lines may be present on the median portion of adult shells.

Young valves which have the radials obsolete and the concentric sculpture emphasized may be confused with the associated *Hydras litoniana* of the same size and this resemblance is warranted by the similarity of the hinge. In general the present form is slightly more convex, with more prominent lobes and a

stronger hinge; these differences are, however, slight and when they fail the creulations of the inner margin of radiatus, which on young valves is usually more prominent than on adults, serve as an infallible criterion for separation.

P. radiatus (Conrad) (1), which ranges from the Duplin Mio-

- (1). Trans. Amer. Assoc. Nat. and Geol., vol. 1, p. 110, 1849;
Promey and Holmes, Pleist. Fos. S. Car., p. 57, pl. 11,
figs. 4, 5, 1857 (as Lobina radiatus).
-

close to the recent, is very closely related, but is in general slightly more convex, not as wide nor as compressed toward the margins, with a relatively long, sloping anterior dorsal margin, which rather abruptly joins the lateral margin, a more rounded posterior margin, higher narrower and more strongly plicate umbones, stronger sculpture and a decidedly heavier hinge.

Occurrence.- Lower Miocene: Bowden beds, Bowden, Jamaica (Cuppy, and Dall, 1896; Dall, 1903).

PIACOIDES (SALUBRINA) PAUPERATA S. var. OLIGOCOSTATUS n. var.

Description.-- Shell resembling the typical pauperata, but more rounded, usually more inflated, especially toward the margin; umbones tending to be slightly higher; dorsal areas less well defined; radial sculpture weak or obsolete; concentric sculpture coarser, heavier, more regular and present over the entire disk.

Dimensions.-- Lat. 17.6 mm.; alt., 10.9 mm.; semidiam., 4.5 mm.

Remarks.-- This variety is proposed for a number of valves, that are conspicuous because of the their prominent concentric sculpture. Variation affects the convexity and the outline, some of the specimens having a longer anterior dorsal margin and a proportionately greater width than the type. When compared with the typical pauperata, these valves form a rather compact group, the most obvious difference lying in the coarseness and prominence of the concentric sculpture of the variety. P. radialis (Conrad) (1) is separated by its narrower umbones, longer anterior dorsal margin and stronger hinge.

(1). Discussed above.

margin and strong hinge.

Occurrence.-- Lower Miocene: Bowlenbells, Borden, Jamaica.

PTACOIDES (GALLUSINA) JURASSICUS n. sp.

Description.- Shell small, rapidly inflate, suborbicular; antero-lateral margin short, deeply excavated; posteriorly subtruncate, produced and rounded anteriorly; umbo small, narrow, relatively high; lunule cordate, deeply increased; dorsal area obscure; external surface sculpture with relatively broad obsolete radials and fine, closely and evenly spaced low, concentric lamellae, poorly defined in the median dorsal region; left valve with two cardinal; inner margin of the valve with obscure fine crenulations and broader undulations- the undulations conforming to the external radials and extending up toward the umbo posteriorly; right valve not known.

Dimensions.- Lat., 8 mm.; Ht., 7.5 mm.; thickness, 1.5 mm.

Remarks.- This species is represented by one left valve. It is distinguished from the form of neocretus and its variety of the same size by the greater convexity, deeper lunule and much broader, more pronounced radials.

Occurrence.- Lower Miocene: Jordan bells, Jordan, Jamaica.

Subgenus *Parvilucina* Dall.

Section *Parvilucina* n. s.

PHACIDUS (PARVILUCINA) VAQUENSIS (Cobb).

Lucina lantensis Cobb, 1875, Trans. Am. Philol. Soc., new ser.,
vol. 15, p. 251.

Phacidae (Parvilucina) vaquensis (Cobb) Dall, 1905, Trans. Wagner
Free Inst. Sci., Philadelphia, vol. 7, pt. 6, p. 132.

Description.-- "Shell minute, convex, sub-translucent;
beaks central, prominent; hinge line deeply excavated under the
beaks, sloping, slightly convex behind; base and ends regularly
rounded; hinge thin, teeth well developed; lateral area minutely
crenulate. Surface marked by small concentric lines." (Cobb,
1875).

Type locality.-- Santo Domingo.

"This species differs from the Shipolan form, *L. subcylindrica*
Dall (1), in being much more delicate, rather smaller, with

(1). Proc. Phil., p. 1522, pl. 55, fig. 11, 1905.

almost absolute radial sculpture, much smaller beaks, and strong-
ly, more rounded, and almost concentric sculpture; the longest
valve is about four millimeters in length." (Dall, 1905).

Small shell, subequilateral, well-imbricated; anterior-lateral margin
concave, posterior-lateral almost straight, dorsal, meeting
the lateral margin at a subrounded angle; lateral-lateral margin
longitudinally convex along the posterior, the base sloping to-
ward the anterior end; umbones relatively prominent; small shell,
equilateral, moderately imbricated; concentric striae, radial
differentiated; dorsal strongly only defined; ventral only
defined with dorsal, small, thin concentric lamellae and sur-
face, obsolete radials, separated by narrower interspaces; occa-
sionally the radials strong enough to slightly crenulate the lam-
ellae; radials absent on the dorsal surface; like normal, the lat-
erals, especially the posterior, elongate; inner surface of the
valve finely and weakly crenulated.

Dimensions.-- Lat., 5 mm.; alt., 4.5 mm.; width, 1.8 mm.

Remarks.-- This species is fairly well represented. It is
recognized by its small size, close, fine concentric sculpture
and obsolete radials.

Distribution.-- Lower Miocene: Santo Domingo (Dall, 1907;
Dall, 1907); Lower Miocene: London Hill, Florida, America
(Dall, 1907).

FRAGMENTS (PACHYDONTA) PACHYDONTA N. sp.

Description.- Shell small, subglobular, slightly flattened; high; antero-vent. l. margin slightly concave, antero-vent. l. margin, almost straight, joining the subventral suture by a rounded angle; anteriorly rounded, rounded; rounded low; rounded cordate, moderately inflated; dorsal area poorly defined; external surface very finely reticulate, fine, with a few absolute radial, separated by slightly narrower intervals; the radial extend from the dorsal area; entire surface with fine, small, thin lamellae, slightly articulated by the radial, finely corded; inner surface of the valve finely corded.

Dimensions.- Lat., 7.5 mm.; Alt., 3.5 mm.; Circum., 3.1 mm.

Remarks.- Typical forms of this species are rather small and are characterized by the numerous small radial and thin concentric lamellae. They are separated from P. tenuis by their larger size, less inflated and less rounded, more slender radial, thinner and more widely spaced concentric lamellae.

In addition to the typical valves, from which the description is based, a large number of smaller forms are doubtfully referred to this species. They probably should constitute at least a separate variety, but, unfortunately, there are no material, a bewildering array of variation is presented. All have in common the same type of sculpture, coarse, well defined, and the concentric lam-

since, with time after Bell, more, but the outline and position is decidedly inconsistent. Several inflated species, all valves of this group differ from by their structure and rather various and thinner lamellae.

See France. - Peter Pigeon: , , .

PROTEIDUS (PAVIDUS) LIMCIDUS n. sp.

Description.- Shell small, suborbicular, decidedly inflated; more evenly rounded anteriorly; umbo tumid, high, broad; lunule relatively large and deep; irradial; dorsal areas poorly defined; external surface sculptured with numerous, small, narrow radial, separated by interspaces of about the same width and crossed by irregularly disposed concentric wrinkles and low lamellae; hinge with a single cardinal and the laterals, the posterior more elongated and compressed; inner margin of the valve weakly crenulated.

Dimensions.- Lat., 5.7 mm.; alt., 5.5 mm.; semilam., 2 mm.

Remarks.- This species is described from a single valve.

The small convex form described under the preceding species are intermediate between proteidus and limcidus; from these varieties limcidus differs by its greater convexity, more tumid and high-umbo, slightly coarser sculpture, larger and deeper lunule.

Occurrence.- Lower Miocene: Bowden beds, Bowden, Jamaica.

Section Bellucina Ball.

PHACIDUS (BELLUCINA) ACTIVUS Ball.

Phacilus (Bellucina) activus Ball, 1903, Trans. Amer. Phil. Soc.
Sci., Philadelphia, vol. 7, pt. 6, p. 1765, pl. 52,
fig. 7.

Description.-- "Shell small, plump, somewhat inequilateral,
with moderately prominent, slightly decurved beaks; anterior end
larger and more inflated; lunule lanceolate, somewhat longer and
narrower in the right valve, distinctly impressed; escutcheon
impressed, almost linear; disk with sixteen to eighteen rounded
radial ribs, entire and wider towards the base, with narrower deep
interspaces; concentric sculpture of thin lamellae, with much
wider interspaces, which are somewhat crenulate or wavy by over-
riding the ribs and dipping into the radial interspaces; dorsal
areas large, slightly impressed, with no radial sculpture, the
concentric lamellae on the posterior area close-set, low, but
on the bounding rib and on a radial line near the dorsal margin
slightly elevated; hinge normal, delicate, internal margin minutely
crenulate. Alt. 4.5, Len. 4.4, Diam. 7.0 mm."

"This little shell is near the typical Parvilucina, but be-
gins to show the Bellucina characteristics in its sculpture,

which in species of later horizons are fully developed. The chief variations are in outline, some being rounder or higher and shorter than other specimens." (Dall, 1907).

Type locality.-- Bowden, Jamaica.

Remarks.-- The small valves of this species are very abundant. The number of radial ribs may be as high as twenty-two; the escutcheon is not as deeply impressed as the lunule and the posterior dorsal area is more conspicuous than the anterior. The degree of inflation is subject to decided variation. Either the radial or concentric sculpture, or both, may be weak. Valves with suppressed radials closely approach P. jaguensis, from which they may in general be distinguished by their coarser concentric sculpture, more pronounced posterior dorsal area, more deeply impressed lunule, slightly heavier hinge and beaver and coarser internal crenulations; the typical actinus is, of course, readily distinguished because of its more prominent radials. P. actinus is smaller, more rounded and more inflated than P. proteoides, besides having coarser sculpture.

Occurrence.-- Lower Miocene: Bowden beds, Bowden, Jamaica. (Dall, 1907).

PHASIDUS (MUSCULUS) ANSHORLEYI n. sp.

Description.- Shell small, suborbicular, moderately inflated; antero-dorsal margin short, slightly excavated; slightly more produced anteriorly; umbones relatively low; lunule small, moderately impressed; dorsal area differentiated by the absence of radial sculpture but the posterior area obscurely raised, only a radial line near the margin; radial sculpture consisting of about eleven radial ribs, poorly defined on the apical portion of the shell and near the margins, separated by narrower, relatively shallow interspaces; concentric sculpture of prominent, regularly spaced ribs separated by interspaces of the same width, failing to override the radials on the post-convex portion of the disk; hinge heavy; interior of the valve obscurely sculptured near the margin in conformity with the external radials; inner ventral margin finely sculptured.

Dimensions.- Lat., 7 mm.; alt., 7 mm.; semilunule, 2.7 mm.

Remarks.- This characteristically sculptured shell is represented by a single valve. Because of its larger size and more typical sculpture it is sharply differentiated from P. setinus. On the other hand, the sculpture is not as well-developed as on the English P. tuomeyi Dall (1) and its base is not suborbicular.

(1). Trans. Wagner Free Inst. Sci., Philadelphia, vol. 7, pt. 6, no. 1365-1366, pl. 52, fig. 1, 1903.

variety waccamensis Bull (1) and 51. Distances to recent 2.

(1). Idem, p. 1731, pl. 50, fig. 2.

aristatus Bull (2), all of which are closely related.

(2). Proc. U. S. Nat. Mus., vol. 25, p. 81, pl. 50, fig. 10, 1901.

Occurrence.--Lower Miocene: Barren hills, Barren, Jamaica.

Genus *DIVARICELLA* von Martens.

DIVARICELLA ? *DIVARICATA* Guoy.

?*Dacrydium dentatum* Babb, 1873, Trans. Am. Philos. Soc., ser. 3, vol. 17, p. 351 (non vol 1817) et carta.

Divaricella brevaricata Guoy, in Guoy and Bell, 1907, Proc. U. S. Nat. Mus., vol. 33, p. 527, pl. 50, fig. 1.

Divaricella brevaricata Guoy, Bell, 1907, Proc. Warner Free Inst. Sci., Philadelphia, vol. 7, pt. 3, p. 1522.

Description.-- "Suborbicular, inflated, surface minutely lenticulate, some irregularly sculpture. Length of shell, 0.5 mm."

Type locality.-- Jamaica.

Shell of medium size, thin, suborbicular, well inflated; posterior dorsal area slightly longer and stouter than the anterior; more convexly rounded anteriorly; umbones tumid, relatively prominent; lunule small, feebly impressed, almost or entirely confined to the right valve; the characteristic wedge-shaped sculpture fine; incremental lines irregularly coarse and occasionally emphasized; hinge strong, the right posterior cardinal dentition obscurely bifid; both posterior and anterior laterals relatively well developed; inner dorsal area feebly sculptured by the sculpture, the remainder of the margin non-sculptured, but finely striated.

7.45 on the inner side.

Dimensions.-- l , 7.5; w , 7.5; h , 7.5; l , 7.5; h , 7.5.

Description.-- This species is somewhat, rounded and the characters are very regular & distinct that are to be seen in individual. The slightly convex, slightly to the right of the center. The rather small size, convexity, and relatively fine sculpture are the characteristic features. In a flight and a really intermediate closely resembles the so-called quadrisulcata, but it is not obtained the same of the sculpture of the body of the quadrisulcata as the sculpture of the quadrisulcata; in addition, quadrisulcata has a more, but not decidedly increased length, slightly. There is a small tooth and somewhat regular lateral. The shape of both sides is seen, however, to be variable in the strength of the lateral. The shape and length of the lateral. All the characters are almost identical with quadrisulcata (1), which is also very close to quadrisulcata (1). quadrisulcata, p. 100, fig. 1, 1907.

quadrisulcata, but has slightly, since not there.

Gabb's quadrisulcata in quadrisulcata include some forms that perhaps should be referred to quadrisulcata, while others

1. TRICHLIA QUADRISULCATA (1831) 1831).

Trichia quadrisulcata Willd., 1810, Bot. Berol., vol. 1, p. 112 (ex parte).

Trichia quadrisulcata Lamour., 1812, Ann. Bot. Berol., vol. 1, p. 112 (ex parte). *non Lamour.*

Trichia quadrisulcata Lamour., 1812, Ann. Bot. Berol., vol. 1, p. 112 (ex parte). *non Lamour.*

Trichia quadrisulcata Lamour., 1812, Ann. Bot. Berol., vol. 1, p. 112, fig. 3 (non Fries, 1752).

Trichia quadrisulcata Lamour., 1812, Ann. Bot. Berol., vol. 1, p. 112, fig. 3 (non Fries, 1752).

Trichia quadrisulcata d'Orbigny, 1845 (?), Ann. Bot. Berol., vol. 1, p. 112, fig. 3 (non Fries, 1752).

Trichia quadrisulcata d'Orbigny, 1846, Ann. Bot. Berol., vol. 1, p. 112.

Trichia quadrisulcata Lamour., 1812, Ann. Bot. Berol., vol. 1, p. 112, fig. 3 (non Fries, 1752).

Trichia stricilla Fries, 1752, Ann. Bot. Berol., vol. 1, p. 112.

Trichia stricilla d'Orbigny, 1846, Ann. Bot. Berol., vol. 1, p. 112, fig. 3.

Trichia stricilla d'Orbigny, 1846, Ann. Bot. Berol., vol. 1, p. 112, fig. 3.

Lucina quadrilobata d'Orbigny, 1847, *Ann. Sci. Nat. Zool.*,
vol. 1, pt. 1, p. 111, pl. 1, fig. 1 (non Tineo, 1824,
p. 33, pl. 1, fig. 1).

Lucina diversicosta Tineo, 1824, *Ann. Sci. Nat. Zool.*,
vol. 1, pt. 1, p. 111, pl. 1, fig. 1 (non Tineo, 1824,
p. 33, pl. 1, fig. 1).

Lucina diversicosta Tineo, 1824, *Ann. Sci. Nat. Zool.*,
vol. 1, pt. 1, p. 111, pl. 1, fig. 1 (non Tineo, 1824,
p. 33, pl. 1, fig. 1).

Lucina dentata d'Orbigny, 1847, *Ann. Sci. Nat. Zool.*,
vol. 1, pt. 1, p. 111, pl. 1, fig. 1.

Lucina (Lucina) dentata d'Orbigny, 1847, *Ann. Sci. Nat. Zool.*,
vol. 1, pt. 1, p. 111, pl. 1, fig. 1.

Lucina dentata Tineo, 1824, *Ann. Sci. Nat. Zool.*,
vol. 1, pt. 1, p. 111, pl. 1, fig. 1 (non Tineo, 1824,
p. 33, pl. 1, fig. 1).

?Lucina dentata Tineo, 1824, *Ann. Sci. Nat. Zool.*,
vol. 1, pt. 1, p. 111, pl. 1, fig. 1 (non Tineo, 1824,
p. 33, pl. 1, fig. 1).

Diversicella quadrilobata (d'Orbigny) Dall, 1907, *Trans. Amer. Mus. Nat. Hist.*,
vol. 7, pt. 1, p. 111, pl. 1, fig. 1.

Diversicella quadrilobata (d'Orbigny), Glenn, 1904, *Trans. Amer. Mus. Nat. Hist.*,
vol. 7, pt. 1, p. 111, pl. 1, fig. 1.

Lucina (Diversicella) quadrilobata d'Orbigny, 1847, *Ann. Sci. Nat. Zool.*,
vol. 1, pt. 1, p. 111, pl. 1, fig. 1.

Description.- "Lucina testa orbiculari, subrotunda, alba, concentrico subplicata, bifaria, oblique striat, inaequilatera; latera anali brevi, rotundata; latera buccali subangulata, radiatim 4-sulcata; valvula sinistra, lamella breviora, excavata; intus labro tenuissime denticulato." (Orbigny, 1837.

Shell resembling D. prevaricata but heavier and larger; sculpture coarser; lamellae smaller and deeper; on adult shells the cardinal teeth slightly stronger, but the laterals showing a tendency to be weaker; right posterior cardinal more obviously and more usually bifid.

Dimensions.- Lat., 14.3 mm.; alt., 17.3 mm.; umbilical ., 1.7 mm.

Remarks.- Several valves, which cannot be distinguished from the Miocene and Recent representatives, are referred to this species. Only one is mature; it is larger than any of the associated prevaricata. The differences between these two species are discussed under prevaricata. D. chipolana Dall (1), a member of

(1). loc. cit., 1905, p. 1529, pl. 51, fig. 1, 1907.

Chipola, Oak Grove and Palousebutchik faunas, reaches a larger size than the fossil forms of quadrisulcata, is typically less inflated, with more equal and equally sloping dorsal margins, occasion-

all, obscure radial impressions on the anterior slope, and the right anterior lateral striae. It should be noted that the angle between the posterior dorsal margin and the lateral margin on the single adult valve at hand is more rounded than on most quadrisulcata; typically, quadrisulcata has the dorsal angles subangular, while on chicoline they are rounded, but these features are not constant.

Occurrence.— Lower Miocene : Greenhills, Sweden, Jamaica. Miocene: Calvert formation, Maryland (anctores), Maryland (Dall, 1907; Dean, 1904); St. Mary's formation, Virginia (Gardner, 1888.), North Carolina (Gardner, 1888.); Yorktown formation, Virginia (anctores), North Carolina (Gardner, 1888.); Duplin formation, North Carolina (anctores), South Carolina (Gardner, 1888.); Choctawhatchee Marl, Florida (Dall, 1907). Pliocene: Ocala formation, North Carolina (Gardner, 1888.), South Carolina, (Gardner, 1888.); Santa Maria, Tatavla, Rio Grande, Mexico (Dall, 1900). Pleistocene: Simmons bluff, North Carolina (Dall, 1907). Recent: Nahant, Massachusetts southward through the West Indies to San a Catarina, Brazil in both shallow and deep water.

Family: Diplodontidae.
Genus: *DIPLODONTA* Say.
Section: *Diplodonta* s. s.
DIPLODONTA *ALLI* n. sp.

Description.-- Shell small, suborbicular, laterally inflated; slightly more convexly rounded anteriorly; umbones small, broad, conspicuous, subcentral; external surface smooth with irregularly dispersed, obscure, concentric striations; the left anterior cardinal strong, bifid, the posterior lamellar, subterminal; right cardinal subequal, moderately heavy, the posterior obscurely bifid.

Dimensions.-- Lat., 1.5 mm.; Hgt., 0.5 mm.; Umb. dist., 2.5 mm.

Remarks.-- *D. walli*, which is described from two valves, has been referred to (1) as *D. canaliculatus* (Say) (2), a *Cardo* species.

(1). Dall, W. A., Trans. Amer. Free Inst. Sci., Philadelphia, vol. 7, pt. 3, p. 1125, 1900 (pt. 5, p. 1727, 1903 (check 1904) as *D. canaliculatus* (Say)).

(2). Trans. Am. Philos. Soc., new ser., vol. 27, p. 372 (as *Myia canaliculatus*).

form, which is, however, not a *Diplodonta*, but a *Cooperella*.

The Boxler form is distinguished from the preceding by the

of the genus by its restricted distribution in the world, high occurrence.
The name is given in honor of Mr. T. A. Hall, one of the workers
of the Early Tertiary Survey and a contributor to the literature
of the geology of other part of the world.

Occurrence.-- Lower Miocene: Jordan hills, Jordan, Palestine
(Hall, 1900).

DIPLODONTA (DIPLODONTA) (DIPLODONTA).

Description.- Shell small, subcircular in shape, slightly more rounded and more strongly rounded anteriorly; umbones relatively low and inconspicuous; internal surface of left valve with fine, close-set, regular concentric striations; internal character of shell.

Dimensions.- Lat., 0.5 mm.; alt., 0.3 mm.; length, 1.5 mm.

Remarks.- In the discussion of the *Diplofonta* (Diplofonta) (1)

(1). Trans. Amer. Mus. Nat. Hist., Philadelphia, vol. 5, pt. 5, pp. 1101-1117, 1900; pt. 6, p. 1117, 1905 (check list).

has called this species, which is represented by the collection at hand by two valves, *D. subquadrata* (Abb.) (= *D. subquadrata*).

(2). Trans. Am. Mus. Nat. Hist., Philadelphia, vol. 17, p. 110, 1905 (as *D. subquadrata*).

by Abb. (3) *Diplofonta* (Diplofonta) (Diplofonta) (4).

(5). Proc. Zool. Soc. London, 1870, p. 117, fig. 106.

(6). Proc. Zool. Soc. London, 1870, p. 117, 1875.

In the British Museum collection of fossil shells, the
type of the genus Diolobos is represented by a single
specimen, which is a small, rounded, slightly flattened
shell, with a slightly convex surface, and a slightly
concave interior, with lower umbilical region, broader con-
vex surface.

The British Museum specimen is recognized by its slightly irregular-
al, moderately convex outline and its slightly concave interior.
A very closely related form, somewhat more convex than the
Diolobos no. 7 (1) occurs in the collection; it reaches a larger

(1). J. G. S. W. vol. 1, 1897, vol. 5, p. 11, pl. 1,
fig. 13, 1900.

size; it is to be slightly larger, and more convex than the
specimen.

Occurrence.-- Lower Miocene: Jordan, 1897, Jordan, 1900
(Dall, 1900).

Section *Planicella* Dall.

DIPLODOLIA (PLANICELLA) MINOR Dall.

Diplopora (*Planicella*) *minor* Dall, 1900, Trans. Amer. Geol. Soc.

Sci., Philadelphia, vol. 5, pt. 7, p. 1187, pl. 24, fig. 17.

Description.- "Shell small, moderately convex, smooth, polished, oblique, inequilateral, the lower anterior side produced, the posterior side shorter, rounded; surface simple, callial line and adductor scars smooth, the right anterior callial marginal, rather long; the post-ventral callial short, slightly bifid, the beak low, bifid, with the left anterior cardinal short, the anterior bifid. Alt., 1.5, lat. 3.5, diam. 2.5 mm."

"This is very similar to the Claibornian *D. minor* and to the young of the Helioconcha *D. planicella* Philippi." (Dall, 1900).

Remarks.- The collections it had have several hundred of valves of this species. It is distinguished from the other members of the genus by its deformed anterior obliquity and moderate inflation. The surface was often very finely and evenly striated. The Claiborne form is smaller than *D. minor* (1),

(1). Trans. Geol., p. 25, pl. 1, fig. 20, 1897.

has definite concentric striae.

Occurrence.— Lower Miocene: Brown bed, Brown, Jamaica
(Dall, 1900).

Synthetic Phlyctiderma Dall.

DIPLODONTA (PHLYCTIDERMA) MONETARELLA Dall.

Diplo donta monetarella Dall, 1900, Jour. Conch., vol. 1, no. 2,
p. 245-246.

Diplo donta (Phlyctiderma) monetarella Dall, 1900, Amer. Natural
Free Inst. Sci., Philadelphia, vol. 7, no. 5, p. 1177,
pl. 15, fig. 26.

Diplo donta (Phlyctiderma) monetarella Dall, Dall and Simpson,
1901, Bull. U. S. Fish Comm., vol. 20, pt. 1, p. 157.

Not Diplo donta (Phlyctiderma) monetarella Dall, 1915, Bull. U.
S. Nat. Mus., no. 30, p. 140.

Description.-- "Shell small, thin, rounded, moderately con-
vex, with inconspicuous beaks, outline nearly circular, the beak
smooth, but the rest of the external surface closely minutely
punctate all over, other characteristics in typical Diplo donts,
like D. eximoides, but less turgid. Alt. 6.7, lat. 3.5, diam.
4 mm."

"The punctation of the surface is very close and regular,
not reticulate, like most of the species of this section." (Dall,
1900).

Type locality.-- Borden, Jamaica.

Remarks.-- The two valves that are the type representatives

of this species differ markedly in size, the ant. vent valve, being 1.0 cm. in diameter, and the other, a right, 1.2 cm. The shell is higher than wide, slightly more inflated anteriorly, translucent, with obscure concentric lines toward the margin and the left anterior cardinal line and anteriorly bifid.

G. puncturella is recognized by its translucent shell, nearly circular outline and minutely punctate surface. It also occurs in the recent West Indian fauna. The Tampa Bay form is larger, more orbicular with coarser punctation and probably should be considered distinct. Among Webb's Santo Domingo G. subquadrata (1) is a Palaeotidius that is very close to, if not identical with, puncturella, although it is smaller and less inflated.

Occurrence.—Lower Miocene: Bowden beds, Bowden, Jamaica (Dall, 1900, 1915). Recent: Jamaica, Porto Rico and St. Thomas (Dall, 1915).

Superfamily I L - I O P A C I A .

Family Leptonidae.

Genus MUSA Lamarck.

Subgenus *pygmaea* . s .

MUSIA QUADRATA (Gabb).

Measeromya quadrata Gabb, 1875, Trans. Am. Philol. Soc., New Ser.,
vol. 15, p. 247.

Measeromya quadrata Gabb, 1875, Proc. Acad. Nat. Sci., Philadelphia,
for 1872, p. 274, pl. 13, figs. 4, 4a-b.

Description.- "Shell small, rounded, sub-quadrate; higher
posterior; anterior end rounded, rounded, and slightly incurved;
posterior end broadly rounded; base nearly straight. Sur-
face polished, marked only by minute lines of growth. Length
.3 inch, height .25 inch." (Gabb, 1875.)

"..... hinge with a prominent tooth in the right valve,
articulating behind a smaller similar one in the left valve.
An anterior and posterior lateral tooth in each valve." (From
"Diagnosis of *Measeromya*." Gabb, 1875.)

Type locality.- Santo Domingo.

Shell small, thin, elongated, subquadrate, beakless; lateral
lateral, being much produced anteriorly; the long antero-lateral

margin and the ventral margin subparallel throughout their length, the ventral margin very feebly invaginated apically, by a slight constriction of the shell near the margin; apically rounded posteriorly, more convexly rounded anteriorly; about 10x, placed near the posterior end; external surface with fine, inconspicuous irregularities; the "cardinal" of the left valve placed before theumbo, curved parallel to the margin; the lateral laminae strong, the posterior long; chondrophore deep.

Dimensions.-- Length, 1.5 mm.; alt., 1.3 mm.; semilength, .9 mm.

Remarks.-- This species, the type of which is Macro-
ma, is, as Hall (1) has pointed out, a typical ma. The

(1). Trans. Amer. Phil. Soc., Philadelphia, vol. 6, pt. 3, p. 1145, 1900.

collections at hand have contained two small left valves, smaller than the type. They are recognized by their unusually elongated outline and virtually parallel dorsal and ventral margins. Hall (2) has already noted the occurrence of this form in the ma.

(2). Idem.

fauna.

Deccanites. - Upper Miocene: Santo Domingo (1905, 175);

Lower Miocene : Laredo beds, Texas, Leach (1911, 126).

RIOYIN

Description.-- Shell of section 186, 187, subventral view, elongate, well inflated, low, 1.5 mm.; ventral edge heavily rounded anteriorly; anterior edge of the shell slightly, bending broadly into the edge of the ventral edge; posterior-lateral margin shorter, convex, curved, both the rounded ventral edge; some straight; umbilical, ventral, and the median horizontal; ventral-lateral margin of the shell with slightly constricted; surface bearing some small pits; striae; 187 valve with small radial and spiral lateral laminae.

Dimensions.-- Length, 5 mm.; dia., 1 mm.; thickness, 1.5 mm.

Remarks.-- A single specimen of this species was found in the collection. It is probably a single specimen of the species by its small size and low lateral margin. The species (Daglin) and Plicaria (Daglin and Plicaria) are similar. The shell (1) is larger, less elongated and less inflated.

(1). Trans. Amer. Mus. Nat. Hist., vol. 1, pt. 7, p. 115, pl. 44, figs. 3, 22, 1900.

Occurrence.-- Lower Miocene: Daglin, Texas, U.S.A.

were delicate. The sculpture is minutely granulate, and though
small, the diameter about 1.5 mm. (Hall, 1922).

Type locality.-- Mexico, Acapulco.

Shell small, thin, subequal sides, moderately inflated,
transversely elongated, highest apically; vent rostrum
short, almost straight, bending basally into two long sub-
parallel, obtruncated postero-lateral spines, which abruptly
rounds into the base; more attenuated and rounded anteriorly,
base gently ascends, ascending toward the posterior end; umbil-
low, placed toward the anterior end, at the same elevation as
the highest part of the posterior margin; growing from the umbil-
to the postero-ventral angle, as rounded heel, flattened toward
the margin; near the margin the surface of the shell with relative-
ly coarse granulation; lined with suborbital "radiation".

Dimensions.-- Length, 1.5 mm.; width, 1.5 mm.; elevation, 1.5 mm.

Remarks.-- This species is represented by an indurated,
small left valve. When compared with the type this valve shows
certain differences that probably are due to immaturity; it is
more definitely beveled, with a lower base, and more obviously and
coarsely granulate surface. Other features that are not in accord
are due to the differences between right and left valves; the
edge of the postero-dorsal margin of the right valve is tilted to-
ward the interior of the shell, while on the left valve it flares
outward and the left tooth is directed more to the rear.

Occurrence.- Lower Miocene: Powder River, Wyoming
(Hall, 1900).

Family: Meliellidae ?

Genus: MONTICULTA Norton ?

MONTICULTA ? MONTICULTA n. sp.

Description.- Shell small, weakly flattened, close to sub-
quadrate, decidedly inequilateral; rounded anteriorly, least
vertically subtruncated posteriorly; base slightly arcuate, dis-
cussing toward the anterior end; antero-dorsal margin short,
slightly convex, with a steep slope, rounding gently into the pos-
terior subtruncation; umbonal, placed at about the posterior
third of the length; external surface sculptured with strong,
fine concentric striae of varying width, the striae occasionally
slightly lamellose; left valve with a subumbonal posteriorly di-
rected resiliary sulcus and an obscure lunula on either side, the
anterior lunula more conspicuous.

Dimensions.- Length, 7.2 mm.; alt., 7.5 mm.; width, 7 mm.

Remarks.- This species is known from a single left valve.
It apparently belongs in the same group with Monticulta ? retro-
phora Dall (1), of the Oak Grove fauna, since the hinge of the left

(1). Trans. Wagner Free Inst. Sci., Philadelphia, vol. 5, pt. 7,
p. 1172, pl. 34, fig. 2, 1900.

valve consists merely of obscure anterior and posterior cardinal lines.

ance. The Oak Grove form is larger, higher than isopylar, with weaker sculpture. In outline Montacuta resembles Montacuta 1. Montacuta ? chipolensis Dall (1), but that species is larger and

(1). Idem, pp. 1171-1172, pl. 44, fig. 4.

has a stout left cardinal.

Occurrence.-- Lower Miocene: Bowden beds, Bowden, Jamaica.

Superfamily: LAMNIDAE.

Family: Lamnidae.

Genus: LAMNUS (Linnaeus) 1758.

Subgenus: Lamnus s. s.

LAMNUS (LAMNUS) LAMNUS LAMNUS.

Description.- Shell small, well inflated, subequilateral, suborbicular, the lower part of the posterior ear in slightly subtruncated bluntly; umbones small and broad, but not very high; external sculpture of forty-three low axial ribs, 11-15 to per, but slightly raised at their origin, separated by lower, sharply defined, channelled interaxial ribs; each rib bearing a row of laterally compressed, triangular, large or small, hollow spines, their even ends being directed toward the ventral margin; in the median portion of the shell ribs bearing large spines and those ornamented with small spines alternating; anteriorly large spines predominating and posteriorly small ones; posterior margin of the valve deeply serrate; internal surface with relatively conspicuous radial markings.

Dimensions.- Lat., 25 mm.; alt., 25.4 mm.; umbilical, 1.5 mm.

Remarks.- This extremely well preserved species is represented by 5 complete valves and several fragments. That is, probably

larger size than the type is somewhat of a surprise, and if complete, would have, for example, the following dimensions: lat., 75 mm., alt., 57 mm.; umbilic., 11 mm.; incidentally, the hinge of this specimen is extremely orthochoel, being localized in thickened and long and reflexed toward the umbil. On the larger valves the contrast between the rows of larger and smaller spines is decided, although the actual difference in size is slight; but on the other, this difference, though present, is not as noticeable. When the spines are very small, the ventral side, which is open when the spines are large, ventrally is closed. As usual, only a part of the ornamentation is intact. Where the spines have been removed the ribs are smooth and flat, with thin margins slightly raised; if eroding outside further, the middle of the rib is excavated and the discharge opening would be narrow ridges.

The laterally compressed, tubular, ventral, open valves of two orders of magnitude of size, are the most characteristic feature of this species. Hall has described a closely related form, A. sericeum (1), from the Miocene; although smaller

(1). Trans. Amer. Paleont. Soc., Philadelphia, vol. 7, no. 7, p. 1081, pl. 46, fig. 2, 1908.

It has the same outline and similar type of radial ribs which

[illegible]

... () ...

Vol. 1, 1890-1891, 1890, 1891. 1891. 1891. 1891.

Southern Inconsistency, p. 174, Ford. Rev., vol. 1, p. 168 (check list).

Leptis inconspicuum (Wied., 1871, 1874. Berl. Ent. Ver-
ein, 1871, 72, p. 571 (=J. Linn. Soc. 1871, 1874).

1. 1. 1. 1. - 1. 1. 1. 1.

... the ... the ... (...) ...
to aid the
... the ... will be ... of ...
... . If ... the ... , the ...
... the
of the " (Dall, 1900).

Shell of ... , ... , well inflated, ... flat ... ,
... . Above ... , the curve of the ...
... more convex than that of the ... ; ...
low; external surface of shell ... with ...
... low, subventral ... ribs ... by ...
very ... , anterior ...
with ... , ... , ...
... , ... of the ... ; ...
... of the shell the ribs ...
er, the ... , as well as the ... of the
... ribs, ... , ... , ...
... of the ... , ... of the ... , in the
interior ... of the ... ; ...
... and the The ... border and the
interior ... ; the ... ribs ... , ...
... of ... , ... , ...
... ribs ... ; ... of the shell ...

2. *sculptus*.

Dimensions.-- Lat., 25.5 mm.; hb., 10.7 mm.; umbilicus, 8 mm.

Remarks.-- Four valves of *S. indonesianus* are at hand, three of these being adult and considerably larger than the specimen figured by Sowerby. The immature valve is only 11 mm. long, both ribs and lat spaces being wider than on the adult and the umbilical slightly higher. On adult shells the distal portions of a few of the anterior ribs may be smooth. The suture lines are continued to the first ten or fifteen ribs, but farther toward the center of the shell they appear near the distal edge of a few additional ribs.

This species is characterized by its subglobose form, low umbones, and low, narrow ribs which become more numerous distally. Guppy has doubt concerning the possibility of connecting *dominicensis* with *indonesianus*; *dominicensis*, first described from Santo Domingo (1) and later synonymized with *indonesianus* (2), and *indonesianus* (7), being entirely different. The

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- (1). Proc. Am. Philoa. Soc., new ser., vol. 17, pp. 570-571, 1877.
(2). Gabb, W. H., Jour. Acad. Nat. Sci., Philadelphia, 1880, vol. 1, p. 744, 1881.
(7). Gabb, W. H., 1881; Gabb, W. H., Phila. Acad. Nat. Sci., vol. 1, pp. 700-701, p. 27, fig. 1; vol. 2, fig. 1, 1880, as *S. (Gracilicollum) dominicensis* Gabb (not *S. (Gracilicollum) dominicensis* Gabb, 1880), Phila. Acad. Nat. Sci., Philadelphia, vol. 60, p. 307, 1881.
-

most conspicuous features of dominica are the high, tall ribs, the large number of ribs (forty-five to sixty).

The single Chipola specimen referred to this species is a somewhat worn, imperfect valve with the antero-ventral carina longer than on the typical Jordan form, the curve of the antero-lateral margin more convex, the radial ribs with flat tops and sloping sides so that the inter-ribs are wider; the difference in ornamentation is probably due to wear.

Occurrence.-- Upper Oligocene: Chipola, Florida (Dall, 1900);
Lower Miocene: Borden, Jamaica (Dall, 1906, 1974; Dall, 1970).

Shell moderately large, solid, longitudinally, subovate, decidedly inflated; upper portion of the anterior lateral margin obliquely obtuse, lower portion, grading broadly into the gently arcuate base; median portion of the anterior margin subtruncate or scarcely curved, the subtruncation extending lower than on the anterior side and joining the base more abruptly; umbones high, prominent; exterior surface scabrous with thirty-one to thirty-three strong radial ribs separated by narrow, deeply channeled interspaces, five anterior ribs bearing medially situated, "disconnected", globular nodules, sometimes absent from the broader distal half of the ribs; the next sixteen or seventeen ribs ornamented with a raised frill placed on the posterior side and overhanging the interspaces, the ornamentation consisting of oblique, noticeably swollen nodules with their extremities attenuated and joined, producing a spiral effect; toward the center of the shell the frill becomes narrower and sharper and the nodules correspondingly narrower and more vertical in position; beyond the center the frill becomes wider and separate from the smooth portion of the rib by a well defined, but slight, groove; on the ten posterior ribs the frill continues to be such, the line of nodules gradually assuming a central position on the ribs, the nodules themselves becoming wider, transversely swollen or lobular and almost or entirely "disconnected", these posterior ribs lower and the anterior ribs wider; sin-

concentric lines or slightly flaring in the interior on any portion of the shell; posterior margin of the valve (shell) serrate.

Dimensions.-- Lat., 37 mm.; Hgt., 10 mm.; weight, 10.5 gm.

Remarks.-- A number of valves of this interesting form representative of the 1. isoperla group is present. The sculpturing is very elaborate (even portions of the shell strongly suggests, as Ball has aptly remarked, twisted ribbons of wax). When the light or weather will be eroded the ribs are flat or subrounded and smooth, except for a rough surface. Young individuals are less elongated and more orbicular than adults.

3. line alba is also represented by its slightly elongated form and sculpture, but the shell is not so large as the other of the above named ribs. (Note: The above description is a rather poor, 3. line alba (1), which is no closer than the above

(2). Spec. Coll. Lat. 371, Phil. Coll. 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.

In addition, and also, to consider the possibility of line alba.

The only possible difference between the smaller and the larger

JARDIN (this is the name of the author).

Jardin marinatum (apt., 1871, vol. 100, fasc. 5, pl. 1, p. 112 (check list), in note, see Jardine).

Jardin (Trachycardium) var. boudinense Dall, 1900, 2nd. Ann. Summer Free Inst. Sci., Philadelphia, vol. 5, pt. 5, p. 177-180.

Jardin (Trachycardium) boudinense Dall, 1901, 1917, Bull. U. S. Nat. Mus., no. 90, p. 142.

Description.-- This species from the Tertiary of the Gulf of Mexico, from the site of the Point of Ponce, Tampa Bay, Florida, was identified with the Jardin marinatum by Cupoy. It has the same number of ribs (thirty-seven to forty-one) and the sculpture is much the same in character, but the Jardin is all in miniature; the shell is also small (alt. 17.5, lat. 17.5, diam. 2.5 for the largest seen), less inflated proportionately than J. marinatum of the same size, with the ribs more closely spaced and more numerous. J. marinatum has not been found in any horizon between the Tertiary and the Pleistocene, which is in itself a very good reason for thinking whether the older shell is identical with the newer. If the older propose for it the name of boudinense, which, in connection with should hereafter be found, it may be called J. boudinense (Dall, 1900).

Type locality.-- Border, Panama.

Shell small, moderately inflated, slightly to subglobular, suborbicular, the anterior end being more convex than the posterior and curving most broadly into the base; umbones low, moderately inflated; external sculpture consisting of thick-line to forty-two low, subrounded radial ribs separated by interspaces of the same width or slightly narrower, the interspaces usually crossed by very fine concentric striae; ribs ornamented with a single row or more or less globular or slightly transverse, swollen nodules; on the anterior eight or nine ribs the nodules largest and occupying the entire width of the ribs; the next seven ribs having the nodules progressively shifted to the anterior side; of the succeeding fourteen ribs on the first four the nodules again occupy the entire width of the rib and are relatively more compressed transverse, while on the remainder the nodules are shifted to the anterior side and the interspaces between the ribs becoming slightly deeper; the ten posterior ribs characterized by a narrow anterior keel and a lower, broader posterior portion on which the nodules are situated, the interspaces between the posterior ribs relatively wide and shallow; posterior margin of the valves deeply concave.

Dimensions.-- Lat., 19.7 mm.; alt., 10.5 mm.; breadth of, 7 mm.

Remarks.-- Several valves of this species are present. The one measured is much larger than any of the others. The ribs on the

middle of the shell are slightly larger than those on either end. The interval between the last (anterior) and the anterior ribs, as well as the interval between the last and the first of the median ribs, are the same. These intervals, taken together, tend to be slightly greater than those of the other ribs, so that the nodules rest in the latter ones.

S. brachyura is recognised by its small size, somewhat irregular shape and numerous undulating ribs. The most closely related form is the recent West Indian S. vivianii Lamarck (1), but, besides the difference in size, the latter, in the

(1). St. Nat., pl. 10, p. 133, 1853; Loewe, Zool. Icon., vol. 2, Gastropoda, pl. 1, fig. 57, 1844.

Besides these there are several other species of the genus, but the most common is S. vivianii Lamarck (1), which is immediately preceding the anterior ribs are usually double, undulating. The above two species, the West Indian S. vivianii Lamarck (1), S. brachyura (2) and S. vivianii (3).

(2). Loc. cit., p. 100, pl. 15, fig. 10, 1853.
(3). Loc. cit., p. 1086, pl. 15, fig. 1, 1853.
(4). Loc. cit., p. 108, pl. 15, fig. 17, 1853.

and broad, flat, inner smooth wall with small area of
rough inner wall. Anterior, is more or less oval, inner
wall smooth to p. allii (1), and series from the middle of

(1). Trans. Amer. Ent. Soc., Philadelp., vol. 1, p. 151,
pl. 12, fig. 70, 1897; vol. 11, pl. 1, fig. 10, 1901,
1902.

Anterior. The dorsal furrow, however, is a shallow
one more than half the depth of the furrow. In addition, the elytra
species has a more deeply serrated internal ventral margin and
the elytra leading up to the umbilicus are broader and deeper, but the
most conspicuous difference lies in the presence of an internal
serration which extends from the umbilicus to the level
of the ventral end of the posterior lateral tooth; this feature,
which has been used as the diagnostic character of the section
Anterioria Call, is entirely lacking in allii.

Another, even more closely related species, p. allii
Gabb (2) from the Santa Rosa Eocene, is smaller, without the

(2). Jour. Acad. Nat. Sci., Philadelp., 1881, vol. 1, p. 171,
pl. 17, fig. 77, 1881.

angle between the posterior-lateral and anterior-lateral margins, with
a more rounded post-ro-lateral margin and more conspic-
uous internal radial lines; the sculpture is virtually the same,

even in the number of ribs.

The above species are most distinctive and agree in distinction by the recent West Indian form for which the earliest name probably is D. leucostomum ¹ Corn., but which is commonly known as leucostomum.

(1). Rept. Ind. Mus. Vindob., 1. 30, pl. 7, fig. 10, 170.

Rept. Ind. Mus. Vindob. (2) leucostomum Corn. (3). The recent species has narrower and more distinct ribs.

(4). Ann. Mus. Nat.,

(5). Proc. Zool. Soc. London 1834, .

This species is named for Mr. E. William Howard, Chief of the Division of Coastal Plain Investigation of the United States Geological Survey, under whose direction the investigation of the West Indian region is being carried on.

Occurrence.-- Lower Eocene: Jordan, Woods, Barro Colorado, Costa Rica.

Subgenus Fragum Bolten.

Section Fragum Bolten.

CARDIUM (BRADY) LINNÆUS.

Cardium medium Linnaeus, 1758, Syst. Nat., vol. 1, p. 57.

Cardium medium Linnaeus, 1758, Syst. Nat., vol. 1, p. 57.
Cardium, pl. 8, fig. 70.

Cardium medium Linnaeus, 1758, Syst. Nat., vol. 1, p. 57.

Cardium medium Linnaeus, 1758, Syst. Nat., vol. 1, p. 57.
p. 108, pl. 8, fig. 5-7.

Cardium (Fragum) medium Linnaeus, 1758, Syst. Nat., vol. 1, p. 57.
Sci., Philadelphia, 2nd ser., vol. 1, p. 57, 1758.

Cardium columb Tellin, 1868, Trans. Amer. Phil. Soc., vol. 1, p. 37, pl. 11, fig. 26.
Sci., Philadelphia, vol. 1, p. 37, pl. 11, fig. 26.

Cardium (Fragum) sp. indet., Dall, 1900, Trans. Amer. Phil. Soc., vol. 1, p. 1131.
Sci., Philadelphia, vol. 1, p. 1131.

Cardium (Fragum) medium Linnaeus, Dall, 1900, Trans. Amer. Phil. Soc., vol. 1, p. 1131-1132.

Cardium (Fragum) medium Linnaeus, Dall, 1900, Trans. Amer. Phil. Soc., vol. 1, p. 1131-1132.
Survey, Misc. vol., p. 538, pl. 40, fig. 3a, b.

Description.— The Cardium specimens are of medium size and thickness, outline roughly subtriangular; anterior margin broadly into the hinge; posterior margin slightly notched above,

subtruncated below, defining the base of a carina of about 1 mm.; umbones blunt, relatively high and sharp; posterior carina strong, subangular; upper portion of the depressed posterior part of the shell is elevated; external surface sculptured with thirty-six to forty low, subrounded to rounded radial ribs, separated by narrower, slightly increased interspaces; the ribs and interspaces increase in size from the anterior end to the carina; the eight to ten ribs behind the carina asymetrically rounded, being slightly elevated toward the anterior end of the shell; an arm section of the ribs shows arches, slightly projecting, narrow concentric striae between which are finer, similarly arched striae.

Dimensions.-- Lat., 20 mm.; alt., 14 mm.; thickness., 17 mm.

Remarks.-- Several valves which are identical with recent specimens of this low-ranging species are present. The ornamentation of the ribs is usually intact on shell, a few small patches, the ribs usually appearing polished and with indications of arched concentric lines. If this surface is removed both ribs and interspaces are crossed by fine concentric striae, which, in general, are arched on the ribs.

The Jordan specimens are recognized by the strong, bright carina, the presence of a elevated area in the locally depressed posterior region, and the numerous closely ribs which are separated by well-defined interspaces. When compared with certain fossil and recent forms of this species it is seen that the fossil

J. elatocostatus (Forsk.) Blane J. Marshall (F.),
 1000 ft. on slopes, 2000 ft. on slopes, 12000 ft. on slopes.

(1). *Annals of the Entomological Society of America*, Vol. 10, No. 1, p. 101, Pl. 12, Fig. 17.

Dimensions. - Lat., 17.5 mm.; alt., 7 mm.; length, 10 mm.

carina is sharper on right valve than on left one; on some small left valves, however, it is somewhat broader and the carinal rib can be slightly indented and each form probably the variety homocentric, although they retain the principal characters of the typical form. The number of ribs anterior to the carina may be as low as twelve, but this number is constant; behind the carina again is the carinal rib number, thirteen right or thirteen left. The nodules are abundant from base of all of the ribs; in fact, so small and closely spaced that all of them intersect. When deprived of their nodules the ribs are smooth and polished, but have suggestions of incremental lines. If the surface of the ribs or interrib is removed, both upper and lower concentric striae, finer than those on the smooth interrib. An interesting feature lies in the location of the ribs, all of them anterior to the carina. These ribs, although not all as wide as those preceding, appear narrower, and the first rib of each corresponds to the entire width of the preceding rib. The heel decreases in width posteriorly. Both the lower portion of the rib and the heel itself are usually smooth. In some cases, however, a small rough spot on lower rib, generates the irregular wavy surface from the first rib. The middle lobe consists of 1. limited to the nodulation which consists of small, four- to three-noded, high, narrow ribs, which are separated by concentrically striated, deep interribes of the same width. The striation

in the lower portion of the
section occurs in the
its character: in fact, the section is

Among Sappho's
are

(1). Call (Trans.
pt. 5, p. 1107, 1900)

... ..
in his 1894 check list.
and was described by Call (1) as ...; it is similar,
with lower, broader, more rounded ribs,

(2). loc. cit., p. 1107, pt. 5, Ch. 7, 1900.

do not
the
the

(3).
fig. 1.

(4). loc. cit., p. 1107, pt. 5, Ch. 7, 1900.

... ..

[illegible]

from the dorsal apophysis having the same shape as the
apophysis, i. e. long and slender and the sides rounded. In the case of the apophysis, the sides are rounded and the apophysis is more rounded on the lateral side than on the dorsal side. It is usually surrounded on its base by a small depression. At the base of the apophysis of the dorsal rib there is a small depression which is lower than the dorsal apophysis, these small depressions are the origin of the apophysis between the dorsal and lateral ribs, and the apophysis is usually long and slender and the sides are rounded.

The apophysis of S. (S. S.) apophysis apophysis (1), is produced from the apophysis of the apophysis, also of the apophysis of the apophysis.

(1). Trans. Reg. Soc. Sci., Phil. Soc., vol. 1, pt. 1, p. 1100-1101, 1900.

and it is, longer from the dorsal side, having a more oblique posterior margin, narrower lateral margin, wider, lower and more rounded anterior and posterior sides, separated by a small depression and a prominent dorsal side, the dorsal side is behind the dorsal. The apophysis apophysis (2) of the apophysis.

(2). Trans. Reg. Soc. Sci., Phil. Soc., vol. 1, pt. 1, p. 1100-1101, 1900.

side are narrower than the dorsal side, the dorsal side is behind the dorsal.

See remarks. - Lower Miocene: 35 to 40 ft., 10 ft., 10 ft.

OSTIUM (IN SPERMATOPHYTES) HAWKINSII

Description.-- Shell small, oblique, broadly ovate; anterior margin broadly, gently, convex, sub-linearly truncated anteriorly; angles high, gently convex; surface very smooth, curved; portion of the shell anterior to the suture sculptured with ten, relatively wide ribs, increasing in size from the anterior margin to the center of the shell and then slightly decreasing, the ventral rib being subrounded, the others flat; the interspaces anteriorly broader than the ribs, toward the suture broader broader and much deeper; posterior margin depressed, ornamented with several narrow, low, flat ribs, later toward the margin of the shell; none or all of the ribs ornamented with small, globular nodules, these are slightly irregular, prominent in the middle ventral region; interspaces with fine concentric striation; immediately before the suture, smooth, concave and behind the suture slightly more convexly differentiated from the low first anterior rib.

Dimensions.-- Lat., 7.5 mm.; Alt., 10 mm.; Osculum., 4 mm.

Remarks.-- A single right valve of this small shell was found in the collection. It is 11 mm. in length, 7 mm. in width, oblique, oval, strongly curved and the deep lateral notch on the hinge which is completely present to the suture. This species is not to be confused with Hawkinsia or Hawkinsia as it is not

(1). *Ann. Inst. Sci.*, 1961, vol. 7, p. 117, 1. 1, fig. 5, 1-6.

(c). *ibid.*, vol. 5, pt. 1, pp. 1105-1106, pt. 2, pt. 3, 1960.

(7). Collected by Dr. Marc I. Hoff.

occurrence. - Lower Miocene: Boulder, Colorado, U.S.A.

Cardium serratum Linnaeus.

Cardium (Bull. 1811) Cardium Linnaeus.

Cardium serratum Linnaeus, 1758, Syst. Nat., vol. 1, p. 33;
1760, Men, vol. 1, p. 1147.

Cardium lituina serratum Hermitte, 1780, Journ. Phil., vol. 1,
p. 104, pl. 13, fig. 170.

Cardium lituina Gmel, 1791, Ann. Zool., p. 337, pl. 1, fig. 5.

Cardium laevigatum Lamarck, 1811, Moll. Syst. Nat., vol. 1,
p. 11 (non Linnaeus, 1758; non Gmel 1791 fig. 5). Cardium
var. laevigatum (?).

Cardium serratum Linnaeus, Reeve, 1844, Journ. Phil., vol. 1,
pl. 1, fig. 1.

Cardium ovipetatum Reeve, 1844, Journ. Phil., fig. 50.

Cardium serratum Linnaeus, M'Orbigny, 1847 (1), in de la Roche,
Hist. Nat., polit., de l'Etat de la Ligne de l'Inde, vol. 1,
p. 1 (Lamarck 1811).

Cardium serratum Linnaeus, M'Orbigny, 1847, Journ. Hist. Nat.,
vol. 1, p. 500.

Cardium serratum Linnaeus, M'Orbigny, 1847, in de la Roche, 1847,
Hist., polit., de l'Etat de la Ligne de l'Inde, vol. 1,
p. 1, p. 500, (Lamarck 1811).

Cardium serratum Lamarck, 1811, Moll. Syst. Nat., vol. 1,
p. 11, fig. 1.

Cordium serotum Linnaeus, 1757, Flora. Arn. Villoi. Scil., vol. 12, p. 271, not C. serotum Linnaeus, 1751.

Cordium (Leptocordium) serotum Linnaeus, 1751, Flora. Arn. Villoi. Scil., Philadelphia, vol. 12, p. 271.

Cordium serotum Linnaeus, 1751, 1751, Flora. Arn. Villoi. Scil., vol. 12, p. 271; 1751, vol. 1, p. 271.

Cordium serotum Linnaeus, 1751 and 1751, 1751, Flora. Arn. Villoi. Scil., vol. 12, p. 271.

Cordium (Leptocordium) serotum Linnaeus, 1751, 1751, Flora. Arn. Villoi. Scil., Philadelphia, vol. 12, p. 271, 1751-1751.

Cordium (Leptocordium) serotum Linnaeus, 1751, 1751, Flora. Arn. Villoi. Scil., vol. 12, p. 271.

Cordium (Leptocordium) serotum Linnaeus, 1751 and 1751, 1751, Flora. Arn. Villoi. Scil., vol. 12, p. 271.

Leptocordium serotum (Linnaeus) Boeck, 1751, Flora. Arn. Villoi. Scil., Mexico, no. 22, p. 20, pl. 11, fig. 1.

? Cordium (Leptocordium) serotum Linnaeus, 1751, 1751, Flora. Arn. Villoi. Scil., Reichensbalt, vol. 5, p. 222, pl. 27, fig. 1 (not C. serotum (Leptocordium) serotum Linnaeus, 1751).

Cordium (Leptocordium) serotum Linnaeus, Flora. Arn. Villoi. Scil., 1751, Flora. Arn. Villoi. Scil., Philadelphia, vol. 12, p. 271.

? Cordium (Leptocordium) serotum Linnaeus, 1751, 1751, Flora. Arn. Villoi. Scil., 1751, 1751.

Description.-- The specimens referred to this species are of medium size, sterile, well inflated, usually elliptical, produced

in Bull. Acad. Nat. Sci. Philadelphia, vol. 1, p. 110, 1896; loc. cit., pp. 1110-1111, 1900.

(2). loc. cit., pp. 1110-1111, 1900.

and also in Bull. Acad. Nat. Sci. Philadelphia, vol. 1, p. 110, 1896.

(3). Bull. Acad. Nat. Sci. Philadelphia, vol. 1, p. 110, 1896.

(4). Jour. Acad. Nat. Sci. Philadelphia, vol. 1, p. 110, 1896.

and also in Bull. Acad. Nat. Sci. Philadelphia, vol. 1, p. 110, 1896.

Bull. Acad. Nat. Sci. Philadelphia, vol. 1, p. 110, 1896; loc. cit., pp. 1110-1111, 1900.

(5). In Curry and Bull, Jour. U. S. Nat. Mus., vol. 12, p. 587, 1896; loc. cit., pp. 1110-1111, 1900.

(6). Bull. U. S. Nat. Mus., vol. 12, p. 587, 1896; Bull. U. S. Nat. Mus., vol. 12, p. 587, 1896.

Bull. U. S. Nat. Mus., vol. 12, p. 587, 1896; loc. cit., pp. 1110-1111, 1900.

Genus *Protophysa* Bell.

Protophysa Bell.

Protophysa *belli* Bell, 1900, Trans. Amer. Ent. Soc.

Sci., Philadelphia, vol. 7, pt. 3, p. 111; 1900, pt. 3, pl. 40, fig. 5.

Description.-- "Shell small, elongate, subcylindrical, with rather high subcentral umbones; anterior end broadly rounded, posterior end slightly rounded truncate; surface with very numerous radiating threads crossed by concentric lines, small, which at the intersections reveal themselves by underlying the shell beaded; this sculpture covers a little less than the anterior half of the disk, behind which the nodules are narrower and not beaded, separated by still narrower channels; in the channel separating the anterior from the posterior type of sculpture there is a low erect line, a string of small beads, larger than in the second or third channel, sides a row of small, erect, very close-set spines, those on the anterior edge smaller and shorter than those on the sides; internally the valves are minutely beaded; the hinge is dorsal. Len. 0.6, ht., 0.3, diam. 0.7 mm."

"This species is named *Protophysa belli* (27/11),

(1). Bull. Hist. Nat. Phil. 1900, vol. 7, pt. 3, p. 111; vol. 18, pt. 3, p. 111, 1900, pt. 3, p. 111, 1900, pt. 3, p. 111.

PLATE 10. 1701.

A small Polysiphonia is represented by a number of the posterior ventral portion of a single valve. It is much larger than Isopora with the inter-axes decidedly larger, the sides and inter-axes subequal, the sides more oblique and the central line in the lower inter-axes broader. It appears to represent a form closer to Polysiphonia than Isopora.

See also.- Lower Miocene: Isopora, Isopora, Isopora.

Simultaneously, I received a letter from:

Qual, seu facio e ?

Folio 100v. 11. cm.

Stimolo .- ξένος ,stranger; species, de cet.

1935.- Yanaucis bohemiana (Ball)

DESCRIPTION OF SPECIES

Amorloporhina barkeri Dall, 1927, Trans. Amer. Mic. Soc.
Sci., Philadelph., vol. 5, no. 6, pp. 1704-1707,
pl. 37, fig. 8.

Description.-- Shell small, ovate-triangular, subacute to
with a flexure at the apex; length 4.5 mm, width 3.5 mm;
lunule large, imbricated, well-defined, but with no lateral
suture, posterior end pointed, anterior end rounded, base
arcuate, rather prominent apically; surface sculptured with con-
centric striae with flatish wider interspaces; hinge small,
rather heavy, inner margin entire; cardinalium small, length
4.5, height 3.5, diameter 3.0 mm.

"The small valve from which the above description is given
on the diameter of shell being twice the thickness of the valve)
is up to the present time the only record outside of the genus
known from the Tertiary world. It is certainly unique." (Dall,
1927).

Type locality.-- Boston, Jamaica.

Remarks.-- This structure is well-represented in the
material at hand and there is no reason for assuming that the
lost valves are not lost. The character, including some
of the lines, is consistent with all the specimens of the genus.
The large valve is the following: Length 15 mm, width 12 mm;

Superfamily Volutacea.

Family Volutidae.

Subfamily Volutinae.

Genus *TRANSNELLA* Dall.

TRANSNELLA *transnella* n. sp.

Callosanassa sp. in lat. Dall, 1907, *Proc. U.S. Nat. Mus.*,
Philadelphia, vol. 3, pt. 1, p. 101 (fig. 10).

Description.— Shell small, sub-globose, slightly imbricated-lateral, rounded subtrapezoidal in profile, white; a distinct anterior dorsal keel, typically subequal, the ventral keel longer and slightly convex, the anterior straight; umbones moderately exserted, subequal in position; small, low, rounded; lateral surface is marked with irregular transverse striae, small, and is often smooth or with fine granules but with no distinct spiral striae; base well defined, the middle left ventral oblique, with depression; marginal (apertural) groove poorly defined.

Dimensions.— Length, 7.5 mm.; lat., 7 mm.; thickness, 2 mm.

Locality.— The locality of this species is unknown, but it is of variable size. The shell is small, from 1 to 2 mm. in length, and is rounded subtrapezoidal with rounded lateral keels, and

Genus Amphiprion Dill.

Amphiprion Dill.

Amphiprion Dill, 1907, Trans. Amer. Soc. Zool.,
Philadelphia, vol. 1, pp. 1-10, pl. 1, fig. 1.

Description.-- "Small fish, thin, elongate, compressed, with 11, concentrically striated; dorsal fin 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 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408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 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1006, 1007, 1008, 1009, 1010, 1011, 1012, 1013, 1014, 1015, 1016, 1017, 1018, 1019, 1020, 1021, 1022, 1023, 1024, 1025, 1026, 1027, 1028, 1029, 1030, 1031, 1032, 1033, 1034, 1035, 1036, 1037, 1038, 1039, 1040, 1041, 1042, 1043, 1044, 1045, 1046, 1047, 1048, 1049, 1050, 1051, 1052, 1053, 1054, 1055, 1056, 1057, 1058, 1059, 1060, 1061, 1062, 1063, 1064, 1065, 1066, 1067, 1068, 1069, 1070, 1071, 1072, 1073, 1074, 1075, 1076, 1077, 1078, 1079, 1080, 1081, 1082, 1083, 1084, 1085, 1086, 1087, 1088, 1089, 1090, 1091, 1092, 1093, 1094, 1095, 1096, 1097, 1098, 1099, 1100, 1101, 1102, 1103, 1104, 1105, 1106, 1107, 1108, 1109, 1110, 1111, 1112, 1113, 1114, 1115, 1116, 1117, 1118, 1119, 1120, 1121, 1122, 1123, 1124, 1125, 1126, 1127, 1128, 1129, 1130, 1131, 1132, 1133, 1134, 1135, 1136, 1137, 1138, 1139, 1140, 1141, 1142, 1143, 1144, 1145, 1146, 1147, 1148, 1149, 1150, 1151, 1152, 1153, 1154, 1155, 1156, 1157, 1158, 1159, 1160, 1161, 1162, 1163, 1164, 1165, 1166, 1167, 1168, 1169, 1170, 1171, 1172, 1173, 1174, 1175, 1176, 1177, 1178, 1179, 1180, 1181, 1182, 1183, 1184, 1185, 1186, 1187, 1188, 1189, 1190, 1191, 1192, 1193, 1194, 1195, 1196, 1197, 1198, 1199, 1200, 1201, 1202, 1203, 1204, 1205, 1206, 1207, 1208, 1209, 1210, 1211, 1212, 1213, 1214, 1215, 1216, 1217, 1218, 1219, 1220, 1221, 1222, 1223, 1224, 1225, 1226, 1227, 1228, 1229, 1230, 1231, 1232, 1233, 1234, 1235, 1236, 1237, 1238, 1239, 1240, 1241, 1242, 1243, 1244, 1245, 1246, 1247, 1248, 1249, 1250, 1251, 1252, 1253, 1254, 1255, 1256, 1257, 1258, 1259, 1260, 1261, 1262, 1263, 1264, 1265, 1266, 1267, 1268, 1269, 1270, 1271, 1272, 1273, 1274, 1275, 1276, 1277, 1278, 1279, 1280, 1281, 1282, 1283, 1284, 1285, 1286, 1287, 1288, 1289, 1290, 1291, 1292, 1293, 1294, 1295, 1296, 1297, 1298, 1299, 1300, 1301, 1302, 1303, 1304, 1305, 1306, 1307, 1308, 1309, 1310, 1311, 1312, 1313, 1314, 1315, 1316, 1317, 1318, 1319, 1320, 1321, 1322, 1323, 1324, 1325, 1326, 1327, 1328, 1329, 1330, 1331, 1332, 1333, 1334, 1335, 1336, 1337, 1338, 1339, 1340, 1341, 1342, 1343, 1344, 1345, 1346, 1347, 1348, 1349, 1350, 1351, 1352, 1353, 1354, 1355, 1356, 1357, 1358, 1359, 1360, 1361, 1362, 1363, 1364, 1365, 1366, 1367, 1368, 1369, 1370, 1371, 1372, 1373, 1374, 1375, 1376, 1377, 1378, 1379, 1380, 1381, 1382, 1383, 1384, 1385, 1386, 1387, 1388, 1389, 1390, 1391, 1392, 1393, 1394, 1395, 1396, 1397, 1398, 1399, 1400, 1401, 1402, 1403, 1404, 1405, 1406, 1407, 1408, 1409, 1410, 1411, 1412, 1413, 1414, 1415, 1416, 1417, 1418, 1419, 1420, 1421, 1422, 1423, 1424, 1425, 1426, 1427, 1428, 1429, 1430, 1431, 1432, 1433, 1434, 1435, 1436, 1437, 1438, 1439, 1440, 1441, 1442, 1443, 1444, 1445, 1446, 1447, 1448, 1449, 1450, 1451, 1452, 1453, 1454, 1455, 1456, 1457, 1458, 1459, 1460, 1461, 1462, 1463, 1464, 1465, 1466, 1467, 1468, 1469, 1470, 1471, 1472, 1473, 1474, 1475, 1476, 1477, 1478, 1479, 1480, 1481, 1482, 1483, 1484, 1485, 1486, 1487, 1488, 1489, 1490, 1491, 1492, 1493, 1494, 1495, 1496, 1497, 1498, 1499, 1500, 1501, 1502, 1503, 1504, 1505, 1506, 1507, 1508, 1509, 1510, 1511, 1512, 1513, 1514, 1515, 1516, 1517, 1518, 1519, 1520, 1521, 1522, 1523, 1524, 1525, 1526, 1527, 1528, 1529, 1530, 1531, 1532, 1533, 1534, 1535, 1536, 1537, 1538, 1539, 1540, 1541, 1542, 1543, 1544, 1545, 1546, 1547, 1548, 1549, 1550, 1551, 1552, 1553, 1554, 1555, 1556, 1557, 1558, 1559, 1560, 1561, 1562, 1563, 1564, 1565, 1566, 1567, 1568, 1569, 1570, 1571, 1572, 1573, 1574, 1575, 1576, 1577, 1578, 1579, 1580, 1581, 1582, 1583, 1584, 1585, 1586, 1587, 1588, 1589, 1590, 1591, 1592, 1593, 1594, 1595, 1596, 1597, 1598, 1599, 1600, 1601, 1602, 1603, 1604, 1605, 1606, 1607, 1608, 1609, 1610, 1611, 1612, 1613, 1614, 1615, 1616, 1617, 1618, 1619, 1620, 1621, 1622, 1623, 1624, 1625, 1626, 1627, 1628, 1629, 1630, 1631, 1632, 1633, 1634, 1635, 1636, 1637, 1638, 1639, 1640, 1641, 1642, 1643, 1644, 1645, 1646, 1647, 1648, 1649, 1650, 1651, 1652, 1653, 1654, 1655, 1656, 1657, 1658, 1659, 1660, 1661, 1662, 1663, 1664, 1665, 1666, 1667, 1668, 1669, 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1836, 1837, 1838, 1839, 1840, 1841, 1842, 1843, 1844, 1845, 1846, 1847, 1848, 1849, 1850, 1851, 1852, 1853, 1854, 1855, 1856, 1857, 1858, 1859, 1860, 1861, 1862, 1863, 1864, 1865, 1866, 1867, 1868, 1869, 1870, 1871, 1872, 1873, 1874, 1875, 1876, 1877, 1878, 1879, 1880, 1881, 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890, 1891, 1892, 1893, 1894, 1895, 1896, 1897, 1898, 1899, 1900, 1901, 1902, 1903, 1904, 1905, 1906, 1907, 1908, 1909, 1910, 1911, 1912, 1913, 1914, 1915, 1916, 1917, 1918, 1919, 1920, 1921, 1922, 1923, 1924, 1925, 1926, 1927, 1928, 1929, 1930, 1931, 1932, 1933, 1934, 1935, 1936, 1937, 1938, 1939, 1940, 1941, 1942, 1943, 1944, 1945, 1946, 1947, 1948, 1949, 1950, 1951, 1952, 1953, 1954, 1955, 1956, 1957, 1958, 1959, 1960, 1961, 1962, 1963, 1964, 1965, 1966, 1967, 1968, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207,

Type locality.-- London, Jamaica.

Material.-- One collection at New York, New York, U.S.A., consisting of 1 specimen of the species, which was preserved from a single valve.

Occurrence.-- Lower Miocene: London, Jamaica (Hall, 1905).

Genus *Strophodon* Bolton.

Strophodon *Strophodon* n. s.

Section *Strophodon* U. S. A. 1891.

Strophodon (*Strophodon*) *Strophodon* *Strophodon* .

Strophodon (*Strophodon*) *Strophodon* *Strophodon*, 1901, Bull. U. S. Fish Comm., vol. 20, pt. 1, p. 197, pl. 13, fig. 1.

Strophodon (*Strophodon*) *Strophodon* *Strophodon*, 1907, Bull. U. S. Fish Comm., vol. 27, pt. 1, p. 197, pl. 13, fig. 1.

Description.— "Shell small, yellowish white, its size, 1-1.5 mm, moderately convex, with a prominent, rounded anterior beak; sculpture of shell, close-set, subequal, somewhat irregular, with irregular interrupted and fine lines, crossed by fine radial striae, which are stronger towards the apex of the valves, where the interrupted lines continue across the striae; imbrication small, closely appressed, rather to the apex; surface smooth; interior white, the surface of the valves with a fine radial line parallel to it across the shell; hinge small; radial line white but slightly raised to the apex."

"Length 5.5; height 1; diameter 3." (Bull. U. S. Fish Comm., 1901).

Type locality.— San Juan, Maragosa Harbor, Puerto Rico.

Remarks.— This small species is very easily identifiable. A typical small shell has the following dimensions: length 3.8 mm.; ht., 5.5 mm.; dia., 7.5 mm. The body valve is broadly ovate, moderately micollate all over shell-inlets, while the umbones have orbicular and the flange less micollate all over. Usually have a poorly defined lunule. A considerable degree of variability is noticeable, especially among junior valves, the most common valves having at the base the higher ridges and columellar ridge. The sculpture of the sculpture is also subject to variation. Invariably the umbones are more pronounced than either side. The lunule is sculptured like the rest of the surface, but with the sculpture coarser.

Shell (1) has reminded that often associated with several localities

(1). Loc. cit., 1907.

From the above, the shells are a little more; all of them usually more produced in front, but these are more micollate. This species is characterized by its small size, broadly ovate outline and strong, fine, regular sculpture. The umbones have the same "Pachia" micollate (2) 1 1 to 1 1/2 mm. in diameter.

(2). Jour. Acad. Nat. Sci., Philadelphia, 1907, vol. 1, p. 575, pl. 27, fig. 71, 1901.

Geography. - Lower Tertiary: Lower Tertiary, London, England
(Dall, 1907). Locality: San Juan and Magdalena, Colombia, in
in 1907 (Dall and H. H. H. H., 1907).

Genus *Pillaria* (Guss.)

Section *Hypopharodon* Dall.

Pillaria (*Guss.*) (*Guss.*) (*Guss.*)

Urtica (*Guss.*) (*Guss.*) (*Guss.*) (*Guss.*) (*Guss.*)

Urtica, vol. 22, p. 122, pl. 12, fig. 17.

Urtica (*Guss.*) (*Guss.*) (*Guss.*) (*Guss.*) (*Guss.*)

Urtica, vol. 17, p. 122.

Urtica (*Guss.*) (*Guss.*) (*Guss.*) (*Guss.*) (*Guss.*)

Urtica (1892) (1892).

Urtica (*Guss.*) (*Guss.*) (*Guss.*) (*Guss.*) (*Guss.*)

Urtica, vol. 22, p. 122.

Urtica (*Guss.*) (*Guss.*) (*Guss.*) (*Guss.*) (*Guss.*)

Urtica (*Guss.*) (*Guss.*) (*Guss.*) (*Guss.*) (*Guss.*)

Urtica (*Guss.*) (*Guss.*) (*Guss.*) (*Guss.*) (*Guss.*)

Urtica, vol. 7, pp. 727-728, pl. 12, fig. 12.

Urtica (*Guss.*) (*Guss.*) (*Guss.*) (*Guss.*) (*Guss.*)

Urtica, vol. 17, p. 122.

Urtica (*Guss.*) (*Guss.*) (*Guss.*) (*Guss.*) (*Guss.*)

Urtica (*Guss.*) (*Guss.*) (*Guss.*) (*Guss.*) (*Guss.*)

Urtica (*Guss.*) (*Guss.*) (*Guss.*) (*Guss.*) (*Guss.*)

Urtica (*Guss.*) (*Guss.*) (*Guss.*) (*Guss.*) (*Guss.*)

Urtica (*Guss.*) (*Guss.*) (*Guss.*) (*Guss.*) (*Guss.*)

Strophomena ? or *Strophomena* ?
Section *Strophomena* all.

Pitarica (*Strophomena*) *Strophomena* (all).

Strophomena (*Strophomena*) *Strophomena* (all), 1876, *Trans. Geol. Soc. London*, vol. 32, pt. 1, pl. 12, fig. 1.

Strophomena (*Strophomena*) *Strophomena* (all), 1877, *Trans. Geol. Soc. London*, vol. 33, pt. 1, p. 157.

Strophomena (*Strophomena*) *Strophomena* (all), 1878, *Trans. Geol. Soc. London*, vol. 34, pt. 1, p. 442 (check list).

Strophomena (*Strophomena*) *Strophomena* (all), 1879, *Trans. Geol. Soc. London*, vol. 35, pt. 1, p. 571.

Pitarica (*Strophomena*) *Strophomena* (all), 1880, *Trans. Geol. Soc. London*, vol. 36, pt. 1, p. 187.

Description.— "Shell inequilateral, transverse, oval, compressed; valves polished, ornamented with numerous close, slightly irregular, concentric ribs, which ascend higher than their interstices; umbones prominent, approximate; dorsal valve slightly depressed." (Strophomena, 1880).

Type locality.— Jamaica.

Shell large, solid, polished, slightly inequilateral, elongate-oval; dorsal valve low, broad; ventral valve on the side of the shell, the intercostal line broad, slightly curved.

translucent and obsolete lines, replaced by feeble concentrications of the concentric rings; no radial lines; smooth from the apical to the ventral end of the anterior portion; the outer surface is covered, beneath, by a transparent layer; concentric sculpture with concentric rings, usually concentric toward the margin; large strong, the left anterior lateral strong and prominent, the right anterior cardinal mid-collal sinus deep and broad.

Dimensions.— Height, 30 mm.; lt., 70.5 mm.; width, 17.5 mm.

Remarks.— *P. planivista* is one of the most abundant of the Veneridae. Except for the usual variation in the width of the concentric rings and an occasional irregularity in their arrangement, the characters are quite uniform. It is characterized by its relatively large size, height and strong, regular, concentric sculpture.

A closely related undescribed form occurs in the Duplin fauna. *P. bore* Brown and Pilsbry (1) from the latter beds, is smaller, less elongated (some of the specimens are very elongated).

(1). Pac. Acad. Sci. Bull., Vol. 1, 1911, p. 55, pl. 30, fig. 5, 1911.

than the one figured, with slightly higher and more erect anterior and finer sculpture. Said's Costa Rican *Pisidium* *P. plan-*

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See also .-
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Description.-- Shell of ... size, ... shape, ...
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Dimension.-- Ht., ...; W., ...; ...

Locality.-- O. ... is known from ...
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(1). Jour. de l'École, vol. 7, p. 10, pl. 1, 1', 1900,
as Dorville (Antenne) ten in.

(2). Jour. de l'École, vol. 7, p. 10, pl. 1, 1', 1900.

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Ball (1) are better and decidedly less common.

(2). *Rept. Geol. Surv. I. 4. Sci., Vol. 11, 1907, Pl. 11, 1907.*

Occurrence.-- Lower Miocene: Boston beds, Boston, Jamaica.

Genus *Venus* Woodwardi (part) 1937.

Subgenus *Venus* L. S.

Section *Venus* L. S.

Venus *Woodwardi* L. S.

Venus *Woodwardi* L. S., 1937, *Trans. Amer. Mus. Nat. Hist.*, vol.

28, p. 528, pl. 1, fig. 2 (ex parte). fig. excl.

Venus *Woodwardi* L. S., 1937, *Trans. Amer. Mus. Nat. Hist.*, vol. 28, p.

- 442 (check list) ex parte.

Venus *Woodwardi* L. S., 1937, *Trans. Amer. Mus. Nat. Hist.*, vol.

28, p. 528 (= *V. ferruginea* Abb, 1936).

Venus *Woodwardi* (part) L. S., 1937, *Trans. Amer. Mus. Nat. Hist.*

Sci., Philadelphia, vol. 2, pt. 1, p. 1121-1122,

(ex parte).

Description.- Shell of medium size, rounded anteriorly, not so much inflated, well inflated; subcircular to oval, rounded anteriorly, lower portion of anterior margin obliquely truncated; hinge crossed by unusually developed smaller continuation of the concentric ribs; sculpture relatively smooth, striated, bounded by a low, raised ridge, on the left side of the hinge adjacent to the dorsal margin along the entire length of the length; a short line of small teeth on the

longer and the reflected light on the surface is more
diffuse and less brilliant.

The sand is given in color of Mr. J. L. Smith, who
succeeded Mr. Carr as Director of the Earl, Indiana, Ind.

Occurrence. - Lower Miocene: ...
(Gill, 1901, 1904; Dall, 1907).

31722 LITIGIDA M. M.

Description.— Shell small, subcircular, 1.5 mm. long, 1.2 mm. wide; slightly flattened; anterior end rounded into the hinge; hinge not slightly curved in its median portion and at the anterior end turning up abruptly, meeting the ventral margin at a sharp angle; the beveled line bounding the dorsal foot; a process; escautcheon long and broad, covering the top of the shell, the dorsal half of its margin adjacent to the hinge slightly raised; in front of the subrounded ear, limiting the escautcheon, the surface of the shell slightly depressed toward the ventral margin, but not enough to affect the shape; external surface reticulated with a moderate number of concentric ribs with prominent, beveled radialia crossing the intercostals; along the dorsal edge of the concentric ribs turned toward the ventral margin and shell. Prominence, but over the remainder of the anterior two-thirds of the shell the edge turned toward the hinge, flattened and the elevation is feeble or absent; on the posterior third, the edge is again flattened, longitudinal and rounded; small continuations of the ribs present on the lateral; escautcheon striate by the lines, concentric lines crossing the radialia; hinge small, the dorsal anterior cardinal angle and the posterior commissure.

Dimensions.-- Length, 7 mm.; alt., 5.5 mm.; umbilic., 1.5 mm.

Remarks.-- A number of small valves (smaller than those of this species, most of them being less than 4 mm. long, but somewhat wider, the largest being the following: Length 6.5 mm., alt., 5 mm.; umbilic., 1.5 mm. The arrangement of ribs here is of the type that is well-characterized by S. subquadrata, as in that species, on small valves the ribs are beaded and rounded out, while on larger ones they are thickened to a smooth edge part of the anterior two-thirds. Nine to eleven ribs are present on the ventral five-fifths of large shells, but on small valves this number may be increased to fourteen.

The small size, long, almost linear transverse section, almost posterior to anterior edge of the ventral margin and well-defined ribs that enclose the posterior part of the umbilical area, are diagnostic features of S. subquadrata. It is probably a primitive offshoot of the stock which produced subquadrata, from the young valves of which it differs by being more elongated, with a longer and straighter posterior dorsal margin and more distinct ribs.

See also.-- Lower Miocene: Boulder beds, Denver, Colorado.

Van der Meer 1901, 1902, 1903, 1904, 1905, 1906, 1907, 1908, 1909, 1910, 1911, 1912, 1913, 1914, 1915, 1916, 1917, 1918, 1919, 1920, 1921, 1922, 1923, 1924, 1925, 1926, 1927, 1928, 1929, 1930, 1931, 1932, 1933, 1934, 1935, 1936, 1937, 1938, 1939, 1940, 1941, 1942, 1943, 1944, 1945, 1946, 1947, 1948, 1949, 1950, 1951, 1952, 1953, 1954, 1955, 1956, 1957, 1958, 1959, 1960, 1961, 1962, 1963, 1964, 1965, 1966, 1967, 1968, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 230

"The Court" 1907, Vol. 1, No. 1, Page 1, Col. 1, Line 1.
is (check line). ex parte.

of Yunnan Indomalaya subsp., 1976, Trans. Zool. Soc. London,
vol. 25, p. 550. (= Yunnan subsp., 1975).

Thieme Vol. 1 (1904) 177, 1787, 1788, 1789, 1790, 1791, 1792, 1793, 1794, 1795, 1796, 1797, 1798, 1799, 1800, 1801, 1802, 1803, 1804, 1805, 1806, 1807, 1808, 1809, 1810, 1811, 1812, 1813, 1814, 1815, 1816, 1817, 1818, 1819, 1820, 1821, 1822, 1823, 1824, 1825, 1826, 1827, 1828, 1829, 1830, 1831, 1832, 1833, 1834, 1835, 1836, 1837, 1838, 1839, 1840, 1841, 1842, 1843, 1844, 1845, 1846, 1847, 1848, 1849, 1850, 1851, 1852, 1853, 1854, 1855, 1856, 1857, 1858, 1859, 1860, 1861, 1862, 1863, 1864, 1865, 1866, 1867, 1868, 1869, 1870, 1871, 1872, 1873, 1874, 1875, 1876, 1877, 1878, 1879, 1880, 1881, 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890, 1891, 1892, 1893, 1894, 1895, 1896, 1897, 1898, 1899, 1900, 1901, 1902, 1903, 1904, 1905, 1906, 1907, 1908, 1909, 1910, 1911, 1912, 1913, 1914, 1915, 1916, 1917, 1918, 1919, 1920, 1921, 1922, 1923, 1924, 1925, 1926, 1927, 1928, 1929, 1930, 1931, 1932, 1933, 1934, 1935, 1936, 1937, 1938, 1939, 1940, 1941, 1942, 1943, 1944, 1945, 1946, 1947, 1948, 1949, 1950, 1951, 1952, 1953, 1954, 1955, 1956, 1957, 1958, 1959, 1960, 1961, 1962, 1963, 1964, 1965, 1966, 1967, 1968, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 246

7. 6 Locality. - Jauli S.

stippled, limited by a broad white; on middle to front of posterior portion of body, dorsal portion of shell smooth, fine, slightly irregular and raised, showing the radial margin to be finely imbricate; dorsal sculpture of relatively widely spaced smaller concentric ribs, somewhat well-defined radially extending across the interspaces; the transverse ribs present on the middle, but irregularly developed, is situated behind the dorsal middle and the interspaces separating them relatively broad, toward the center of the shell the ribs retaining their width or slightly narrower, but the interspaces becoming narrower, as the space between is occupied by the radial spire, becoming narrower, typically the concentric ribs becoming abruptly at the radial bounding the excavation; hinge normal, the right anterior cardinal angle internal marginal articulation relatively coarse.

Dimensions.- Length, 31 mm.; alt., 10.0 mm.; width, 7 mm.

Color.- The coloration is yellowish white with a pale blue or greenish white. The ventrally situated anterior dorsal and posterior dorsal margins of the ventral margin is somewhat raised and on young shells is distinct, the color being more reddish brown white. There is also some variation in the coloration of the dorsal to light. One of two of the broad anterior dorsal and posteriorly enlarged. Occasionally the dorsal ribs are, sometimes

vated, but were destroyed in all the specimens examined. In
the young, the ventral surface of the shell is smooth and
of the shell is smooth and polished; the surface is much smoother
than in *C. pallidus*; the surface is smooth, the shell is thin, the
ballial sinus small and angular, the surface is smooth and polished.
Length of an average specimen 22.1, height 10.5, width 11.5 mm."

"The Doonan specimen was compared with others with the
recent *C. pallidus* by up, as above stated. Only a slight difference
needed to prove the identity." (Dall, 1907).

Type locality.— Doonan, Vancouver.

Shell medium size, well inflated, ovate-elongated; surface
sharply excavated anteriorly, posteriorly almost straight; um-
boes high and tall; lobe sharply defined, striated; cost-
al area broad, bounded by a well marked suture, slightly
of fifteen to twenty-two concentric ribs, all except the one at the
tip of the umbo thickened and inflated; along a radial line about
three-fourths of the distance from the exterior end, the ribs of
the ribs suddenly flared outward and becoming lower and thinner
and as such continued to the rim forming the umbilical rim; an-
teriorly the ribs becoming strongly curved and distant from the in-
closed line limiting the lobe, the edge of the ventral rib be-
ing, when perfect, gently reflected; ventral base of the ribs ob-
scurely or obviously annulate; between the ribs numerous

recent, however, were probably covered, and consequently the
position of the lower and middle ribs.

Diagnosis.— Length, 37.5 mm.; alt., 17.5 mm.; width, 1 mm.

Remarks.— O. halli is a variable form of the same
time is very variable, the and of the series of ribs are con-
vex and having higher lobes, a stronger posterior flange, more
excavated anterior margin and a more rounded and broader than
the other. Each anterior lobe is connected to the next by a
narrowly by lateral lobes. The number of ribs is rather variable
feature, but is not correlated with the others, either and pro-
ducts being relatively few or numerous ribs. The average number
of ribs is sixteen to eighteen. When the lateral lobes are wide,
a result of the reduction in the number of ribs, the number of the
are smaller in the lateral lobes, and the ribs are more
characterized. The ribs are very closely connected to the
down in Hall's figure.

This species is characterized by its rather numerous ribs
and the relatively wide anterior lobe over which the ribs are
lower and flatter. For further information in the original descrip-
tion, O. halli Dall (1), p. 10, fig. 1, 1907.

(1). Proc. U.S. Nat. Mus., 34, 1907, p. 10, fig. 1, 1907.

However, and in all of the other, and that the other at-
tached closer to the dorsal margin. The only other O. typicus

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1911 (7). - Lower Miocene: 1911 (7), 1911 (7), 1911 (7).

Superfamily: TELLINACEA.

Family: Tellinidae.

Genus: TELLINA (Linnaeus) Lamarck.

Subgenus: Arcobaria (Leach).

Section: Merisca Dall.

TELLINA (MERISCA?) ACROCOSMIA Dall.

Tellina (Merisca?) acrocosmia Dall, 1900, Trans. Amer. Inst. Sci., Philadelphia, vol. , pt. 3, pp. 1040-1041, pl. 46, fig. 10.

Description .- "Shell small, rounded, triangular, with nearly central inconspicuous beaks, and hardly pointed, slightly flexed, posterior end, the anterior end evenly rounded, base convexly arched; lunule obsolete; disk covered with a fine radial threading, more or less concealed by fine, elevated, concentric sharp lamellae; hinge normal, teeth large and strong for the size of the shell; pallial sinus large, nearly reaching the anterior adductor scar, largely confluent below; above rising above the level of the posterior adductor. Len. 7, alt. 3.5, diam. 5 mm."

"This very compact and slenderly sculptured little shell is very distinct from any of the other local or any American species." (Dall, 1900).

Type locality .- Bowden, Jamaica.

Remarks.- This species, which is one of the most abundant of the Tellinas, is immediately recognized by its sharp sculpture, sharper than in the average form of the section. The radial striae are fine, but relatively conspicuous and they finely and sharply crenulate the edge of the concentric lamellae, except when the lamellae are heavier than usual. The areas before and behind the umbo are flattened, especially on the left valve where the margins are compressed. The average shell is slightly more elongate than the one figured by Dall.

Occurrence.- Lower Miocene: Bowden beds, Borden, Jamaica (Dall, 1900).

TELLINA (MORISCA) SCILERA Dall.

Tellina (Morisca) scilera Dall, 1900, Trans. Warner Free Inst. Sci., Philadelphia, vol. 7, pt. 6, p. 1021; pt. 6, pl. 40, fig. 5.

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

"This little shell is not unlike T. accosmia Dall, but smaller and without the strong radial sculpture." (Dall, 1900).

Type locality.- Borden, Jamaica.

Remarks.- The largest of the valves of this species has the following dimensions:- length, 5.1 mm.; alt., 3.3 mm.; diam., 1.5 mm.

Occurrence.- Lower Miocene: Borden beds, Borden, Jamaica (Dall, 1900).

TELLITA (MERISSA) SOLERA var. *LEADERA* n. var.

Description.- Sac 1 small, moderately inequilateral, decidedly inflated; broadly rounded anteriorly, bluntly pointed below and flexed posteriorly; umbo tumid, low, broad, placed nearer the posterior end; external surface sculptured as in the typical sclera, but the concentric striae less conspicuous posteriorly; hinge normal, heavy.

Dimensions.- Length, 5 mm.; alt., 4 mm.; semidian., 2 mm.

Remarks.- The single left valve on which this variety is based stands in decided contrast to the other representatives of the species; it is decidedly more inflated, less inequilateral, less elongated, more pointed and more flexed posteriorly, with a broader umbo and heavier hinge.

Occurrence.- Lower Miocene: Bowden beds, Bowden, Jamaica.

TELLINA (MERISCA) ALBICOSTATA Say var. BORDENI B. var.

Tellina (Merisca) albicostata Bell, 1900, Trans. Warner Free
Inst. Sci., Philadelphia, vol. 2, pt. 5, p. 1020 (ex
parte, non Say).

Description.- Shell of medium size, thin, moderately elongated, inequilateral, slightly convex anteriorly, compressed and flexed posteriorly; antero-dorsal margin excavated near the umbo, rounding into the broadly rounded anterior end; postero-dorsal margin straight, meeting the subtruncate margin of the narrow posterior slope at a sharp angle of about 110° ; base asymmetrically arcuate, being more convex posteriorly; umbo acute, placed behind the median horizontal; posterior carina low, but well-defined by the change in direction of the concentric sculpture, placed near the margin; surface sculpture with relatively fine concentric lamellae, abruptly flexed at the posterior carina and slightly arched on the posterior slope; right valve with well-defined laterals.

Dimensions.- Length, 1.5 mm.; alt., 1.2 mm.; semidiag., .5 mm.

Remarks.- The collections at hand have furnished a single right valve of this variety, which differs from the typical albicostata, ranging from the Miocene to the Recent, by being more elongated, more inequilateral, more produced and higher

anteriorly, with inner sculpture, heavier about posterior vertical and more distinct lateral. Presence of its relatively large size, height and strong posterior flexure is in itself distinguished from the associated retinas.

Occurrence. - Lower Miocene: Borden beds, Borden, Jamaica (Dall, 1900).

Section Phylloids. Dall.

TELLINA (PHYLLODINA) HALISTREATA Dall.

Tellina (Phylloдина) halistreata Dall, 1900, Trans. Amer. Mus. Nat. Hist., Philadelphia, vol. 5, pt. 3, p. 1027, pl. 47, fig. 17.

Description.- "Shell obovoid, flattish, subequilateral, lower than high; beaks small, low, resembling a point on the summit of the broad smooth apical shell; surface marked anteriorly with rather close, low, elevated, concentric threads with about equal interspaces; near the posterior third of the disk these threads become less numerous by the cessation of alternate threads, making the interspaces wider, while the intermittent threads become lamellose; in the young, which is a young shell, the dorsal margin is not coronate, but in an adult there are probably dorsal scales corresponding to the later lamellae; hinge normal for the section, pallial line obscure. Lon. 3, alt. 5.6, diam. 1.2 mm."

"Although this specimen is young, it is sufficiently characteristic and distinct to be recognized, though the shell varies in size twice or thrice the size of the one described." (Dall, 1900).

Type locality.-- Bowden, Jamaica.

Remarks.-- This species has not appeared in the collections at hand. It is hardly typical of the section since the sculpture does not rise above the dorsal area in a condition which may, as suggested above, be due to immaturity.

Occurrence.-- Lower Miocene: Bowden beds, Bowden, Jamaica (Dall, 1930).

Umbilina (Pseudumbilina) umbilicaria n. sp.

Telling (Eurytellina) ~~Co. Dall, 1901, Trans. Amer. Mus. Nat. Hist.~~
~~Sci., Philadelphia, vol. 2, pt. 5, p. 1024.~~ (but)

Description.— Shell of median size, laterally inequilateral, moderately inflated; rounded anteriorly; posterior end obliquely sub-truncated above, base gently arcuate; dorsal margin almost straight diverging at an angle of about 140° , the anterior longer; umbo low, acute, situated before the median horizontal; surface, except near the umbo, sculptured with relatively conspicuous, evenly spaced concentric striae, becoming coarser posteriorly by the termination of some of the striae, the remainder becoming more lamellose; left valve with strong cardinals and obscure laterals; right laterals strong; pallial sinus obscure.

Dimensions.— Length, 18 mm.; alt., 11 mm.; height, 8.5 mm.

Remarks.— This species is represented by a right and left valve. On the right valve the sculpture becomes more conspicuous and coarser posteriorly. The sculpture is not typical of the section since it is finer than usual and the lamellae do not arise above the dorsal margin as crests. The present form differs from *umbilicaria* by being more convex, with finer sculpture.

Occurrence.— Lower Miocene: Bowden beds, Borden, Jamaica.

Section *Eurytellina* Fischer.

Tellina (*Eurytellina*) sp. indet.

Tellina (*Eurytellina*) sp. Dall, 1900, Trans. Amer. Mus. Nat. Hist.
Sci., Philadelphia, vol. 5, pt. 5, p. 104.

Fragments of a small *Tellina*, apparently referable to this section, are present in the National Museum collection and also in the collections at hand. The shell is moderately convex and moderately inequilateral; the postero-lorsal margin excavate; the sculpture consisting of fine, relatively distant, regular concentric striae that become slightly lamellose posteriorly.

Occurrence.— Lower Miocene: Bowden beds, Bowden, Jamaica (Dall, 1900).

Subgenus *Hoerella* Fischer.

TELLINA (*HOERELLA*) *SIMPSONI* Dall.

Tellina (*Hoerella*) *simpsoni* Dall, 1900, Trans. Warner Nat. Inst. Sci., Philadelphia, vol. 7, pt. 5, p. 1024, pl. 46, fig. 15.

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

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

Type locality.- Borden, Jamaica.

Remarks.- *T. simpsoni* is distinguished by its decidedly inequilateral outline, convexity and slight posterior constriction. The surface may be sculptured with fine concentric striae.

Gabb's (1) Santo Dominican E. connecta 'Orbigny' is more like that

(1). Trans. Am. Philos. Soc., New Ser., vol. 14, . 349, 1873.

recent species than simsoni, being less convex than the Bowden form, more evenly rounded posteriorly, without the posterior constriction and with rather regular, fine concentric striae.

Occurrence.- Lower Miocene: Bowden bells, Bowden, Jamaica (Dall, 1900).

TELLINA (MOERELLA) HENDERSONI Dall.

Tellina (Moerella) hendersoni Dall, 1900, Trans. Wether. Free Inst. Sci., Philadelphia, vol. 7, pt. 3, pp. 1024-1025, pl. 46, fig. 5.

Description.-- "Shell small, moderately convex, very inequilateral; from resembling the preceding species T. simpsoni but less inflated, more regular, with posterior end not constricted or markedly flexed; surface polished, with, except near the beaks, fine, rather distant, concentric threads, which on the basal half of the posterior end rise into extremely delicate low lamellae; hinge normal, strong; pallial sinus connecting the adductor scars and confluent below; there is a slightly impressed narrow lunule. Lon. 7.5, alt. 4, diam. 3 mm."

"This species differs in sculpture, form of the pallial sinus, and other details from the other allied forms." (Dall, 1900).

Type locality.-- Borden, Jamaica.

Remarks.-- T. hendersoni agrees with T. simpsoni the distinction of being the most abundant member of the genus. It closely resembles T. simpsoni, the most obvious difference being the absence of a posterior constriction on the present form. Separated on this basis, hendersoni is larger than simpsoni, one of the largest valves of the former reaching 7.5 mm. in length,

5 mm. in altitude and 7 mm. in diameter, whereas the longest valve of the latter has these dimensions: length 8.5 mm.; alt., 5 mm.; diam., 8 mm. Although the former Hendersoni is less inflated than simsoni, some valves are equally inflated. T. apertus all (1) from the Shipola marl, is smaller, less inflated, and

(1). Loc. cit., p. 195, pl. 46, fig. 18, 19 C.

more elongated.

Occurrence.— Lower Miocene: Borden beds, Borden, Kansas
(Dall, 1900).

Sub genus Anulus variegatus.

Section Anulus s. s.

PHILINA (1831) PHILINA Dall.

Philina (Anulus) placida Dall, 1890, Trans. Amer. Mus. Nat. Hist.
Sci., Philadelphia, vol. 2, pt. 2, p. 1125, pl. 46,
fig. 7.

Description.-- "Shell small, globose, very inequilateral,
moderately convex; anterior end produced, rounded; posterior end
short, roundly pointed, with a slight flexure; base in the post-
erior third; surface covered with extremely fine close-set grooves;
sculpture as usual a little stronger near the posterior end; beak
low, pointed; lunule obsolete; hinge normal, pallial sinus ob-
scure in the hollow of the interior but probably normal; no
thickened edge. Lon. 5.5, alt. 3, diam. 1.5 mm."

"This small form recalls P. cyathifera Dall (1) but it

(1). Bull. Mus. Comp. Zool., Harvard, vol. 2, p. 100, pl. 181;
vol. 18, p. 277, pl. 5, fig. 11, 1886.

which is a larger, more solid and more globose shell. It may
be fully adult, but is not so young as any of the other

species which were obtained from the Bowden Marl at the same time." (Dall, 1900).

Type locality.-- Bowden, Jamaica.

Remarks.-- This species is distinguished by its low, elongate outline and relatively sharp posterior carina, the shell being slightly depressed in front of the carina. The largest of the few valves at hand is larger than the type, with the following dimensions: length, 3 mm.; alt., 4 mm.; diam., 1.5 mm. A closely related species, T. parva Dall (1), is found in the Oak Grove

(1). loc. cit., p. 1027, pl. 46, fig. 11, 1900.

beds; it is slightly larger, more inflated anteriorly and with more prominent sculpture. The Pliocene T. umbra Dall (2) reaches

(2). loc. cit., p. 1033, pl. 46, fig. 12, 1900.

a larger size and is slightly less inflated; otherwise it is very similar to pharusa.

Occurrence.-- Lower Pliocene: Bowden beds, Bowden, Jamaica (Dall, 1900).

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SPINOSA (A. 1813) SPINOSA A. sp.

Description.-- Shell small, elongate, unilocally inflated, decidedly inequilateral; anterior end broadly rounded, posterior end abruptly rounded below; ante o-ccipital margin low, slightly convex, sloping gently; posteriorly the slope is steeper, base descending toward the anterior end; umbilicus situated at about the posterior third; posterior carina scarcely differentiated from the general convexity of the shell, the posterior slope rounded; external sculpture of fine concentric striae, becoming slightly coarser posteriorly; axial striae obscure.

Dimensions.-- Length, 7.5 mm.; alt., 4.5 mm.; width, 1.7 mm.

Remarks.-- This species is represented by a single left valve. It appears to find its place in the section *Spinosa* A. sp. near *Spinosa*. From that species it differs by being steeper, more convex, more produced posteriorly, with a less pronounced posterior carina and without the depressed area in front of the carina.

Occurrence.-- Lower Miocene: 9 when beds, rounded, James.

TRITIA (ANOMIA) PHARCIANA n. sp.

Description.- Shell small, elongate, well-inflated, decidedly inequilateral; broadly rounded anteriorly, bluntly produced below posteriorly; antero-dorsal margin low, straight, postero-dorsal margin slightly excavate along the length of the ligament, the remainder convex, rounding abruptly below into the slightly arcuate base; umbones low, placed at about the posterior third; posterior carina poorly defined, the area in front of it slightly depressed, causing the basal margin to be obscurely emarginate; external surface sculpture with fine, regular, conspicuous concentric striae, becoming slightly lamellar on the posterior depressed area; hinge dorsal, the right posterior lateral very weak; pallial sinus obscure.

Dimensions.- Length, 6 mm.; alt., 4 mm.; diam., 1.8 mm.

Remarks.- T. anomia is described from two right valves.

The most characteristic feature is the fine, regular well-developed sculpture. Aside from the greater prominence of the sculpture, anomia is distinguished from pharcida by its greater inflation and greater height and from conida by its less rounded anterior end, steeper antero-dorsal margin, more pronounced posterior carina and accompanying depression of the shell anteriorly and accompanying depression of the shell posteriorly and indentation

of the margin.

Occurrence.- Lower Miocene: Golden bells, Jordan, Jamaica.

VALVINA (ARCHIVAL) N. n. n.

Description.- Shell small, thin, elongated, moderately inequilateral, moderately convex; rounded anteriorly, posteriorly almost vertically subtruncated below; antero-dorsal ear in line, straight; postero-dorsal ear in slightly excavated near the umbo, joining the subtruncated posterior end at a subrounded angle of about 110°; umbo acute, placed behind the median horizontal; posterior earina poorly defined, rounded; surface smooth, or bearing a few distant concentric striae; hinge of the left valve normal, the cardinalia weak; right valve not known; pallial sinus obscure.

Dimensions.- Length, 4.5 mm.; alt., 2.5 mm.; semi-diam., 1.8 mm.

Remarks.- *V. browni* is represented by two left valves, the type being slightly smaller. It is distinguished from the young of the coexistent *Archival* by the position of the earina, subtruncated posterior end, slightly excavated posterior dorsal margin and poorly defined posterior earina.

This species is named for Mr. J. P. Brown, a member of the early Jamaican Survey.

Occurrence.- Lower Miocene: Borden beds, Borden, Jamaica.

ELLINGIA (A. S. S. S.) PRESSA Dall.

Ellingia (A. S. S. S.) Pressa Dall, 1900, Trans. Amer. Mus. Nat. Hist.

Sci., Philadelphia, vol. 5, pt. 5, p. 1093, pl. 17,
fig. 3.

Description.- "Shell thin, compressed, inequilateral; beak low, hardly interrupting the dorsal profile, but sharp and almost pustular; ligament rather low, hinge delicate but normal; surface polished, with rather distinct, fine concentric impressed lines; the posterior dorsal slope with a large, sharp, little elevated concentric line; near the beaks the shell is smooth; interior with a faint anterior elevated ray which separates the adductor scar from the anterior part of the long, high pallial sinus, which is wholly confluent below; the interior more or less obscurely radially striate. Lon. 12.5, alt. 7.5, diam. 8 mm."

"A thin and delicate species with no observable flange or ridge on the posterior end, and whose especial characteristic is the high dorsal profile behind the beaks." (Dall, 1900).

Type locality.- Chipola River, Jackson County, Florida.

Remarks.- On the valves at least the shell is slightly raised on the dorsal half of the radial line near the posterior end and along which a carina is usually developed. When the shell

is especially thin, and therefore translucent, so that radial striations are visible throughout.

Occurrence.— Upocr Oligocene: Chipola Marl, Florida (Dall, 1901); Lower Miocene: London beds, London, Jamaica (Dall, 1900).

Section Scissula Dall.

TRITIA (SCISSULA) SCISSULA Dall.

Tellina (Scissula) Scissula Dall, 1900, Trans. Amer. Mus. Nat. Hist.
Sci., Philadelphia, vol. 5, pt. 3, p. 132, pl. 47,
fig. 15.

Description.-- "Shell small, thin, elongate-ovate, polished,
imbricated; rounded in front, moderately pointed behind;
beaks low; surface with fine, regular, rather close, striae or-
tenting obliquely backward towards the base, with more or less
evident microscopic radial striulation; posterior dorsal area
minutely concentrically waved; interior with no distinct ridge;
hinge normal, very delicate; pallial sinus long, high, normal.
Ion. 0, alt. 4.2, diam. 1.5 mm."

"From the point of L. iris Say (1) Reprint of the same size

(1). Jour. Acad. Nat. Sci., Philadelphia, vol. 6, p. 1, 1851.

it is at once distinguished by the much thinner and closer and
more oblique striation and the more pointed posterior end."

(Dall, 1900).

Locality.-- "Cape Cod, Massachusetts."

Remarks.-- The posterior carina is well-defined, but low.

Since this species is the only member of the section it is
convenient for the collection of the same, as it is, however,
the only one.

Occurrence.- Upper Miocene: Santo Domingo (Dall, 1900);
Lower Miocene: San Juan, New Mexico (Dall,
1900).

Genus of Iridaea Burton.

STRIGILLA STRIGOSA (Linnaeus).

Uvula strigosa Linnaeus, 1758, Faun. Suec., pt. 12, p. 677.

Cardium strigosa Montagu, 1805, Zool. Brit., p. 21.

Uvula strigosa Linnaeus, 1758, Faun. Suec., pt. 12, p. 677, pl. 51, fig. 33.

Strigilla strigosa (Linnaeus) Dall, 1877, Zool. Bull. Philad. Soc. nat. hist., vol. 17, p. 222.

Strigilla strigosa (Linnaeus) Dall, 1877, Zool. Bull. Philad. Soc. nat. hist., vol. 17, p. 222.

Strigilla strigosa (Linnaeus) Dall, 1877, Trans. Amer. Mus. Nat. Hist., Philadelphia, vol. 2, pt. 3, pp. 1072-1073.

Strigilla strigosa (Linnaeus) Dall and Gibson, 1901, Bull. U. S. Fish Comm., vol. 20, pt. 1, p. 132.

Description.- Shell small, short-ovate, strongly inflexed, inequilateral; broadly rounded anteriorly, more attenuated, but rounded posteriorly; ant. ro-stral sur in short, straight or slightly concave, passing abruptly into the dorsal sur in, ant. ro-stral longer, straight or slightly convex, rounded and broadly into the posterior end; umbones small, broad, erect, placed nearer the anterior end; area before and behind the umbo

feebly impressed; external surface is lower with divaricollis
 stria, passing obliquely over the lower part of the shell,
 gently flexed upward near a parallel line in the posterior third,
 behind which the striae are finer and more closely spaced once
 or twice, forming a zigzag sculpture; five ribs, posterior and
 anterior lateral in each valve, two right cardinals, the posterior
 larger and obscurely bifid, two left cardinals, the anterior
 small and scarcely differentiated from the margin.

Dimensions.-- Length, 7.5 mm.; alt., 0.5 mm.; semilam., 2.5
 mm.

Remarks.-- The characteristically sculptured valves of this
 species are numerous and can not be confused with any other mem-
 ber of the genus, the divaricollis, the only other divaricately
 sculptured form, having an orbicular outline and the sculpture
 of shell over the entire dist. The largest valve has the
 following dimensions: length, 0.5 mm.; alt., 0.5 mm.; diam.,
 2.7 mm. The sharp change in sculpture is totally crossed on a
 line along which, in some specimens, a slight plicose is developed.
 The posterior sculpture is variable, being closely imbricate,
 once or twice, or merely passing to the margin of the submargin.
 Young valves are more orbicular than adults.

Dall (1) refers to that species reported as divaricollis by

(1). loc. cit., Trans. Amer. Mus. Nat. Hist., 1900.

den, but Guppy's 1874 blue-list (1) gives the species from

(1). Geol. Mag. Occis., vol. 1, p. 441.

the Pliocene of Trinidad.

Occurrence.-- Upper Oligocene: Santo Domingo (Gamb, 1875);
Lower Miocene: Bowden beds, Bowden, Jamaica (Dall, 1900).
Pliocene: Trinidad (? Guppy, 1874; Dall, 1900); Pleistocene:
Antille region (Dall, 1900). Recent: From Hatteras south-
ward throughout the West Indies to Guadeloupe.

Genus *MACOMA* Leach.

Subgenus *Psammacoma* Dall.

Section *Psammacoma* n. s.

MACOMA (*PSAMMACOMA*) *TRACTA* Dall.

Macoma (*Psammacoma*) *tracta* Dall, 1900, Trans. Amer. Mus. Nat. Hist., Philadelphia, vol. 7, pt. 5, p. 157, pl. 47, fig. 13.

Description.— "Shell small, thin, rather compressed, elongate, inequilateral, the anterior end longer; beaks low, not conspicuous; posterior end slightly flexed to the right; anterior end higher, rounded, posterior attenuated, bluntly terminated; surface smooth except for faint incremental lines; interior (inaccessible in the specimens). Lon. 12.7, alt. , diam. 3.5."

"This small species differs from the young of the next [*M. olivella* Dall] in its more attenuated posterior end and slight flexure." (Dall, 1900).

Type locality.— Bowden, Jamaica.

Remarks.— A single large left valve is present; it has the following dimensions: length, 12 mm., alt., 10 mm.; diam. 3.5 mm. The surface of the shell is not perceptibly pitted posteriorly. As in the case of the *Psammacoma* section the interior is not accessible. The discovery of the large

gives lappet about the same dimensions as the coarctatus lappet, but they are distinguished by the lower bottle, more attenuated posteriorly, longer and steeper posteriorly and tracata.

Occurrence.-- Lower Miocene: Florida (Dall, 1900). Lower Miocene: London (Dall, 1900). Lower Miocene: London (Dall, 1900).

USCIA (PSAMACOMA) MIV. CA. 11.

uscia (Psamaco-) olivella Call, 1901, Trans. Amer. Free Ent. Sci., Phila. Acad., vol. 5, pt. 3, p. 190, pl. 7, fig. 2.

Description.-- "Shell large, solid, not polished, rather rather dull, conspicuous, olive, very inequilateral; anterior dorsal edge rectilinear, anterior end rounded; posterior dorsal edge slightly concave, posterior end even, rounded, bluntly truncally; and subtruncate at its junction with the dorsal line; on elevated low low of a platform, moderately irregular, not very definitely limited, low, smooth; surface smooth, except for lines of growth and on the ridge bounding the lunule, which is slightly indented, especially near the beak; hinge normal, teeth rather small, ballist sinus gibbous, small, with the below. Lon. 7, alt. 13, diam. 5 mm."

"This species resembles M. (Psamaco-) clavata (1) of the recent Psamaco forms." (Call, 1900).

(1).

Locality.-- Borden, Jamaica.

Remarks.-- This species is not represented in the material at hand.

Occurrence. - Lower Miocene: 20 feet below London, Jamaica
(Dall, 1930).

Subgenus *Syntrocha* Dall.

MASSACHUSETTS (SYNTROCHA) VANDREYI Dall.

Massachus (Syntrocha) vandreyi Dall, 1900, Trans. Amer. Mus. Nat. Hist., Philadelph., vol. 7, pt. 1, p. 100, pl. 48, fig. 5.

Description.-- "Shell minute, thin, biconvex, moderate, inequivalve, inequilateral, apical basin, moderately inflated, anterior end full, rounded, shorter; posterior end lower, rectilinear above, sinuous below, produced into an obliquely truncated rostrum; beak low, protractile, left valve slightly less convex than the right and a little longer, surface concentrically irregularly undulated except on the posterior dorsal area, which is transversely striated; pallial sinus small, short, slightly confluent below with the pallial line. Lon. 7, alt. 4, diam. 3 mm.

"This species is considerably smaller than the recent *M. orientalis* (Dall & Hillebrand), the concentric wave-like sculpture

(1). Proc. U. S. Nat. Mus., vol. 12, p. 73, pl. 10, fig. 1, 1889.

is finer and less pronounced, and the shell is relatively more inflated. The teeth are quite feeble and minute." (Dall, 1900).

Type locality.-- Borden, Jamaica.

Remarks.-- This species, the earliest member of the subgenus, is represented by several valves, of which the largest is slightly larger than the type. The rostrum is situated behind the median horizontal, so that the anterior end is lower. From the other specimens this species is at once distinguished by its decidedly flexed posterior end and an relatively coarse, irregular concentric sculpture.

Occurrence.-- Lower Miocene: Borden, Borden, Jamaica.
(Dall, 1900).

Family: Scaphiropoda.

Genus: SEMEL. Schumacher.

Section: Semel s. s.

SEMEL MULTICOSTATUS n. sp.

Description.— Shell small, subelliptical, moderately inequilateral, moderately inflated; rounded anteriorly and posteriorly, the curve of the anterior end more convex; antero-dorsal margin straight or slightly concave, postero-dorsal shorter and slightly convex; base ventrally arcuate; umbones low, acute, situated behind the median vertical; external surface reticulated; sculptured with strong, equally spaced concentric lamellae, their edges thickened and crenulated at the points of intersection with prominent radial, the radial separated by slightly wider interspaces and closer on the median portion of the shell; near the antero- and postero-ventral margins conspicuous nodules developed at the intersections; between the concentric lamellae fine concentric striae present; hinge dorsal, the blunt laterals heavy.

Dimensions.— Length, 3 mm.; alt., 0.5 mm.; semilength, 1.5 mm.

Remarks.— The small, beautifully sculptured valves of this species can not be confused with any other member of the genus. They closely resemble the valves of the species to which it is nearest.

bellistriata (G. S. S.) (1), but are more inflated, more granular.

(1). Jour. Acad. Nat. Sci., Philadelphia, Vol. 7, p. 558, pl. 20, fig. 1, 1847 (as Amphileta bellistriata) = Amphi-
lepta cancellata d'Orbigny, 1847.

rounded anteriorly and posteriorly, with, on the whole, fewer and broader striae.

Occurrence.-- Lower Miocene: Bracken beds, Bracken, Jamaica.

Genus ABIA (Lac.) Lamarck.

ABIA LIMBUTANA Dall.

Lord trill plate Dall, 1903, Trans. Warner Free Inst. Sci.,
Philadelphia, vol. 7, pt. 1, p. 307, pl. 20, fig. 1.

Description.-- "Shell small, thin, polished, subtriangular,
nearly equilateral, wider than high, moderately inflated; beak
pointed, not much elevated, the dorsal margin straight, diverg-
ing at the umbo in an angle of somewhat over ninety degrees;
base arcuate; anterior end slightly longer, rounder; posterior
end shorter, more pointed; exterior polished; anterior small
margin in the right valve with a lateral tooth at some distance
from the hinge-plate; on the posterior margin is a short fold
not elevated to become a tooth; the left valve shows no teeth.
Alt. 5.5, lat. 6.85, diam. 1.0 mm."

"This species is not unlike A. lioia Dall (1) of the recent

(1). Bull. Mus. Zool. Zool., Harvard, vol. 1, p. 100, pl. 1,
(as Syndosmya lioia); vol. 14, p. 27, pl. 1, fig. 1, 1900.

forma, but quite more oval; triangular outline and with the ante-
rior part less produced." (Dall, 1900).

Type locality.-- London, Jamaica.

Remarks.- Several valves of this species are + 1000, the largest being 1.5" rather than the 1.0". The shell, triangular outline and relatively strong inflation are the distinguishing features. Toward the apex in faint suggestions of radial sculpture are occasionally visible; they do not, however, rise above the general surface of the shell.

Occurrence.- Lower Miocene: Bowden 601, Bowden, Ischia (Dall, 1900).

Atrina dentata n. sp.

Description.-- Shell small, thin, ell-inflated, subtriangular, subunilateral, being slightly more rounded anteriorly; dorsal margin virtually straight, the anterior half lower; rounded anteriorly and posteriorly with a very slight constriction near the posterior end; base ventral, arcuate; umbonal, low, subcentral in position; external surface sculptured with very fine, regularly spaced concentric striae, occasionally emphasized into sharp, thin lamellae, and fine, more obscure, widely spaced radial markings; right valve with a narrow resilifer groove, the cardinals and laterals relatively strong.

Dimensions.-- Lat., 4 mm.; alt., 5.5 mm.; umbonal, 1.8 mm.

Remarks.-- *A. dentata* is known from two right valves. It is distinguished from the young of *A. triangulata* by its low, more inflated, greater inflation and the presence of well-defined sculpture. When the shell is translucent the radial striae are very obscure.

Occurrence.-- Lower Miocene: Golden Gate, Golden Gate, California.

Family Donaxidae.

Genus Donax (Linnaeus) Lamarck.

Donax dentatus n. sp.

Donax dentatus Dall, 1900, Trans. Amer. Microsc. Soc., Phila-
delphia, vol. 1, p. 3, pl. 96, (ex parte, non sub,
1875).

Description.- Shell small, thin, subtranslucent, somewhat
inflated, moderately inequilateral; antero-lateral margin low,
straight, the anterior end blunt; postero-lateral margin slightly
convex, the posterior end rounded and slightly rounded below;
base slightly arcuate; posterior surface smooth, polished, the
posterior slope almost flattened; the surface, except near the
umbo, bearing distinct, fine radial striae, straight in relief
only on worn surfaces; left valve with weak laterals, received
into well-marked sockets on the right valve; inner ventral mar-
gin of the valve with fine serrations, extending over a short
distance on the posterior margin; pallial line obscure.

Dimensions.- Length, 5 mm.; alt., 2 mm.; width, 1 mm.

Remarks.- A fragmentary valve is slightly larger than
the type. The radial markings are distinct, but do not consti-
tute striations except where the surface is smooth. This species

has been confused with D. *carolinensis* Webb (1), described from

(1). Trans. A. Philos. Soc., new ser., vol. 17, p. 10, 1877.

Santo Domingo, but that species is larger, the diameter 1, with a short and less steep antero-posterior margin, more bluntly rounded anterior end, straighter postero-dorsal margin and more slender. The Costa Rican species D. *moenensis* Webb (2)

(2). Jour. Acad. Nat. Sci., Philadelphia, 2d ser., vol. 4, p. 571, pl. 47, fig. 72, 1881.

is smaller, more elongate, with more rounded posterior end and more convex postero-dorsal margin.

The name is given for Mr. Arthur Lenoir, member of the early Jamaican survey.

Occurrence.— Lower Miocene: Jordan belt, Jordan, Jamaica.

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DORVILLEA n. sp.

Description.— Shell small, elongate subelliptical, moderately inequilateral, moderately inflated; rounded anteriorly and posteriorly, the anterior end more attenuated; umbonal, slightly subtriangular, situated behind the median vertical; external sculpture of fine, regular, impressed concentric striae, becoming crowded toward the apex, with prominent radial ribs on the posterior end, the radials becoming weaker over the middle of the shell and obsolete anteriorly; left valve with a prominent pseudocardiac resiliary groove, followed, posteriorly, by the cardinals, the posterior small, depressed, its axis almost at right angles to that of the anterior; right valve with two cardinals; on both valves the hinge date anterior, the laterals relatively distant and strong; inner margin of the anterior end of the shell weakly crenulate; pallial sinus moderately deep, rounded.

Dimensions.— Length, 3 mm.; alt., 1.5 mm.; width, 1.5 mm.

Remarks.— Several valves of this beautifully sculptured species are at hand. It has a more modern aspect than the group to which lemonii belongs and can not be confused with that species. The posterior radials are subangular, separated by narrower interspaces and modified by the overlying concentric sculpture.

Occurrence.— Lower Miocene: Brown's Bluffs, Denver, Colorado.

Superfamily: SOLECOLEPTOIDEA.

Family: Solenidae.

Genus PSAMMOSELEN Hillebrand.

PSAMMOSELEN JUMINIANUS (Dunker).

Nacha juminiana Dunker, 1881, Proc. Zool. Soc. London, for 1881, p. 445.

Tarelus lineatus Cobb, 1881, Jour. Acad. Nat. Sci., Philadelphia, 2nd ser., vol. 3, p. 570, pl. 47, fig. 71.

Nectra multilinea Fall, 1893, Trans. Amer. Ent. Soc., Philadelphia, vol. 3, pt. 1, pl. 10, fig. 15.

Psammosolen vicksburgensis Dall, 1900, idem, pt. 5, p. 900 (ex parte, non Aldrich, 1885).

Psammosolen juminianus Dunker, Dall, 1900, idem, p. 901.

Solecortus juminianus (Dunker) Böke, 1906, Vol. Soc. Geo. Mexico, no. 22, p. 42, pl. 11, fig. 7.

? Solecortus californicus Coula, 1908, Jour. N. A. Acad. Sci., San Francisco, vol. 13, p. 752, pl. 20, fig. 12.

Description.— "Testa ovali, sublonga, convexa, angusta, que rotundata, alba, et his incrementis concentricis lineamentis obliquis elevatis subtilioribus instructa, aperturam ovalem, decidua, submellonem indurata; umbones 2 vili, ante-membris, corosis; basis dorso subparallela. Lon. 41, lat. 17, alt. 11

mm." (Dunker, 1881).

Type locality. - Antilles.

Shell large, thin, clove-colored, decidedly more lateral, well-inflated, with a deep, shallow, broad depression; rounded anteriorly and posteriorly, the curve broader posteriorly; dorsal and ventral margins subparallel; antero-dorsal margin shorter and with a slightly steeper slope; ventral margin slightly emarginated medially by the depression; umbones low, displaced about the anterior third of the length; anterior and posterior carina broad, rounded, not differentiated from the general convexity of the shell; surface sculptured with irregularly disposed incrementals, occasionally emphasised and fine, relatively closely spaced oblique striations, beginning on the anterior carina, flexed upward over the posterior carina and continuing across the posterior slope, but more obscure; hinge normal; anterior muscle scar high, the posterior lower and larger; pallial sinus extending to a line beyond theumbo, barely confluent below with the pallial line.

Dimensions. - Length, 43 mm.; alt., (umbonal) 19.5 mm.; semi-infl., 1.5 mm.

Remarks. - In the whole the Antilles resembles the Pliocene and recent Antilles, although none of the specimens at hand are so large as those found at later horizons. The close similarity of the Antilles to the Antilles is

posteriorly and with less conspicuous sculpture. E. aspei resembles more closely the Duplin E. lateralis (1) and the recent E. concentrica-Gemm (2), both of which are slightly more ine-

(1). Idem, p. 914, pl. 55, fig. 20.

(2). Proc. Boston Soc. Nat. Hist., vol. 6, p. 280, 1862; Bell, and Simpson, Bull. U. S. Fish Comm., vol. 20, pt. 1, p. 474, pl. 58, fig. 12.

lateral and more compressed. The Eocene E. polita Bell (3) is slightly larger, more inequilateral, more compressed, with

(3). loc. cit., p. 915, pl. 55, fig. 17, 1862.

feeble sculpture.

The name is given in memory of William Ware Cobb, whose Santo Domingo memoir is a classic in the zoological literature of the West Indies.

Occurrence.-- Lower Eocene: Rothenboms, Borden, Jamaica.

Superfamily *Corbuloidea*.

Family Corbulidae.

Genus *Corbula* (Pruvotière) Janssen.

Section *Aloidiis* Janssen.

CORBULA (ALOIDIS) *EXCISE* Guppy.

Corbula vieta Guppy, 1876, Quart. Jour. Geol. Soc. London, vol. 22, p. 480, pl. 26, fig. 8 (right valve); n. 187, pl. 26, fig. 8, (left valve, as Erycina tenax^{Guppy} ex parte.

Corbula disparilis Gabb, 1877, Trans. Am. Philos. Soc., new ser., vol. 13, p. 247, (non d'Orbigny, 1857); Erycina tenax^{Guppy}, idem, p. 252.

Corbula vieta Guppy, 1874, Geol. Trans., decade 2, vol. 1, p. 141, (check list); Erycina tenax^{Guppy}, idem, p. 142 (ex parte).

Corbula vieta Guppy, 1874, Quart. Jour. Geol. Soc. London, vol. 32, p. 570; Erycina tenax^{Guppy}, idem, p. 571.

? Corbula disparilis Gabb, 1881, Jour. Acad. Nat. Sci., Philadelphia,^{2nd ser.} vol. 3, pp. 745, 771.

Corbula disparilis Guppy and Gabb, 1884, Proc. U. S. Nat. Mus., vol. 19, p. 727 (non d'Orbigny, 1857).

Corbula (*Aloidiis*) heterorhiza (Guppy Mss.), Gabb, 1880, Trans. Warner Tree Inst. Sci., Philadelphia, vol. 3, pt. 1, p. 350, pl. 16, fig. 15.

Corbula heterocoma (Gray), Brown and Pilobry, 1911, Proc. Acad.
Nat. Sci., Phila. 1911, vol. 63, p. 571.

Description.— "This form is very close to C. vista, but
differs from it in having the beaks narrower, less elevated, and
less prominent, and the posterior part of the shell more pro-
duced. Lon. 9.5, alt. , diam. 5 mm." (Hall, 1899).

Type locality.— Bowden, Jamaica.

Right valve of medium size, high, decidedly inflated, sub-
equilateral to moderately inequilateral, slightly more produced
posteriorly; dorsal margins subequal, both concave, rounded anter-
iorly below, posteriorly truncate below, base gently concave;
umbones tumid, high, strongly incurved and moderately to decid-
edly produced, subcentral in position; near the posterior margin
an obscure carina present, followed anteriorly by a stronger,
broadly rounded carina, the area between the two flattened or
slightly depressed; surface sculptured with concentric ridges of
medium width; left valve small, elongate subovate, well-inflated,
moderately inequilateral; rounded anteriorly, truncated poster-
iorly; antero-dorsal margin slightly concave, postero-dorsal
slightly longer and straight; umbones tumid, moderately high,
placed before the median vertical; posterior margin low, oblique;
sculpture of obscure, fine concentric ridges, strengthened over each
or all of the surface and about ten to twelve very narrow radi-
als, the posterior closed without radial sculpture; the ventral

of the ligament pit decidedly thickened and posteriorly forming a projecting process.

Dimensions.-- A right valve: length, 3 mm.; alt., 2 mm.; diam., 3 mm. A left valve: length, 5.5 mm.; alt., 1 mm.; diam. 2 mm.

Remarks.-- Right valves of O. heterogona are very abundant, but, curiously enough, left valves are much less numerous. The two can not be confused with the other borbules, the right valves being recognized by its high, narrow outline and the left by its more elongate outline and radial sculpture. Right valves display an inconstant outline, some being more produced posteriorly; the largest has the following dimensions: length, 4.5 mm.; alt., 7.5 mm.; diam., 4.5 mm. The average valve is higher and narrower than the one figured by Leff. Both sets of sculpture on the left valve are usually obscure. An interesting feature is the localized thickening of the hinge-margin on the left valve behind and under the ligament pit.

The type of O. vieta is from the Miocene of Manzaniella, Trinidad, but Cuvier also reported it from the "Upper Miocene, Jamaica", confusing it with the present species. In the 1900 notice of Antillean fossils Hall apparently consolidated both vieta and the Jordan form with the recent O. disparilis d'Arbigny (1),

(1). In de la Barra, Hist., nat., polit. et nat., de l'île de Cuba, Mollusques, vol. 2, p. 247, pl. 27, figs. 1-4, 1853. (French ed).

although the "Oligocene of Jamaica" is the only horizon and locality given. Later in the same paper the three forms are differentiated. The Santo Domingo form under the name disparilis apparently cannot be distinguished from the Bowden species. Gabb's Costa Rican Miocene specimens of disparilis (1) are poor but closely resemble heterotoma. None of

(1). loc. cit., p. 747, 1881.

the Costa Rican Miocene disparilis (2) are as large, but valves of the same size show no constant differences. In both these

(2). loc. cit., p. 771, 1881.

cases only; right valves are available for comparison. The recent disparilis is larger, with wider and higher umbones and less regular sculpture.

Occurrence.-- Upper Oligocene: Micola Marl, Florida (Hall, 1888); Grove sand, Florida (Hall, 1888); Saturn formation, Panama (Hall, 1888); Santo Domingo (Gabb, 1877; 1883, 1874, 1875); Lower Miocene: Bowden beds, Bowden, Jamaica (Guppy, 1886, 1871; Guppy and Hall, 1886; Hall, 1888). Pliocene: Chocomaatchie formation, Florida (Hall, 1888); ? Costa, Costa Rica (Gabb, 1881). Pliocene: Chocomaatchie Marl, Florida

(Hall, 1888). ? Trinidad (Gunn, 1871); ? Lima, Costa Rica
(Cobb, 1881).

Section 30. *Corbula* *loismanni*.*Corbula* (*Neocorbula*) *sericea* Dall.

? *Corbula cubaniana* Cady, 1871, Col. Mag., Secs. 2, vol. 1,
p. 441 (ex parte, non d'Orbigny, 1835).

Corbula (*Neocorbula*) *sericea* Dall, 1898, Trans. Amer. Mus.
Nat. Hist., Philadelphia, vol. 5, pt. 4, p. 348; 1900,
pt. 5, pl. 70, fig. 8.

? *Corbula sericea* Dall, Brown and Wilsb., 1911, Proc. Acad.
Nat. Sci., Philadelphia, vol. 6, p. 571.

Description.-- "Shell much like the preceding species *C.*
seminella Dall in general form, but slightly larger and with
less emargination behind the rostrum, the sculpture, however,
is quite different, being of very numerous, small, fine, sharp,
close-set ribs, the interspaces crossed by fine, close, sharp
radial striation, which at once distinguishes it from any of the
allied species. Both valves are similarly sculptured, the sculpture
becoming obsolete on the beaks. Lon. 4.5, alt. 3.5, diam. 2.5
mm. The largest valve measures 5.4 by 4 mm."

"As the ribs are not overrun by the radial sculpture, the
effect is not reticulate. *B. lavelleana* Orbigny, of the recent
Antillean fauna is said to be radially striated, but I have not

been able to obtain specimens of it for description.' (Dall, 1893)

Type locality.-- Bowden, Jamaica.

The shell is small, well-inflated, moderately inequilateral, elongate, rostrate; left valve slightly smaller than the right; abruptly rounded anteriorly, posteriorly the margin sloping above, obliquely subtruncated below, the angle between the two portions, obtuse and subrounded to rounded; base gently arcuate, slightly emarginated posteriorly, the postero-ventral angle sharp and less than 90° ; posterior carina well-defined, sharp or subrounded, ventrally the surface of the shell slightly depressed in front of the carina.

Remarks.-- *J. sericea* is very prolific, being the most abundant *Corbula*. It is recognized by its somewhat elongate outline, fine, but strong concentric sculpture and weak, fine radials. The radials are never prominent and may be entirely absent. Some of the valves are higher than the typical form.

Dall has placed in synonymy the fossil form which Quoy determined as the recent *J. cubaniana* d'Orbigny (1), but as recent-

(1). In de la Harpe, Hist. ch. n., polit. et natur., de l'île de Cuba, Mollusques, vol. 2, p. 127, pl. 21, figs. 51-54, 1857

1) Quoy reported this species only from the Pliocene of Trinidad and if the Trinidad form is *sericea* that locality and horizon

must be added to the list. The Santo Domingo form which I have called L. lavaleana d'Orbigny (1) is very close, but is larger,

(1). Trans. Am. Philos. Soc., New Ser., vol. 10, p. 117, 1875.

(2). loc. cit., p. 114, pl. 17, Figs. 9-12, 1855.

with the base more decidedly flared posteriorly, the posterior margin straighter and with a steeper slope, the posterior slope narrower and the sculpture slightly coarser. In general terms the same is true for this Costa Rican Pliocene lavaleana (2); while the Costa Rican Pliocene form under that name (3) is even

(3). Jour. Acad. Nat. Sci., Philadelphia, 1875, vol. 1, p. 343.

(4). idem, p. 371.

more elongated. The single valve from Saturn, identified as sericea is perhaps distinct, being larger, with a straighter posterior margin, more acute postero-ventral angle, and wider posterior slope.

Occurrence.- Upper Pliocene: ?Saturn formation, Jamaica (Brown and Pilsbry, 1911); Lower Pliocene: Boulder beds, Jamaica (Dall, 1900). ? Pliocene (?): Trinidad (Shufeldt, 1901).

Section *Both corbula* Gabb.

Both corbula (Guppy) Gabb, 1872, Proc. Acad. Nat. Sci.,

Corbula viminea Guppy, 1866, Quart. Jour. Geol. Soc. London,
vol. 2, p. 247, pl. 13, fig. 11.

Bothrocorbula viminea (Guppy) Gabb, 1872, Proc. Acad. Nat. Sci.,
Philadelphia, for 1872, p. 274, pl. 13, figs. 7, 3s.

Bothrocorbula viminea (Guppy) Gabb, 1872, Trans. Am. Philos. Soc.,
New Ser., vol. 15, p. 247.

Corbula viminea Guppy, Geol. Mag., 1874, Decade 1, vol. 1, p.
441 (check list).

Corbula viminea Guppy, 1876, Quart. Jour. Geol. Soc. London, vol.
32, p. 583.

Corbula (*Bothrocorbula*) *viminea* Guppy, 1898
Trans. Warner Free
Inst. Sci., Philadelphia, vol. 3, pt. 4, p. 250.

Corbula viminea Guppy, Brown and Pilchery, 1911, Proc. Acad. Nat.
Sci., Philadelphia, vol. 67, p. 372.

Description.-- "Shell thick, transversely oblong, rounded
anteriorly, produced posteriorly into a large beak; surface
with rather round, concentric ribs; hinge with a
single prominent tooth and a deep orbicular pit in front of it."
(Guppy, 1866).

Type locality.-- Jamaica.

Shell large, heavy, moderately inflated, elongate, inequilateral; left valve slightly smaller; rounded anteriorly, posteriorly the margin curves gently to the sharp postero-ventral angle; base gently convex, gently emarginated posteriorly; umbilicus broad, placed anterior to the median vertical; lunular depression deep, subcircular, larger on the left valve; posterior carina sharp, more pronounced ventrally, situated near the posterior margin, the posterior slope narrow and flattened; external surface sculptured with coarse concentric ridges, suppressed before the posterior carina is reached, with fine concentric striae intercalated between the ridges and continuous across the posterior slope and the area in front of it; radial sculpture of fine, obscure, distant radial striae between the ridges, the radials absent on the posterior slope; the cardinal tooth in the right valve strong.

Dimensions.- Length, 17.5 mm.; alt., 12 mm.; umbilical, 4.8 mm.

Remarks.- This species, which well-represented, is remarkable for the depth of the lunular depression, on the basis of which Cobb erected as a separate genus Lothracorbula. The radial sculpture is often obsolete or even absent. The largest valve has the following dimensions: length, 50 mm.; alt., 30 mm.; diam., 7 mm.

Call has described several closely related species, - the Chipola C. spinarostes (1), the Oak Grove C. radiatula (1) and

the Balosahatchia B. willcoxii (5), all of which are smaller and, except for the last, with a smaller and shallower regular pit. B. hercynica Brown and Pilabry (4), from the latter horizon,

- (1). loc. cit., pp. 350-351, pl. 70, figs. 12, 13, 1004; 1005.
(2). idem, p. 351, pl. 76, figs. 1-3.
(3). idem, pp. 351-352, pl. 70, fig. 2.
(4). Proc. Acad. Nat. Sci., Phil. Delphi, vol. 64, pp. 512-519, pl. 20, fig. 4, 1912.
-

is more elongate, with fewer concentric umbilical striae and without the deep depression in front of the umbo, - at least on the right valve.

Occurrence.- Upper Eocene: Santo Domingo (Abbott, 1873; Guppy, 1874, 1876; Dall, 1898); Patuxent Formation, Vago^{-a-}vacos, Panama (Dall, 1898); Lower Eocene: Bowden beds, Bowden, Jamaica (Guppy, 1866, 1874; Dall, 1898).

April, 1901, p. 11.

1901, p. 11, A (1901) 1901.

1901, p. 11, A (1901) 1901.

Castrochaca ovata (Dall, 1901, p. 11, A (1901) 1901.

1901, p. 11, A (1901) 1901.

1, p. 11.

2 Castrochaca ovata (Dall, 1901, p. 11, A (1901) 1901.

1901, p. 11, A (1901) 1901.

Description.— "Shell resembling the ovata of the same size, but not attaining so large a size as the ovata, with a more rounded posterior end and rather short siphon, the siphon being small, slender, and not so long as the siphon of the ovata, lat. 1.5, diam. 1.5 mm."

"The difference between the present and the ovata shells are so slight, and the characters of the present specimens so mixed, that I feel compelled, however, to distinguish characters above mentioned specimens, as the ovata shells are very small and will not bear a larger number of specimens." (Dall, 1901).

Locality.— 1901, p. 11.

Small shell, thin, slender, elongate, slightly curved, with a prominent siphon; siphon is, slightly curved anterior end; siphon is slightly curved and slightly curved.

Family: *Pholadidae*.

Subfamily: *Jonannetinae*.

Genus: *Leach*.

Leach ? sp. indet.

The fragment in the National Museum collection to which Dall referred (1) as a *Hyolodonta* was probably a *Leach* since

(1). Proc. U. S. Nat. Mus., Philadelphia, vol. 3, pt. 1, p. 822, 1898.

the median sulcus on the shell is pronounced. This form and the other burrowers of doubtful position are mentioned merely in order to complete the faunal list.

Occurrence.-- Lower Miocene: Bowden beds, Bowden, Jamaica (Dall, 1898).

Genus MYLODONTA ?

MYLODONTA ? sp. indet.

Pterodroma ? doubtful species, Guppy and Dall, 1896, Proc. U. S. Nat. Mus., vol. 19, pp. 327-328.

Description.-- "Almost globular, anterior end finely closely laminose, posterior area subequal, nearly smooth, the orbital groove feebly marked; callum apparently complete, sigmoidal and slightly raised, truncate, the margins thickened and reflected the dorsal plates wanting, probably lost. Alt. 6 mm."

"This very singular little skull is unfortunately imperfect, rendering it advisable to await more material before describing it. It was received with the manuscript name of Martesia schaefferoidalis, but it is not a Martesia and none of the above Pterodroma." (Guppy and Dall, 1896).

Remarks.-- No further material is available to supplement Guppy's single specimen, which may be a Mylodon.

Occurrence.-- Lower Pliocene: Golden Gate, Golden Gate, (Guppy and Dall, 1896).

Subfamily Leredininae.

Genus LEREDIA Lamarch.

LEREDIA BOWDENIANA Dall.

Leredina bowdeniana Dall, 1898, Trans. Amer. Soc. Sci.,
Philadelphia, vol. 3, pt. 4, pp. 822-823, pl. 36, fig. 4.

Description.- "The specimen obtained is the portion of a tube containing most of the left valve of Leredia, with very marked sculpture. The anterior border is formed by a narrow, irregularly broken strip of the shelly matter belonging to the missing tube. The thin posterior border of the valve is not intact, though enough remains to show the character of the sculpture. The sculpture of the anterior part of the valve is composed of small, four-sided lozenges, separated by sharp, narrow, arcuate grooves in such a way as to produce the effect of a cartilage on the periphery of the valve. This grooved and faceted sculpture ceases abruptly behind, but the rows of facets are continued as wider longitudinal ribs posteriorly. The umbonal reflection is heavy and radially striate; the anapophysis seems to have been obsolete and its remains are pressed to the internal arch of the umbo. The whole is rather thick and solid, and the antero-posterior length of the fragment is six and a half millimeters.

"The very distinct sculpture of this shell instantly dis-

- 11 -
tinsuishes it from any other known "reolina." (Dall, 1908).

Type Locality.— Bowden, Jamaica.

Remarks.— This species has not been recognized in the collections at hand.

Occurrence.— Lower Miocene: Bowden beds, Bowden, Jamaica (Dall, 1908).

Family Perodiniidae.

Genus PEREDO Linnaeus ?

PEREDO sp. indet.

Small fragments of calcified tubes, apparently referable to the genus Peredo, are present in the collections. Dall (1) has assigned them to T. incrassata (Sabb) (2), an unpretentious

(1). Trans. Wagner Free Inst. Sci., Philadelphia, vol. 3, pt. 4, p. 617, 1898; pt. 6, p. 137, 1907 (check list).

(2). Trans. Am. Philos. Soc. new ser., vol. 13, p. 541, 1873.
(as Lophus incrassata)

species described from Santo Domingo.

Occurrence.— Lower Miocene: Bowden beds, Bowden, Jamaica.

VITA.

Benbell Phillips Johnson was born in Reading, Pennsylvania, June the 15th, 1891. After attending the public schools of that city, and also of Allentown and Pomeroytown he received pre-collegiate training at Albright Preparatory School, Pomeroytown, Pennsylvania. In 1907 he entered Albright College, from which institution he received the degree of Bachelor of Arts in 1910. The next two years were spent in High-School instruction. Throughout the last four academic years he has been engaged in graduate work in the Department of Geology of the Johns Hopkins University. During 1912-1913 and 1913-1914 he held a University Scholarship and in 1914-1915 he was a University Fellow in Paleontology.

The field season of 1915 was spent as a geologic aid in a field party of the Section of Western Mineral Fuels of the United States Geological Survey over time in northwestern Colorado and northeastern Utah. During the following summer he was with a similar party in northwestern Wyoming. In the position of Junior Geologist he was a member of a party that conducted investigations in northern Montana during the field season of 1916.

Woodring, V. P.

The mollusks of the Bowden
beds of Jamaica.

1916

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