

**STATE OF FLORIDA
DEPARTMENT OF CONSERVATION**

R. L. DOWLING, Supervisor

GEOLOGICAL BULLETIN NO. 15

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**MOLLUSKS OF THE
TAMPA AND SUWANNEE LIMESTONES
OF FLORIDA**

By
W. C. MANSFIELD
of the United States Geological Survey

TALLAHASSEE, FLORIDA

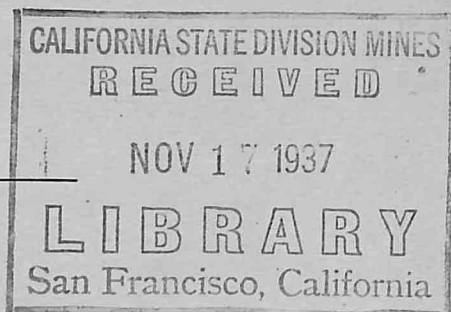
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LETTER OF TRANSMITTAL

HONORABLE R. L. DOWLING,
Supervisor of Conservation.

SIR:

I have the honor to transmit a report on the Mollusks of the Tampa and Suwannee Limestones of Florida by Dr. W. C. Mansfield of the United States Geological Survey, to be published as Geological Bulletin No. 15.

It is quite generally known that limestones constitute much of the strata over large areas within the State. However, these deposits of limestone were not laid down during a single geological epoch, but during several, in each of which the sea advanced landward and then withdrew seaward. It is important for various practical purposes to be able to distinguish the several deposits of limestone from one another. In the past the Tampa and Suwannee limestones have been confused, and the present paper is intended to supply a basis on which they may be discriminated.

The most readily available means of interpreting the stratigraphic sequence of deposits and of interpreting their relative ages is the character of the life, or fossil remains, entombed within them. It is on this basis largely that the new formational name of Suwannee was established.

The report describes and figures fossils of the Tampa and Suwannee limestones and clearly shows that the organisms in the Suwannee limestone had greater antiquity than those in the succeeding Tampa limestone.

In a former report, too, it was shown that of the two limestones the Suwannee contained a higher percentage of calcium carbonate and a lower percentage of silica than the Tampa, indicating different physical conditions accompanying the deposition of the two. A corresponding indication of differing physical conditions was noted in the study of the faunas.

The report is a distinct contribution to the stratigraphy of the State and it is a pleasure to acknowledge the generous cooperation of the United States Geological Survey in transmitting the results of this study without expense other than limited transportation facilities during the field work and in the preparation of the illustrations and publication.

Let me also express appreciation of the interest you have manifested in the work of the Geological Survey and the support that you have given.

Very respectfully,

HERMAN GUNTER,
*Assistant Supervisor,
State Board of Conservation,
Geological Department.*

Tallahassee, Florida,
June 22, 1937.

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MOLLUSKS OF THE TAMPA AND SUWANNEE LIMESTONES OF FLORIDA

By W. C. MANSFIELD¹

INTRODUCTION

This paper is a product of an attempt to define more accurately than has been done in the past the stratigraphic and geographic scope of the Tampa limestone (lower Miocene) of Florida. As the delimitation of the formation has to rest in considerable part on faunal data, it was necessary to examine all the species of mollusks listed from the type locality, and to compare with them those reported from other localities. Various revisions of species in the Tampa fauna were found desirable and some new forms were recognized. Dall² in 1915 described many species from the Tampa limestone. These original descriptions, except for the non-marine species, are repeated in this paper, but as the species are adequately figured in Dall's paper the illustrations are not repeated.

Certain beds long confused with the Tampa limestone have been separated from it as the Suwannee limestone,³ and a description of the contained fauna is included.

Many of the specimens studied in the preparation of this paper were deposited in the U. S. National Museum a number of years ago (see list of localities on pp. 39-42). Additional material has been added from year to year by members of the U. S. Geological Survey. During the years 1931, 1932, and 1936, many more collections were obtained by Herman Gunter, State Geologist of Florida, and his assistants, and by F. S. MacNeill, of the U. S. Geological Survey, and the writer. Miss Helen I. Tucker (now Mrs. R. A. Rowland), of Cornell University, Ithaca, N. Y., kindly lent her collections from Sixmile Creek, near Orient Station (No. 57) and from Blackwater River at the crossing of the Seaboard Air Line Railway (No. 17).

¹ Published with the permission of the Director of the United States Geological Survey.

² Dall, W. H., A monograph of the molluscan fauna of the *Orthaulax pugnax* zone of the Oligocene of Tampa, Florida: U. S. Nat. Mus. Bull. 90, January 21, 1915.

³ Cooke, C. W., and Mansfield, W. C., Suwannee limestone of Florida (abstract): Geol. Soc. Am., Proc. for 1935, p. 71, 1936.

Grateful acknowledgment is made to the officials of the U. S. National Museum for the use of collections; to Mr. Herman Gunter for his close cooperation and interest manifested in the preparation of this report, especially by furnishing transportation facilities for my field investigations during the years 1931-1932; to Dr. Henry A. Pilsbry of the Academy of Natural Sciences of Philadelphia, and to Mr. Carl Boyer, Director of the Wagner Free Institute of Science, Philadelphia, for the opportunity to examine type material. The writer has had the benefit of the advice of L. W. Stephenson, C. W. Cooke, Julia Gardner, W. P. Woodring, and Ralph B. Stewart of the United States Geological Survey. F. Stearns MacNeil assisted in the preparation of the fossils, and in field work in 1936.

The photographs used for illustrations were made by Nelson W. Shupe, and the prints were retouched by Frances Wieser, both of the U. S. Geological Survey.

The types of the new species are deposited in the U. S. National Museum. A duplicate set of named species from the Suwannee limestone, as complete as the collections will allow, is deposited with the Florida State Geological Survey.

TAMPA LIMESTONE

PREVIOUS WORK

The beds here included in the Tampa limestone have long been noted for their excellently preserved fossils and for the unusual silicification of some of the material. The name "silex beds" was commonly used to designate the silicified portions of the formation. Opinions have differed greatly as to the relations of the rocks in the vicinity of Tampa and elsewhere, as may be seen in the following review of the earlier work.

The first description of the Tampa limestone was given in 1846 by Allen.⁴ He reports a limestone beneath the soil in the neighborhood of Fort Brooke at the head of Tampa Bay and other nearby localities. He mentions silicified fossils without specific names. No age determination of the deposit is given.

Later in the same year Conrad⁵ published articles on the geology of Florida based on a visit in 1842. He described the rock at Tampa, and described and illustrated 9 species of invertebrate fossils, 8

⁴ Allen, J. H., Some facts respecting the geology of Tampa Bay, Florida: *Am. Jour. Sci. and Arts*, 2d ser., vol. 1, pp. 38-42, Jan., 1846.

⁵ Conrad, T. A., *Amer. Jour. Sci. and Arts*, 2d ser., vol. 2, pp. 36-48, July; pp. 393-398, Nov.; pp. 399-400, Nov., 1846.

of which came from Ballast Point. The following species were described:

Bulimus floridanus
"Bulla" *petrosa*
Nucula tellinula
Venus penita
Venus floridana

Cytherea floridana
Balanus humilis
"Nummulites" *floridanus*
"Cristellaria" *rotella*

Conrad referred this fauna to the upper Eocene.

At a later date Prof. J. W. Bailey, United States Army, visited Ballast Point, and described what he thought to be a deposit of infusorial earth.⁶ Since then this material has been determined to be merely a part of the limestone sequence containing diatoms and Foraminifera and not a separate deposit.

In 1887, Heilprin⁷ described and figured 47 species of mollusks from Ballast Point, and the study of them convinced him that the "silex beds" were of lower Miocene age. He⁸ described two distinct rocks from the Tampa Bay and Hillsboro regions: a "hard siliceous blue rock or *Cerithium* rock without any traces of the 'Orbitolite,'" and overlying it a "highly fossiliferous yellow limestone carrying a large number of the singular foraminifera, '*Nummulites floridanus*.'" The species *Cerithium hillsboroensis*, is reported to occur in the "underlying cherty-rock" of the Hillsboro region and in the "tough blue rock" at Ballast Point, and to be absent from the rock with *Orbitolites*.

W. H. Dall was the next to study the Tampa region. His work began in the winter of 1886-1887 and resulted in a series of publications.

In 1892, Dall⁹ recognized divisions which he designated the "*Orthaulax* bed" and the "Tampa limestone." Because of the presence of the gastropod genus *Orthaulax* the name "*Orthaulax* bed" was introduced to replace the local name, "Tampa silex bed." Dall stated that he found the same rock on Sixmile Creek near Orient Station, about 6 miles east of Tampa. At Ballast Point the fossils of the *Orthaulax* bed were reported to be chiefly marine with a minor admixture of land shells, the latter becoming more abundant toward the top of the bed. The name Tampa limestone was applied to the limestone overlying the *Orthaulax* bed. Dall stated that an examination of the rock in the Hillsboro River from Tampa to the falls showed

⁶ Smithsonian contributions to knowledge, vol. 2, art. 8, p. 19, 1850.

⁷ Heilprin, Angelo, Explorations on the West Coast of Florida: Wagner Free Inst. Sci. Trans., vol. 1, pp. 105-119, 1887.

⁸ Idem, pp. 61-62.

⁹ Dall, W. H., The Neocene of North America: U. S. Geol. Survey Bull. 84, pp. 112-119.

that what Heilprin called "*Cerithium* rock" and mistook for the lower (*Orthaulax*) bed was merely a cherty layer of the Tampa limestone, characterized by an abundance of *Cerithium hillsboroensis* and everywhere overlying the *Orthaulax* bed. In a section of the bank of the Hillsboro, near Lapenotières Spring,¹⁰ the Tampa limestone of Dall is 10 to 15 feet in thickness. In other places¹¹ the maximum thickness of Tampa limestone is said to be 25-30 feet. In referring to the *Cerithium* rock of Heilprin, Dall writes:¹² "From these observations [along Hillsboro River and around Tampa] it appears that, while the existence of a *Cerithium* rock under the *Orthaulax* bed is *a priori* probable, sufficient evidence of its existence is still to be collected, and the rock identified as such by Heilprin may very possibly have been a portion of the Tampa limestone."

In 1903, Dall¹³ briefly discussed the "Tampa silex beds" and gave a list of species from Ballast Point, from dredgings presumably at the same horizon in the ship canal near Ballast Point, and from a locality 15 miles south of Tallahassee, near Wakulla. He stated that 193 species were then known from the "silex beds."

In the same publication, pages 1570 to 1572, Dall briefly discussed his Tampa limestone, or "*Orbitolite* bed," and gave a list of fossils from a number of localities at which he thought the limestone to occur. In this list he included species collected at Sixmile Creek and near Orient. Fifty-nine species are identified, of which 37 are common to the "silex beds."

In 1909, Matson and Clapp¹⁴ obtained additional information concerning the rocks in the vicinity of Tampa, and their report offers a classification that approaches the modern concept. They included the "silex bed" and the Tampa limestone of Dall in a single formation—the Tampa formation. They wrote:¹⁵ "The upper member of the Tampa formation comprises a well stratified greenish clay containing some calcareous nodules and thin beds of limestone near the base. Scattered throughout the clay are many silicified corals, some of them having a diameter of two or three feet. The clay is very plastic and hence is valuable for the manufacture of brick. Beneath the clay is the light-gray to yellow limestone which was formerly called the "Tampa limestone." The "silex bed" represents a silicified zone in

¹⁰ Idem, p. 118.

¹¹ Idem, p. 119.

¹² Idem, p. 119.

¹³ Dall, W. H., Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, pp. 1564-1568.

¹⁴ Matson, G. C., and Clapp, F. G., Florida Geol. Survey 2d Ann. Rept., pp. 84-91.

¹⁵ Idem, pp. 86, 87.

this limestone and is, therefore, a zone of replacement. This is well shown by some of the fossils which have been only partially silicified; and by the presence of more or less unaltered carbonate of lime in the original rock. * * * Resting upon the "silex" at some localities is a siliceous residual material which was formerly thought to be infusorial earth, but is now known to be weathered material derived from the underlying rock." The log of a well drilled at Tampa¹⁶ shows 14 feet of rock assigned to the Tampa limestone, 4 feet assigned to the "silex beds," 6 feet of soft limestone, and 41 feet of tough, plastic, greenish, sandy clay. The base of the clay is considered by Matson and Clapp to be the base of the Tampa formation, making the total thickness of the formation in this well 65 feet. The same authors¹⁷ reported some "silex" near the base of a 6-foot bed of gray to yellow limestone that crops out at the railroad bridge at Orient.

In 1915 Dall's final paper¹⁸ on the Tampa area appeared. In this paper the name "*Orthaulax pugnax* zone" is proposed for the old name "*Orthaulax* bed" or the colloquial name "Tampa silex bed," although Dall uses the name "Silex beds" throughout his paper. Dall wrote (p. 16): "The number of species and varieties of mollusks now known from the [*Orthaulax pugnax*] zone is 312. Of these nearly two-thirds are peculiar to the zone and have chiefly been obtained from the siliceous layer. Of the total molluscan fauna, 219 species were new to science when first explored by the United States Geological Survey, and 95 of these are described in this monograph. Of the previously known species 15 were named by Conrad and 29 by Heilprin, while 36 were first described from other horizons by various writers. * * * Above the *Orthaulax* zone we find 51 of its species surviving in the *Cardium cestum* zone [Chipola formation], but only 14 reach the zone of *Scapharca dodona* [Alum Bluff group]." In referring to the limestone Dall¹⁹ wrote: "The molluscan fauna of the limestone immediately above the silex beds has not been thoroughly studied, but it is notable for the number of *Cerites* contained in it and for the profusion of *Orbitoides floridanus* Conrad (?*complanatus* Lamarck), and it seems allowable to apply the name of the latter species as a designation of this zone, with the type locality at Ballast Point." In referring to the *Cerithium* rock of Heilprin, Dall²⁰ wrote: "Curiously enough the layer called *Cerithium* rock, by Heilprin, which

¹⁶ Idem, p. 89.

¹⁷ Idem, pp. 90-91.

¹⁸ Dall, W. H., A monograph of the molluscan fauna of the *Orthaulax pugnax* zone of the Oligocene of Florida: U. S. Nat. Mus. Bull. 90, 1915.

¹⁹ Idem, p. 15.

²⁰ Idem, p. 3.

he thought to be below the horizon of the silex beds, but which has since proved to be part of the "Tampa limestone" overlying the silex beds, he placed as forming the "transition ground" between the Miocene and Oligocene."

In 1929 Cooke and Mossom²¹ included in the Tampa limestone [called Tampa formation in some citations] not only the Tampa of earlier workers but most of the Chattahoochee formation and part of the Hawthorn formation of Matson and Clapp. They also included in the Tampa what has since been named the Suwannee limestone by Cooke and Mansfield²².

PRESERVATION OF THE FOSSILS

The attention of naturalists was early attracted to the excellently preserved fossils found along the northwest shore of Tampa Bay, especially at Ballast Point. The shells, which were deposited in a limestone matrix, have been replaced by pure silica, and converted into pseudomorphs that preserve in a remarkable manner the original shape and delicate sculpture of the shells. This change in composition appears to be due to the exposure of the fossil-bearing limestone to surface waters charged with silica in solution. Fossils exposed on the surfaces that are exposed between tides, in the cliffs along stream channels, or in crevices in the rock are most affected by this type of replacement; those in more deeply buried limestones and in rock from newly opened quarries are less completely replaced. Fossils that have not been silicified are preserved as external or internal molds. Casts or squeezes of these external molds usually reveal the delicate sculpture of the original shells.

GENERAL OBSERVATIONS ON THE TAMPA LIMESTONE

In 1936 a number of species were collected by F. S. MacNeil and the writer from dredgings taken at a depth of 32 to 36 feet below water-level off Hooker Point, Sparkman Bay, inlet of upper Hillsborough Bay (station 13848). The matrix consists of an indurated, speckled material containing medium-sized sand grains throughout. The following species were collected:

- Conus* sp. mold.
- Solenostera quinquespina* (Dall).
- Urosalpinx*? *inornata* Dall, abundant.
- Potamides hillsboroensis* (Heilprin) common.

²¹ Cooke, C. W., and Mossom, Stuart, *Geology of Florida*: Florida State Geol. Survey 20th Ann. Rept., pp. 78-96.

²² Cooke, C. W., and Mansfield, W. C., *The Suwannee limestone of Florida* (abstract): *Geol. Soc. Am. Proc.*, p. 71, June, 1936.

Potamides campanulatus Heilprin.
Rapana? sp.
Vermetus sp.
Turritella litharia Dall?
Ampullina (Ampullinopsis) amphora (Heilprin).
Anadara hypomela Dall?
Ostrea vauhani Dall.
Modiolus blandus Dall.
Cyrena floridana (Dall).
Diplodonta? sp.
Cardium pinellasense Mansfield.
Antigona shepardii Dall?
Macrocallista? sp.
Macoma? sp.

No foraminifera were noted.

The rock corresponds to the "hard siliceous blue rock or *Cerithium* rock" of Heilprin, which he placed underneath a highly fossiliferous yellow limestone carrying a large number of Foraminifera.

Another collection of fossils preserved as molds was obtained in 1936 by F. S. MacNeil and the writer from material thrown out in constructing a road near the new quarantine station at Gadsden Point, about 4 miles south of Ballast Point (station 13847). The matrix consists of buff to dirty-white limestone containing a minor amount of quartz sand grains. The following species were found:

Cerion? sp.
Morum chipolanum tampanum Mansfield.
Strombus cf. *S. liocyclus* Dall.
Potamides campanulatus Heilprin.
Turritella cf. *T. pagodaeformis* Heilprin.
Arca sp. (mold).
Venericardia serricosta (Heilprin).
Phacoides wacissanus Dall.
Anomalocardia penita (Conrad).
Antigona glyptoconcha Dall.
Semele silicata Dall.
Panope aff. *P. goldfussii* Wagner.
Bryozoa and Foraminifera.

The position of this fauna appears to be in the uppermost part of the Tampa limestone and may correspond to the *Orbitolites floridanus* zone of Dall.

The faunas collected at the above two localities, indicate strongly that the *Cerithium* rock of Heilprin is stratigraphically below the *Orthaulax pugnax* zone of Dall, and that the *Orbitolites floridanus* zone of Dall is equivalent to his *Orthaulax pugnax* zone, perhaps the upper part of it. In general, Dall considered that all silicified fossils came from his *Orthaulax pugnax* zone, or "silex bed," and those that are preserved as external molds came from the overlying *Orbitolites floridanus* zone. He placed the *Cerithium* rock of Heilprin above his

Orthaulax pugnax zone. The species *Potamides hillsboroensis* Heilprin, a species characteristic of the *Cerithium* rock of Heilprin, has not been found outside of the Tampa area.

In the study of the faunas from localities outside of the Tampa area, the writer has not been able to determine with assurance whether they should be correlated with the *Cerithium* zone of Heilprin, the *Orthaulax pugnax* zone of Dall, or with the *Orbitolites floridanus* zone of Dall. Consequently he has viewed these localities, formerly regarded as distinct, as a single formation, the Tampa limestone. In partial support of this view, *Orthaulax pugnax* is now known to occur in the youngest beds of the Tampa limestone, as well as in the *Orthaulax* zone. Doubtless there are faunal zones in the Tampa limestone, but present conditions for observing the relationships of the beds at Ballast Point and up the Hillsborough River are not as favorable as they once were, and divisions are not advisable.

The lowest bed exposed at Old Chattahoochee Landing is tentatively placed at the base of the Tampa limestone, though it appears to be a little lower stratigraphically than the lowest bed exposed around Tampa.

There is no conclusive evidence to show that the "tough, plastic, greenish sandy clay," 41 to 64 feet thick, penetrated beneath a limestone in wells at Tampa, belongs to the Tampa limestone, as thought by Matson and Clapp.²³ However, there is a possibility that the upper bed exposed on Blackwater Creek at the crossing of the Seaboard Air Line Railway, $2\frac{1}{2}$ miles south of the Pasco County line, which carries Tampa limestone species, may represent this clay bed in part.

The thickness of the Tampa limestone in the Tampa area, as indicated by well borings, is about 65 feet. This thickness does not include the tough plastic clay found in the well at Tampa. The thickness, as shown in the bluffs at Old Chattahoochee Landing and at River Junction, is about 88 feet.

The Tampa limestone, as defined in this paper, includes the beds in Hillsborough County, Florida, which are exposed at Ballast Point and the vicinity; along the Hillsborough River above Tampa; at Six-mile Creek near Orient; and beds carrying a similar fauna elsewhere.

²³ Matson, G. C., and Clapp, F. G., Florida Geol. Survey 2d Ann. Rept., p. 89, 1909.

**COMPARISON OF SPECIES FROM THE TAMPA LIMESTONE WITH
SPECIES FROM OTHER FORMATIONS**

Tropical America.—The following list shows species of the Tampa limestone identical with or closely related to species from tropical America:

TAMPA LIMESTONE SPECIES	TROPICAL AMERICAN SPECIES
Lyria musicina Heilprin	Lyria vaughani Cooke, Anguilla formation, Anguilla.
Xancus polygonatus (Heilprin)	Xancus rex Pilsbry and Johnson, Baitoa formation, Dominican Republic.
Vasum subcapitellum Heilprin	Vasum aedificatum (Guppy), (Middle Miocene Gurabo formation, Dominican Republic.
Potamides hillsboroensis Heilprin	Potamides herculeanum (Cooke), Anguilla formation, Anguilla.
Turritella tarponensis Mansfield	Turritella ceibana Cooke, Antigua formation, Antigua.
Globularia solidula (Dall)	Globularia anguillana (Cooke), Anguilla formation, Anguilla; also Sta. 3474, Cuba.
Ampullina amphora (Heilprin)	Ampullina spenceri (Cooke), Anguilla and Antigua formations.
Orthaulax inornatus Gabb	Orthaulax inornatus Gabb, Baitoa formation, Dominican Republic.
Anadara latidentata ballista Mansfield	Anadara perplura (Woodring), Bowden marl, Jamaica, middle Miocene.
Chlamys crocus Cooke	Chlamys crocus Cooke, Anguilla formation, Anguilla.
Chlamys anguillensis Guppy	Chlamys anguillensis Guppy, Anguilla and Antigua formations.
Pholadomya sp.	Pholadomya walli Maury, Machapoorie beds, lower Miocene, Trinidad.
Chione cf. C. spenceri Cooke	Chione spenceri Cooke, Antigua formation, Antigua.

The species from the Tampa limestone in this list indicate a closer affinity with the Anguilla formation than with the Antigua formation. The Baitoa formation contains *Orthaulax inornatus* (Gabb), and also *Xancus rex* Pilsbry and Johnson, a species closely related to *X. polygonatus* Heilprin, of the Tampa limestone. Woodring²⁴ listed a few species of mollusks characteristic of the Baitoa formation, among them "*Phos*" *costatus* Gabb, a species closely related to "*Phos*" *chipolanus* Dall, a Chipola formation species. Some of the species listed from the Baitoa formation by Woodring²⁵ range upward into the Cercado and Gurabo formations. One of these, *Pachycrommium guppyi* (Gabb), (Baitoa, Cercado, and Gurabo) is the same as, or closely allied to, *P. floridana* Dall, a Tampa limestone species. According to Wood-

²⁴ Woodring, W. P., Miocene mollusks from Bowden, Jamaica; Carnegie Inst. Washington, Pub. 385, Pt. 2, p. 51, 1928.

²⁵ Idem.

ring²⁶: "The fauna of the Baitoa formation is clearly recognizable and it is considered of lower Miocene age, the upper one of the two lower Miocene zones now recognized in this region." He²⁷ placed this zone above the Anguilla formation. As the Tampa limestone is considered equivalent, or nearly equivalent, to the Anguilla formation, the Baitoa formation would be a little higher stratigraphically than the Tampa limestone and perhaps more nearly equivalent to the Chipola formation.

An undetermined species of *Pholadomya* from the Tampa limestone appears to be closely related to *P. walli* Maury from the lower Miocene (Machapoorie beds) of Trinidad.

Chipola formation of Florida.—The following species of the Tampa limestone are the same as or closely related to the species from the Chipola formation (lower Miocene) of Florida:

TAMPA LIMESTONE SPECIES	CHIPOLA LIMESTONE SPECIES
<i>Marginella intensa</i> Dall	<i>Marginella eleutheria dasa</i> Gardner (MS.).
<i>Marginella mollitor</i> Dall	<i>Marginella brithia</i> Gardner (MS.).
<i>Lyria musicina</i> Heilprin	<i>Lyria musicina</i> subsp.
<i>Vexillum myrum</i> (Dall)	<i>Vexillum ambipleura</i> Gardner (MS.).
<i>Cypraea ballista</i> Dall	<i>Cypraea heilprinii</i> Dall.
<i>Diodora chipolana</i> (Dall)	<i>Diodora chipolana</i> (Dall).
<i>Arca umbonata</i> Lamarck	<i>Arca umbonata</i> Lamarck.
<i>Barbatia marylandica</i> Conrad	<i>Barbatia marylandica</i> Conrad.
<i>Arcopsis adamsi</i> (Dall)	<i>Arcopsis adamsi</i> (Dall).
<i>Anadara hypomela</i> Dall	<i>Anadara hypomela</i> Dall.
<i>Chlamys burnetti</i> Tucker	<i>Chlamys acanikos</i> Gardner.
<i>Plicatula densata</i> Dall	<i>Plicatula densata</i> Dall.
<i>Pseudochama draconis</i> Dall	<i>Pseudochama draconis</i> Dall.
<i>Cardium berberum</i> Dall	<i>Cardium aliculum</i> Dall.
<i>Dosinia chipolana</i> Dall	<i>Dosinia chipolana</i> Dall.

The Trent marl, as exposed at Silverdale, Onslow County, N. C., was carefully studied by Kellum.²⁸ He wrote (p. 13): "The conclusion is therefore reached that the Trent marl is of approximately the same age as the "silex beds" of the Tampa of Florida. The collection of more material from this horizon and the study of the microscopic element of the fauna may show the Trent to be somewhat older or younger than the Tampa, but the evidence presented by the fraction of the fauna studied indicates the Tampa as the closest known formation." A number of specimens from the Trent marl, some collected after the publication of Kellum's paper, are still unstudied, and more exact data concerning the relationship of the Trent fauna

²⁶ Idem, p. 52.

²⁷ Idem, table facing p. 41.

²⁸ Kellum, L. B., Paleontology and stratigraphy of the Castle Hayne and Trent marls in North Carolina: U. S. Geol. Survey Prof. Paper 143, 1926.

to those of outside areas may be expected when this material is examined.

Kellum has pointed out that a few species, such as *Oliva posti* Dall, *Lyria carolinensis* Kellum, *Turritella fuerta* Kellum and *Antigona lamellacea* Kellum, are closely allied to species in the Tampa limestone, whereas other species, such as *Conus postalveatus* Kellum, *Busycon spiniger onslowensis* Kellum, *Crassatellites mississippiensis silverdalensis* Kellum, and *Macrocallista tia* Kellum are more closely related to species in the Oligocene Vicksburg group. The writer agrees with Kellum that the evidence now available shows the Trent marl to occupy about the same horizons as the Tampa limestone.

The following lists indicate the relationship of the species at Silverdale to those in other deposits.

Species from Silverdale, referred to Trent marl by Kellum	Closest relative and range (Kellum)	Related species and range (Mansfield)
<i>Conus postalveatus</i> Kellum	<i>Conus alveatus</i> Conrad, Vicksburg	<i>Conus alveatus</i> Conrad, Vicksburg. Also aff. <i>C. planiceps wakullaensis</i> Mansfield, Tampa limestone. Early whorls on Vicksburg species more beaded.
<i>Oliva posti</i> Dall	<i>Oliva posti</i> Dall, Tampa	<i>Oliva posti</i> Dall, Tampa limestone.
<i>Scaphella stromboidella</i> Kellum	Undescribed species, Shoal River	Very close to an undescribed species from (?) Whites Creek, Fla., Shoal River?
<i>Lyria carolinensis</i> Kellum	<i>Lyria heilprini</i> Dall, Tampa	<i>Lyria heilprini</i> Dall, Tampa limestone.
<i>Busycon spiniger onslowensis</i> Kellum	<i>Busycon spiniger</i> var. <i>spiniger</i> , Vicksburg (Red Bluff)	<i>Busycon spiniger</i> var. <i>spiniger</i> , Vicksburg (Red Bluff); ?aff. <i>Busycon scalaspira</i> Conrad, Jerico, N. J. (Calvert).
<i>Turritella fuerta</i> Kellum	<i>Turritella medioconstricta</i> Dall, Tampa	<i>Turritella indenta</i> var. <i>mixta</i> Dall, Chipola.
<i>Sinum imperforatum</i> Dall	<i>Sinum imperforatum</i> Dall, Claiborne to Duplin	<i>Sinum</i> cf. <i>imperforatum</i> Dall, Tampa limestone.
<i>Calyptraea trochiformis</i> Lamarek	<i>Calyptraea trochiformis</i> Lamarek, Claiborne to Duplin	<i>Calyptraea aperta</i> (Solander) Calvert and Choptank (fide Martin).
<i>Glycymeris anteparilis</i> Kellum	<i>Glycymeris parilis</i> Conrad, Calvert	Unnamed form from Tampa limestone at Kendrick (Higher beak than <i>G. parilis</i>).
<i>Arca (Scapharca) silverdalensis</i> Kellum	<i>Arca carolinensis</i> Wagner, Duplin	<i>Anadara tarponensis</i> Mansfield, n. sp. Tampa limestone at Tarpon Springs, Fla.
<i>Plicatula densata</i> Conrad	<i>Plicatula densata</i> Conrad, Vicksburg to Bowden	<i>Plicatula densata</i> Conrad, Tampa limestone, Calvert formation, Chipola formation, Oak Grove sand.
<i>Astarte onslowensis</i> Kellum	<i>Astarte undulata</i> , Duplin	<i>Astarte sima</i> Gardner, Shoal River formation.
<i>Crassatellites mississippiensis silverdalensis</i> Kellum	<i>Crassatellites mississippiensis</i> Conrad, Vicksburg	<i>Crassatellites mississippiensis</i> Conrad, Vicksburg. Sculpture over beak different from that of the Vicksburg species.
<i>Venericardia nodifera</i> Kellum	<i>Venericardia hadra</i> Dall, Chipola	<i>Venericardia nodifera</i> Kellum, Tampa limestone.
<i>Venericardia (Cyclocardia) granulata</i> Say	<i>Venericardia (Cyclocardia) granulata</i> , Calvert to Pliocene	<i>Venericardia castrana</i> Glenn, Calvert.
<i>Phacoides (Pseudomiltha) nocariensis</i> Kellum	<i>Phacoides anodonta</i> Say, Calvert to Pliocene	Same as <i>Phacoides anodonta</i> Say, Calvert to Pliocene; one specimen collected—?P. <i>paradonta</i> Gardner Shoal River, Cardium bearing bed.
<i>Venus gardnerae</i> Kellum	<i>Venus halidona</i> Dall, Tampa	<i>Venus plena</i> Conrad, Calvert to Yorktown.
<i>Antigona (Artena) lamellacea</i> Kellum	<i>Antigona shepardii</i> Dall, Tampa	<i>Antigona shepardii</i> Dall; species from Silverdale has a sharper shoulder.
<i>Macrocallista minuscula</i> Kellum	<i>Macrocallista acuminata</i> Dall, Tampa and Chipola	<i>Macrocallista floridana</i> Conrad, Tampa limestone.
<i>Macrocallista tia</i> Kellum	<i>Macrocallista sobrina</i> (Conrad), Vicksburg	<i>Macrocallista sobrina</i> (Conrad), Vicksburg.

SPECIES FROM SILVERDALE (Mansfield and MacNeil, collectors)	RELATED SPECIES (Mansfield)
<i>Terebra</i> sp.	<i>T. divisura</i> Conrad, Vicksburg; <i>T. unilincata</i> , Calvert and Duplin.
<i>Siphonalia</i> sp.	<i>S. migrans</i> Conrad, Calvert.
<i>Cancellaria</i> sp.	<i>C. aff. buplicata</i> Conrad, Calvert and Choptank.
<i>Ecphora</i> sp.	Genus in Calvert and later formations.
<i>Rapana</i> sp.	<i>R. biconica</i> Dall, Tampa limestone.
<i>Rapana vaughani</i> Mansfield	<i>Rapana vaughani</i> Mansfield, Tampa limestone.
<i>Rapana</i> sp.	<i>R. tampaensis</i> Dall, Tampa limestone.
<i>Coralliophila</i> sp.	<i>C. cumberlandiana</i> (Gabb), Calvert.
<i>Turritella</i> sp.	<i>Turritella aequistriata</i> Conrad, Calvert; <i>T. alcida</i> Dall, Oak Grove sand, but more slender than either.
<i>Arcopsis adamsi</i> (Dall) var.?, (slightly lower than typical form).	<i>Arcopsis adamsii</i> (Dall) lower Miocene to Recent.
<i>Glycymeris</i> sp.	Aff. <i>G. intercostata</i> Gabb, Oligocene.
<i>Pododesmus</i> sp.	Cf. <i>P. scopelus</i> Dall, Chipola.

BEDS ENCLOSING THE TAMPA LIMESTONE

The beds that underlie the Tampa limestone are discussed in connection with the Suwannee limestone (see pp. 46-63). The Tampa limestone is overlain by either the Hawthorn formation or the Chipola formation.

In certain areas in Marion County, according to Cooke and Mossom,²⁹ remnants of the Hawthorn formation rest upon the Tampa.

The southernmost outcrop of Tampa limestone in Wakulla County is along the highway about 3 miles south of Crawfordville (stations 12294 and 12296). At a locality one mile farther south (station 12295), rock containing Chipola fossils was excavated in constructing the highway, apparently from horizons above the Tampa. The fossils collected are: *Turritella dalli* Gardner (Ms.) (Chipola formation), *Turritella subgrundifera* Dall (Chipola and Oak Grove), *Arca staminata* Dall (Chipola), *Ostrea haitensis* Sowerby (Chipola to Shoal River), *Modiolus* sp. This fauna appears to be a little older than that of the Hawthorn at Sopchoppy (Sopchoppy limestone of Dall) and is here referred to the Chipola formation. The top of the Tampa limestone has been placed by Ponton at a depth of 72 feet in an excavation for a pump pit at the Tallahassee Water Works.³⁰ In this excavation a few species of mollusks were found, at depths of 50 to 55 feet, that are considered diagnostic of the Hawthorn formation, especially that

²⁹ Cooke, C. W., and Mossom, Stuart, *Geology of Florida*: Florida Geol. Survey 20th Ann. Rept., p. 131, 1929.

³⁰ Ponton, G. M., quoted by Colbert, Edwin H., *Aphelops* from the Hawthorn formation of Florida: Florida State Geol. Survey Bull. 10, p. 57, 1932.

part of the Hawthorn included in the Sopchoppy limestone. The limestone in this well immediately above the Tampa limestone, between the depths of 60 to 72 feet, is also referred to the Sopchoppy.

At Ponto Springs in the northeast corner of Gadsden County (see section drawn up by Ponton and Mansfield in Bulletin 9, p. 21, Florida Geol. Survey, 1932), a hard, compact, gray to buff limestone constitutes the lower 10 feet of the section. Although no determinable fossils were found in this limestone, it probably should be referred to the Tampa limestone. The section here closely duplicates the section at Rock Bluff on the Apalachicola River, both as to lithology and as to the character of the overlying beds. These, although referred to the Hawthorn formation, are probably nearly the age equivalent of the Chipola formation. The following species of mollusks were collected by Ponton and Mansfield from beds overlying this limestone at Ponto Springs: *Pleurodonte* sp., *Scaphander* sp., *Mitra* sp., *Melongena sculpturata* Dall, *Cerithium* cf. *C. chipolana* Dall, *Turritella dalli* Gardner Ms., var., *Turritella subgrundifera* Dall, *Glycymeris* sp., *Arca staminata* Dall?, *Ostrea normalis* Dall, *Chione* near *C. burnsii* Dall, *Chlamys acanikos* Gardner, *Pododesmus scopelus* Dall (also at Rock Bluff) and *Lithophaga* sp.

Unfossiliferous beds above the Tampa limestone in the section at Old Chattahoochee Landing, Gadsden County, are referred to the Hawthorn formation by Cooke and Mossom.³¹

The strata above the Tampa limestone along the Apalachicola River are shown in the sections drawn up for that area.

At Baileys Old Ferry, on the Chipola River, Calhoun County, the Tampa limestone is overlain by the Chipola.

LOCAL DETAILS

HILLSBOROUGH COUNTY

The following species have been collected on Sixmile Creek, near Orient:

- **Cepolis direpta* (Dall).
- **Pleurodonte haruspica* Dall.
- Pleurodonte cunctator* (Dall).
- **Bulimulus americanus* (Heilprin).
- Cerion anodonta* (Dall).
- **Humboldtiana? tuckerae* Mansfield.
- **Conus illiolus* Dall.
- Conus planiceps* Heilprin.
- **Olivella eutorta* Dall.
- **Ancilla shepardi* Dall.
- **Marginella ballista* Dall.

³¹ Idem, p. 94.

- **Marginella gregaria* Dall.
- **Lyria heilprini* Dall.
- Conomitra angulata* (Heilprin)
- **Busycon perizonatum* Dall.
- Melongena sculpturata* Dall?.
- **Alectrion ethelinda* Dall.
- **Urosalpinx? hillsboroensis* Mansfield.
- **Rapana tampaensis* Dall.
- Cypraea tumulus* Heilprin.
- **Strombus liocyclus* Dall.
- **Potamides transecta* Dall.
- Potamides campanulatus* Heilprin.
- **Turritella atacta* Dall.
- Turritella tampaensis* Heilprin.
- Globularia streptostoma* (Heilprin)
- Ampullina amphora* (Heilprin).
- Pachycromnium floridana* (Dall).
- **Helicina tampaensis* Dall.
- **Nerita tampaensis* Dall.
- **Yoldia* cf. *Y. frater* Dall.
- **Glycymeris lamyi* Dall.
- **Arca umbonata* Lamarck.
- **Barbatia marylandica* Conrad.
- Anadara hypomela* Dall.
- Chlamys crocus* Cooke.
- Chlamys burnetti* Tucker.
- **Modiolus blandus* Dall.
- **Modiolus cinnamomeus* (Lamarck).
- **Celliforma nuda* (Dall) Brown.
- Cardita tegea* Dall.
- Venericardia serricosta* (Heilprin)
- **Cyrena pompholyx* Dall.
- Chama tampaensis* Dall.
- Phacoides vacissanus* Dall.
- Phacoides hillsboroensis* (Heilprin)
- **Cardium gadsdenense* Mansfield.
- Cardium phlyctaenum* Dall.
- **Macrocallista floridana* Conrad.
- Antigona glyptoconcha* Dall.
- Antigona shepardii* Dall.
- Anomalocardia penita* (Conrad)
- **Venus halidona* Dall.
- **Tellina merula* Dall.
- **Tellina halidona* Dall.
- Panope* aff. *P. goldfussii* (Wagner).

The species preceded by an asterisk were collected by Miss Helen I. Tucker (her locality no. 57), a number of them being previously unrecorded at the locality.

Of the 57 species in the list 52 occur in the Tampa limestone in the Tampa area, the 5 species not identified from the Tampa area being *Humboldtiana? tuckeri* Mansfield, *Urosalpinx? hillsboroensis* Mansfield, *Chlamys crocus* Cooke, *Chlamys burnetti* Tucker, and *Cardium gadsdenense* Mansfield. Dall³² referred the fauna to his

³² Dall, W. H., Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, pp. 1571-1572, 1903.

Tampa limestone or orbitolite bed, and it is very similar to that which occupies a position in the uppermost part of the Tampa limestone (of the writer) at station 13847, Gadsden Point, 4 miles south of Ballast Point.

The rock along Sixmile Creek is calcareous, but silicified shells are found in the bed of the creek, and also at or near the contact of the limestone with the overlying Pleistocene bed.

POLK COUNTY

The following species have been determined from station 2470, Phosphate mine, 1 mile west of Bartow. G. H. Eldridge, collector, about 1894.

Conus planiceps Heilprin.
Turritella tampa Heilprin.
Turritella litharia Dall.
Chlamys crocus Cooke.
Chlamys burnetti Tucker?
Spondylus chipolanus tampaensis Mansfield.
Crassatella deformis (Heilprin)
Venericardia serricosta (Heilprin)
Antigona glyptoconcha Dall.

PINELLAS COUNTY

The following species have been determined from stations 7358 (C. W. Cooke) and 12763 (G. M. Ponton and W. C. Mansfield), Anclote River about 300 yards above the wagon bridge at Tarpon Springs:

Conus designatus Dall.
Xancus polygonatus (Heilprin)
Lyria heilprini Dall (cf. *L. tampaensis* Mansfield).
Busycon perizonatum Dall?
Solenostera quinquiespira (Dall).
Urosalpinx? inornata (Dall).
 (Referred by Dall to his Tampa limestone.)
Murex trophoniformis Heilprin.
Rapana vughani Mansfield.
 (Occurs also in the lower bed at River Junction.)
Orthaulax pugnax (Heilprin).
Strombus liocyclus Dall.
Cerithium praecursor Heilprin?
Potamides campanulatus Heilprin.
Potamides cornutus Heilprin.
Serpulorbis granifera (Say)?
Turritella tarponensis Mansfield.
Globularia solidula Dall.
Ampullina amphora Heilprin.
Sinum imperforatum Dall?
Arca umbonata Lamarck.
Anadara tarponensis Mansfield.
Amusium sp.
Plicatula densata Conrad.

Chione
 Lithophaga bisulcata D'Orbigny.
 Cardita anclotensis Mansfield.
 Cyrena floridana (Dall).
 Diplodonta anclotensis Mansfield.
 Cardium anclotense Mansfield.
 Cardium pinellasense Mansfield.
~~Antigona~~ rhodia Dall.

This fauna includes species that were supposed to characterize both the *Orthaulax pugnax* zone of Dall and the overlying Tampa limestone of Dall.

PASCO COUNTY

The following species have been determined from station 12760, one-half mile west of New Port Richey:

Potamides cornutus Heilprin.

Although this species occurs in the so-called *Orthaulax pugnax* zone of Dall, it appears to be more often associated with *Potamides hillsboroensis* Heilprin, of the *Cerithium* zone of Heilprin.

MARION COUNTY

The species listed below have been determined from one or more of the following localities: station 11115, Cummer Lumber Company lime pit at Kendrick; station 7353, Road from Anthony to Martin, just east of crossroads midway between them; station 11186, pits on old Raysor property near hilltop, midway between Lowell and Sparr:

Pleurodonte cf. *P. cunctator* (Dall).
 Pleurodonte kendrickensis Mansfield.
 Mitra silicata Dall?.
 Mitra cf. *prodroma* Gardner (MS.), a *Chipola* species.
 Xancus polygonatus (Heilprin).
 Alectrion aff. *A. harrisi* Maury.
 Murex trophoniformis Heilprin.
 Turritella tampae Heilprin.
 Calyptraea trochiformis Lamarck?.
 Arca kendrickensis Mansfield.
 Chlamys crocus Cooke.
 Chlamys marionensis Mansfield.
 Chlamys burnetti Tucker.
 Venericardia nodifera Kellum.
 Phacoides wacissanus Dall.
 Phacoides hillsboroensis Heilprin?.
 Cardium hernandoense Mansfield?.
 Dosinia chipolana Dall?.
 Clementia sp.
 Callocardia albofonte Gardner, a *Chipola* species.
 Antigona cf. *A. tarquinia* Dall.
 Venus halidona Dall.
 Venus marionana Mansfield.
 Tellina silicata Mansfield?.
 Panope aff. *P. goldfussii* (Wagner).

The assemblages at the three localities are very similar. Most of the species in the above list appear to have lived in late Tampa time. However, the presence of two or more species identical with or closely allied to species of the Hawthorn formation indicates a mixture (mechanical or otherwise) of the earlier and later faunas. Cooke and Mossom²³ believed that "A thin bed of Tampa Limestone was found between the Hawthorn formation and the Ocala limestone in the test pits on the old Raysor property midway between Lowell and Sparr" (station 11186).

JEFFERSON COUNTY

The species listed below have been determined from one or more of the following localities: station 6830 (C. W. Cooke and E. H. Sellards) and station 12300 (H. Gunter, G. M. Ponton and W. C. Mansfield), at and above a disappearing stream, $1\frac{1}{4}$ miles northeast of Lloyd. Clay overlying a limestone at Baileys Mill Creek sink, three-fourths mile northeast of Lloyd (L. C. Johnson), Wacissa (G. H. Eldridge):

Pleurodonte cf. cunctator Dall.
Bulimulus americanus patulinus Dall?.
Helicina ballista Dall?.
Planorbis? sp.
Conus planiceps Heilprin.
Fusiturricula lapconotierei (Dall).
Olivella entorta Dall?.
Marginella bellula Dall.
Lyria musicina Heilprin.
Latirus floridanus Heilprin.
Cypraea tumulus Heilprin.
Strombus liocyclus Dall.
Orthaulax pugnax (Heilprin).
Bittium adela Dall.
Cerithium precursor Heilprin.
Potamides transecta Dall.
Potamides campanulatus Heilprin.
Turritella megalobasis Dall.
Hipponix tampaensis Mansfield.
Helicina ballista Dall?.
Glycymeris cf. G. lamyi Dall.
Barbatia domingensis (Lamarck).
Ostrea vaughani Dall.
Chlamys crocus (Cooke).
Crassatella deformis (Heilprin).
Venericardia serricosta (Heilprin).
Cyrena floridana (Dall).
Cardium gadsdenense Mansfield.
Hippopus? *gunteri* Mansfield.
Chione spada Dall?.
Anomalocardia penita (Conrad).
Venus halidona Dall?.

²³ Cooke, C. W., and Mossom, Stuart, *Geology of Florida: Florida State Geol Survey, 20th Ann. Rept., p. 89, 1929.*

These fossils probably all came from the same horizon. Baileys Mill Creek sink may be the same locality as station 6830. Dall³¹ briefly discussed the geology in the vicinity of Lloyd. At a place said to be $2\frac{1}{2}$ miles east of Lloyd (probably the same place as station 6830), Dall states that the limestone appears to be Tampa, as it contains many specimens of *Orbitolites floridanus* Conrad and other fossils.

WAKULLA COUNTY

The species listed below have been determined from one or more of the following localities: Station 3420, on the railroad to St. Marks, 15 [probably 16] miles south of Tallahassee (T. W. Vaughan). Station 12293, 200 yards south of Wakulla Railroad Station, 16 miles south of Tallahassee (G. M. Ponton and W. C. Mansfield). Station 12292, Cherokee sink, about 2 miles west of Wakulla Spring or about 5 miles west of Wakulla Station (G. M. Ponton and W. C. Mansfield). Station 12732, along a drainage ditch of highway from Wakulla Station to St. Marks, 3.7 miles south of Wakulla Station. Station 12294, along Florida State Highway No. 10, 2.5 miles south of Crawfordville; from pieces of rock thrown out in constructing the highway (G. M. Ponton and W. C. Mansfield). Station 12296, "The Swirl," $3\frac{1}{2}$ miles southeast of Crawfordville (G. M. Ponton and W. C. Mansfield).

- Pleurodonte cf. *P. cunctator* (Dall).
- Bulimulus americanus wakullae* Mansfield.
- Bulimulus americanus patulinus* Dall?
- Cerion anodonta* (Dall).
- Scaphander ballistus* Mansfield.
- Conus princeps wakullensis* Mansfield.
- Fusiturricula condomina* (Dall).
- Lyria heilprini* Dall?
- Conomitra angulata* (Heilprin).
- Xancus polygonatus* Heilprin.
- Murex tritonopsis* Heilprin.
- Coralliophaga magna* Dall.
- Cypraea tumulus* Heilprin?
- Strombus liocyclus* Dall.
- Orthaulax pugnax* (Heilprin).
- Cerithium praecursor* Heilprin.
- Cerithium* aff. *C. georgianum* Lyell and Sowerby.
- Potamides transecta* Dall.
- Potamides campanulatus* Heilprin.
- Potamides cornutus* Heilprin.
- Turritella tampae* Dall.
- Turritella pagodaeformis* Heilprin.
- Turritella megalobasis* Dall?
- Calyptrea trochiformis* Lamarck?
- Globularia streptostoma* Heilprin?

³¹ Dall, W. H., U. S. Geol. Survey Bull. 84, p. 121, 1892.

Ampullina amphora Heilprin.
Nuculana flexuosa (Heilprin).
Glycymeris cf. *G. lamyi* Dall.
Arca umbonata Lamarck.
Arca grammatodonta Dall.
Barbatia arcuata Heilprin.
Anadara hypomela Dall.
Ostrea vauhani Dall.
Chlamys crocus (Cooke).
Chlamys burnetti Tucker?.
Chlamys sp. a.
Modiolus blandus Dall?.
Modiolus cinnamomeus (Lamarck).
Celliforma nuda (Dall) Brown?.
Crassatella deformis (Heilprin) var.?.
Venericardia serricosta (Heilprin).
Cyrena pompholyx Dall.
Phacoides wacissanus Dall.
Phacoides hillsboroensis Heilprin?.
Cardium gadsdenense Mansfield.
Cardium parile Dall.
Cardium phlyctaenum Dall.
Cardium hernandoense Mansfield?.
Chione cf. *spenceri* Cooke.
Antigona glyptoconcha Dall.
Tellina silicata Mansfield?.
Tellina merula Dall.
Semele sardonica Dall?.
Panope aff. *P. goldfussii* Wagner.
Pholadomya species.
Gastrochaena aff. *G. cuneiformis* Spengler.

The assemblages at the several localities are very similar. The fauna is believed to represent the latest fauna of the Tampa limestone. The horizon is overlain by beds containing fossils of the Alum Bluff group.

LEON COUNTY

The species listed below were collected at station 12735, W. K. Cooke and Sons property, about 11 miles slightly southwest of Tallahassee (G. M. Ponton and W. C. Mansfield):

Turritella tampae Heilprin.
Anadara hypomela Dall.
Venericardia serricosta (Heilprin)?.
Phacoides silicatus Mansfield.
Cardium gadsdenense Mansfield.
Anomalocardia penita (Conrad)?.

This locality is the nearest to Tallahassee at which near-surface fossils have been collected from the Tampa limestone. About 15 feet of limestone is exposed; the lower part is rather dense, white to gray; the upper part contains more fossils.

A nearby locality, locally called "Dismal Sink," is 300 to 400 feet in diameter and is at a higher level than the surrounding area. On

March 18, 1932, the level of the water in the sink was about 35 feet below the rim. A collection of fossils of Hawthorn age, obtained about 10 feet below the rim, included an interesting species, "*Anomia suwanneensis*" Gardner, which occurs in the Hawthorn formation at White Springs, on the Suwannee River. These Hawthorn species lie at a higher elevation than the place from which the Tampa fossils were collected.

SECTIONS ON THE FLINT RIVER, GEORGIA, AND THE APALACHICOLA RIVER, FLORIDA

Figure 1 shows a series of sections exposed on the Flint River, Georgia (no. 1), and along the Apalachicola River, Florida (nos. 2-6).

The sections exposed along the Apalachicola River are classic in the study of the geology of western Florida. Since their discovery by Langdon in 1887 they have been visited and studied by many geologists and a number of papers have been written about them. These are listed in the "Bibliography of Florida Geology," published in the First Annual Report, pp. 73-108, 1908. The excellent reports of Sellards and Gunter³⁵ are the most recent. They describe the lithologic rather than the faunal character of the beds. The sections at Aspalaga Bluff, Rock Bluff, and Alum Bluff given in this paper are mainly adapted from these reports.

In figure 1 stratigraphic sections of the bluffs from Wyley Landing, Ga., to Alum Bluff, Fla., have been drawn up with the river stage of March 5, 1909, as a datum. The distances between the sections may not be exact but are in accord with the most reliable information at hand. The names of a few characteristic fossils have been intercalated at the proper levels in these sections, and an attempt has been made to correlate the faunas of the Tampa limestone from one section to another. Most of the fossils in the limestones are preserved as molds and in some instances it is difficult to make specific determinations from the imprints taken from these molds. This is, however, the first attempt to correlate the beds and any errors will doubtless be corrected in future work.

The sections and their faunal content will be discussed in order beginning with Wyley Landing on the Flint River at the north and proceeding down the Apalachicola River.

³⁵ Sellards, E. H., and Gunter, Herman, The fullers earth deposits of Gadsden County, Fla.; Florida State Geol. Survey 2d Ann. Rept., pp. 257-291, 1909. (Especially the "Apalachicola River Section," pp. 265-285.) Geology between the Apalachicola and Ocklocknee Rivers in Florida: Florida Geol. Survey 10th and 11th Ann. Repts., pp. 11-54, 1918.

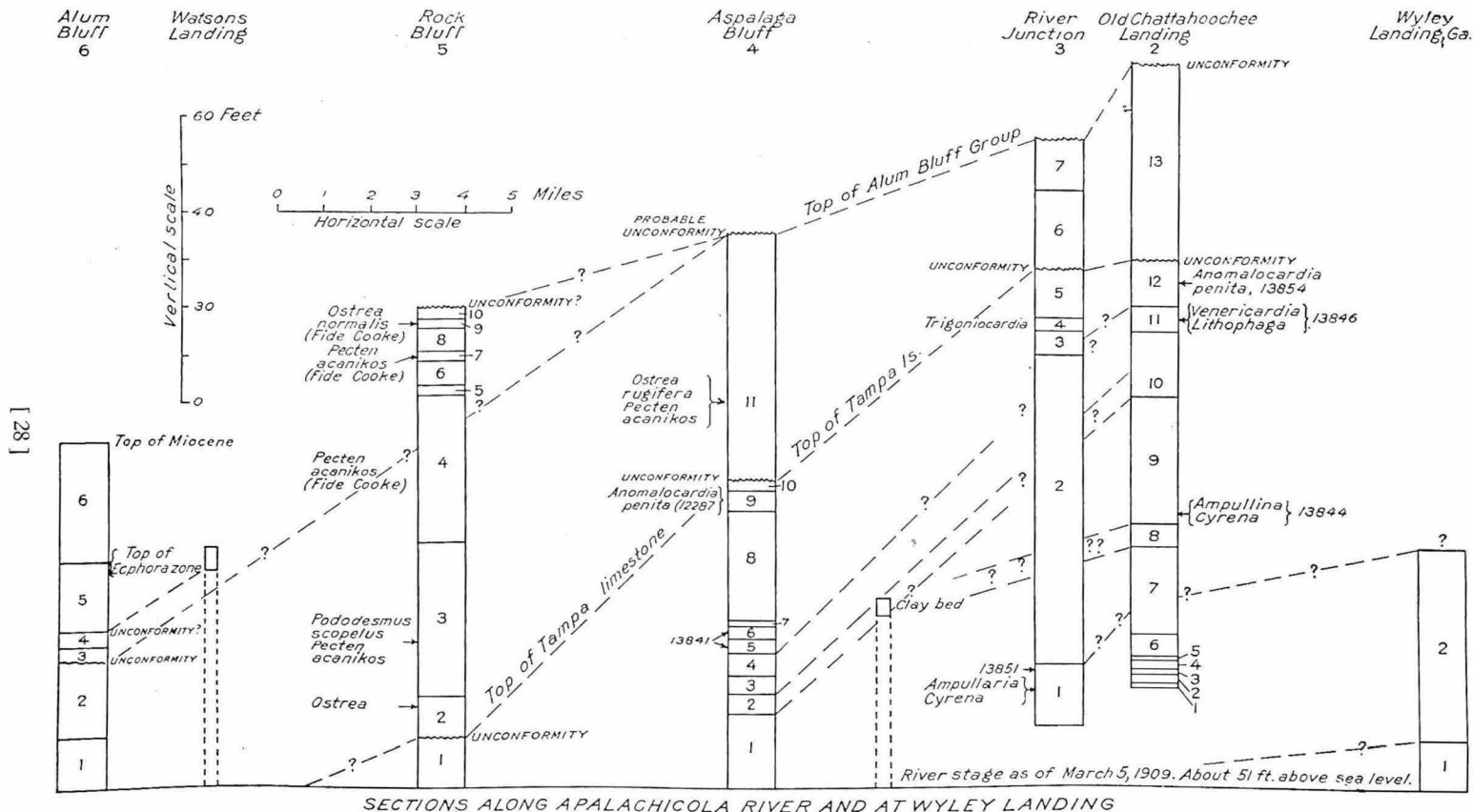


FIGURE 1
Sections on the Flint River, Georgia, and along the Apalachicola River, Florida.

Wyley Landing.—Wyley Landing is on the south bank of the Flint River about 5 miles northeast of Old Chattahoochee Landing. The section here (figure 1, no. 1) follows:

Section at Wyley Landing, Georgia, after J. O. Veatch and L. W. Stephenson.

Pliocene? [Mansfield]:	Feet
3. Bright-red sand, capping the bluff	?
Lower Miocene, Tampa limestone (part):	
2. Massive-bedded, weathered grayish or white limestone	40
Oligocene; probably Flint River formation:	
1. Greenish or bluish clay containing rock fragments	10

The details of the sequence are obscured by debris from the bluff, and the exact positions in the bluff at which collections have been made are not definitely known. However, the fossils collected indicate that both the Tampa limestone and the Flint River formation are present. The basal 10 feet of the section, consisting of greenish or bluish clay, probably belongs to the Flint River formation. Perhaps the Tampa limestone of this exposure is the same as the Wileys Landing Bed of Foerste,³⁰ but no fossils were listed by Foerste, and the correlation is uncertain.

The species collected from Wyley Landing, station 3403 (T. W. Vaughan), station 7077 (Vaughan, Cooke, and Mansfield), station 13845 (Cooke, Mansfield, and MacNeil), are listed below. Those preceded by an asterisk probably came from the Tampa limestone and those by the letter "F" from the Flint River formation.

- **Bulimulus* sp. (7077).
- **Potamides campanulatus* Heilprin (13845, 7077).
- **Potamides cornutus* Heilprin (3403, 7077).
- **Cerithium* cf. *C. praecursor* (Heilprin) (3403).
- **Rapana vughani* Mansfield (3403).
- **Turritella* cf. *T. tampae* Dall (7077).
- Calyptraea* sp. (7077).
- **Ampullina amphora* (Heilprin) (3403).
- Tegula*? (3403).
- **Barbatia* (Acar) cf. *B. (A.) domingensis* (Lamarck) (7077).
- ?**Ostrea* sp. (3403).
- Lithophaga* sp. (3403, 7077).
- F, *Lima* cf. *L. halensis* Dall (7077).
- **Crassatella deformis* (Heilprin) (7077).
- **Cyrena floridana* (Dall) (3403, 13845).
- Venus* sp. (3403).
- Corbula* sp. (7077).

³⁰ Foerste, August F. The upper Vicksburg Eocene and the Chattahoochee Miocene of Southwest Georgia and adjacent Florida: *Am. Jour. Sci.*, 3d ser., vol. 48, p. 51, 1894.

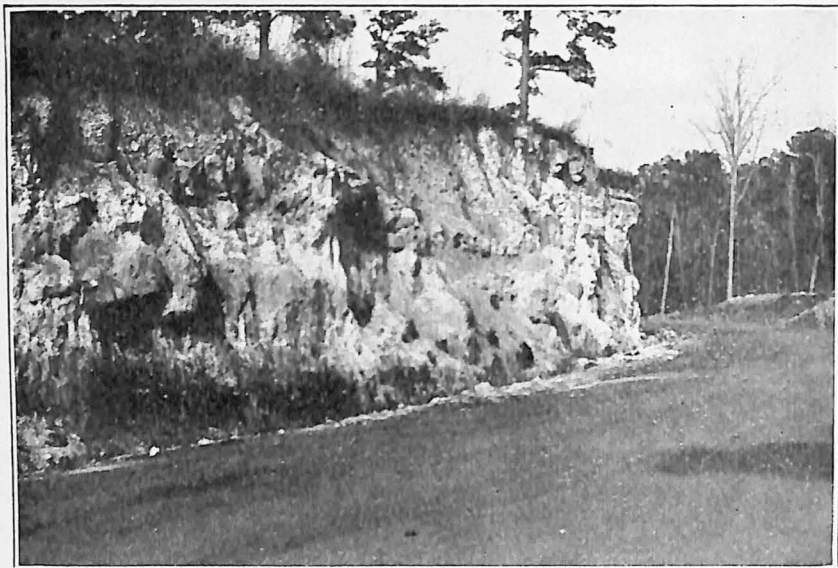


Fig. 1. Tampa limestone at eastern end of Victory bridge (Old Chattahoochee Landing) over Apalachicola River. Photo by N. B. Davis, 1925. (See Florida Geol. Survey, 16th Ann. Rept., p. 85, 1925.)

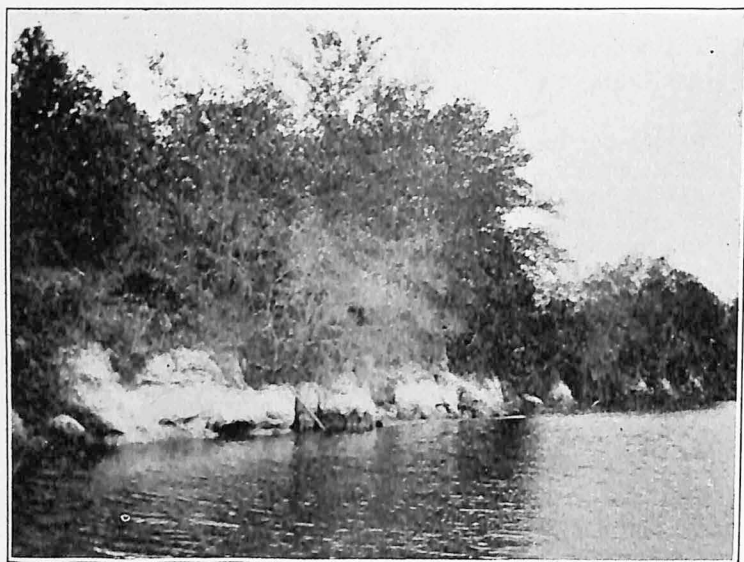


Fig. 2. Tampa limestone on Sixmile Creek, a quarter of a mile below the bridge at Orient. Photo by Florida Geol. Survey. (See pl. 9[a], Florida Geol. Survey, 20th Ann. Rept.)

Old Chattahoochee Landing, Florida.—This is the type locality of the Chattahoochee formation, now included under the Tampa limestone. The section (figure 1, no. 2) was taken by Ponton and Mansfield along the road on the east side of Victory bridge, about one-half mile south of the Florida-Georgia state line.

Section at Old Chattahoochee Landing, by W. C. Mansfield, G. M. Ponton, and C. W. Cooke.

	Feet
Miocene, Alum Bluff group, Hawthorn formation (fide Cooke):	
13. Alternating beds of sand, clay, sandy clay, and clayey sand	42.5
Unconformity.	
Lower Miocene, Tampa limestone:	
12. Limestone with <i>Sorites</i> , <i>Anomalocardia penita</i>	8.2
11. Limestone with <i>Venericardia</i> and <i>Lithophaga</i>	7.4
10. Concealed	12.2
9. White chalky limestone containing some quartz sand	27.0
8. Limy clay (fide Sellards and Gunter)	4.0
7. Same as no. 9	19.0
6. Concealed, probably clay	5.0
5. Ledge with calcite crystals	1.0
4. Dirty white limestone	2.0
3. Ledge	1.0
2. Same as no. 4	2.0
1. Echinoderm bed, dominantly sand	1.0
Concealed to river	20.0

Four fossiliferous horizons were recognized in this section, the first at the base (bed 1), the second about 37 feet above (bed 9), the third (bed 11), and fourth (bed 12) near the top. The fossils collected from each of these horizons are listed below.

Maury³⁷ states that a layer of *Helices* was noted by Professor Harris at an elevation of 43 feet in the section. The position of this bed appears to be about 18 feet above the echinoderm bed, or in the lower part of bed 7.

The following species have been collected from bed 1, the lowest zone in the section, the bed carrying "*Echinocardium*" *depressum* Clark (elevation 77.4 to 78.4 feet above sea level); station 2565 (Dall and Stanley-Brown, 1893), station 3405 (Vaughan, 1900), station 4836 (F. G. Clapp and others, 1913), station 6185 (L. W. Stephenson, 1908), station 7168 (T. W. Vaughan, 1914), station 12282 (G. M. Ponton and W. C. Mansfield, 1931; W. C. Mansfield and F. S. MacNeil, 1936):

Scaphander ballistus Mansfield?
Epitonium sp.
Arca umbonata Lamarck?
Ostrea aff. *O. antiguensis* Brown.

³⁷ Maury, Carlotta Joaquina, Bull. Am. Paleontology No. 15, pp. 52, 53, 54, 1902.

Chlamys crocus (Cooke).
Chlamys sp. b.
Modiolus blandus Dall.
Divaricella sp.
Protocardia sp.
Cardium gadsdenense Mansfield.
Venus? sp.
Semele silicata Dall?.
Panope aff. *P. goldfussii* (Wagner).
 "Echinocardium" depressum Clark.

The echinoderm bed is provisionally placed at the base of the Tampa limestone, although there is a little evidence for placing it in the upper part of the Flint River formation. The *Ostrea* preserved as a mold resembles also *O. vicksburgensis* Conrad from the Oligocene, as well as *O. antiquensis*. The rest of the fauna, however, appears to be more closely related to that of the Tampa limestone.

The following species occur in bed 9, the second zone, at station 13844, 37 feet above the echinoderm bed:

Conus sp.
Potamides campanulatus Heilprin.
Xenophora sp.
Ampullina cf. *A. amphora* (Heilprin).
Glycymeris sp.
Chlamys crocus (Cooke)?.
Lithophaga bisulcata D'Orbigny.
Venericardia sp.
Cyrena cf. *C. floridana* Dall.
Antigona shepardii Dall.

It may be noted that the genera *Potamides*, *Ampullina*, and *Cyrena* occur in this zone.

The following species occur in beds 11 and 12, the highest fossiliferous zones; station 7169, bed 6 of Vaughan, elevation 122.5-124 feet (Vaughan); station 12283, elevation 155-165 feet, beds 11 and 12 (G. M. Ponton and W. C. Mansfield); station 13846, elevation 155 feet, bed 11 (W. C. Mansfield and F. S. MacNeil); station 13854, elevation 165 feet, bed 12 (W. C. Mansfield and F. S. MacNeil):

Turritella pagodaformis Heilprin? (7169).
Chlamys crocus (Cooke) (7169, 12283).
Chlamys burnetti Tucker? (12283).
Lithophaga bisulcata D'Orbigny (13846).
Lithophaga antillaria (D'Orbigny) (7169).
Venericardia sp. (13846).
Anomalocardia penita Conrad (12283, 13854).

River Junction.—This section (figure 1, no. 3), about 1 mile southeast of Old Chattahoochee Landing and about the same distance from the Apalachicola River, is as follows:

Section at River Junction, by W. C. Mansfield and G. M. Ponton.

	Feet
Miocene, Alum Bluff group, Hawthorn formation:	
7. Clay and fuller's earth (Vaughan)	10
6. Unexposed, probably argillaceous sands (Vaughan)	17
Unconformity.	
Lower Miocene, Tampa limestone:	
5. Layers of harder and softer limestone	10±
4. Ledge with many <i>Trigoniocardia</i>	2
3. Soft white limestone	5
2. Concealed	65
1. Very siliceous limestone with <i>Ampullina</i> and <i>Cyrena</i>	12±

The species listed below were collected from bed 1 at localities in the vicinity of River Junction; station 3407, west end of roadway (T. W. Vaughan, 1900); station 3408, ditch on south side of the railroad, east of crossing (T. W. Vaughan, 1900); station 3413, north side of creek on road from River to Chattahoochee, one-half mile north of River Junction (T. W. Vaughan, 1900); station 3414, River Junction (T. W. Vaughan, 1900); station 7172, north side of creek, outskirts of River Junction (T. W. Vaughan, 1914); station 7173, west of River Junction, north side of L. & N. R. R. west Y, about 10 feet below level of railroad tracks (T. W. Vaughan, 1914); station 7174, east side of Y, south side of L. & N. R. R. tracks, ditch along railroad, 8-10 feet below level of railroad tracks (T. W. Vaughan, 1914); station 7175, west of River Junction, east side of Y, north of L. & N. R. R., 9-10 feet below level of railroad tracks (T. W. Vaughan, 1914); station 7176, north of L. & N. R. R., west of Y, elevation about 74 feet (T. W. Vaughan and others, 1914). The elevation of tracks is about 82 feet above sea level.

Rapana vaughani Mansfield (7175).
Modiolus cinnamomeus (Lamarck) (7172).
Cyrena floridana (Dall)? (3407, 7174, 7175).
Cardium hernandoense Mansfield? (3408).
Cardium brooksvillense conjunctionense Mansfield?
Antigona shepardii Dall? (7172).
Corbula kaghriana Dall? (7172).

The species found in bed 1 at station 13851, about one-fourth mile north of railroad station at River Junction, at an elevation of about 80 feet, are:

Solenostera quinquespina Dall?
Turritella tampae Dall?
Ampullina amphora Heilprin?
Arca umbonata Lamarck.
Anadara tarponensis Mansfield?
Chlamys crocus (Cooke).
Venericardia sp.
Cardium hernandoense Mansfield?.

Cardium brooksvillense conjunctionense Mansfield?
Venus halidona Dall?
Antigona shepardii Dall.
Semele sardonica Dall?

The horizon of these fossils is a little higher in the section than that of the localities below the railroad tracks (station 3407 and other localities). The matrix in both assemblages is very sandy, more so than at station 13844, at Old Chattahoochee Landing, and they may be a little lower stratigraphically than station 13844, although the faunas are similar.

The species listed below have been collected from an abandoned quarry, one-half mile south of River Junction at an elevation around 150 feet, at several localities: Station 3409, above cement bed (Vaughan, 1900); station 3410, cement quarry (Vaughan, 1900); station 3411, above cement horizon (Vaughan, 1900); station 7080, cement quarry (Vaughan and others, 1914); station 12285 (Ponton and Mansfield, 1931). They are mainly from bed 4 of the section.

Scaphander ballistus Mansfield.
Conus illiolus Dall?
Conus planiceps Heilprin.
Corallophila magna Dall?
Cypraea tumulus Heilprin.
Orthaulax pugnax (Heilprin)?
Siliquaria tampaensis Mansfield?
Turritella pagodaeformis Heilprin?
Turritella megalobasis Dall.
Calyptrea trochiformis Lamarck?
Globularia streptostoma Heilprin.
Nucula gadsdenensis Mansfield.
Glycymeris gadsdenensis Mansfield.
Arca umbonata Lamarck?
Barbatia marylandica Conrad?
Modiolus cinnamomeus (Lamarck)
Lithophaga antillarum D'Orbigny.
Venericardia serricosta Heilprin.
Phacoides wacissanus Dall.
Phacoides silicatus Mansfield.
Diplodonta catopotium Dall?
Cardium gadsdenense Mansfield.
Cardium brooksvillense conjunctionense Mansfield.
Hippopus? gunteri Mansfield?
Antigona shepardii Dall
Anomalocardia penita Conrad.
Tellina silicata Mansfield?.

This fauna is high in the Tampa limestone. It seems to correspond to the *Anomalocardia* bed (No. 12) at Old Chattahoochee Landing. No specimens of *Trigoniocardia*, which is common at River Junction locality, were collected here.

Aspalaga Bluff.—Aspalaga Bluff is in Gadsden County, about 5½ miles southwest of River Junction. The section (figure 1, no. 4) follows:

Section at Aspalaga Bluff, after Sellards and Gunter, 1909.	
Pliocene, Citronelle formation (Mansfield):	Feet
12. Covered	60
Probably Miocene, Hawthorn formation (Mansfield):	
11. Mostly covered with few outcrops of impure limestone with fossil casts	51
Unconformity (Mansfield).	
Lower Miocene, Tampa limestone:	
10. White granular limestone with fossils	2
9. White limestone	4
8. Light-colored impure limestone (where exposed) with clay inclusions	23
7. White granular limestone with fossils	1
6. White limestone	2.5
5. Light-colored limestone	2
4. White limestone	6
3. Sandy light to pale yellow limestone	2.75
2. Gray to bluish calcareous clay	4
1. Yellowish and sandy limestone with fossils	15.75

The following species occur at station 13841, about 10 feet above a 4-foot clay bed in beds 5 and 6:

Conomitra angulata Heilprin.
Solenostera quinquespina Dall.
Rapana sp.
Cerithium cf. *praecursor* Dall.
Potamides aspalagensis Mansfield.
Ampullina amphora Heilprin.
Turbo sp.
Modiolus cinnamomeus (Lamarck).
Lithophaga antillarum (Orbigny).
Phacoides sp.
Cyrena floridana Dall.
Anomalocardia penita Conrad.

The matrix is a porous, nearly white, pure limestone containing the foraminifer, *Archais floridanus* Conrad. The fauna is somewhat similar to that of the "*Cerithium* rock" of Heilprin but may be a little younger. *Potamides aspalagensis*, described from here, is closely related to *Potamides hillsboroensis* Heilprin.

This part of the section corresponds to the *Madrepora* bed of Harris (see Maury, op. cit., p. 54, 1902.)

Station 3406, elevation in the bluff not known (Vaughan) has yielded:

Turritella tampae Heilprin.
Chlamys sp. b.
Cyrena floridana (Dall)?
Phacoides silicatus Mansfield.
Phacoides wacissanus Dall.

At station 12287, at estimated elevation 45 to 50 feet above the river level, in bed 9 of section, Ponton and Mansfield collected a large form of *Anomalocardia penita* Conrad.

At an estimated elevation of 80 feet above the river *Ostrea rugifera* and *Pecten acanikos* Gardner, Chipola formation species, were collected by Mansfield and MacNeil from bed 11 of the section.

Prof. G. D. Harris, who made a section of this bluff in 1901, reports *Pecten* and *Placuna* in place at an elevation of 145 feet above the base of the cliff. This may be an error, as this elevation appears to be too high to be in the Alum Bluff group.

Rock Bluff.—Rock Bluff, Liberty County, is on the left bank of Apalachicola River, about 5½ miles south southwest of Aspalaga Bluff, or about 12½ miles from the state line. The section here (figure 1, no. 5) is as follows:

Section at Rock Bluff, after Sellards and Gunter, 1909.		
Miocene, Alum Bluff group, Hawthorn formation:		Feet
10. Fuller's earth (exposed)		3
9. Ledge with shells (<i>Ostrea normalis</i> fide Cooke)		1
8. Gray sand		5
7. Ledge with shells (<i>Pecten acanikos</i> fide Cooke)		2
6. Gray sand with lime inclusions		5
5. Covered		2
4. Light-gray calcareous sand (<i>Pecten acanikos</i> fide Cooke)		30
3. Bluish-green to gray sands (<i>Pododesmus scopelus</i> , <i>Pecten acanikos</i> , Mansfield)		34
2. Compact sandy marl with concretions near the base and an <i>Ostrea</i> layer 6 feet above the base		8
Unconformity.		
Lower Miocene, Tampa limestone:		
1. Limestone		10

The lower part of the section (bed 1), about 10 feet exposed, belongs to the Tampa limestone. Above the Tampa limestone about 90 feet of the strata have been referred to the Alum Bluff group by Sellards and Gunter,³⁸ but this amount appears to be excessive. Cooke and Mossom³⁹ follow Sellards and Gunter in this respect, though choosing their own limits. The part referred to the Alum Bluff group closely duplicates the section above the Tampa limestone at Ponto Springs (the species occurring in the Alum Bluff group at Ponto Springs are given in the discussion of the section at that place).

Alum Bluff.—Alum Bluff, in Liberty County, is on the left side of Apalachicola River about 6½ miles in a direct line from Rock Bluff.

³⁸ Sellards, E. H., and Gunter, Herman, The fullers earth deposits of Gadsden County, Fla.: Florida State Geol. Survey, 2d Ann. Rept., pp. 265-286, 1909.

³⁹ Cooke, C. W., and Mossom, Stuart, Florida Geol. Survey 20th Ann. Rept., p. 118, 1929.

The section (figure 1, no. 6) is drawn up to show the relation of the Alum Bluff group to the exposures upstream. The Tampa limestone goes under near the mouth of Sweetwater Creek, $2\frac{1}{2}$ to 3 miles below Rock Bluff.

Section at Alum Bluff, modified from that of Berry, Sellards, and Gunter, by Cooke.

Miocene, Choctawhatchee formation:	Feet
6. Brown, sandy micaceous, pyritiferous clay (aluminous clay of Dall)	25
5. Brown or dirty-green fine sand mixed with clay (<i>Ecphora</i> zone)	15
Erosional unconformity?	
Miocene, Alum Bluff group?:	
4. Medium-fine white or greenish micaceous sand	3
3. Leaf-bearing bed	3
Unconformity.	
Miocene, Alum Bluff group; Chipola formation:	
2. Light-gray tough calcareous sand with typical Chipola fossils in lower part, but casts alone in the upper part (Alum Bluff sands of Dall).....	16
1. Very fossiliferous fine quartz sand in a yellow calcareous clay, above water level of March 5, 1909	10

The top of the Tampa limestone would appear to be about 15 or more feet below the lowest exposed part of bed 1 of the section at Alum Bluff. The *Ostrea* bed (bed 2 at Rock Bluff) would also lie below bed 1 at Alum Bluff.

Dip of the Tampa limestone along the Apalachicola River.—Foerste⁴⁰ assumed a rate of dip of the Tampa limestone of about 9 feet per mile. Sellards and Gunter⁴¹ estimated the rate of dip from Aspalaga Bluff to Rock Bluff to be 10 feet per mile. The same authors, using a calcareous clay bed that crops out at Aspalaga Bluff (bed 2 of section), at the locality 3 miles southwest of River Junction, and at Old Chattahoochee Landing, estimated a dip of 7 feet or more per mile.

As the writer has used the sections constructed by Sellards and Gunter along the Apalachicola River, except those at Old Chattahoochee Landing and at River Junction, his estimate of the dip of the strata naturally conforms with theirs. The average rate of dip over the whole distance along the Apalachicola River appears to be 7 to 10 feet per mile. Small folds in the Tampa limestone in the vicinity of Old Chattahoochee Landing and a small syncline near the middle of Aspalaga Bluff are reported by Sellards and Gunter.⁴² These folds appear to be of a local and minor character and probably do not involve large areas.

⁴⁰ Foerste, Aug. F., Am. Jour. Sci. (3), vol. 48, p. 54, 1894.

⁴¹ Sellards, E. H., and Gunter, Herman, Florida State Geol. Survey 2d Ann. Rept., pp. 277-279, 1909.

⁴² Idem, pp. 270, 277.

At a later date Gunter and Sellards⁴³ concluded that "the actual average dip is probably close to the estimate formerly given of 7 feet per mile" for the Tampa limestone along the Apalachicola River.

The same authors⁴⁴ wrote: "These measurements [between Apalachicola and Ocklocknee Rivers] which are consistent with others previously obtained indicate that the Chattahoochee formation dips to the east from River Junction and rises somewhat again at the Ocklocknee River."

From the information so far obtained it seems that the Tampa limestone in western Florida was deposited in a wide embayment whose waters entered from the south and extended northward into Georgia. This area slowly sank during Tampa time and sediments accumulated in a shallow sea. An uplift of the area possibly ended Tampa time. If so, it was soon followed by a subsidence which permitted the invasion of the Alum Bluff sea. None of the movements seem to have been of large amplitude and the resulting dips are gentle.

CALHOUN COUNTY

The species listed below were collected by G. M. Ponton and W. C. Mansfield from the following localities on the Chipola River: Station 12725, Baileys old Ferry at the mouth of Tenmile Creek. Station 12728, Hamilton Spring, about 1½ miles below Willis bridge over Chipola River. Station 12727, Willis bridge. Station 12726, about 2.2 miles above Willis bridge.

- Pleurodonte cunctator* Dall? (12726).
- Morum chipolanum tampanum* Mansfield (12727).
- Calyptraea trochiformis* Lamarck? (12726).
- Glycymeris lamyi* Dall (12728)
- Chlamys crocus* Cooke (12725)
- Chlamys burnetti* Tucker? (12727)
- Venericardia serricosta* Heilprin (12727).
- Phacoides silicatus* Mansfield (12725).
- Cardium gadsdenense* Mansfield (12725)
- Antigona glyptoconcha* Dall (12727).
- Antigona shepardii* Dall (12727).
- Anomalocardia penita* (Conrad) (12728).

WASHINGTON COUNTY

The following species have been collected from bed 2 at Falling Water in the NW¼ sec. 27, T. 4 N., R. 13 W., 4 miles south of Chipley, at station 10111 and station 7244:

⁴³ Sellards, E. H., and Gunter, Herman, Geology between the Apalachicola and Ocklocknee Rivers: Florida Geol. Survey 10th and 11th Ann. Repts., p. 34, 1918.

⁴⁴ Idem, p. 37.

Cerithium aff. *C. precursor* Dall.
Ostrea rugifera Dall?
Ostrea caducaqua Mansfield.
Chlamys crocus Cooke.
Chlamys anguillensis Guppy.
Chlamys aff. *C. crucianus* Cooke.
Chlamys gardnerae Cooke.
Amusium sp.
Modiolus blandus Dall.
Chione aff. *C. spenceri* Cooke.

The *Ostrea* identified as *O. vicksburgensis* Conrad by Cooke and Mossom⁴⁵ from bed 2, may be closer to *O. rugifera* Dall.

The fauna listed above appears to be similar in some features to that in the lowest bed exposed at Old Chattahoochee Landing, although it may have lived at a little later time.

LIST OF STATIONS

The positions of U. S. Geological Survey Stations on the Tampa limestone are indicated on the map, figure 2, by circles numbered to correspond to the numbers in parentheses at the left of the station numbers in the list below. The numbered squares indicate stations on the Suwannee limestone (p. 40). 59-61

HILLSBOROUGH COUNTY

As most of the specimens in the older collections from Ballast Point, Tampa Bay, and surrounding areas are designated by U. S. National Museum numbers which are mentioned with the descriptions of species in the text, the station numbers for these are omitted.

(1), 13847. Gadsden Point, about 4 miles south of Ballast Point. Thrown out in constructing a road near new quarantine station. W. C. Mansfield and F. S. MacNeil.

(2), 13848. Hooker Point, Sparkman Bay (inlet of upper Hillsborough Bay). Dredgings said to have been taken at a depth of 32-36 feet below water level. W. C. Mansfield and F. S. MacNeil.

(3), 4998 (F. G. Clapp, 1908); 5000, 5002 (G. C. Matson, 1908); 11117 (C. W. Cooke, 1926); 11150 (C. W. Cooke and Stuart Mossom, 1927); 12765 (G. M. Ponton and W. C. Mansfield, 1932); 57 (H. I. Tucker). Sixmile Creek, near Orient Station.

POLK COUNTY

(4), 2470. Phosphate mine, 1 mile west of Bartow. G. H. Eldridge, about 1894.

PINELLAS COUNTY

(5), 7358 (C. W. Cooke, 1915); 12763 (G. M. Ponton and W. C. Mansfield, 1932). Right bank of Anclote River at Tarpon Springs, 300 yards above high-water bridge over river.

⁴⁵ Cooke, C. W., and Mossom, Stuart, *Geology of Florida: Florida Geol. Survey 20th Ann. Rept.* p. 70, 1929.

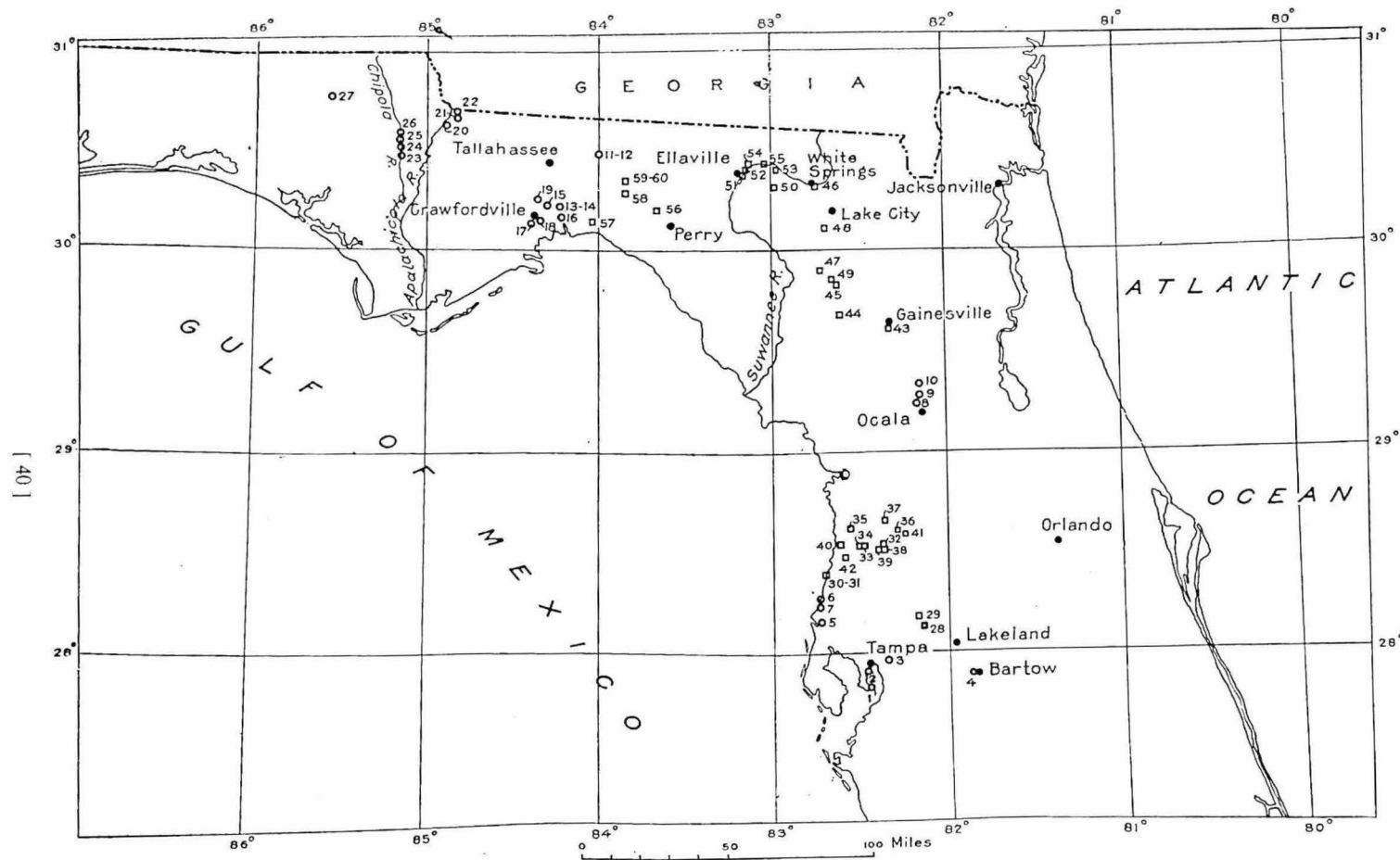


FIGURE TWO

Map Showing Geographical Distribution of Localities of the Tampa and Suwannee Limestones.

PASCO COUNTY

(6), 7359. Limestone quarry at Port Richey. C. W. Cooke, 1915.

(7), 12760. One-half mile west of New Port Richey. G. M. Ponton and W. C. Mansfield, 1932.

MARION COUNTY

(8), 11115 (C. W. Cooke, D. S. Mossom, 1915); 12314 (H. Gunter and W. C. Mansfield, 1931); 12753 (G. M. Ponton and W. C. Mansfield, 1932). Cummer Lumber Company quarry at Kendrick, 4.8 miles north of Ocala. From a bed about 3 feet thick in places overlying the Ocala limestone (upper Eocene).

(9), 7353. Just east of crossroads midway between Anthony and Martin. C. W. Cooke, 1915.

(10), 11186. Pits on old Raysor property, hilltop midway between Lowell and Sparr. Elevation approximately 128 feet. C. W. Cooke and S. Mossom, 1927.

JEFFERSON COUNTY

(11), 6830 (C. W. Cooke and E. H. Sellards, 1913); 12300, 12736 (H. Gunter, G. M. Ponton, and W. C. Mansfield, 1931-1932). At and above a disappearing stream, 1¼ miles northeast of Lloyd.

(12). Baileys Mill creek sink, ¾ mile northeast of Lloyd, clay overlying a limestone. L. C. Johnson.

"Wacissa," G. H. Eldridge.

WAKULLA COUNTY

(13), 3420. On the railroad to St. Marks, 15 miles south of Tallahassee. T. W. Vaughan, 1900.

(14), 12293, 200 yards south of Wakulla Railroad Station, 16 miles south of Tallahassee. G. M. Ponton and W. C. Mansfield, 1931-1932.

(15), 12292. Cherokee sink, about 2 miles west of Wakulla Spring and about 5 miles west of Wakulla Station. G. M. Ponton, Clarence Simpson, and W. C. Mansfield, 1931, 1932.

(16), 12732. Along a drainage ditch of highway, Wakulla Station to St. Marks, 3.7 miles south of Wakulla Station. G. M. Ponton and W. C. Mansfield, 1932.

(17), 12294. Along Florida State Highway No. 10, 2.5 miles south of Crawfordville. From pieces of rock thrown out in constructing the highway. G. M. Ponton and W. C. Mansfield, 1931.

(18), 12296, "The Swirl," 3½ miles southeast of Crawfordville. G. M. Ponton and W. C. Mansfield, 1931.

LEON COUNTY

(19), 12735. W. K. Cooke and sons' property, about 11 miles slightly southwest of Tallahassee. G. M. Ponton, Clarence Simpson and W. C. Mansfield, 1932.

GADSDEN COUNTY

(20), 3406. Aspalaga Bluff, Apalachicola River. Elevation in bluff not given. T. W. Vaughan, 1900.

(20), 12287. Aspalaga Bluff, highest fossiliferous bed, estimated 45 to 50 feet above the river level. G. M. Ponton and W. C. Mansfield, 1931.

(20), 13841. Aspalaga Bluff, Apalachicola River, about 10 feet above a 4-foot clay bed. W. C. Mansfield and F. S. MacNeil.

(21), 3409 (just above cement bed, T. W. Vaughan, 1900); 3410 (cement quarry, Vaughan, 1900); 3411 (just above cement horizon, Vaughan, 1900); 7080 (cement quarry, Vaughan, et al., 1914); 12285 (mainly an indurated 1-foot bed, G. M. Ponton and W. C. Mansfield, 1931). Abandoned quarry at an elevation around 150 feet above sea level, one-half mile south of River Junction.

(21), 3407, 3408, 3413, 3414 (T. W. Vaughan, 1900); 7172, 7173, 7174, 7175, 7176 (T. W. Vaughan, 1914). Lower beds at and in the vicinity of River Junction.

(21), 13851. About $\frac{1}{4}$ mile north of railroad station at River Junction at an elevation 75 to 80 feet above sea level. W. C. Mansfield and F. S. MacNeil.

(22), 2565 (W. H. Dall and Stanley-Brown, 1893); 3405 (T. W. Vaughan, 1900); 4836 (F. G. Clapp, et al., 1908); 6185 (L. W. Stephenson, 1908); 7168 (T. W. Vaughan, 1914); 12282 (G. M. Ponton and W. C. Mansfield, 1931). Lower part of section or from bed carrying "*Echinocardium*" *depressum* Clark at an elevation of 77.4-78.4 feet above sea level at old Chattahoochee Landing.

(22), 13844. Old Chattahoochee Landing, 37 feet (Lock level) above echinoderm bed. W. C. Mansfield and F. S. MacNeil.

(22), 13846. Old Chattahoochee Landing 74 feet (Lock level) above echinoderm bed. W. C. Mansfield and F. S. MacNeil.

(22), 7169 (bed no. 6, elevation 122-124 feet, T. W. Vaughan, 1914). Old Chattahoochee Landing, Apalachicola River.

(22), 12283. Elevation 155-165 feet above sea level. G. M. Ponton and W. C. Mansfield, 1931. Old Chattahoochee Landing, Apalachicola River.

CALHOUN COUNTY

(23), 12725. Baileys old ferry, Chipola River, at the mouth of Tenmile Creek. G. M. Ponton and W. C. Mansfield, 1932.

(24), 12728. Hamilton Spring, about $1\frac{1}{2}$ miles below Willis bridge over Chipola River and about $2\frac{1}{2}$ miles above the mouth of Tenmile creek. G. M. Ponton and W. C. Mansfield, 1932.

(25), 12727. Willis bridge, Chipola River. G. M. Ponton and W. C. Mansfield, 1932.

(26), 12726. About 2.2 miles above Willis bridge, Chipola River. G. M. Ponton and W. C. Mansfield, 1932.

WASHINGTON COUNTY

(27), 7244 (C. W. Cooke and W. C. Mansfield, 1914); 10111 (C. W. Cooke and Julia Gardner, 1921). Bed 2 at Falling Water in the N. W. $\frac{1}{4}$ sec. 27, T. 4 N., R. 13 W., 4 miles south of Chipley.

GEOGRAPHIC DISTRIBUTION OF TAMPA LIMESTONE

The accompanying map (figure 2) shows the localities of both the Tampa and Suwannee limestones. The numbered circles refer to localities on the Tampa limestone and the numbered squares to localities on the Suwannee limestone.

The Tampa limestone in Pasco, Pinellas, Hillsborough, and Polk Counties, as indicated by figure 2, strikes northwest and apparently dips southwest, the limestone at Port Richey (no. 6) being near the base and that at Gadsden Point (no. 1), at or near the top of the formation. In Marion County at Kendrick (no. 8) and to the north (nos. 9, 10), the Tampa rests on the Eocene Ocala limestone and may have been deposited by a sea that advanced from the east or southeast at a time near the end of the Tampa epoch. In western Florida, in Wakulla County, the Tampa is exposed at the present-day surface and is at a lower level than that near Lloyd, Jefferson County (nos.

11, 12). The easternmost exposures are between the St. Marks and the Wacissa Rivers. The Tampa underlies later deposits in the western half of Jefferson County and all of Leon and Gadsden Counties. On the Apalachicola River it disappears below stream level near the mouth of Sweetwater Creek, in Liberty County, and rises to an elevation around 100 feet above stream level at Old Chattahoochee Landing, Gadsden County, about 15 miles farther north. Along the Chipola River in Calhoun County, the Tampa rises only a few feet above the surface of the stream at normal stages. In Washington County, at Falling Water (no. 27), 4 miles south of Chipley, the base of the Tampa limestone (bed no. 2) is 65 feet above the bottom of the sink, using the section measured here by Cooke.⁴⁶ The fauna at this place, as noted before, is similar in some features to that at the base of the section at Old Chattahoochee Landing, 40 miles east of Falling Water. If so this would indicate that the Tampa limestone in the area of Falling Water has been elevated to a higher position than that in the area of Chattahoochee Landing.

DISTRIBUTION OF SPECIES IN THE TAMPA LIMESTONE

The following list includes the species and subspecies of mollusks (land, fresh-water, and marine Gastropoda, and marine Pelecypoda) from the Tampa limestone.

In the column headed "Ballast Point and vicinity" are included all species from this area whether they were formerly referred to the *Orthaulax pugnax* zone of Dall, or to the Tampa limestone of Dall, or to the *Cerithium* zone of Heilprin. The column headed "13848, Hooker Point" includes the species known from the *Cerithium* zone of Heilprin and that headed "13847, 4 miles south of Ballast Point" includes the species high in the Tampa limestone.

(See table of distribution, inserted on back cover page.)

RÉSUMÉ OF THE TAMPA LIMESTONE

In the revision of the mollusks of the Tampa limestone the following approximate results have been obtained:

Number of determined species and subspecies	279
Number of undetermined species	27
Total	306
Number of Tampa limestone species and subspecies in the Chipola formation	8
Number of Tampa limestone species and subspecies in the Recent fauna	6

⁴⁶ Cooke, C. W., and Mossom, Stuart, *Geology of Florida: Florida Geol. Survey 20th Ann. Rept.*, p. 70, 1929.

The Tampa limestone fauna probably is more closely related to that of the Chipola formation than the above figures would indicate, as a number of other species in both horizons are closely related and were united by earlier workers. A comparison of some of the molluscan species from the Trent marl, as exposed at Silverdale, N. C., with those of the Tampa, indicates that the two faunas lived at about the same time. The Tampa is believed also to be of about the same age as the Anguilla formation, Anguilla, and a little older than the Baitoa formation, Dominican Republic.

The Tampa limestone has a smaller content of calcium carbonate and a greater content of silica than the underlying Suwannee limestone. The high percentage of silica and the character of the fauna, which includes land and freshwater gastropods and the pelecypod *Cyrena*, a genus now living in fresh and brackish water in Florida, indicate that the Tampa limestone was deposited in shallow water near the shore line.

The lithologic and the faunal difference between the Tampa limestone and the succeeding Alum Bluff group seem too great to attribute solely to shifting of shore-line currents and therefore strongly suggest a period of uplift at the end of Tampa time, followed by subsidence and deposition of the Alum Bluff group.

From observation of beds overlying the Tampa limestone, it appears that the fuller's earth deposits at Quincy, Midway, and elsewhere and the "Sopchoppy limestone" lie stratigraphically above the Chipola marl, which includes the very fossiliferous basal bed and the overlying "Alum Bluff sands" of Dall, as exposed at Alum Bluff, Apalachicola River, Fla., and that these beds represent in part at least, the Hawthorn formation and are equivalent in part to the Oak Grove sand, middle Miocene.



Fig. 1. Contact of the Suwannee limestone (above) and a member of the Vicksburg group (Byram marl?) in the left bank of the Withlacoochee River near its junction with the Suwannee River at Ellaville, Florida. The man is sitting on the upper surface of the lower bed. Photograph by Herman Gunter, April 22, 1932.



Fig. 2. Tampa limestone exposed in a sink about $1\frac{1}{2}$ miles northeast of Lloyd, Jefferson County. At the time, April 27, 1932, the photograph was taken no water was draining, owing to a very dry season, from Lake Miccosukee, from which the sink receives its water. Photograph by Herman Gunter.

SUWANNEE LIMESTONE

GENERAL FEATURES^{*}

The Suwannee limestone was named in 1936 by Cooke and Mansfield⁴⁷ from exposures on the Suwannee River, in northern peninsular Florida. The formation is well exposed along the Suwannee at various places from the mouth of Withlacoochee River at Ellaville (where it is the highest fossiliferous stratum) to White Springs, a distance of about 40 miles.

The stratigraphic unit to which Cooke and Mansfield applied the name Suwannee has been assigned in the past to several formations. In 1892, Dall and Harris⁴⁸ referred it to the Tampa limestone (Miocene). In 1909, Matson and Clapp⁴⁹ placed it in the Hawthorn formation (Miocene). Hopkins⁵⁰ referred to it in 1920 as Chattahoochee limestone which was then and still is regarded as of Tampa age. In 1925 Mossom⁵¹ put it in the Glendon (Vicksburg), but in the following year⁵² restored it to the Tampa. Cooke and Mossom⁵³ in 1929 included it with the Tampa limestone.

The formation consists almost entirely of limestone. The unweathered rock is a granular to dense, compact, usually cream-colored, rather pure limestone. The lower part is at many places more granular than the upper. Mossom⁵⁴ gives the following analysis of Suwannee limestone for the quarry of the Florida Hard Rock Products Co., Brooksville, Fla.:

"Silica (SiO ₂)	6.54
Iron and alumina (Fe+Al)	1.44
Calcium carbonate (CaCO ₃)	91.09
Magnesium carbonate (MgCO ₃)	trace
Undetermined	.93
	100.00"

⁴⁷ Cooke, C. W., and Mansfield, W. C., *Geol. Soc. Am. Proc.*, p. 71, June, 1936 (Abstract).

⁴⁸ Dall, W. H., and Harris, G. D., *Correlation papers; Neocene: U. S. Geol. Survey Bull.* 84, p. 121, 1892.

⁴⁹ Matson, G. C., and Clapp, F. G., *A preliminary report on the geology of Florida: Florida Geol. Survey 2d Ann. Rept.*, p. 74, 1909.

⁵⁰ Hopkins, O. B., *U. S. Geol. Survey Press Bull.* 442, April 21, 1920; *Florida Geol. Survey 13th Ann. Rept.*, p. 18, 1921.

⁵¹ Mossom, Stuart, *A preliminary report on the limestones and marls of Florida: Fla. Geol. Survey 16th Ann. Rept.*, pp. 73-77, 1925.

⁵² Mossom, Stuart, *A review of the structure and stratigraphy of Florida: Florida Geol. Survey 17th Ann. Rept.* (1926), p. 182. These correlations of Mossom's were based on recommendations of C. W. Cooke.

⁵³ Cooke, C. W., and Mossom, Stuart, *Geology of Florida: Florida Geol. Survey 20th Ann. Rept.*, pp. 78-98, 1929.

⁵⁴ Mossom, Stuart, *A preliminary report on the limestones and marls of Florida: Florida Geol. Survey 16th Ann. Rept.*, p. 140, 1925.

The limestone in the Brooksville quarry as well as the limestone in other nearby quarries has a higher percentage of calcium carbonate and a lower percentage of silica than the Tampa limestone at Sixmile Creek,⁶⁵ the latter containing 24.2 per cent of silica and 74.12 per cent of calcium carbonate.

The Suwannee is overlain at some places by the Tampa limestone, at others by the Hawthorn formation. On Blackwater Creek a mixture of Tampa and Suwannee fossils on the spoil bank appears to indicate that the Tampa is in contact with the Suwannee, but neither formation appears above water level. An unconformable contact of the Suwannee limestone with the Hawthorn formation, the intervening Tampa being absent, is visible at low-water stages in the bank of the Suwannee River about three-quarters of a mile above White Springs.⁶⁶

The Suwannee limestone rests on the Eocene Ocala limestone or some part of the Vicksburg group. At High Springs, Alachua County, it lies between the Eocene Ocala limestone and Miocene Hawthorn formation. At Ellaville, Suwannee County, the Suwannee limestone lies unconformably on a thin bed of white limestone containing molds of many Vicksburg fossils. Some of these fossils are listed in the "Geology of Florida,"⁶⁷ and in addition the *Lepidocyclina* sp. in this list has recently been identified by T. W. Vaughan as *L. supera* (Conrad), a species very common in the typical part of the Byram marls and perhaps restricted to deposits of that age.

The Suwannee contains many fossils, most of which are preserved only as molds, although a few are preserved as siliceous pseudomorphs scattered through the weathered surface material. In general the faunal characteristics of the Suwannee limestone are as follows: No land or fresh-water shells have been observed. Among the Gastropoda *Conus* is very rare, if present; *Strombus* is present in the Brooksville area but the species are not determinable; *Orthis*, which is represented by a new subspecies of *O. pugna*, is quite common; among the Cerithiidae a few genera are rather common, some of the species being too poorly preserved for determination; *Turritella* is present at a number of localities, but more individuals occur in the Brooksville area than elsewhere. Among the Pelecypoda, *Glycymeris* is present, some forms being rather large; *Ostrea* is rare and the species

⁶⁵ Idem, p. 145.

⁶⁶ Mansfield, W. C., and Gunter, Herman, Washington Acad. Sci. Jour., vol. 23, p. 109, 1933.

⁶⁷ Cooke, C. W., and Mossom, Stuart, op. cit., p. 73.

are indeterminable; *Phacoides* is quite common, especially a rather large form of the type of *P. hillsboroensis*; among the Veneridae, *Chione*, similar to *C. bainbridgensis* Dall, a Flint River species, is present at nearly all localities; large *Teredo*-like tubes are common. Among the echinoderms, *Rhyncholampas gouldii* (Bouvé) is present at nearly all localities and appears to be confined to this zone; and a large regular form has been collected in the Brooksville area and along Blackwater Creek. Among the foraminifers, the cone-shaped form, "*Coskinolina cookei* Moberg," described from a limestone now referred to the Suwannee limestone, is present at a number of localities.

A few species that appear to be characteristic of the Suwannee limestone are: *Orthaulax pugnax hernandoensis* Mansfield, n. subsp.; *Ampullina flintensis* Mansfield, n. sp.; *Chlamys flintensis* Mansfield, n. sp.; *Chlamys brooksvillensis* Mansfield, n. sp.; *Chione* aff. *C. bainbridgensis* Dall; *Teredo?* *incrassata* (Gabb); and *Rhyncholampas gouldii* (Bouvé).

A few species occurring in the Tampa limestone that have not been found with certainty in the Suwannee limestone are: Many land and fresh-water species; *Lyria musicina* (Heilprin); *L. heilprini* Dall; *Latirus*, a number of species; *Potamides hillsboroensis* Heilprin; *P. campanulatus* Heilprin; *Turritella tampa* Heilprin; *Ampullina amphora* Heilprin; *Globularia streptostoma* (Heilprin); *Glycymeris lamyi* Dall; *Arca hypomela* Dall; *Chlamys crocus* (Cooke); *Crassatella deformis* (Heilprin); *Venericardia serricosta* (Heilprin); *Cyrena pompholyx* Dall; *C. floridana* (Dall); *Anatigona glyptoconcha* Dall; *A. shepardi* Dall; *Chione rhodia* Dall; *Anomalocardia penita* Conrad.

COMPARISON OF THE FAUNA OF THE SUWANNEE LIMESTONE WITH OTHER FAUNAS

Flint River formation.—Dall,⁵⁵ after a study of the fauna above and below Bainbridge, Georgia, recognized two faunal groups characterizing two zones, an upper zone represented chiefly south of Bainbridge and a lower zone found around and north of the town. The so-called upper zone, according to Dall, contains a number of species of Cerithiidae and is to be correlated with the *Orthaulax pugnax* zone at Tampa; the lower zone is to be correlated with a horizon between the *Orthaulax pugnax* zone and the Eocene Ocala limestone.

⁵⁵ Dall, W. H., A contribution to the invertebrate fauna of the Oligocene beds of the Flint River, Georgia: U. S. Nat. Mus. Proc., vol. 51, no. 2162, pp. 487-488, 1916.

Cooke⁵⁹ at first placed the chert beds of the Flint River in the Glendon formation of the Vicksburg group, but more recently has⁶⁰ applied the name Flint River formation to the beds, typically exposed along the Flint River between Red Bluff, 7 miles above Bainbridge, and Hales Landing, about 7 miles below the town. Cooke correlated his new formation provisionally with the upper part of the Byram marl of the Vicksburg group. The writer has not studied the faunas of the Flint River formation sufficiently to determine definitely whether this formation embraces two faunal horizons, as Dall believed, or only one faunal horizon, as Cooke thought. However, the bed exposed at Blue Spring, 4 miles below Bainbridge; at Hales Landing; and downstream, that contains many Cerithiidae and corals may be stratigraphically higher than the bed at Red Bluff, 7 miles above Bainbridge.

Most of the species of the Suwannee limestone that are the same as, or closely allied to, those of the Flint River formation occur in the latter formation at exposures along the river between Blue Spring and Lamberts Island, 10 to 12 miles below Bainbridge; but a number of species occurring at Red Bluff have not been recognized in the Suwannee limestone.

The following list shows species of the Suwannee limestone that are the same as, or closely allied to, species of the Flint River formation:

SUWANNEE LIMESTONE SPECIES	FLINT RIVER SPECIES
Cerithium hernandoensis Mansfield	Cerithium halense Dall (Blue Spring and Hales Landing)
Cerithium hernandoensis blackwater- ensis Mansfield	Cerithium vaughani Dall (Hales Landing)
Orthaulax pugnax hernandoensis Mansfield	Orthaulax pugnax Heilprin (Blue Spring and Hales Landing)
Turritella cf. T. halensis Dall	Turritella halensis Dall (Hales Landing and Lambert Island)
Ampullina flintensis Mansfield	= Ampullina solidula Dall (Red Bluff, Hales Landing and Lambert Island)
Chlamys flintensis Mansfield	Chlamys alpha Dall (Cherry Chute and Hales Landing)
Venericardia serricosta brooksvill- ensis Mansfield	"Cardita shepardii" Dall? (Lamberts Island)
Phacoides cf. P. hillsboroensis Heil- prin	Phacoides cf. P. hillsboroensis Heilprin (Blue Springs and Hales Landing)

⁵⁹ Cooke, C. W., The correlation of the Vicksburg group: U. S. Geol. Survey Prof. Paper 133, pp. 5-9, 1923.

⁶⁰ Cooke, C. W., Notes on the Vicksburg group: Am. Assoc. Petroleum Geologists, vol. 19, no. 8, pp. 1170-1171, 1935.

SUWANNEE LIMESTONE SPECIES

FLINT RIVER SPECIES

Chione cf. <i>C. bainbridgensis</i> Dall	Chione <i>bainbridgensis</i> Dall (Bainbridge to Hales Landing)
Rhyncholampàs <i>gouldii</i> (Bouvé)	Rhyncholampàs <i>gouldii</i> (Bouvé) (Lamberts Island)

Well near Thomasville.—An interesting lot of mollusks was taken from a well on the Jim McKinnon estate on the Boston road, $4\frac{3}{4}$ miles east of Thomasville, Thomas County, Georgia, at a depth of about 55 feet below the surface. The species from this well indicate a relationship to both the fauna of the Suwannee limestone and that of the Flint River formation, especially that part of the Flint River formation exposed from 4 miles to 12 miles below Bainbridge, Ga. The species are: *Lyria musicina dalli* Mansfield?, *Cerithium* cf. *C. suwannensis* Mansfield, *Orthaulax pugnax* Heilprin var.?, *Turritella* cf. *T. halensis* Dall, *Cassis* sp. like the form at Blue Spring in the Flint River formation, *Chlamys* cf. *C. flintensis* Mansfield, *Chlamys wawnensis* Mansfield, *Phacoides* cf. *P. hillsboroensis* Heilprin, *Cardium* cf. *C. hernoandoense* Mansfield, *Chione bainbridgensis* Dall, *Teredo?* *incrassata* (Gabb).

A comparison of the fauna of the Suwannee limestone with that of the Flint River formation (upper part of the Vicksburg), and other faunas similar to that of the Flint River formation, indicates that the fauna of the Suwannee limestone as a whole lived during the latter part of the time represented by the Flint River formation and continued on up to the end of the Vicksburg epoch.

LOCAL DETAILS

Hillsborough County.—Fossils apparently from both the Tampa and Suwannee limestones have been collected along Blackwater Creek at the crossing of the Seaboard Air Line Railway, $2\frac{1}{2}$ miles south of the Pasco County Line. The fossils collected from the bed of the stream came from the Suwannee limestone, but others collected from the spoil bank may have come from either limestone. Those species which occur in the Tampa limestone elsewhere may have come from the upper bed, whereas those species that occur also in the Suwannee limestone of the Brooksville area may have come from the lower bed. About one third or more of the species that have been collected at this place may have come from the Tampa limestone. A regular echinoid and the echinoid *Rhyncholampàs gouldii* (Bouvé) are known to have come from the Suwannee limestone.

The matrix of the lower bed appears to be less oxidized than that from the upper bed.

The species from Blackwater Creek are recorded below. Those preceded by an asterisk were collected only by Miss H. I. Tucker at this place (her locality no. 17). The letter "T" following a species suggests that the species came from the Tampa limestone, and the letter "S" that it came from the Suwannee limestone.

- **Conus cookei* Dall?, S.
- **Cryoturris?* hillsboroughensis Mansfield, S.
- **Oliva posti* Dall?, ?T.
- **Olivella brooksvillensis* Mansfield, S.
- **Marginella gregaria* Dall, T.
- **Lyria musicina* (Heilprin)?, ?T.
- **Lyria musicina dalli* Mansfield, S.
- **Xancus polygonatus suwannensis* Mansfield?, ?S.
- *"Phos" *ursula* Dall?, ?T.
- **Purpura propeposti* Mansfield, S.
- **Corralliophila magna* Dall, T.
- Orthaulax pugnax hernandoensis* Mansfield, S.
- **Cerithium* aff. *C. georgianum* Lyell and Sowerby, ?T.
- **Cerithium pascoensis* Mansfield, S.
- Cerithium hernandoensis blackwaterensis* Mansfield, S.
- Turritella bowenae* Mansfield, S.
- **Turritella hillsboroensis* Mansfield, ?T.
- **Turritella blackwaterensis* Mansfield, ?T.
- **Ampullina flintensis* Mansfield, S.
- **Sinum* aff. *imperforatum* Dall, S.
- Glycymeris suwannensis* Mansfield, S.
- Glycymeris hillsboroughensis* Mansfield.
- Glycymeris tuckeræ* Mansfield, S.
- Chlamys brooksvillensis* Mansfield, S.
- Chlamys liveoakensis* Mansfield?
- **Modiolus blandus* Dall, T.
- Modiolus grammatus* Dall?
- Venericardia serricosta brooksvillensis* Mansfield, S.
- **Chama tampaensis* Dall, ?T (larger than Tampa specimens).
- Phacoides wacissanus* Dall, S (larger than Tampa specimens).
- **Phacoides hillsboroensis* Heilprin, T.
- Cardium phlyctaena* Dall, ?T.
- **Cardium brooksvillensis* Mansfield, S.
- Pitaria* aff. *P. imitabilis* Conrad, S.
- **Antigona tarquina* Dall, ?T.
- Chione* aff. *C. bainbridgensis* Dall, S.
- **Pitaria heilprini* Mansfield, ?T.
- Teredo?* *incrassata* (Gabb), S.
- Rhyncholampas gouldii* (Bouvé), S.

Pasco County.—The following species from the Suwannee limestone were collected by G. M. Ponton and W. C. Mansfield at station 12762, prospect pits on property of Florida Trap Rock Co., about 2¾ miles south of Zephyrhills:

Cerithium pascoensis Mansfield.
Turritella bowenae Mansfield.
Ampullina flintensis Mansfield.
Glycymeris suwannensis Mansfield.
Lima halensis Dall.
Modiolus silicatus Dall.
Phacoides hillsboroensis Heilprin?
Cardium aff. *gadsdenense* Mansfield.
Chione aff. *C. bainbridgensis* Dall.
Teredo? *incrassata* (Gabb).
Rhyncolampas gouldii (Bouvé).

The following species occur respectively one and two miles north of Hudson (stations 7356 and 12761):

Lyria musicina dalli Mansfield.
Orthaulax pugnax hernandoensis Mansfield.
Cerithium brooksvillensis Mansfield.
Turritella bowenae Mansfield.
Cypraea sp.
Thracia vicksburgiana brooksvillensis Mansfield.
Phacoides? sp.
Cardium aff. *C. gadsdenense* Mansfield.
Cardium phlyctaena Dall.
Semele silicata Dall?
Panope brooksvillensis Mansfield?
Teredo? *incrassata* Gabb.

Hernando County.—The species listed below have been collected from the Suwannee limestone at one or more of the following localities: Station 11113 (C. W. Cooke and Stuart Mossom), station 12322 (H. Gunter and W. C. Mansfield), station 12755 (G. M. Ponton and W. C. Mansfield), Florida Rock Products Company quarry about one mile southwest of Brooksville; station 7361, Peck sink, $3\frac{1}{2}$ miles west of Brooksville (C. W. Cooke); station 12318, abandoned pit on Florida State Road No. 15, 5 miles west of Brooksville (H. Gunter and W. C. Mansfield); station 12317 (from all parts of quarry), station 12757 (upper part of quarry), station 12756 (floor of quarry), Florida Portland Cement quarry, 10.2 miles northwest of Brooksville (H. Gunter, G. M. Ponton, W. C. Mansfield); station 12758, Camp Concrete Rock quarry, 5.9 miles northeast of Brooksville (G. M. Ponton and W. C. Mansfield); station 10513, 7 miles north of Brooksville (O. B. Hopkins); station 7362, Varnes quarry, $2\frac{3}{4}$ miles southeast of Brooksville (C. W. Cooke); station 12319, quarry 2 miles south of Brooksville (H. Gunter and W. C. Mansfield); station 12320, 2 miles east of Bayport (H. Gunter and W. C. Mansfield); station 7363, $1\frac{1}{2}$ miles west of Croom (C. W. Cooke).

Scaphander sp.
Knefastia? *brooksvillensis* Mansfield.
Conus aff. *C. cookei* Dall.
Olivella brooksvillensis Mansfield.
Lyria musicina dalli Mansfield.
Vasum egonatum Dall?.
Cassis sp.
Orthaulax pugnax hernandoensis Mansfield.
Terebellum hernandoensis Mansfield.
Cerithium pascoensis Mansfield.
Cerithium brooksvillensis Mansfield.
Potamides cornutus Heilprin?.
Cerithium hernandoensis Mansfield.
Cerithium aff. *C. vaginatum* Dall.
Turritella bowenae Mansfield.
Xenophora conchyliophora Born?.
Ampullina flintensis Mansfield?.
"Amauropsis" aff. *A. burnsii meridionalis* Pilsbry.
Sinum aff. *imperforatum* Dall.
Calliostoma silicatum Mansfield?.
Glycymeris cf. *G. tuckerae* Mansfield.
Barbatia marylandica Conrad?.
Ostrea aff. *O. antiquensis* Brown.
Chlamys brooksvillensis Mansfield.
Modiolus blandus Dall.
Modiolus grammatus Dall?.
Thracia vicksburgiana hernandoensis Mansfield.
Venericardia serricostata brooksvillensis Mansfield.
Phacoides wacissanus Dall.
Phacoides hillsboroensis Heilprin?.
Phacoides hernandoensis Mansfield.
Divaricella sp.
Cardium aff. *C. gadsdenense* Mansfield.
Cardium brooksvillense Mansfield.
Cardium hernandoense Mansfield.
Pitar aff. *P. imitabilis* Conrad.
Chione aff. *C. bainbridgensis* Dall.
Venus? sp.
Panope brooksvillensis Mansfield.
Teredo? *incrassata* (Gabb).
Rhyncholampas gouldii (Bouvé).

One specimen of the genus *Rhyncholampas*, apparently the same as an unpublished species from the lowest bed of the Vicksburg (Oligocene) at Ellaville, was collected from a pit some 30 feet below the main floor of the quarry at Brooksville (station 12755a). This may indicate the presence of a lower horizon in the Vicksburg than that exposed in the main walls of the quarry.

The following species occur at station 13853, 14.5 miles southwest of Brooksville, Hernando County:

Cerithium sp.
Turritella bowenae Mansfield.
Cardium aff. *C. gadsdenense* Mansfield.
Cardium? sp.
Phacoides sp.
Semele silicata Dall?.



Fig. 1. Contact of the Suwannee limestone and the Hawthorn formation in the left bank of the Suwannee River at White Springs, Florida; about half a mile above old bridge on the White Springs-Lake City road. The head of the hammer is on the contact. Photograph by Herman Gunter, April 22, 1932.



Fig. 2. Upper surface of the Suwannee limestone in the bed of Suwannee River, three-fourths mile above the old bridge on the White-Springs-Lake City road at White Springs, Florida. River at a very low stage. Photograph taken by Herman Gunter, April 22, 1932.

Suwannee limestone, same horizon as bed 2 miles north of Hudson.

Alachua County.—The echinoid *Rhyncholampas gouldii* (Bouvé) has been collected in Alachua County from the following localities: station 378b, 2 miles south of Gainesville (L. C. Johnson); station 6811, Cummer Lumber Company Phosphate Plant No. 10, one mile north of Newberry (not in place) (C. W. Cooke); station 6786, Main Street, High Springs (T. W. Vaughan and C. W. Cooke).

Columbia County.—The following species have been collected from a small island in the Suwannee River three-fourths of a mile above White Springs; station 6178 (L. W. Stephenson), station 6774 (T. W. Vaughan and C. W. Cooke), station 12745 (H. Gunter, G. M. Ponton and W. C. Mansfield):

Scaphander sp.
Orthaulax pugnax hernandoensis Mansfield.
Ampullina flintensis Mansfield.
Calliostoma silicatum Mansfield.
Dentalium ladinum Dall.
Glycymeris suwannensis Mansfield.
Modiolus grammatus Dall.
Phacoides wacissanus Dall.
Phacoides hillsboroensis Heilprin?
Cardium brooksvillense Mansfield.
Chione aff. C. bainbridgensis Dall.
Rhyncholampas gouldii (Bouvé).

The species listed below have been collected in the Suwannee limestone from the *Rhyncholampas*-bearing bed which overlies the Ocala limestone in an old phosphate quarry one-fourth mile southeast of Fort White; station 6818 (C. W. Cooke, 1913), station 12749 (G. M. Ponton and W. C. Mansfield, 1932):

Modiolus grammatus Dall.
Chione aff. C. bainbridgensis Dall.
Rhyncholampas gouldii (Bouvé).

The species listed below have been collected from the Suwannee limestone at Bass, 7 miles south of Lake City; station 4960, 100 yards west of station (G. C. Matson, 1908); station 6827, 100 yards south of Bass (C. W. Cooke, 1913); station 12307, about one-fourth mile south of Bass, near and on east side of railroad (G. M. Ponton and W. C. Mansfield):

Scaphander sp.
Modiolus silicatus Dall.
Modiolus grammatus Dall.
Phacoides wacissanus Dall.
Rhyncholampas gouldii (Bouvé).

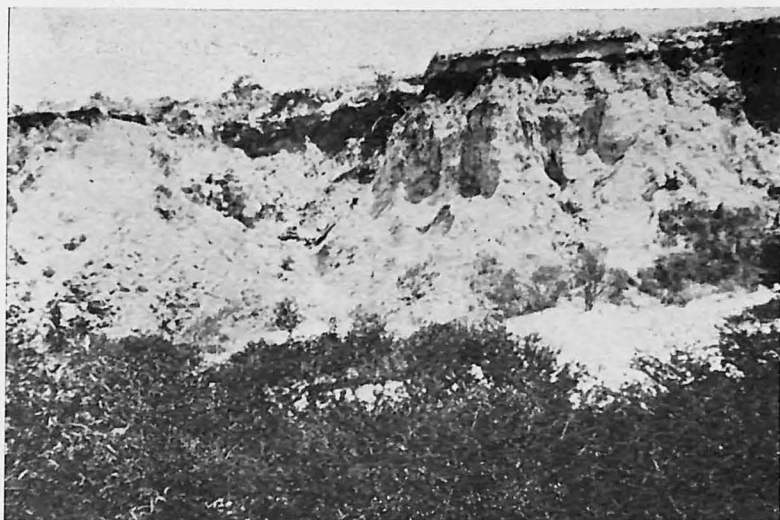


Fig. 1. Suwannee limestone exposed in old Lyle quarry, 1½ miles north of Live Oak, Florida. Photograph by W. C. Mansfield.

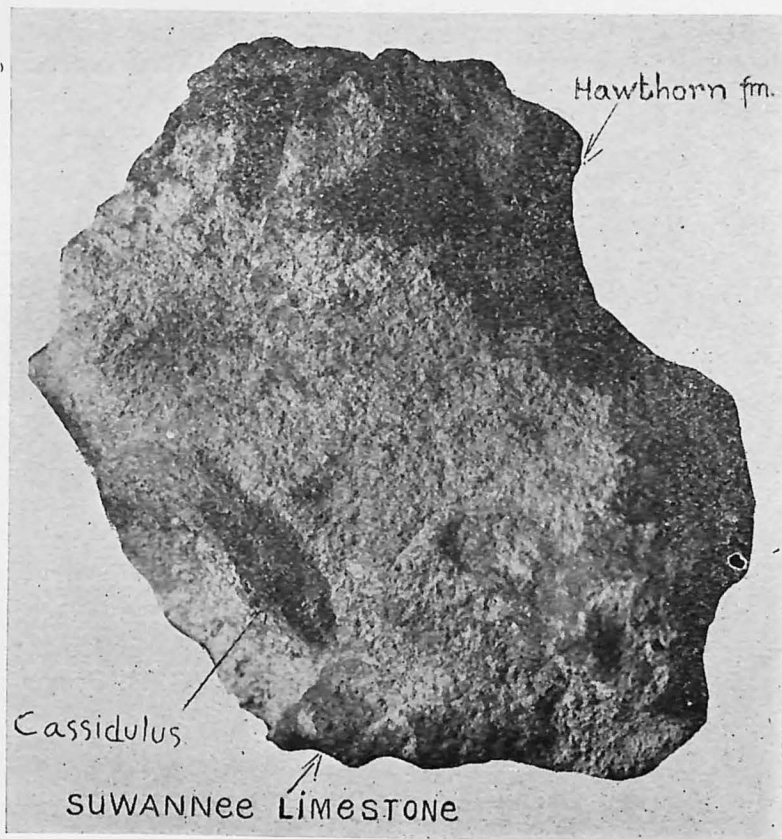


Fig. 2. A rock specimen taken from the same place as pl. C, fig. 1, showing the contact of the Suwannee limestone (light colored) and the Hawthorn formation (dark colored). Specimen collected April 21, 1932, by members of the Florida Geological survey and W. C. Mansfield. Photograph by U. S. Geological Survey.

Rhyncholampas gouldii (Bouvé) has been collected in Columbia County at station 12035, near an old stream channel near Florida State Road No. 5a, about $1\frac{1}{2}$ miles west of Santa Fe River (G. M. Ponton and W. C. Mansfield).

Suwannee County.—The following species have been collected from the old Lyle quarry, $1\frac{1}{2}$ miles north of Live Oak; stations 6826, 11109 (C. W. Cooke); station 12308 (G. M. Ponton and W. C. Mansfield):

Scaphander sp.
 Euclathurella? liveoakensis Mansfield.
 Olivella liveoakensis Mansfield.
 Lyria mississippiensis Conrad?
 Lyria musicina dalli Mansfield.
 Nancus polygonatus suwannensis Mansfield.
 Alectrion sp. a.
 Purpura propeposti Mansfield.
 Terebellum hernandoensis Mansfield?
 Cerithium pascoensis Mansfield?
 Cerithium suwannensis Mansfield.
 Cerithium liveoakensis Mansfield.
 Modiolus liveoakensis Mansfield.
 Turritella cf. T. halensis Dall.
 Xenophora conchyliphora Born?
 Sinum aff. S. imperatum Dall.
 Ampullina flintensis Mansfield.
 Glycymeris suwannensis Mansfield.
 Glycymeris tuckeræ Mansfield?
 Barbatia marylandica Conrad?
 Chlamys flintensis Mansfield.
 Chlamys aff. C. vaum wythei Hertlein.
 Chlamys liveoakensis Mansfield.
 Chlamys liveoakensis wannensis Mansfield.
 Modiolus grammatus Dall.
 Cardita liveoakensis Mansfield.
 Venericardia serricostata brooksvillensis Mansfield?
 Phacoides wacissanus Dall.
 Phacoides hillsboroensis Heilprin?
 Cardium precursor Dall.
 Chione aff. C. bainbridgensis Dall.
 Tellina silicata Dall?
 Teredo? incrassata (Gabb).
 Rhyncholampas gouldii (Bouvé).

The following species have been collected from the Suwannee limestone at Suwannee Sulphur Spring; station 7339, upper bed (C. W. Cooke); station 11110 (C. W. Cooke); station 12303 (G. M. Ponton and W. C. Mansfield):

"Drillia" aff. D. pleutonica Casey.
 Euclathurella? liveoakensis Mansfield?
 Chlamys flintensis Mansfield.
 Modiolus grammatus Dall?
 Cardita liveoakensis Mansfield?
 Cardium suwannensis Mansfield.

Cardium precursor Dall.
 Chione aff. *C. bainbridgensis* Dall.
 Tellina silicata Mansfield?
 Teredo? *incrassata* (Gabb).
 Rhyncholampas gouldii (Bouvé).

Rhyncholampas gouldii (Bouvé) has been collected in Suwannee County at the following localities not previously mentioned in this paper: station 12309, east bank of Suwannee River, opposite Ellaville, 15-20 feet above river level; station 12741-2, left bank of Suwannee River $2\frac{1}{2}$ miles (airline) above Ellaville (H. Gunter *et al.*); deep wells at Padlock, 7 miles south of Live Oak.

Hamilton County.—*Rhyncholampas gouldii* (Bouvé) has been collected in Hamilton County from the following localities: station 12738, Suwannee River, right bank, about 4 miles (airline) above Ellaville (H. Gunter *et al.*); station 12739, Suwannee River, right bank just below Noble Ferry bridge, Jasper-Live Oak road, 6 miles (direct line) above Ellaville (H. Gunter *et al.*).

Taylor County.—The following species have been collected from the Suwannee limestone at station 12737, along highway no. 19, 9.7 miles west of Perry (G. M. Ponton and W. C. Mansfield):

Chlamys flintensis Mansfield.
 Teredo? *incrassata* (Gabb).
 Rhyncholampas gouldii (Bouvé).

Jefferson County.—The following species were collected from the Suwannee limestone at station 12298, rock quarry, $1\frac{1}{2}$ miles east-southeast of Flint Rock (G. M. Ponton and W. C. Mansfield):

"Amauropsis" aff. *A. burnsii meridionalis* Pilsbry.
 Glycymeris tuckerae Mansfield?
 Ostrea sp. aff. *O. antiguensis* Brown.
 Chlamys flintensis Mansfield.
 Phacoides hillsboroensis Heilprin?
 Tellina silicata Mansfield?
 Teredo? *incrassata* (Gabb).
 Rhyncholampas gouldii (Bouvé)

The following species have been collected at station 4990 (F. G. Clapp, 1908); station 12299 (G. M. Ponton and W. C. Mansfield, 1931), Walker Spring, one-fourth mile south of the railroad and about half a mile southeast of Walker Spring Railroad depot. Fossils from surface material blasted out in the construction of the highway:

Cerithium liveoakensis Mansfield.
 Chlamys flintensis Mansfield.
 Phacoides waccisanus Dall.
 Teredo? *incrassata* (Gabb).
 Rhyncholampas gouldii (Bouvé).

The following species were collected from the Suwannee limestone at stations 12301 and 12302 along highway 8 and 10 miles, respectively, east of Wacissa (G. M. Ponton and W. C. Mansfield):

Cerithium hernandoensis Mansfield?
Cardium aff. *C. gadsdenense* Mansfield.
Chione aff. *C. bainbridgensis* Dall.
Tellina silicata Mansfield?
Rhyncholampas gouldii (Bouvé).

These two localities are the most westerly points at which the fauna of the Suwannee limestone has been found.

LIST OF STATIONS

The positions of U. S. Geological Survey stations on the Suwannee limestone are indicated on the map, figure 2, by numbered squares corresponding to numbers in parentheses at the left of the station numbers in the following list. The numbered circles indicate localities in the Tampa limestone (see p. 40). 39-42

HILLSBOROUGH COUNTY

(28). 11116 (C. W. Cooke, 1927); 12766 (G. M. Ponton and W. C. Mansfield, 1932); Tucker 17 (H. I. Tucker), Blackwater Creek at Seaboard Air Line crossing. Tampa limestone and Suwannee limestone.

PASCO COUNTY

(29). 12762, prospect pits on property of Florida Trap Rock Company, about 2¾ miles south of Zephyrhills (G. M. Ponton and W. C. Mansfield, 1932).

(30). 7356, one mile north of Hudson (C. W. Cooke).

(31). 12761, two miles north of Hudson (W. C. Mansfield and G. M. Ponton, 1932); (W. C. Mansfield and F. S. MacNeil, 1936).

HERNANDO COUNTY

(32). 11113 (C. W. Cooke and Stuart Mossom, 1926); 12322 (H. Gunter and W. C. Mansfield, 1931); 12755 (G. M. Ponton and W. C. Mansfield, 1932, lowest part of quarry), Florida Rock Products Company quarry, about one mile southwest of Brooksville.

(33). 7361, Peck sink, 3½ miles west of Brooksville on line between secs. 29-30, T. 22 S., R. 18 E., middle of N. ½ sec. (C. W. Cooke, 1915).

(34). 12318, at abandoned pit of Florida State Road no. 15, 5 miles west of Brooksville (H. Gunter and W. C. Mansfield, 1931).

(35). 12317 (from all parts of the quarry; 12756 (floor of quarry); 12757 (mainly from upper part of quarry), Florida Portland Cement quarry, 10.2 miles northwest of Brooksville (H. Gunter, G. M. Ponton, 1931-2).

(36). 12758, Camp Concrete Rock quarry, 5.9 miles northeast of Brooksville (G. M. Ponton and W. C. Mansfield, 1932).

(37). 10513, small quarry, 7 miles north of Brooksville on Inverness-Citrus County Road (O. B. Hopkins, 1917).

(38). 7362, Varne's quarry, 2¾ miles southeast of Brooksville (C. W. Cooke, 1915).

(39). 12319, abandoned quarry, about 2 miles south of Brooksville (H. Gunter and W. C. Mansfield, 1931).

(40). 12320, 2 miles east of Bayport (H. Gunter and W. C. Mansfield, 1931).

(41). 7363, 1½ miles west of Croom (C. W. Cooke, 1915).

(42). 13853, quarry along highway no. 19, 14.5 miles southwest of Brooksville and 2 miles west of Weekiwachee Springs (W. C. Mansfield and F. S. MacNeil).

ALACHUA COUNTY

(43). 378b, 2 miles south of Gainesville (L. C. Johnson).

(44). 6811, Cummer Lumber Company Phosphate Plant no. 10, one mile north of Newberry. Loose blocks *Cassidulus*-bearing rock (C. W. Cooke, 1913).

(45). 6786, Main Street, High Springs (T. W. Vaughan and C. W. Cooke, 1913).

COLUMBIA COUNTY

(46). 6178 (L. W. Stephenson, 1908); 6774 (T. W. Vaughan and C. W. Cooke, 1913); 12745 (H. Gunter, G. M. Ponton and W. C. Mansfield, 1932), small island in Suwannee River three-fourths mile above White Springs.

(47). 6818 (C. W. Cooke, 1913); 12749 (G. M. Ponton and W. C. Mansfield, 1932), old phosphate quarry one-fourth mile southeast of Fort White.

(48). 4960 (G. C. Matson, 1908); 6827 (C. W. Cooke, 1913); 12307 (G. M. Ponton and W. C. Mansfield, 1931), near Bass.

(49). 12035, near an old stream channel near Florida State Road no. 5a, about 1½ miles west of Santa Fe River (G. M. Ponton and W. C. Mansfield, 1931).

SUWANNEE COUNTY

(50). 6826, 11109 (C. W. Cooke, 1913, 1926); 12308 (G. M. Ponton and W. C. Mansfield, 1931-2), old Lyle quarry, 1½ miles north of Live Oak.

(51). 12309, east bank of Suwannee River, opposite Ellaville, 15-20 feet above river level (H. Gunter, G. M. Ponton, W. C. Mansfield, 1931-2).

(52). 12711-2, left bank of Suwannee River, 2½ miles (air line) above Ellaville or about one mile above Clarks fishing camp (H. Gunter, G. M. Ponton and W. C. Mansfield, 1932).

(53). 7339 (C. W. Cooke, 1915, upper bed); 11110 (C. W. Cooke, 1926); 12303 (G. M. Ponton and W. C. Mansfield, 1931), Suwannee Sulphur Spring.

HAMILTON COUNTY

(54). 12738, right bank of Suwannee River about 4 miles (air line) above Ellaville (H. Gunter, G. M. Ponton and W. C. Mansfield, 1932).

(55). 12739, right bank of Suwannee River just below Noble Ferry bridge, about 6 miles (air line) above Ellaville (H. Gunter and W. C. Mansfield).

TAYLOR COUNTY

(56). 12737, along highway no. 19, 9.7 miles northwest of Perry (G. M. Ponton and W. C. Mansfield, 1932).

JEFFERSON COUNTY

(57). 12298, rock quarry 1½ miles east-southeast of Flint Rock (G. M. Ponton and W. C. Mansfield, 1931).

(58). 4990 (F. G. Clapp, 1908); 12299 (G. M. Ponton and W. C. Mansfield, 1931), Walker Spring, one-fourth mile south of the railroad and about

half mile southeast of Walker Springs railroad depot. Fossils from surface rock blasted out in the construction of the highway.

(59), 12301; (60), 12302, along highway 10 and 8 miles, respectively, east of Wacissa (G. M. Ponton and W. C. Mansfield, 1931).

GEOGRAPHICAL DISTRIBUTION OF THE SUWANNEE LIMESTONE

The map, figure 2, shows the southernmost exposure of the Suwannee limestone to be in the northeastern part of Hillsborough County along Blackwater Creek (no. 28). It appears at the surface in the southeastern part (no. 29) and again in the northwestern part (nos. 30, 31) of Pasco County. In nearly all of Hernando County, the Suwannee limestone either crops out at the surface or is overlain by later deposits (nos. 32-42).

Remnants of this limestone, usually resting on the Ocala limestone of Eocene age occur in Alachua County (nos. 43, 44 and 45); and in Columbia County (nos. 47, 48, 49). In Suwannee County, it has been quarried near Live Oak (no. 50), and is exposed along the Suwannee River from Ellaville (no. 51) to White Springs (no. 46).

West of the Suwannee River the Suwannee limestone crops out at 9.7 miles northwest of Perry, Taylor County (no. 56); at Flint Rock (no. 57); at Walker Spring (no. 58); and along the highway 8 and 10 miles east of Wacissa (nos. 59, 60), Jefferson County.

DISTRIBUTION OF SPECIES IN THE SUWANNEE LIMESTONE

The following list includes the species (Gastropoda, Pelecypoda, Scaphapoda, and Echinoidea) in the Suwannee limestone. (See table of distribution, inserted on back cover page.) The list of species from Blackwater Creek, Hernando County, is given on page 51.

RESUMÉ OF THE SUWANNEE LIMESTONE

The Suwannee limestone is typically exposed along the Suwannee River, Florida, from Ellaville, where it unconformably overlies a white limestone containing Vicksburg (Oligocene) fossils, to a short distance above White Springs, where it is unconformably overlain by the Miocene Hawthorn formation. Another large area of the Suwannee limestone centering near Brooksville, Hernando County, lies between the Eocene Ocala limestone (on the north) and the Miocene Tampa limestone (on the south). West of the Suwannee River, this limestone crops out a few miles west of the Aucilla River, Jefferson County.

The fauna of the Suwannee limestone, as a whole, lived during the latter part of the time represented by the Flint River formation (Oligocene).

Cooke⁶¹ correlates the Flint River formation (S. C., Ga., and Ala.) with the Chickasawhay marl member of the Byram marl (Ala. and Miss.); the Antigua formation (Leeward Islands); and the Meson formation (Mexico). The Flint River formation is correlated with the European Rupelian.

The fauna of the Tampa limestone was derived from that of the Suwannee limestone. Some species appear to be confined to the Suwannee limestone. As noted before, the echinoid *Rhyncholampas gouldii* (Bouvé) has not been found in deposits now referred to the Tampa limestone. It is not known with certainty whether some species dredged from the Blackwater River in Hillsborough County came from the Tampa limestone or from the Suwannee limestone.

The fauna indicates warm water conditions rather than cool.

The contact between the Suwannee limestone and the succeeding Tampa limestone has not been observed, but the transgression of the Hawthorn formation beyond the shore line of the Tampa, as observed at White Springs, Suwannee River, causing the Hawthorn to rest directly on the Suwannee limestone, indicates a hiatus between the Suwannee and the Hawthorn.

⁶¹ Cooke, C. W., Notes on the Vicksburg group: Bull. Amer. Assoc. Petroleum Geologists, vol. 19, no. 8, pp. 1171, 1172, Aug., 1935.

DESCRIPTIONS OF SPECIES OF THE TAMPA AND SUWANNEE LIMESTONES

Phylum MOLLUSCA

Class GASTROPODA

Subclass ANISOPLEURA

Superorder **EUTHYNEURA**

Nonmarine species

In recording the land and fresh-water species, the writer has followed Dall's classification as given in the U. S. National Museum Bulletin 90. In some instances Dall referred species provisionally to certain genera. Some of these species may belong to other genera and some closely related forms perhaps should be united under one specific name. The main purpose, however, is to record in other deposits the forms identical with or similar to those occurring in the Tampa "silex beds." The marine forms follow the non-marine.

Order PULMONATA

Family HELICIDAE

Tribe BELOGONA

Genus CEPOLIS Montfort, 1810

Key to species of the genus *Cepolis*

Shell rotund, full and rounded with a rather low spire.....*C. latebrosa*
 Shell depressed, body whorl slightly angled at the periphery.....*C. instrumosa*
 Shell elevated and moderately narrow; whorls full and rounded.....*C. direpta*

Subgenus PLAGIOPTYCHA Pfeiffer, 1856

CEPOLIS (PLAGIOPTYCHA) LATEBROSA (Dall)

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

1915. *Cepolis* (*Plagioptycha*) *latebrosa* Dall, U. S. Nat. Mus. Bull. 90, p. 22, pl. 2, figs. 13, 17, 19.

Holotype: U. S. Nat. Mus. No. 111944.

Type locality: "silex bed," Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene.

The shell of this species is rotund, with a rather low spire and weakly convex whorls; margin of lower lip within supporting a large callus.

The holotype is the only specimen at hand.

CEPOLIS (PLAGIOPTYCHA) INSTRUMOSA (Dall)

1890. *Helix* (*Jeanneretia*) *instrumosa* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 9, pl. 1, figs. 7, 8b.
 1915. *Cepolis* (*Plagioptycha*) *instrumosa* Dall, U. S. Nat. Mus. Bull. 90, p. 23, pl. 2, figs. 6, 15.

Cotypes: U. S. Nat. Mus. No. 111945.

Type locality: "silex bed," Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene.

The shell of this species is depressed and the body whorl is angled at the periphery.

The species has not been recognized outside of its type locality.

CEPOLIS (PLAGIOPTYCHA) DIREPTA (Dall)

1890. *Helix* (*Jeanneretia*) *direpta* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 10, pl. 1, figs. 7a, 7b.
 1900. *Helix* (*Plagioptycha*) *direpta* Dall, idem., pt. 5, pl. 39, figs. 4, 5.
 1915. *Cepolis* (*Plagioptycha*) *direpta* Dall, U. S. Nat. Mus. Bull. 90, p. 23, pl. 2, figs. 12, 14.

Holotype: U. S. Nat. Mus. No. 111955.

Type locality: "silex bed," Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene.

The shell of this species is elevated, rather narrow; the whorls are full and rounded.

Other occurrence: Sixmile Creek, near Orient Station, Hillsborough County (Tucker).

Tribe EPIPHALLOGONA

Genus PLEUODONTE Fischer de Waldheim, 1808

Key to the species of the genus *Pleurodonte*:

- Shell large, low-spined, whorls carinated, umbilicus concealed in the adult *P. haruspica*
 Shell rather small, low-spined, whorls rounded, umbilicus not covered, *P. crusta*
 Shell similar to *P. crusta*, but smaller *P. cunctator*
 Shell similar to *P. crusta*, but larger, more covered umbilicus and with a more flattened base (Dall) *P. diespiter*
 Shell of medium size, low-spined, umbilicus nearly concealed *P. kendrickensis*

PLEUODONTE HARUSPICA (Dall)

1890. *Helix* (*Jeanneretia*) *haruspica* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 11, pl. 1, figs. 7c, 7d.
 1915. *Pleurodonte haruspica* Dall, U. S. Nat. Mus. Bull. 90, p. 23, pl. 1, figs. 12, 13, 14 (paratype); pl. 2, fig. 11 (holotype).

Holotype: U. S. Nat. Mus. 111957; figured paratype: U. S. Nat. Mus. No. 165005.

Type locality: "silex bed," at Ballast Point, Tampa Bay, Florida.

Horizon; Tampa limestone, lower Miocene.

Other occurrence: Sixmile Creek, near Orient Station, Hillsborough County (Tucker), one silicified specimen.

The shell of this species is large and low spired, with carinated whorls. The young shell is preforate, but adult specimens have the umbilicus hermetically sealed.

PLEUODONTE CRUSTA (Dall)

1890. *Helix (Jcanneretia) crusta* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 9, pl. 1, figs. 6e, 6f (holotype); figs. 4, 4a, 4b (paratype).

1915. *Pleurodonte crusta* Dall, U. S. Nat. Mus. Bull. 90, p. 24, pl. 2, figs. 8, 16 (holotype).

Holotype: U. S. Nat. Mus. No. 111946; paratype 111947.

Type locality: "silex bed," Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene.

The shell of this species is small, low spired with rounded whorls. The umbilicus is uncovered. This species appears to be confined to the area of its type locality.

PLEUODONTE CUNCTATOR (Dall)

1890. *Helix (Jcanneretia) crusta* var. *cunctator* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 10.

1915. *Pleurodonte cunctator* Dall, U. S. Nat. Mus. Bull. 90, p. 24, pl. 4, figs. 8, 9.

Holotype: U. S. Nat. Mus. No. 111950.

Type locality: "silex bed," at Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene.

This species is similar to *P. crusta*, but Dall states that it is smaller, with a more bevelled base in the area of the umbilicus; however, it is very closely allied to *P. crusta*.

Other occurrences: Sixmile Creek, near Orient Station, Hillsborough County (Tucker); station 12292, Cherokee sink, Wakulla County (internal molds, specific determination not confirmed); station 12726, 2.2 miles above Willis bridge on the Chipola River (internal molds, determination not confirmed); station 7353, between Anthony and Martin, Martin County (external mold, identification not confirmed); station 12300, 1¼ miles N.E. of Lloyd, Jefferson County (Internal mold, determination not confirmed).

PLEUODONTE DIESPITER (Dall)

1890. *Helix (Jcanneretia) diespiter* Dall, Wagner Free Inst. Sci. Trans., vol. 3, p. 10, pl. 1, figs. 1, 1a. (Figure based on several partly defective specimens.)

1915. *Pleurodonte diespiter* Dall, U. S. Nat. Mus. Bull. 90, p. 24, pl. 2, figs. 18, 20.

Cotype: U. S. Nat. Mus. No. 111951.

Type locality: "silex bed" at Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene.

Dall states that this species resembles *P. crusta* in form but is larger with a more covered umbilicus, more horizontally flattened base and a larger and more oval aperture.

This species appears to be confined to the area of its type locality.

PLEURODONTE KENDRICKENSIS Mansfield, n. sp.

Plate 1, Figures 8, 11, 14

Shell solid, with a very low spire consisting of $4\frac{1}{2}$ whorls. Suture shallow, close-fitting but not appressed. Early whorls very weakly convex. Body whorl narrowly rounded at the periphery. Aperture wider than high; lower margin nearly at right angles with the axis of the shell. Peristome of aperture thickened and reflected. Parietal wall covered with a rather heavy wash of callus. Umbilicus nearly concealed, only a small chink lies behind the peristome. The shell is smooth except for faint growth lines.

Holotype (U. S. Nat. Mus. No. 495996) measures: Height, 10.8 mm.; greatest diameter, 21.0 mm.

Type locality: Station 12314, Cummer Lumber Company quarry at Kendrick, 4.8 miles north of Ocala, Marion County, Florida; from a bed about 3 feet thick that overlies the Ocala (Eocene) limestone.

Horizon: Tampa limestone, lower Miocene.

Pleurodonte kendrickensis, n. sp., has a lower spire than the species referred to this genus from the "silex bed" at Tampa Bay.

Genus HUMBOLDTIANA von Ihering, 1892

HUMBOLDTIANA? TUCKERAE Mansfield, n. sp.

Plate 1, Figures 9, 12

Shell of moderate size, globose, wider than high, rather thin and consisting of about $4\frac{1}{2}$ whorls in all. Apical turn corroded but apparently lowly domed and rapidly enlarging. Following whorls evenly convex. Suture shallow, weakly appressed. Last whorl composing most of the shell, similarly rounded above and below. Sculptured with rather coarse retractive growth lamellae. Aperture oblique and a little wider below than above; margin weakly reflected. Parietal wall probably originally covered with a thin callus. Umbilicus small, partly concealed at the upper part by the dilation of the peristome. Columella weakly concave medially.

Holotype measures: Height, 14 mm.; greatest diameter, 20 mm.

Type locality: Sixmile Creek, near Orient Station, Hillsborough County, Florida. Collected by Miss Helen I. Tucker.

Horizon: Tampa limestone, lower Miocene.

Only two specimens were received with the material from Miss Tucker, the holotype being a little better preserved but a little smaller than the other specimen.

U. S. Nat. Mus. No. 4959340.

I am not certain that the specimens belong to the genus *Humboldtiana*. In general outline they appear closely related to *H. texana* Pilsbry from Texas. The surface of the shell is somewhat corroded and no color bands or granulose ornamentation can be seen, if originally present.

Tribe POLYGYRA

Genus POLYGYRA Say, 1818

POLYGYRA ADAMNIS (Dall)

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

1915. *Polygyra adamnis* Dall, U. S. Nat. Mus. Bull. 90, p. 24, pl. 2, figs. 7, 9.

Holotype: U. S. Nat. Mus. No. 111959.

Type locality: "silex bed," at Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene.

This species has not been recognized outside of its type locality.

Family BULIMULIDAE

Genus BULIMULUS Leach, 1814

Key to the species of genus *Bulimulus*

- Shell moderately long and with a relatively long body whorl*B. floridanus*
- Shell small, rather stout, whorls slightly convex*B. heilprinianus*
- Shell rather large and stout*B. americanus*
- Shell similar to *B. americanus* but a little more slender,
.....*B. americanus* var. *partulinus*
- Shell more slender than *B. americanus* and with stronger growth lines.....
.....*B. americanus* var. *laxus*
- Shell of moderate size and moderately slender*B. tampae*
- Shell similar to *B. heilprinianus* but more slender*B. ballistae*
- Shell small, very slender*B. stearnsii*
- Shell small, rather stout, similar to *B. heilprinianus**B. tortilla*
- Shell small and rather slender*B. remolina*
- Shell very large*B. americanus wakullae*

Subgenus HYPERAULAX Pilsbry, 1897

BULIMULUS (HYPERAULAX) FLORIDANUS Conrad

1846. *Bulimus floridanus* Conrad, Amer. Jour. Sci., ser. 2, vol. 2, p. 399, fig. 1.

1865. *Bulimus floridanus* Conrad, Amer. Jour. Conch., vol. 1, p. 144, pl. 11, fig. 11.

1881. *Bulimulus longaevus* Ancey, Le Naturaliste, 1881, p. 414.
 1890. *Bulimulus* (?*Anctus*) *floridanus* Conrad. Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 1, p. 5, pl. 1, fig. 11.
 1915. *Bulimulus* (*Hyperaulax*) *floridanus* Conrad. Dall, U. S. Nat. Mus. Bull. 90, p. 25, pl. 2, fig. 2.

Type not found in the collection of the Academy of Natural Sciences, Philadelphia.

Type locality: "silex bed," Ballast Point, Tampa, Florida.

Horizon: Tampa limestone, lower Miocene

According to Dall,⁶² *B. floridanus* differs from *B. americanus* and *B. heilprinianus* in being more elongated and less abruptly tapered at the ends.

BULIMULUS (HYPERAULAX) HEILPRINIANUS Dall

1890. *Bulimulus* (?*Anctus*) *heilprinianus* Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 1, p. 6, pl. 1, figs. 6b, 10.
 1915. *Bulimulus* (*Hyperaulax*) *heilprinianus* Dall, U. S. Nat. Mus. Bull. 90, p. 25, pl. 2, figs. 1, 10.

Holotype: U. S. Nat. Mus. No. 111962.

Type locality: "silex bed, Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene.

This species is small, fusiform with a rather pointed conical spire. The suture is distinct but not deep.

BULIMULUS (HYPERAULAX) AMERICANUS (Heilprin)

1887. *Partula americana* Heilprin, Wagner Free Inst. Sci., Trans., vol. 1, p. 115, pl. 16, fig. 60.
 1890. *Bulimulus* (?*Anctus*) *americanus* (Heilprin). Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 1, p. 7, pl. 1, figs. 9, 9a (with varieties *partulinus* and *laxus*).
 1915. *Bulimulus* (*Hyperaulax*) *americanus* (Heilprin). Dall, U. S. Nat. Mus. Bull. 90, p. 26, pl. 2, fig. 5 (forma typica); pl. 3, fig. 3 (forma typica); pl. 4, fig. 12 (var. *partulinus*), pl. 4, fig. 14 (var. *laxus*).

Holotype: Forma typica deposited in the collection of Wagner Free Inst. Science, Philadelphia; var. *partulinus* (U. S. N. M. No. 111970) and var. *laxus* (U. S. Nat. Mus. No. 111971) deposited in the U. S. National Museum.

Type locality: "silex bed," Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene.

The species is rather large and stout. It is the most abundant species in the "silex bed."

Other occurrence: Sixmile Creek, near Orient Station, Hillsborough County (Tucker). An imperfect specimen, collected at sta-

⁶² Dall, W. H., Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 6, 1890.

tion 12294, 2.5 miles south of Crawfordville, Wakulla County, appears to belong or is closely allied to *B. americanus*.

B. americanus var. *partulinus* is very similar to *B. americanus* but *B. americanus* var. *laxus* is more slender than the typical form.

BULIMULUS (HYPERAULAX) TAMPÆ Dall

1915. *Bulimulus (Hyperaulax) tampæ* Dall, U. S. Nat. Mus. Bull. 90, p. 26, pl. 1, fig. 3.

Holotype: U. S. Nat. Mus. No. 165012.

Type locality: "silex bed," Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene.

The shell of this species is of moderate size and subfusiform in outline.

BULIMULUS (HYPERAULAX) BALLISTÆ Dall

1915. *Bulimulus (Hyperaulax) ballistæ* Dall, U. S. Nat. Mus. Bull. 90, p. 26, pl. 1, fig. 5.

Holotype: U. S. Nat. Mus. No. 165013.

Type locality: "silex bed," Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene.

Shell similar to *B. heilprinianus* but more slender.

BULIMULUS (HYPERAULAX) STEARNSII Dall

1890. *Bulimulus (?Anctus) stearnsii* Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 1, p. 7, pl. 1, fig. 12.

1915. *Bulimulus (Hyperaulax) stearnsii* Dall, U. S. Nat. Mus. Bull. 90, p. 27, pl. 2, fig. 4.

Holotype: U. S. Nat. Mus. No. 111964.

Type locality: "silex bed," Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene.

Shell rather small and very slender.

BULIMULUS (HYPERAULAX) TORTILLÆ Dall

1915. *Bulimulus (Hyperaulax) tortillæ* Dall, U. S. Nat. Mus. Bull. 90, p. 27, pl. 1, fig. 2.

Holotype: U. S. Nat. Mus. No. 165015.

Type locality: "silex bed," Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene.

Shell small, rather stout, similar to *B. heilprinianus*.

BULIMULUS (HYPERAULAX) REMOLINÆ Dall

1915. *Bulimulus (Hyperaulax) remolina* Dall, U. S. Nat. Mus. Bull. 90, p. 27, pl. 1, fig. 18.

Holotype: U. S. Nat. Mus. No. 165014.

Type locality: "silex bed," Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene.

This species is somewhat similar to *B. tampae* but smaller and more slender.

BULIMULUS AMERICANUS WAKULLAE Mansfield, n. subsp.

Plate 1, Figures 10, 13

A number of specimens, one an external mold and a number of internal molds, were collected at station 12293, about 200 yards south of Wakulla railroad station, Wakulla County, Florida, and about 16 miles south of Tallahassee. These specimens appear to be closely related to *Bulimulus americanus* Heilprin and until better specimens may be procured are placed as a subspecies of Heilprin's species.

The mold of the new subspecies is twice the size of the largest specimen of Heilprin's species. The molds reveal a rather stout shell with moderately inflated whorls. Only retractive growth lines ornament the shell.

An impression of an external mold measures: Height, 30 mm.; greatest diameter, about 17 mm.

Holotype: U. S. Nat. Mus. No. 495932.

Horizon: Tampa limestone, lower Miocene.

Family CERIONIDAE

Genus CERION Bolten, 1798

Section EOSTROPHIA Dall, 1890

CERION (Eostrophia) ANODONTA (Dall)

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

1915. *Cerion (Eostrophia) anodonta* (Dall), U. S. Nat. Mus. Bull. 90, p. 28, pl. 1, fig. 15.

Holotype: U. S. Nat. Mus. No. 111972.

Type locality: "silex bed," Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene.

Other occurrence: Sixmile Creek, near Orient Station, Hillsborough County, Florida (Tucker) (? Mansfield and MacNeil): station 12294, 2.5 miles south of Crawfordville, Wakulla County, Florida; station 12292, Cherokee sink, Wakulla County, Florida (external mold, identification questioned); station 12293, Wakulla Station, Wakulla County (external mold, identification questioned).

CERION (Eostrophia) ANODONTA VAR. FLORIDANUM Dall

1915. *Cerion (Eostrophia) anodonta* var. *floridanum* Dall, U. S. Nat. Mus. Bull. 90, p. 28, pl. 3, fig. 4.

Holotype: U. S. Nat. Mus. No. 111975.

Type locality: "silex bed," Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene.

This variety is shorter and stouter than the typical form.

Genus *MICROCERION* Dall, 1915

***MICROCERION FLORIDANUM* Dall**

1915. *Microcerion floridanum* Dall, U. S. Nat. Mus. Bull. 90, p. 29, pl. 1, figs. 16, 17.

Holotype: U. S. Nat. Mus. No. 165018.

Type locality: "silex bed," Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene.

This species is very rare; it has not been found outside of its type locality.

Family PUPILLIDAE

Genus *PUPOIDES* Pfeiffer, 1854

***PUPOIDES PILSBRYI* Dall**

1915. *Pupoides pilsbryi* Dall, U. S. Nat. Mus. Bull. 90, p. 29, pl. 1, fig. 6.

Holotype: U. S. Nat. Mus. No. 165017.

Type locality: "silex bed," Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene.

Dall states that the pillar and aperture of this species are without teeth or callosities. The figured specimen (Dall, pl. 1, fig. 6) has teeth and it is not the same as the specimen in the U. S. Nat. Mus. marked "Type." The figured specimen may not be the specimen described by Dall.

Family UROCOPTIDAE

Genus *UROCOPTIS* Beck, 1837

***UROCOPTIS FLORIDANA* (Dall)**

1890. *Cylindrella floridana* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 13, pl. 1, fig. 6a.
1915. *Urocoptis floridana* Dall, U. S. Nat. Mus. Bull. 90, p. 30, pl. 1, fig. 4; pl. 2, fig. 3 (holotype).

Holotype: U. S. Nat. Mus. No. 111976. Figured paratype: U. S. Nat. Mus. No. 165019.

Type locality: "silex bed," Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene.

This species appears to be confined to the area of its type locality.

Family PLANORBIDAE

Genus PLANORBIS Müller, 1774

PLANORBIS TAMPAENSIS Dall

- 1915.
- Planorbis tampaensis*
- Dall, U. S. Nat. Mus. Bull. 90, p. 30, pl. 1, fig. 1.

Holotype: U. S. Nat. Mus. No. 165020.

Type locality: "silex bed," Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene.

The holotype, a poor specimen, is the only specimen in the collection at the U. S. National Museum.

Section TORQUIS Dall, 1905

PLANORBIS (TORQUIS) WILLCOXII Dall

- 1890.
- Planorbis willcoxii*
- Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 1, p. 4, pl. 1, figs. 6c, 6d.

- 1915.
- Planorbis (Torquis) willcoxii*
- Dall, U. S. Nat. Mus. Bull. 90, p. 31, pl. 3, figs. 5, 6.

Holotype: U. S. Nat. Mus. No. 111938.

Type locality: "silex bed," Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene.

The holotype is the only specimen in the U. S. National Museum.

PLANORBIS (TORQUIS) ELISUS Dall

- 1915.
- Planorbis (Torquis) elisus*
- Dall, U. S. Nat. Mus. Bull. 90, p. 31, pl. 1, figs. 8, 9.

Holotype: U. S. Nat. Mus. No. 165021.

Type locality: "silex bed," Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene.

The holotype and only specimen, is smaller than *P. willcoxii* and the relationship to it is difficult to determine.

Family OLEACINIDAE

Genus SPIRAXIS C. B. Adams, 1850

SPIRAXIS? TAMPAE Dall

Plate 1, Figure 1.

- 1915.
- Spiraxis? tampa*
- Dall, U. S. Nat. Mus. Bull. 90, p. 31.

Holotype: U. S. Nat. Mus. No. 214738.

Type locality: "silex bed," Tampa, Florida.

Horizon: Tampa limestone, lower Miocene.

The holotype is the only specimen in the U. S. National Museum.

Marine species
Order OPISTHOBRANCHIATA
Suborder TECTIBRANCHIATA
Family ACTEONIDAE
Genus ACTEON Montfort, 1810

ACTEON TAMPAE Dall

1915. *Acteon tampa* Dall, U. S. Nat. Mus. Bull. 90, p. 32, pl. 4, fig. 10.

Dall described this species as follows:

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

"Height 7, diameter 4.5 mm.

"Tampa silex beds, at Ballast Point, Tampa Bay, Florida. U. S. Nat. Mus. No. 166094."

Horizon: Tampa limestone, lower Miocene.

Acteon shilohensis Whitfield, a species from the Kirkwood formation, middle Miocene, of New Jersey, has a higher and more turreted spire than *A. tampa* Dall and also differs in other features.

Acteon tampa is represented by a single individual which constitutes the holotype. I have not seen it outside of its type locality.

Family ACTEONIDAE
Genus ACTEOCINA Gray, 1847

ACTEOCINA WETHERILLI I. Lea?

I find only one specimen collected at La Penotiere's sulphur spring, about 6 miles northeast of Tampa, Fla., and labelled "*Tornatina* wetherilli Lea" under No. 97469 in the U. S. National Museum collection. Another poorly preserved shell which may belong to this species was collected by me at Ballast Point, Tampa Bay, Fla. The holotype of *Acteocina wetherilli* (Lea)⁶³ came from the Tertiary at Deal, N. J. I have not seen this specimen and am not sure that the specimens from the "silex beds" and the Tampa limestone of Dall referred to the species by Dall are correctly identified.

The specimen mentioned above (U. S. N. M. No. 97469) has about

⁶³ Lea, Isaac, Contributions to Geology, p. 213, pl. 6, fig. 224, 1833.

4 whorls in all, the last whorl comprising most of the shell. The spire is acute but not much elevated. A spiral incised line is situated below the suture forming a subsutural cord between it and the suture. The body whorl is weakly compressed medially and the columella bears a single fold. The illustration of the figured holotype of *A. wetherilli* (Lea) appears to be a relatively shorter shell than the Tampa form referred to this species by Dall.

ACTEOCINA SQUARROSA Dall

1915. *Acteocina squarrosa* Dall, U. S. Nat. Mus. Bull. 90, p. 33, pl. 6, fig. 8.

Dall described this species as follows:

"Shell of moderate size, subcylindrical, slightly wider anteriorly, of about 4 whorls, separated by a very deeply excavated channeled suture; the outer margin of the suture is formed by a sharp-edged thin carina, the inner margin is duplicated by a layer of enamel so that in the adult, in the whorls preceding the last, the carina seems double-edged; nucleus small, swollen, sunken so that the nuclear whorl is not visible above the squarely truncated posterior end of the shell; axial sculpture of faint vertical incremental lines, somewhat irregular in strength and receding arcuately to and near the carina; spiral sculpture on the anterior half of the whorl at first faint, but becoming accentuated anteriorly, and extending to the labial callus, composed of fine, nearly equally spaced grooves or striae, apparently not punctuate; aperture as long as the shell, narrow behind, where the commissure is deeply incised, wide in front; outer lip straight, sharp, simple; body without enamel; pillar short, almost horizontally twisted, bearing a single strong plait on a heavy callus behind which is a rather deep narrow bounding furrow; anterior sinus wide and deep. Length of shell, 11.5, depth of sutural channel 1, maximum diameter of shell 5.5 mm.

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

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

Horizon: Tampa limestone, lower Miocene.

The species has not been found outside of the type locality.

Genus *RETUSA* Brown, 1827

RETUSA? VAGINATA Dall

1890. *Utriculus vaginatus* Dall, Wagner Free Inst. Trans., vol. 3, pt. 1, p. 16.

1892. *Utriculus vaginatus* Dall, idem., pt. 2, p. 219, pl. 20, fig. 2.

1915. *Retusa vaginata* Dall, U. S. Nat. Mus. Bull. 90, p. 34.

Dall described this species in 1890 and 1915 as follows:

"Shell small, elongate ovate in profile, with a subtruncate spire above the last whorl; surface smooth or marked with incremental lines; whorls three or four; spire depressed, barely visible above the last whorl; suture narrow, deeply excavated, the rim in front of it sharp; last whorl descending toward the aperture; shell slightly wider in front than behind; aperture very narrow behind, more than three times as wide in front; outer lip simple, sharp, rounding

imperceptibly into the simple uniplicate pillar, behind which there is no umbilicus; lon. 4.0; lat. 2.0 mm.

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

Horizon: Tampa limestone, lower Miocene.

This species, as pointed out by Dall, has a deeper suture than *Retusa mayoi* Dall. It also has a deeper suture than *Retusa obtusa* (Montagu) usually regarded as the genotype. However, the character of the uniplicate pillar of the Tampa form is quite similar to that of *R. obtusa* and in this respect appears to be nearer the genus *Retusa* than to other genera of the Tectibranchiata. The species belonging to the genus *Retusa* are usually found in rather cool water.

Family SCAPHANDRIDAE

Genus SCAPHANDER Montfort, 1810

SCAPHANDER BALLISTUS Mansfield, n. sp.

Plate 1, Figures 5, 6

1890. *Scaphander primus* Aldrich (part). Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 17.

1915. *Scaphander primus* Aldrich (part). Dall, U. S. Nat. Mus. Bull. 90, p. 34.

Shell large, ovate, expanding anteriorly, with a depressed spire. Body whorl weakly transversely depressed at about upper third of shell which is distinctly indicated by a narrow furrow on the internal mold of specimens which have lost the shells. Sculpture of regularly spaced concentric striae over the whole shell. Aperture inverted ear-shaped, extending posteriorly as far as the body whorl; outer lip thin.

Dimensions: Holotype (U. S. Nat. Mus. no. 165026), length, 9.8 mm.; greatest diameter, 5.6 mm. Larger paratype (U. S. Nat. Mus. No. 495935), length, 23.2 mm.; greatest diameter, 12.7 mm. Smaller paratype, length, 12 mm.; greatest diameter, 7.8 mm.

Type locality: Holotype, "silex beds," Ballast Point, Tampa Bay, Florida; Paratype, station 12285, quarry, half mile south of River Junction, Gadsden County, at an elevation of about 150 feet above sea level.

Horizon: Tampa limestone, lower Miocene.

Scaphander primus Aldrich from the Oligocene at Red Bluff, Miss., is smaller, more inflated in the posterior region and marked with stronger primary striae than the new species. The primary striae also on *S. primus* are usually interpolated with secondary striae whereas on the new species there appear to be no secondary striae.

Occurrence: "silex beds" at Ballast Point, Tampa Bay, Florida; La Penotiere's Sulphur Spring, 6 miles northeast of Tampa, Hillsborough County (large specimens in a limestone matrix); station 12292, Cherokee sink, Wakulla County (three internal molds); stations 3411 and 12285, quarry half mile south of River Junction, Gadsden County; station 4836, Old Chattahoochee Landing, Gadsden County, echinoderm bed (internal molds and identification not certain).

SCAPHANDER sp.

Specimens belonging to the genus *Scaphander*, too poorly preserved for specific determination, occur at three localities in Florida. Although these specimens may represent more than one species they appear to differ from *S. ballistus*, n. sp., in having the posterior extremity more contracted.

Horizon: Suwannee limestone, Oligocene.

Occurrence: station 11109, 1½ miles north of Live Oak, Suwannee County (silicified specimens); station 6872, Bass, Columbia County; station 6774, rock island, three-fourths mile above White Springs, Columbia County (posterior end of a silicified specimen); station 12753a, lower part of quarry at Brooksville, Hernando County.

Family BULLIDAE

Genus BULLA Linné, 1758

BULLA PETROSA Conrad

1846. *Bulla petrosa* Conrad, Amer. Jour. Sci., vol. 2, ser. 2, p. 399, with figure.
 1890. *Bulla petrosa* Conrad. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 18.
 1915. *Bullaria petrosa* (Conrad). Dall, U. S. Nat. Mus. Bull. 90, p. 35.

Conrad described in 1846 this species as follows:

"Oval, destitute of striae?, summit oblique. Ballast Point, Tampa Bay, Rare."

Dall⁶⁴ states:

"Rare in the Tampa silex beds, where it was first found by Conrad and later by Dall, U. S. Nat. Mus. No. 97488. This belongs to the typical section of the genus with perforate apex and resembles *Bullaria solida* but is of smaller size.

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

Horizon: Tampa limestone, lower Miocene.

The specimen under U. S. National Museum number 97488, referred to "*Bullaria*" *petrosa* (Conrad) by Dall, is a poor specimen.

⁶⁴ Dall, W. H., U. S. Nat. Mus. Bull. 90, p. 35, 1915.

It has a perforate apex and has spiral striations on the anterior third of the body whorl.

The specimens from Jacksonboro, Georgia, that Dall identified as "*Bullaria*" *petrosa* (Conrad), are internal molds, and I am not sure that they are identical with Conrad's species.

Genus HAMINEA Leach, 1847

HAMINEA? SULCOBASIS Dall

1915. *Bullaria* (*Haminea*?) *sulcobasis* Dall, U. S. Nat. Mus. Bull. 90, p. 35, pl. 6. fig. 6.

Dall described this species as follows:

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

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

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

Horizon: Tampa limestone, lower Miocene.

No more specimens have been obtained from Ballast Point to aid in placing the species in the proper genus.

Superorder STREPTONEURA

Order CTENOBRANCHIATA

Suborder ORTHODONITA

Superfamily TOXOGLOSSA

Family TEREBRIDAE

Genus TEREBRA Bruguière, 1789

Subgenus STRIOTEREBRA Sacco, 1891

TEREBRA (STRIOTEREBRA) BALLISTA Mansfield, n. sp.

Plate 1, Figure 3

1915. *Terebra* (*Oxymeris*) *tantula* Conrad (part). Dall, U. S. Nat. Mus. Bull. 90, p. 36.

Shell small, moderately slender, sculpture stronger axially than spirally. Ten remaining whorls on holotype, about 12 or 13 in all; nuclear whorls missing on holotype; postnuclear whorls nearly straight

and gradually enlarging. Suture shallowly depressed and closely appressed. Axial sculpture of rather strong, arcuate ribs (18 on the penultimate whorl) which are retractive above and protractive below and separated by interspaces a little wider than the ribs. These ribs are transversely weakly incised at the upper third of the whorl. Spirally sculptured over the whole shell with very narrow bands separated usually by narrower incised lines, which are situated mainly between the ribs. Aperture not entirely preserved. Columella apparently uniplicate, the sulcus being at the lower part of the pillar.

Holotype (U. S. Nat. Mus. no. 165028) measures: Height, 17.5 mm.; greatest diameter, 4.5 mm.

Type locality: "silex beds" at Ballast Point, Tampa Bay, Florida. E. J. Post, collector. Not known outside of the type locality.

Horizon: Tampa limestone, lower Miocene.

Terebra ballista n. sp. differs from *T. tantula* Conrad, an Oligocene species, in having a larger shell with a greater apical angle, and a much shallower incised spiral delimiting the subsutural band.

Terebra are very rare in the Tampa limestone, there being only two specimens which I have referred to the new species, *T. ballista*, in the U. S. National Museum collection. The specimen figured by Dall,⁶⁵ and referred to *T. dislocata* Say came from the Shoal River formation, 5 miles east of DeFuniak Springs, Florida.

Family CONIDAE

Genus CONUS Linnaeus, 1758

Key to the species of *Conus*

1. Shell slender, elongate and turreted.
 Anal fasciole concave.
 Spire whorls sharply keeled at the shoulder and undulated on the earlier whorls, ornamented within the anal fasciole with 2 feeble spiral threads and on the vertical area below the carina by protractive to nearly vertical axial folds *Conus illiolus*
2. Shell broadly conical.
 Nucleus erect, rising from a nearly flat surrounding area.
 Anal fasciole weakly concave to nearly flat.
 Spire whorls gently inclined to nearly flat, sculptured on the anal fasciole with about 3 spiral threads.
 Lower half of body whorl sculptured with rather coarse, sharp spiral lines *C. planiceps*
3. Shell similar to *C. planiceps* but differing from it in having a higher spire, and in the absence of strong spiral ornamentation in the area of the anal fasciole *Conus designatus*
4. Shell similar to *C. planiceps* but differing from it in having a less broadly conical shell and a higher spire *C. planiceps wakullensis*

⁶⁵ Dall, W. H., U. S. Nat. Mus. Bull. 90, pl. 5, fig. 2, 1915.

CONUS ILLIOLUS Dall

1915. *Conus illiolus* Dall, U. S. Nat. Mus. Bull. 90, p. 37, pl. 6, figs. 3, 5.

Dall described this species as follows:

"Shell solid, slender, elongate, turreted, of about $9\frac{1}{2}$ whorls; nucleus small, bulbous, of about one whorl, smooth and oblique; suture distinct; the shoulder of the whorl sharply keeled, the space between it and the suture slightly excavated, with two feeble spiral threads equidistant from each other, the suture and the keel; excavated space transversely sculptured with numerous concavely flexuous, equal, close-set, slightly elevated incremental lines; suture meeting the whorl behind at nearly a right angle some distance below the keel; axial sculpture, beside that above mentioned, comprising a series of very small, short, subequal, and nearly equidistant folds on the whorl just below the keel, with subequal interspaces, which do not nodulate the keel and are stronger on the earlier whorls and nearly obsolete on the last whorl; these are crossed by two or three feeble spiral threads with narrower intervals, below which the spiral sculpture is obsolete and the surface practically smooth for two-thirds the length of the whorl; anterior third has rather coarse spiral threading of which the first 10 are paired, the anterior 10 being coarser and equidistant, aperture narrow, outer lip (defective); pillar straight, the anterior edge a little prominent and twisted. Length 41.5, breadth at keel 17 mm.

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

Horizon: Tampa limestone, lower Miocene.

This species is well characterized and has been well described by Dall. The holotype is the only specimen in the U. S. National Museum collection from the "silex beds" at Tampa Bay.

Occurrence: Sixmile Creek, near Orient Station, Hillsborough County (Tucker); station 7080, quarry half mile south of River Junction, Gadsden County, at an elevation of about 150 feet above sea level (imperfect specimen, identification not fully confirmed).

CONUS PLANICEPS Heilprin

1887. *Conus planiceps* Heilprin, Wagner Free Inst. Sci., Trans., vol. 1, p. 110, figs. 48, 48a.
1890. *Conus planiceps* Heilprin. Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 1, p. 25, pl. 11, figs. 5, 5a.
1892. *Conus planiceps* Heilprin. Dall, idem, pt. 2, p. 219.
1915. *Conus planiceps* Heilprin. Dall, U. S. Nat. Mus. Bull. 90, p. 37, pl. 6, figs. 1, 2.

Heilprin described this species in 1887 as follows:

"Shell broadly conical, rapidly tapering toward the base; spire reduced to a minimum, represented in most specimens by an exceedingly gentle rise, crowned by a papilla (apex); whorls about seven, all of them fully exposed on the crown, the shoulders concentrically lined; revolving lines nearly obsolete over the greater extent of the body-whorl, prominent on the basal portion; notch?

"Length 1.4 inches; width of crown, .8 inch."

Horizon: Tampa limestone, lower Miocene.

The cotypes are deposited in the Wagner Free Institute of Science, Philadelphia. The spire or crown in most specimens gradually descends from the nucleus but in a few specimens it is nearly flat. The nucleus is erect and consists of about 3 moderately inflated whorls. The sculpture on each spire whorl consists of about 3 raised, rather strong, spiral threads crossed by fine acute axials. The specimen figured by Dall⁶⁶ has a stronger and sharper shoulder behind the suture than most of the other specimens referred to this species but in other features is identical.

Conus demiurgus Dall from the Chipola formation of the Alum Bluff group of Florida has a slimmer and larger shell with a larger nucleus than *C. planiceps* Heilprin. In outline *C. sulculus* Dall from the Chipola resembles the "silex bed" form, but the former species has a different type of sculpture on lower part of the body whorl and a higher spire.

Conus aemulator Brown and Pilsbry from the Cerado formation of the Dominican Republic, a close relative to *C. sulculus* Dall, is somewhat similar to the "silex bed" species but differs from the latter in having a stouter shell, more conical early whorls and a more inflated shell below the shoulder of the body whorl.

Occurrence: Type locality (common), Sixmile Creek, near Orient Station, Hillsborough County (Tucker); station 2470, one mile west of Bartow, Polk County; Baileys Mill Creek sink, Jefferson County; "Wacissa," Jefferson County; station 12285, quarry half mile south of River Junction, Gadsden County, at an elevation around 150 feet above sea level.

CONUS DESIGNATUS Dall

1915. *Conus designatus* Dall, U. S. Nat. Mus. Bull. 90, p. 37, pl. 6, fig. 4.

Dall described this species as follows:

"Shell of moderate size with low, broadly conical spire of about 8 whorls; nucleus prominent, subglobular, inflated, smooth; subsequent whorls flattened on the spire, narrow, bordered at the shoulder by a slightly rounded keel, and separated by a distinct but not deep suture; the whorls on the spire are not spirally sculptured, but show faint traces of incremental, concavely accurate lines; last whorl in front of the shoulder smooth, acutely conic, the only sculpture being in the anterior third, which has about a dozen fine spiral threads with wider interspaces becoming more crowded and feebly minutely nodulous anteriorly; on the smooth posterior part of the whorl in certain lights can be seen spiral lines distant and fine, but which appear rather to be in the substance of the shell and do not sculpture the surface; aperture narrow elongate, the canal

⁶⁶ Dall, W. H., U. S. Nat. Mus. Bull. 90, pl. 6, figs. 1, 2, 1915.

short and wide; the outer lip sharp, simple and very slightly convexly arcuate. Length of shell 23.8, of aperture 21.5, maximum diameter 12 mm.

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

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

Horizon: Tampa limestone, lower Miocene.

The holotype and three other specimens of the type lot are siliceous pseudomorphs. All the specimens are small. The last whorl of the holotype is weakly concave in the area of the anal fasciole and is bordered in front of this concavity and at the shoulder by a weak, rounded spiral cord. One specimen shows faint spirals in the anal fasciole.

This species differs from *C. planiceps* Heilprin mainly in having a higher spire without distinct spiral ornamentation in the area of the anal fasciole.

Occurrence: Type locality, rare; station 7358, Anclote River at Tarpon Springs, Pinellas County. (Some of these specimens show spiral sculpture in the anal fasciole, but in other features appear to be the same as the silex beds fossils.)

CONUS PLANICEPS WAKULLENSIS Mansfield, n. subsp.

Plate 1, Figures 2, 4, 7

Shell of medium size, rather broadly conic, low spired, consisting of about 6 postnuclear whorls, nucleus not preserved. Spire very broadly and evenly conic, rising about 7 millimeters above the shoulder of the body whorl. Suture distinct and weakly depressed. Whorls not depressed in the area of the anal fasciole, sculptured with 2 or 3 rather strong concentric threads. Body whorl sculptured only on lower half by rather coarse raised concentric lines, the upper ones being paired.

The holotype (U. S. Nat. Mus. no. 495936) measures: Length, about 40 mm.; greatest diameter, about 22 mm. The holotype consists of an external impression of the original shell.

Type locality: Station 12292, Cherokee Sink, Wakulla County, Florida.

Horizon: Tampa limestone, lower Miocene.

The new subspecies is closely related to both *C. planiceps* Heilprin and *C. designatus* Dall. It has a higher spire than *C. planiceps* and larger and more strongly sculptured in the area of the anal fasciole than *C. designatus*. The sculpture on the base is similar to both of the above species.

Occurrence: Common at the type locality; station 12293, Wakulla Railroad Station, Wakulla County; station 13840, 1¼ miles northeast of Lloyd, Jefferson County.

CONUS SP. AFF. C. COOKEI Dall

Specimens collected at station 12758, 5.9 miles northeast of Brooksville, Hernando County, though poorly preserved, appear to be related to *Conus cookei* Dall, a species described from the Flint River formation at station 7079, east bank of Flint River at Mascot Point, about 4 miles below Bainbridge, Ga.

The largest specimen measures about 45 millimeters in length. The spire, shown by a fragment of an external mold, is moderately high, turreted and sculptured with 4 or 5 spiral lines. Body whorl sculptured throughout with raised(?) spiral lines.

Horizon: Suwannee limestone, Oligocene.

Family TURRIDAE

Genus POLYSTIRA Woodring, 1928

POLYSTIRA GR. P. ALBIDA (Perry)

1915. *Turris albida* Perry (in part?), Dall, U. S. Nat. Mus. Bull. 90, p. 38. (Not pl. 5, fig. 13; pl. 14, fig. 7, specimens from the Chipola formation).

Four poorly preserved specimens (U. S. Nat. Mus. nos. 112083 and 112084), labeled "*Pleurotoma albida*" Perry and from the "silex bed," Ballast Point, Tampa Bay, Fla., have lost their early whorls. In the absence of these parts no comparison can be made with corresponding parts on recent or fossil specimens belonging to this group, and until better preserved specimens are procured I believe their identity with the recent species should be left in doubt.

Horizon: Tampa limestone, lower Miocene.

POLYSTIRA TAMPENSIS Mansfield, n. sp.

Plate 2, Figures 1, 8

1915. *Turris vibex* Dall (in part), U. S. Nat. Mus. Bull. 90, p. 39 (not *Turris vibex*, Bull. Mus. Comp. Zoology, vol. 18, no. 19, p. 73, 1889).

Shell small, slender, with a high spire and long canal. Nucleus decollate. Whorls nearly straight in outline. Suture shallow and closely adhering to a spiral thread. Spiral sculpture on the early whorls consisting of two rather sharp spirals, the anterior being the stronger and forms the low periphery of the whorl; on the penultimate whorl, two secondary spirals are interposed between the peripheral spiral and forward suture and two tertiary spirals lie between

the primary spirals. Interspiral spaces axially crossed by fine threads which are retractive above and protractive below. Canal long and sculptured with primary and secondary revolving threads. Outer lip defective.

Cotypes (U. S. Nat. Mus. no. 166095) measure: Larger cotype, height, 15.4 mm; greatest diameter, 7.5 mm. Smaller cotype, height, 11.1 mm; greatest diameter, 6.0 mm.

Type locality: "silex beds," Ballast Point, Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene.

Polystira tampensis is more slender than the recent species, *P. albida* (Perry). It has a spiral structure different from that of *P. vibex* (Dall), the living species to which Dall referred it.

Polystira cochlearis (Conrad), an Oligocene species, has a less slender shell and stronger spiral sculpture than the new species here described.

Genus KNEFASTIA Dall, 1919

KNEFASTIA? BROOKSVILLENSIS Mansfield, n. sp.

Plate 2, Figures 5, 9

Shell of moderate size, rather stout, with a high spire and probably a rather long canal (end broken away). Suture wide. Sculpture on the spire whorls mainly consisting of three rather strong spirals of about the same strength, two of which are situated below the anal fasciole and one above. Last whorl has eight rather strong, widely spaced spiral threads between the suture and the base of the whorl. Outer lip and end of the canal defective.

Larger cotype (U. S. Nat. Mus. 495937) measures: Height, 23 mm.; greatest diameter, 8.5 mm.

Type locality: Station 11113, Brooksville, Hernando County, Fla.

Horizon: Suwannee limestone, Oligocene.

Occurrence: Type locality, 2 specimens; station 7363, 1½ miles west of Croom, Hernando County (external mold, may be a varietal form of *Knefastia? brooksvillensis*).

Genus FUSITURRICULA Woodring, 1928

FUSITURRICULA CONDOMINIA (Dall)

1915. *Drillia condominia* Dall, U. S. Nat. Mus. Bull. 90, p. 39, pl. 12, fig. 25.

Dall described this species as follows:

"Shell of moderate size, rather thin, with an elongated, turreted spire of about eight whorls, separated by a closely appressed but distinct suture; nucleus defective, subsequent whorls strongly shouldered and sculptured; axial sculpture of (on the penultimate whorl 10) rounded ribs beginning at the shoulder, on the

spire reaching the suture in front, and on the last whorl obsolete on the base, with subsequent interspaces which become wider on the last part of the last whorl; these ribs are slightly protractive; lines of growth not conspicuous; spiral sculpture of (on the spire 3 to 5) revolving threads, the posterior two paired, the others more distant, on the last whorl about 15, becoming obsolete on the canal and slightly swollen where they override the ribs; on the base these threads are slightly undulated by their intersection with the lines of growth, and many of the interspaces have one (or even two) much finer intercalary threads; anal fasciole behind the shoulder but not quite at the suture, wide, smooth, or marked with concave growth-lines corresponding to the anal sulcus somewhat excavated, and having a single thick obscurely defined thread between it and the suture; aperture rather wide; anal sulcus wide, shallow; outer lip thin, internally smooth, arcuately protractive, receding toward the canal, slightly crenulated by the spiral sculpture; pillar straight, smooth; canal nearly straight, ample. Length of shell exclusive of the nucleus 25, of aperture 14, maximum diameter 10 mm.

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

Horizon: Tampa limestone, lower Miocene.

It is rather unfortunate that the nucleus on the holotype is defective. This species is closely related to *Fusiturricula paraservata* Gardner (Ms.) from the Chipola formation but it has more ribs than the latter species.

Other occurrence: station 12292, Cherokee Sink, Wakulla County.

FUSITURRICULA CONDOMINIA SEVERINA (Dall)

1915. *Drillia severina* Dall, U. S. Nat. Mus. Bull. 90, p. 40, pl. 5, fig. 4.

Dall described this species as follows:

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

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

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

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

Horizon: Tampa limestone, lower Miocene.

I consider "*Drillia*" *severina* Dall a subspecies of *F. condominiumia* Dall, differing from the latter in having a more slender shell and finer spiral sculpture.

FUSITURRICULA CONDOMINIA SILICATA Mansfield, n. subsp.

Plate 2, Figure 11

Some specimens mixed with others identified as "*Drillia*" *condominia* Dall and "*Drillia*" *severina* Dall are somewhat unlike the holotypes of these forms and are regarded as a subspecies of *Fusiturricula condominiumia*.

Following is a description of this new subspecies:

Shell moderately stout, turreted, with the body whorl a little longer than the spire and consisting of $1\frac{1}{2}$ nuclear and 6 postnuclear whorls. Nucleus rather large, smooth, and naticoid. Suture of postnuclear whorls deep, undulating and closely adhering. Axial sculpture of strong, rounded, protractive ribs (10 on the penultimate whorl) which extend on the spire whorls from the upper shoulder forward to the suture and on the body whorl to the base. Anal fasciole wide, delineated behind by a double row of spirals and in front by the abruptly rising ribs, and sculptured with very fine spiral threads. Spire whorls over the ribs and interspaces sculptured with about 5 spiral threads interlineated with finer spirals similar in strength to those on the anal fasciole. Upper part of pillar marked with widely spaced spiral threads intercalated with 2 to 4 finer threads. Columella provided with a thin wash of callus behind which at the anterior end of the pillar is a small chink. Anal sinus rather deep and wide. Outer lip arched medially. Anterior siphonal canal short and deflected.

Holotype: U. S. National Museum No. 496122 (separated from 165032).

Dimensions of the holotype: Height, 25 mm.; greatest diameter, 10.5 mm.

Type locality: "silex beds," Ballast Point, Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene.

Fusiturricula condominiumia silicata differs from *Fusiturricula condominiumia severina* Dall in having a less slender shell, larger nucleus, a double row of spirals below the suture and ornamented with more spirals in the anal fasciole and from *Fusiturricula condominiumia* Dall in having a less slender shell, with a double row of spirals below suture, fewer spirals over the whole shell and a shallower anal fasciole.

FUSITURRICULA? AFF. F. SERVATA (Conrad)

Dall⁶⁷ identified specimens from the "silex beds" at Ballast Point as *Turris (Surcula) servata* (Conrad), an Oligocene species from the Byram marl of Mississippi. Only one fragment of a shell, with the early whorls missing (U. S. Nat. Mus. no. 112085), has sculpture somewhat similar to that of the Oligocene species, but as the nucleus is missing the identification must remain in doubt. Nuclei of all other specimens from the Tampa are unlike *F. servata* (Conrad). The specimen figured by Dall⁶⁸ came from the Chipola formation and is referred to a new species, *Fusiturricula paraservata*, by Gardner.⁶⁹ The specimen with U. S. National Museum, no. 115267⁷⁰ is an Oligocene species.

Horizon: Tampa limestone, lower Miocene.

FUSITURRICULA LAPENOTIEREI (Dall)

1900. *Pleurotoma lapenotierei* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 5, p. 1199, pl. 43, fig. 14.
 1915. *Drillia lapenotierei* Dall, U. S. Nat. Mus. Bull. 90, p. 40, pl. 8, fig. 4.

Only one specimen, the holotype (U. S. Nat. Mus. no. 130351) has so far been obtained at the type locality. The specimen is imperfect, the anterior end of the canal has been broken off. It belongs to the same genus as "*Drillia*" *condominia* Dall. The nucleus is rather large, smooth and naticoid. The ribs (8 on the penultimate whorl), which extend from the deep anal fasciole to the forward suture, are strong. The anal fasciole is sculptured with fine spiral threads, and the ribs and interspaces with spiral lines are intercalated with fine spiral threads.

Type locality: "silex beds" at Ballast Point, Tampa Bay, Florida.
 Horizon: Tampa limestone, lower Miocene.

A fragment consisting of the spire, collected at station 12300, 1¼ miles northeast of Lloyd, Jefferson County, Florida, appears to belong to *Fusiturricula lapenotierei* (Dall).

Genus CRASSISPIRA Swainson, 1840

CRASSISPIRA SELLA (Dall)

1915. *Drillia sella* Dall, U. S. Nat. Mus. Bull. 90, p. 41, pl. 12, fig. 10.
 1915. *Drillia belotheca* Dall, idem, p. 42, pl. 4, fig. 7.

Dall described "*Drillia*" *sella* as follows:

"Shell small, slender, acute, solid, with nine whorls separated by a closely appressed suture; nucleus smooth, plump, of about one whorl; subsequent whorls

⁶⁷ Dall, W. H., U. S. Nat. Mus. Bull. 90, p. 39, 1915.

⁶⁸ Idem, pl. 5, fig. 16.

⁶⁹ J. A. Gardner, Manuscript awaiting publication.

⁷⁰ Dall, idem, p. 39.

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

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

Horizon: Tampa limestone, lower Miocene.

CRASSISPIRA EUPORA (Dall)

1915. *Drillia eupora* Dall, U. S. Nat. Mus. Bull. 90, p. 42, pl. 5, fig. 3.

Dall described this species as follows:

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

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

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

Horizon: Tampa limestone, lower Miocene.

The holotype, as stated by Dall, is decollate and the character of the nucleus is unknown.

CRASSISPIRA SMILIA (Dall)

191. *Drillia smilia* Dall, U. S. Nat. Mus. Bull. 90, p. 43, pl. 12, fig. 21.

Dall described this species as follows:

Shell small, slender, solid, with 7 or more whorls, the apex of the specimen defective as well as the outer lip; suture distinct, appressed, preceded by a very

strong cord which separates it from the anal fasciole; axial sculpture of (on the penultimate whorl 15) strong rounded whorls which extend from the anal fasciole to the canal with wider interspaces which are axially striated by rather conspicuous incremental lines; spiral sculpture, comprising the sutural cord; a deep constriction, spirally striated, which forms the anal fasciole; and, in front of the fasciole about a dozen strong, subequal, distant, and nearly equally spaced rounded threads which are distributed over the whole whorl in front of the constriction; these threads are but slightly swollen where they override the ribs, between the sutures only two to four threads are visible; aperture sublunate; anal sulcus shallow; outer lip defective, probably produced with a swollen varix behind it; body and pillar callous; canal moderately wide, straight, short. Length of (decollate) shell 12:5, of last whorl 7, maximum diameter 4 mm.

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

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

Horizon: Tampa limestone, lower Miocene.

CRASSISPIRA EUPATORIA (Dall)

1915. *Drillia eupatoria* Dall, U. S. Nat. Mus. Bull. 90, p. 44, pl. 12, fig. 16.

1915. *Drillia tama* Dall, idem, p. 45, pl. 12, fig. 23.

Dall described "*Drillia*" *eupatoria* as follows:

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

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

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

Horizon: Tampa limestone, lower Miocene.

Genus SYNTOMODRILLIA Woodring, 1928

SYNTOMODRILLIA SPICA (Dall)

1915. *Drillia spica* Dall, U. S. Nat. Mus. Bull. 90, p. 42, pl. 12, fig. 8.

Dall described this species as follows:

"Shell small, slender, thin, acute, elongate, with about 8 whorls; nucleus of 2 smooth whorls rounded above; subsequent whorls sculptured, suture closely appressed but without a sutural cord; axial sculpture of (on the penultimate whorl 12) narrow, rounded flexuous ribs, equal and with subequal interspaces, extending from the suture to the canal, concavely arcuate and compressed in front of the suture, thus indicating the anal fasciole, then arcuately protractive and in front receding to the canal; the ribs and interspaces smooth and in front receding to the canal; the ribs and interspaces smooth or faintly marked by incremental lines; spiral sculpture only of half a dozen oblique threads on the back of the siphonal fasciole; aperture moderately wide; anal sulcus wide and shallow, a narrow strip of callus between it and the suture; outer lip arcuately produced in the middle, sharp edged with a varical rib behind it between which and the last regular rib the whorl is smooth; inner lip and pillar with a moderately thick callus, smooth, and with a slightly raised outer edge; canal short, wide, slightly recurved. Length 13, maximum diameter 5 mm.

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

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

Horizon: Tampa limestone, lower Miocene.

This species differs from *Syntomodrillia newmani* (Dall) and *S. tecla* (Dall) in having a stouter shell, a less depressed sutural area, and a stronger subsutural band.

SYNTOMODRILLIA TECLA (Dall)

1915. *Drillia tecla* Dall, U. S. Nat. Mus. Bull. 90, p. 43, pl. 12, fig. 18.

Dall described this species as follows:

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

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

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

Horizon: Tampa limestone, lower Miocene.

This species is closely allied to *Syntomodrillia newmani* (Dall) but differs from the latter species in having fewer axials on the early whorls.

SYNTOMODRILLIA NEWMANI (Dall)

1890. *Drillia newmani* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 29, pl. 4, figs. 5, 5a.
 1915. *Drillia* (*Cymatosyrina*) *newmani* Dall, U. S. Nat. Mus. Bull. 90, p. 46, pl. 3, fig. 9; pl. 7, fig. 3.

Dall described this species in 1890 as follows:

"Shell small, seven-whorled, with a small, smooth nucleus of two whorls, the remainder is transversely sculptured (on the last whorl eleven) very uniform, rounded, moderately elevated, slightly sigmoid ribs or waves, which are most prominent on or just behind the periphery of the whorls, which do not cross the anal fasciole and on the base become gradually obsolete; the spiral sculpture is hardly visible except on the last whorl, and consists of fine rounded threads, most evident on the base and canal, and fading as they recede from the base; anal fasciole smooth, rather wide, unsculptured except by incremental lines; suture appressed over the ribs of the preceding whorl, and thus rendered slightly wavy; last rib varicoid; canal short and wide; outer lip not internally lirate; inner lip concave, simple, with a moderate callus. Max. lon. of shell 12.5; max. lat. 4.8 mm.

"Ballast Point silex beds, Tampa Bay, Florida; Newman."

Horizon: Tampa limestone, lower Miocene.

SYNTOMODRILLIA GLYPHOSTOMA (Dall)

1915. *Drillia* (*Cymatosyrinx*) *glyphostoma* Dall, U. S. Nat. Mus. Bull. 90, p. 45, pl. 5, fig. 12.

Dall described this species as follows:

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

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

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

Horizon: Tampa limestone, lower Miocene.

"DRILLIA" SILFA Dall

1915. *Drillia* (*Cymatosyrinx*?) *silfa* Dall, U. S. Nat. Mus. Bull., p. 46, pl. 12, fig. 22.

Dall described this species as follows:

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

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

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

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

Horizon: Tampa limestone, lower Miocene.

A small, probably immature shell with the nucleus missing.

"DRILLIA" ILLIOTA Dall

1915. *Mangilia illiota* Dall, U. S. Nat. Mus. Bull. 90, p. 46, pl. 12, fig. 15.

Dall described this species as follows:

"Shell small, solid, acute, with about 8 whorls separated by a distinct but appressed suture; nucleus small, inflated, bulbous, smooth; subsequent whorls strongly sculptured; axial sculpture of (on the last whorl 13) narrow, rounded, nearly straight ribs, separated by wider interspaces and extending from the sutural cord to the vicinity of the canal with a constriction at the anal fasciole; the interspaces behind the periphery are smooth, the surface polished, and the incremental lines hardly visible; spiral sculpture of a rather strong low cord in front of the suture, a constriction indicating the anal fasciole in front of the cord, and in front of the periphery a dozen or more feeble subequal spiral threads growing stronger toward the canal and with about equal interspaces; on the back of the canal there are a number of finer close-set threads; aperture sublunate, anal sulcus shallow, the outer lip thin, simple, not liriate internally; body and pillar smooth, not callous; canal short, wide, straight. Length 8, maximum diameter 3 mm.

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

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

Horizon: Tampa limestone, lower Miocene.

The nucleus is broken away.

"DRILLIA" AFF. PLUTONICA Casey

Plate 2, Figure 3

An external mold of a fragment of a shell collected at station 12303, Suwannee Sulphur Springs, Hamilton County, Florida, appears to be related to "*Drillia*" *plutonica* Casey, a species from the Oligocene of

Mississippi. The exact identification, however, of this fragment can not be confirmed with the material in hand.

Horizon: Suwannee limestone, Oligocene.

Genus EUCLATHURELLA Woodring, 1928

EUCLATHURELLA? LIVEOAKENSIS Mansfield, n. sp.

Plate 2, Figures 2, 6

Shell rather small, turreted, slender, with a long spire and canal. Later whorls more inflated than earlier. Suture deep and fasciole narrow bounded behind by a subsutural cord. Axial sculpture of rather narrow, closely spaced, weakly protractive ribs. Ribs and interspaces crossed by moderately coarse threads forming a somewhat cancellate ornamentation. Canal long and straight. The species is described from a cast of an external mold.

Cotype (U. S. Nat. Mus. no. 495938) measures: Height, 18 mm. (nucleus defective); greatest diameter, 8 mm.

Type locality: station 11109, 1½ miles north of Live Oak, Suwannee County, Florida.

Horizon: Suwannee limestone, Oligocene.

Other occurrence: station 12303. Suwannee Sulphur Springs, Suwannee County (external mold, identification questioned).

Genus CRYOTURRIS Woodring, 1928

CRYOTURRIS? HILLSBOROUGHENSIS Mansfield, n. sp.

Plate 2, Figures 7, 10

Shell small, turreted, axial sculpture stronger than spiral and consists of 4 whorls; early whorls missing. Spire whorls carinated medially by a moderately strong spiral thread forming the periphery of the whorl, from which the strong ribs (10 on the penultimate whorl) descend to the sutures. On the last whorl the ribs are weaker in the broad anal fasciole but strongly developed from the carinated shoulder to the base of the whorl. Spiral sculpture below the carina, on spire whorls and shoulder of last whorl, consisting of uniformly spaced raised threads. Margin of outer lip broken but apparently thin and arched. Columella straight, without observed folds.

Holotype: (U. S. Nat. Mus. no. 495939) measures: Height, 14.4 mm.; greatest diameter, 6.4 mm.

Type locality: Blackwater Creek at S. A. L. Ry. crossing, Hillsborough County, Fla. H. I. Tucker, collector.

I am unable to determine definitely the genus of this species. In outline it somewhat resembles specimens that have been referred to

the genus *Lora* Gistel, a genus inhabiting cold water. The lower columella on the new species here described is different from that on the genus *Colus* and the insinuation of the anal fasciole is deeper.

Family CANCELLARIIDAE

Genus CANCELLARIA Lamarck, 1799

Subgenus TRIGONOSTOMA Blainville, 1826

CANCELLARIA (TRIGONOSTOMA) SUBTHOMASIAE Dall

1890. *Cancellaria (Trigonostoma) subthomasiae* Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 1, p. 44, pl. 11, fig. 3.
1915. *Cancellaria (Trigonostoma) subthomasiae* Dall, U. S. Nat. Mus. Bull. 90, p. 47, pl. 3, fig. 7; pl. 10, fig. 1.

Dall redescribed this species in 1915 as follows:

"Shell of moderate size, strongly sculptured, turreted, of about 7 whorls; nucleus minute, smooth, of about one whorl; subsequent whorls axially sculptured with (on the penultimate whorl 11, on the last whorl nine) strong, crenulated, elevated ribs, angular, or even subspinose at the shoulder behind which the whorl is subtabulate; these ribs are moderately retractive, feeble at the suture, most elevated at the shoulder, and continue over the whorl to the siphonal fasciole, somewhat recurved, and concave behind and axially striated in front; spiral sculpture of numerous fine threads, with a tendency to alternate in strength, subequidistant, the interspaces equal to the threads or wider; the threads override and somewhat crenulate the edges of the ribs; base with a strong siphonal fasciole and small umbilical perforation; aperture subtriangular, with continuous margin, notched in front obliquely by a distinct siphonal sulcus; outer lip subvaricose, with about a dozen internal lirae; pillar lip thinner, free from the body, sharp-edged, with three well-marked plaits, the posterior most prominent. Length of shell 20, of last whorl 14, of aperture 11, maximum diameter 12.2 mm.

"Tampa silex beds at Ballast Point, Tampa Bay, Florida. U. S. Nat. Mus. No. 165042. Dall, 1915.

Holotype: U. S. National Museum no. 112090.

Horizon: Tampa limestone, lower Miocene.

I have not seen this species outside of its type locality.

CANCELLARIA (TRIGONOSTOMA) DEPRESSA Dall

1915. *Cancellaria depressa* Dall, U. S. Nat. Mus. Bull. 90, p. 48, pl. 10, fig. 4.

Dall described this species as follows:

"Shell short, turbinate, solid, with about four well-rounded whorls; nucleus defective; suture deep, not channeled, the whorl in front of it narrowly tabulate; axial sculpture of (on the last whorl about 15) narrow, rounded, more or less unequal, riblets, which extend from the suture, slightly swollen at the angle of the shoulder, to the rounded margin of the umbilical funnel, with usually subsequent interspaces; the incremental lines are also rather coarse and prominent; all the axial sculpture is slightly retractive; spiral sculpture of (at the beginning

of the last whorl about 10) subequal and mostly subequally spaced, flattish threads with wider interspaces, overriding the ribs, but not notably swollen at the intersections; near the periphery a few of these are alternately smaller and closer, there are also two or three finer threads between the shoulder and suture; umbilicus large and deep, funicular, with spirally threaded walls; aperture subtriangular, the margin continuous; body with a rather thick smooth layer of callus; outer lip with a small subsutural internal liration, and about 8 more lirae between the shoulder and canal; margin sharp oblique with a moderately swollen external varix; canal short, narrow, shallow; pillar-lip smooth with three plaits, enlarging posteriorly. Height of shell 17.5, of last whorl 14.5, maximum diameter 12 mm.

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

Horizon: Tampa limestone, lower Miocene.

This species also belongs to the section *Bivetopsis* Jousseume.

Only one poorly preserved specimen, the holotype, is in the U. S. National Museum collection. I have not seen it outside of its type locality.

Superfamily RHACHIGLOSSA

Family OLIVIDAE

Genus OLIVA Martyn, 1786

OLIVA POSTI Dall

1915. *Oliva posti* Dall, U. S. Nat. Mus. Bull. 90, p. 49, pl. 12, fig. 24.

1926. *Oliva posti* Dall. Kellum, U. S. Geol. Survey Prof. Paper 143, p. 41.

Dall described this species as follows:

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

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

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

Horizon: Tampa limestone, lower Miocene.

Only one specimen (the holotype), with a defective nucleus, is in the collection at the U. S. National Museum from the type locality. Two poorly preserved specimens, collected at Blackwater Creek at Seaboard Air Line Railway crossing by Miss Helen I. Tucker, may belong to this species.

Outside occurrence: Silverdale, N. C., Trent marl, lower Miocene.

Genus OLIVELLA Swainson, 1831

OLIVELLA LATA Dall

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

1915. *Olivella lata* Dall, U. S. Nat. Mus. Bull. 90, p. 49, pl. 15, fig. 4.

Dall described this species as follows:

"Shell small, broad, moderate stout, with a rather low spire and about five whorls; surface smooth, suture narrow, deeply channelled and deeply notched at the aperture; spire with little enamel and a rather large globular nucleus of one whorl; outer lip arcuate, simple, sharp; inner lip with a moderate callus, hardly lirate; pillar straight, slightly twisted, with a groove behind it; canal short, wide, shallow; siphonal fasciole distinct, bordered behind by a faint sulcus, behind which again is a still fainter indication of a depressed line. Max. lon. of shell 9.25; max lat. 5.25 mm.

"Ballast Point silex beds; Dall, Shepard.

"It is not unlikely that, when fully adult, this shell has the pillar lip lirate; but if it is immature it cannot be united with any of our Tertiary species."

Holotype: U. S. National Museum no. 112092.

Horizon: Tampa limestone, lower Miocene.

I have not seen this species outside of its type locality.

OLIVELLA EUTORTA Dall

1915. *Olivella eutorta* Dall, U. S. Nat. Mus. Bull. 90, p. 50, pl. 10, fig. 10.

Dall described this species as follows:

"Shell small, stout, solid, with $5\frac{1}{2}$ whorls separated by a deeply channelled suture; first whorl rounded and subglobular; subsequent whorls smooth, moderately convex; aperture wide in front, behind ending in a deep narrow sinus at the end of the suture, between the body and the outer lip; anterior third of the body covered by a revolving band of enamel with a groove at the posterior edge, otherwise smooth; the outer lip sharp, smooth within; body with a thin wash of callus, pillar thick, callous, twisted, with its anterior edge forming a strong rounded fold with a depression behind it, the inner surface of the pillar finely spirally lirate; canal wide, shallow. Length, 12; length of aperture, 8.5; maximum diameter of shell, 6 mm.

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

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

Horizon: Tampa limestone, lower Miocene.

Olivella eutorta Dall has a relatively more elongate shell and a less arcuate outer lip than *O. lata* Dall.

It is a common species at its type locality. One silicified specimen was collected by Miss Helen I. Tucker from Sixmile Creek, near Orient Station, Hillsborough County; and one poorly preserved specimen, which may be this species, was collected at station 12300, $1\frac{1}{4}$ miles northeast of Lloyd, Jefferson County.

OLIVELLA COLLETA Dall

1915. *Olivella colleta* Dall, U. S. Nat. Mus. Bull. 90, p. 50, pl. 12, fig. 9.

Dall described this species as follows:

"Shell very small, smooth, slender, with about $5\frac{1}{2}$ whorls, separated by a deeply channelled suture; nucleus minute subglobular, of about one whorl; sub-

sequent whorls subcylindrical, smooth; last whorl attenuated in front, with a faint fasciolar band of enamel close to the anterior edge; aperture narrow behind, wide in front; outer lip thin, sharp, simple; inner lip not callous; pillar with one or two faint very anterior folds; canal wide and deep. Length of shell 4.5, of aperture 2.5, maximum diameter 1.8 mm.

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

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

Horizon: Tampa limestone, lower Miocene.

The holotype may be an immature specimen. This species has not been recognized outside of its type locality.

OLIVELLA BROOKSVILLENSIS Mansfield, n. sp.

Plate 4, Figures 1, 2, 4

Shell medium-sized, subovate, solid with a rather high conical spire. Nucleus defective on holotype. Postnuclear spire-whorls smooth. Suture rather deeply channeled and bordered below by the sharp overhanging margin of the whorl. Body whorl moderately inflated at the posterior third and gradually slopes forward from this inflation to the anterior end. Margin of outer lip nearly straight between curved extremities. Aperture long, rather narrow, gradually widening anteriorly. Anterior third of body whorl provided with an enamel, the upper edge forming a low ledge. Another low ledge situated halfway between the posterior ledge and the anterior end of the shell encircles the base. Lower two-thirds of columella provided with a callus; the inner part of this callus lirate, whereas the lower and external part consists of two heavy imbrications.

Larger cotype (U. S. Nat. Mus. no. 495941) measures: Height, 18.5; greatest diameter, 8.8 mm.

Type locality: station 11113, quarry about half mile south of Brooksville, Hernando County, Florida.

Other occurrence: Blackwater Creek at S. A. L. Ry. crossing. Hillsborough County, Florida (Tucker); station 12758, quarry 5.9 miles northeast of Brooksville, Hernando County.

Horizon: Suwannee limestone, Oligocene.

OLIVELLA LIVEOAKENSIS Mansfield, n. sp.

Plate 3, Figure 7

Shell small, subovate, moderately stout, with a rather low spire and with about 5 whorls. Suture weakly channeled. Body whorl very weakly rounded medially and restricted behind columellar lip. Margin of outer lip weakly arched. Aperture broader below than above. Anterior canal short, wide and emarginate. Holotype (U. S. Nat.

Mus. no. 495940) measures: Height, 11.4 mm.; greatest diameter, 6.5 mm.

Type locality: station 11109, 1½ miles north of Live Oak, Suwannee County, Florida.

Olivella liveoakensis is closely related to *O. lata* Dall, differing from the latter in having a larger shell, a narrower aperture and a less tapering and fuller lower body whorl.

Horizon: Suwannee limestone, Oligocene.

Genus ANCILLA Lamarck, 1799

ANCILLA SHEPARDI Dall

1890. *Ancillaria shepardi* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 46, pl. 4, fig. 4.

1915. *Ancilla shepardi* Dall, U. S. Nat. Mus. Bull. 90, p. 51, pl. 7, fig. 1.

Dall described this species in 1890 as follows:

"Shell slender, acutely pointed, with its surface on the spire glazed with a coating of enamel, but indicating about 5 whorls; aperture less than half the length of the shell, callous at the posterior commissure and on the body; outer lip arched, simple, thin, perhaps with a slight projection in the adult, near the canal, between the two principal sulci of the whorl; canal wide and deep; pillar concave and twisted, scored with numerous fine shallow, spiral grooves, and with a pronounced sulcus behind it; the anterior end of the pillar is obliquely truncate, shorter than the aperture and with its anterior edge excavated so as to make a shallow gutter, behind which the edge of the whorl projects in a rounded point before falling to the siphonal notch. In this manner, when looked at directly from in front, the shell seems to have two canals, one small and shallow, curving with the pillar, the other larger and deeper, cut out of the wall of the whorl. On the base behind the pillar is the usual sulcus, followed by the siphonal fasciole bordered behind by a sharp impressed line; then follows a band about as wide as the siphonal fasciole, but of which the anterior half is convex and the posterior half impressed; this is bordered by a band or fasciole between two sharply and deeply incised lines; this fasciole is transversely striate with backwardly somewhat concave lines and corresponds to the tooth or projection of the outer lip, if one existed, which is not certain. On the last whorl in front of the suture is another impressed spiral line or groove, not very distinct on the fossils, but which seems to have formed the anterior border of the enamel on the spire; the callus on the inner lip does not thin out over the body, but is bounded by a straight line extending from the collumellar sulcus to the spiral line just described; the posterior commissure of the aperture is more or less filled with callus. Max. lon. of shell 34.75; of aperture 17.0; max. lat. of shell 14.5 mm.

"Silex beds of Ballast Point and the shores of Hillsboro Bay, Tampa Bay, Florida. Shepard, Newman and Dall."

Holotype, U. S. National Museum no. 165049.

Horizon: Tampa limestone, lower Miocene.

Ancilla shepardi is more acutely pointed and a stouter shell and has shallower sutural area than *A. chipolana* Dall from the Chipola formation of Florida. *A. shepardi* is rather abundant at its type locality. It also occurs at Sixmile Creek, near Orient Station, Hillsborough County, Florida.

Family MARGINELLIDAE

Genus MARGINELLA Lamarck, 1799

Key to genus Marginella

- Shell large or small, broad, low-spired, outer lip within without denticulations:
 Shell large....*Marginella (Prunum) ballista* Dall and subspecies *tampae* Dall
 Shell small, aperture rather narrow*M. (Prunum) intensa* Dall
 Shell small, aperture wide*M. (Prunum?) myrina* Dall
 Shell small or rather large, usually slender, spire moderately low, outer lip not denticulated:
 Shell rather large*M. (Porcellanella) gregaria* Dall
 Shell rather small and slender, *M. (Porcellanella) gregaria silicata* Mansfield
 Shell small, solid, biconic, spire rather high, *M. (Porcellanella) posti* Dall
 Shell rather thin, outer lip nearly straight (fidé Dall)
*M. (Porcellanella) bellula* Dall
 Shell small, relatively high spired (fidé Dall)*M. (Porcellanella) inepta* Dall
 Shell stout, sub-biconic with a rather high spire,
*M. (Porcellanella) infecta* Dall
 Shell moderately slender, aperture broad below
*M. (Porcellanella) faunula* Dall
 Shell with a high or moderately high spire, inner margin of outer lip denticulated:
 Shell biconic, high-spired*M. (Serrata) mollitor* Dall
 Shell small, biconic, high-spired*M. (Serrata) newmani* Dall
 Shell moderately high spired, inner margin of outer lip feebly denticulated
*M. (Serrata) elegantula* Dall

Section PRUNUM Herrmannsen, 1852

MARGINELLA (PRUNUM) BALLISTA Dall

1890. *Marginella ballista* Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 1, p. 47, pl. 4, fig. 6.
 1915. *Marginella ballista* Dall, U. S. Nat. Mus. Bull. 90, p. 54, pl. 16, fig. 12.

Dall described this species in 1890 as follows:

"Shell large, strong, rounded, subpyriform; whorls about four; spire short, nearly enclosed by the last whorl; sides convex, compressed about the middle near the adult varix; outer lip thick, differentiated by a sulcus behind it, arcuate in the direction of the whorl and also toward the body-lip, aperture rather wide, especially in front; body-wall with a callus, which extends over the spire from the posterior commissure; anteriorly with four rather oblique plaits; outer lip smooth within. Max. lon. of shell 18.0; lat. 11.7; lon. of aperture 16.2 mm.

"Tampa silex beds at Ballast Point."

Holotype: U. S. National Museum no. 112096. Collected by W. H. Dall.

Horizon: Tampa limestone, lower Miocene.

This species is characterized by its rather large and relatively broad shell with a low spire and a thickened outer lip destitute of internal denticulations.

Occurrence: Type locality, rather common; Sixmile Creek, near Orient Station, Hillsborough County, Florida (Tucker).

MARGINELLA (PRUNUM) BALLISTA TAMPAE Dall

1890. *Marginella (ballista var?) tampa* Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 1, p. 47.

1915. *Marginella tampa* Dall, U. S. Nat. Mus. Bull. 90, p. 54, pl. 11, fig. 6.

Dall at first thought that *M. tampa* might be a varietal form of *M. ballista* but later considered it distinct and raised it to specific rank.

The holotype (U. S. Nat. Mus. no. 112097) is the only well preserved specimen referred to *M. tampa*. This specimen is slightly more angulate at the shoulder and more compressed behind the shoulder than *M. ballista* but in other features appears nearly identical with it.

Type locality: "silex beds." Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene.

This species has not been recognized outside of its type locality.

Marginella (Prunum) incrassata Nelson, from the middle Miocene, Zorritos, Peru, as pointed out by Dall, is related to *B. ballista tampa*.

MARGINELLA (PRUNUM) INTENSA Dall

1915. *Marginella intensa* Dall, U. S. Nat. Mus. Bull. 90, p. 56, pl. 10, fig. 8.

Dall described this species as follows:

"Shell small, short, solid, smooth, with a short spire, obscured by a coat of enamel covering it entirely, and about 3 whorls; aperture narrow; outer lip produced behind over nearly half the penultimate whorl, heavily smoothly varicose, the varix distinctly limited behind, marginating the lip and canal, internally smooth, thicker in the middle; body with a slight wash of enamel; pillar with four low, stout, equal and equally spaced plaits, the anterior on the edge of the pillar at the narrow and shallow canal. Length 8, maximum diameter 5 mm.

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

"Type specimen from the Post collection, U. S. Nat. Mus. no. 165055."

Horizon: Tampa limestone, lower Miocene.

Marginella intensa Dall is a small and solid shell, with a low spire and very heavy outer lip for the size of the shell. A feeble spiral thread is below and adject to the suture. It appears to belong to the same group as *M. ballista* Dall, though it has a much smaller shell.

M. intensa appears to be closely related to *M. (Prunum) clethirada* Gardner Ms. from the Chipola formation of Florida.

MARGINELLA (PRUNUM?) MYRINA Dall

1915. *Marginella myrina* Dall, U. S. Nat. Mus. Bull. 90, p. 57, pl. 12, fig. 2.

Dall described this species as follows:

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

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

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

Horizon: Tampa limestone, lower Miocene.

The holotype of *Marginella (Prunum?) myrina* is a small, short, and poorly preserved shell with a low spire and wide aperture. One poorly preserved shell (not the holotype) from the type locality may also belong to this species.

Section PORCELLANELLA Conrad, 1862**MARGINELLA (PORCELLANELLA) GREGARIA Dall**

Plate 3, Figure 5

1915. *Marginella gregaria* Dall, U. S. Nat. Mus. Bull. 90, p. 55.

Dall described and commented upon this species as follows:

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

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

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

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

"Tampa silex beds at Ballast Point, Tampa Bay, Florida; Dall and Post. U. S. Nat. Mus. No. 165051.

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

Horizon: Tampa limestone, lower Miocene.

This species is rather elongate and moderately narrow, with a rather low spire and concave lower columella bearing 4 plications. The inner margin of the outer lip is smooth.

The species has not been figured. A specimen (U. S. Nat. Mus. no. 165051) is selected for figuring in this report.

This species is rather abundant at the type locality. One specimen has been collected at Blackwater Creek at S. A. L. Ry. crossing, Hillsborough County, and 2 specimens from Sixmile Creek, near Orient Station, Hillsborough County, by Miss H. I. Tucker.

Marginella gregaria Dall, *M. gregaria silicata*, n. subsp., *M. posti* Dall, *M. bellula* Dall, and *M. inepta* Dall are closely related. There is a possibility that some of the small specimens assigned to distinct species may be the young of the larger specimens assigned to other species. However, I have accepted Dall's determinations in nearly all instances.

MARGINELLA (PORCELLANELLA) GREGARIA SILICATA Mansfield, n. subsp.

Plate 3, Figure 6

1890. *Marginella bella* Conrad (not Conrad 1868). Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, pl. 4, fig. 9a.
1915. *Marginella bella* Conrad (part, not Conrad 1868). Dall, U. S. Nat. Mus. Bull. 90, p. 55, pl. 16, fig. 10.
1915. *Marginella bella bellula* Dall (part), idem, p. 53.

I am unable to find the specimen figured by Dall on pl. 16, fig. 10, and identified as *M. bella* Conrad. A number of specimens under U. S. Nat. Mus. no. 165052 are labelled *M. bella* Conrad by Dall. Some of the specimens in the same vial appear to be the young of *M. gregaria* Dall.

Some of the specimens referred to *M. bella* by Dall, although closely related to *M. gregaria*, appear to be a subspecies of *gregaria*. The holotype is rather slender, solid, with a rather low spire. The body whorl is weakly compressed behind the thick marginal outer lip. The columella is concave below and bears 4 equal-sized plications.

Holotype (U. S. Nat. Mus. no. 165052) measures: Height, 11.7 mm.; greatest diameter, 6.0 mm.

Type locality: "silex beds," Ballast Point, Tampa Bay, Florida.
Horizon: Tampa limestone, lower Miocene.

The new subspecies differs from *M. bella* Conrad in having a less pronounced shoulder on the body whorl and less closely spaced plications on the columella. It differs from *M. gregaria* Dall in having a

smaller, relatively more slender shell with a little higher spire. In other features it is very similar.

This subspecies has not been recognized outside of its type locality.

MARGINELLA (PORCELLANELLA) POSTI Dall

1915. *Marginella posti* Dall, U. S. Nat. Mus. Bull. 90, p. 56, pl. 12, fig. 6.

Dall described this species as follows:

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

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

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

Horizon: Tampa limestone, lower Miocene.

The shell of *Marginella posti* Dall is small, solid, sub-biconic, and rather slender, with a rather high spire. It has not been recognized outside of its type locality.

MARGINELLA (PORCELLANELLA) BELLULA Dall

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

1915. *Marginella bellula* Dall, U. S. Nat. Mus. Bull. 90, p. 53, pl. 16, fig. 9.

Dall, in 1890, stated that this form when compared with other forms under consideration represents a thinner, more oval form with a straighter outer lip (length, 6.5; width, 3.6 mm.) which may take the name *bellula*.

Holotype: U. S. Nat. Mus. no. 112100.

Type locality: "silex beds" at Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene.

One specimen collected at "Wacissa," Jefferson County, Florida, appears to be this species.

MARGINELLA (PORCELLANELLA) INEPTA Dall

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

1915. *Marginella inepta* Dall, U. S. Nat. Mus. Bull. 90, p. 53, pl. 15, fig. 2.

In 1890 Dall in considering other related forms states that this form is "smaller (5.5 lon. by 3.0 mm. lat.) with a relatively higher

spire, more evenly tapered shell, and the outer lip less convex in the middle on the inside."

Holotype: U. S. Nat. Mus. no. 112101.

Type locality: "silex beds," Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene.

The holotype is not well preserved.

MARGINELLA (PORCELLANELLA) INFECTA Dall

1915. *Marginella infecta* Dall, U. S. Nat. Mus. Bull. 90, p. 52, pl. 12, fig. 3.

Dall described this species as follows:

"Shell small, smooth, solid, of about 4 whorls, the spire being covered with a coat of enamel which obscured the suture and nucleus; last whorl comprising most of the shell, moderately convex, aperture narrow, wider in front; outer lip thickened, especially toward the middle, its posterior end somewhat protracted on the whorl behind the suture; posterior sinus of the aperture rounded, body with a thin wash of callus; pillar short, carrying four prominent subequal plaits, the anterior of which is coincident with the twisted edge of the pillar; canal very short and wide. Height 7.7, maximum diameter 4.7 mm.

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

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

Horizon: Tampa limestone, lower Miocene.

The shell of *M. infecta* is sub-biconic, rather stout, and with a rather high spire.

It has not been recognized outside of its type locality.

MARGINELLA (PORCELLANELLA) FAUNULA Dall

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

1915. *Marginella faunula* Dall, U. S. Nat. Mus. Bull. 90, p. 53, pl. 16, fig. 14.

Dall described this species as follows:

"Shell thin, ovate, with a rather pointed spire of some four or five whorls covered with a thin glaze of callus, plaits four, subequal, thin, oblique, outer lip little thickened, externally marginated, arcuate in the direction of its growth, nearly straight in an axial direction; callus on the body very thin. Max. lon. 8.0; lat. 4.5 mm.

"Tampa silex beds, rare.

"This shell recalls *M. var. bellula* in some of its features, while others remind one of *M. fauna* Sowerby. The habit of the shell is like the latter, while the form is more like the former."

Horizon: Tampa limestone, lower Miocene.

The holotype is not well preserved.

Section SERRATA Jousseau, 1875

MARGINELLA (SERRATA) MOLLITOR Dall

1915. *Marginella mollitor* Dall, U. S. Nat. Mus. Bull. 90, p. 52, pl. 12, fig. 1.

Dall described this species as follows:

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

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

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

Horizon: Tampa limestone, lower Miocene.

The shell is high spired and biconic. The inner margin of the outer lip bears strong denticulations.

Marginella mollitor is closely related to *M. (Serrata) brithia* Gardner (Ms.) from the Chipola formation of Florida, differing from the latter in having a larger shell and a more excavated area above the denticulations of the inner lip.

MARGINELLA (SERRATA) NEWMANI Dall

1890. *Marginella newmani* Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 1, p. 54, pl. 4, fig. 8.
1915. *Marginella newmani* Dall, U. S. Nat. Mus. Bull. 90, p. 57, pl. 16, fig. 13.

Dall described this in 1890 as follows:

"Shell small, stout, biconic, four-whorled, smooth, the spire glazed with callus; aperture short, wide, the outer lip with about six coarse denticles on the inner side, smooth near the posterior commissure, marginated externally; inner lip with a wash of callus, with four subequal, not prominent, rather oblique plaits. Max. lon. 5.5; lat. 3.7 mm.

"Tampa silex beds, rare; Mr. L. G. Newman."

Holotype: U. S. Nat. Mus. no. 112105.

Horizon: Tampa limestone, lower Miocene.

This species is similar to *M. mollitor*, differing from the latter in being smaller.

MARGINELLA (SERRATA) ELEGANTULA Dall

1890. *Marginella elegantula* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 54, pl. 4, fig. 7.
1915. *Marginella elegantula* Dall, U. S. Nat. Mus. Bull. 90, p. 53, pl. 16, fig. 11.

Dall briefly described this species in 1890 as follows:

"Shell of the group of *M. haematita* Kiener, from which species it differs by being proportionately stouter, rounder and less fusiform, with a shorter spire and wider aperture. Both have four well-marked plaits, which in *M. haematita* are grooved when adult. Both are externally smooth and have the outer lip margined externally and denticulate internally, but in *haematita* the denticulations extend the whole length, while in the present species they are faint and confined to the middle part of the inside of the outer lip. Max. lon. of shell 11.0; lat. 6.5 mm.

"Tampa silex beds, rare."

Horizon: Tampa limestone, lower Miocene.

This species has a lower spire and more feeble denticulations on the inner margin of the outer lip than *M. mollitor* Dall or *M. newmani* Dall.

It has not been recognized outside of its type locality.

MARGINELLA (SERRATA?) IMPAGINA Dall

1915. *Marginella impagina* Dall, U. S. Nat. Mus. Bull. 90, p. 56, pl. 12, fig. 4.

Dall described this species as follows:

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

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

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

"This specimen may be slightly immature."

Horizon: Tampa limestone, lower Miocene.

The holotype and only specimen is small and probably immature.

Family VOLUTIDAE
Subfamily VOLUTINAE
Genus LYRIA Gray, 1847

LYRIA MUSICINA (Heilprin)

Plate 3, Figures 1, 4

1887. *Voluta musicina* Heilprin, Wagner Free Inst. Sci. Trans., vol 1, p. 109, pl. 15, fig. 45.
1890. *Lyria musicina* Heilprin. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 85. (In part, Chipola shell excluded.)
1915. *Lyria musicina* Heilprin. Dall, U. S. Nat. Mus. Bull. 90, p. 59. (In part pl. 9, figs. 1, 4 excluded, a Chipola shell.)

Heilprin described this species in 1887 as follows:

"Shell cylindriciform; spire elevated, of about 7 volutions; whorls convex, strongly costated, impressed below the suture, so as to divide the costae into a double series; costae very prominent, obtuse, about 10 on the body-whorl, crossed at right angles by rather distinctly placed, elevated revolving lines; outer lip with a reflected border; inner lip distinct in its lower half, plicated over its entire extent, the plicae increasing in size from above downward, nearly transverse in direction; aperture considerably over half the length of the shell, narrow. Length, nearly 2 inches; greatest width, at about the middle of the shell, slightly exceeding one inch."

The holotype is deposited in the Wagner Free Institute of Science of Philadelphia.

The Chipola form which Dall identified as *Lyria musicina* (Heilprin) differs slightly from the Tampa species in having a larger nucleus and stronger concentric spirals over the shell. Both forms possess the subsutural insinuation giving the ribs above it a subnodulous appearance. In other features the Tampa and the Chipola shells are very similar and are not more distantly related than subspecies.

Lyria vauhani Cooke, a species from Crocus Bay, Anguilla, differs only slightly from *L. musicina* (Heilprin).

The poor specimen from the upper Eocene at Richards Quarry, Fla., identified by Dall as *L. musicina*, may belong to the genus *Lyria* but it is not the Tampa species. It may be more closely related to *L. costata* (Sowerby) from the Eocene at Barton, England.

Horizon: Tampa limestone, lower Miocene.

Occurrence: "silex beds," Ballast Point (common); ?Blackwater Creek, at S. A. L. Ry. crossing, Hillsborough County (Tucker); station 12300, 1¼ miles northeast of Lloyd, Jefferson County.

LYRIA MUSICINA DALLI Mansfield, n. subsp.

Plate 3, Figure 2

A specimen preserved as a siliceous pseudomorph and collected from Blackwater Creek at Seaboard Air Line Railway crossing, Hillsborough County, Fla., by Miss Helen Tucker of Cornell University, is slightly different from *Lyria musicina* (Heilprin) though closely related to it.

The pseudomorph agrees in all features with *L. musicina* except that it has a relatively longer body whorl and lacks the strongly developed insinuation below the suture which characterizes the latter species.

The holotype (U. S. Nat. Mus. no. 495942) measures: Length, 37.2 mm.; greatest diameter, 19 mm.

Occurrence: Station 7356, 1 mile north of Hudson, Pasco County; station 12758, 5.9 miles northeast of Brooksville, Hernando County; station 12308, 1½ miles north of Live Oak, Suwannee County.

Horizon: Suwannee limestone, Oligocene.

LYRIA HEILPRINI Dall

1887. *Voluta (Lyria) zebra* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 110, pl. 15, fig. 46 (not *Voluta zebra* Leach, 1814).
1890. *Voluta zebra* Heilprin. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 84 (not *V. zebra* Leach, 1814).
1915. *Lyria heilprini* Dall, U. S. Nat. Mus. Bull. 90, p. 58, pl. 10, fig. 13.
1915. *Lyria silicata* Dall, idem, p. 59, pl. 10, fig. 3.
1926. *Lyria carolinensis* Kellum, U. S. Geol. Survey Prof. Paper 143, p. 40, pl. 11, figs. 4, 5.

Heilprin described this species in 1887 as follows:

"Shell cylindriciform, with an elevated, slightly scalariform spire about 6 volutions; whorls costated, the costae (about 20 on the body whorl) closely spaced, sharply-defined, oblique, forming a pseudo-coronation on top the whorls; outer lip greatly thickened on the border, slightly ascending; inner lip irregularly plicated over its entire extent, the 3 or 4 basal plicae much the strongest; aperture somewhat more than half the length of shell, narrow, elliptical, contracted basally into a short open canal; surface of shell, barring the costae, smooth over almost its entire extent, with a few impressed revolving lines on the base of the body whorl."

Length, an inch and a quarter; greatest width, .6 inch.

The specimen figured by Dall (U. S. Nat. Mus. Bull. 90, pl. 10, fig. 13, 1915) is relatively a little longer than Heilprin's original figure for his "*Voluta*" *zebra* but in other features agrees with it. The specimen figured by Dall measures: Length 34.8 mm.; greatest diameter 15.5 mm.

Lyria silicata Dall appears to be a corroded specimen of *L. heilprini*.

Holotype deposited in the Wagner Free Institute of Science, Philadelphia.

Horizon: Tampa limestone, lower Miocene.

Occurrence: "silex beds, Ballast Point (common); Sixmile Creek, near Orient Station, Hillsborough County (Tucker), one fragment of the shell; station 12292, Cherokee Sink, Wakulla County (poor specimen and identification not verified); Trent marl, Silverdale, Onslow County, N. C.

LYRIA HEILPRINI TAMPAENSIS Mansfield, n. subsp.

1915. *Lyria pulchella* Dall, U. S. Nat. Mus. Bull. 90, p. 58, pl. 10, fig. 11 (not *L. pulchella* Sowerby, 1850).

The specimen figured by Dall⁷¹ and referred to *Lyria pulchella* Sowerby is more closely related to *L. heilprini* Dall than to *L. pulchella*.

The shell is subbiconic, solid, with a spire about one-fourth the length of the shell and of about 5 whorls in all. Nucleus large, smooth, with about 1½ rounded whorls. Postnuclear whorls turreted and sculptured with 22 (on the body whorl) moderately strong axials with nearly equal interspaces, and coronated by the projecting ribs over the deep suture. On the lower part of the last whorl the ribs curve backward and extend to the siphonal fasciole. Base sculptured with fine, equally spaced spiral threads. Outer lip thick, ornamented on the margin with feeble denticles; inner lip with a heavy callus on which are situated 9 nearly horizontal plications, the lower ones being the strongest.

Holotype (U. S. Nat. Mus. no. 165064) measures: Length, 27.5 mm.; greatest diameter, 15 mm.

Type locality: "silex beds," Ballast Point, Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene.

The new subspecies is shorter and heavier than *L. heilprini*. *Lyria pulchella* (Sowerby) and *L. soror* (Sowerby) from the Miocene, Dominican Republic, have more inflated shells than the new subspecies and lack the coronated sculpture below the suture.

The specimen referred by Dall⁷² to *L. pulchella* is a young specimen and may be the same as or a varietal form of *L. musicina*

LYRIA MISSISSIPPIENSIS Conrad?

Plate 3, Figure 3

One incomplete external mold of a specimen belonging to the genus *Lyria* has been collected at station 11109, 1½ miles north of Live Oak, Suwannee County, Fla. This mold closely resembles *Lyria mississippiensis* Conrad from the Oligocene, Byram marl, of Mississippi. An exact determination of the species cannot be made from the material at hand.

Horizon: Suwannee limestone, Oligocene.

Figured specimen: U. S. Nat. Mus. no. 496226.

⁷¹ Dall, W. H., *idem*.

⁷² Dall, W. H., Wagner Free Inst. Sci. Philadelphia Trans., vol. 3, pt. 1, p. 84, pl. 4, fig. 3, 1900.

Family MITRIDAE

Genus MITRA Martyn, 1784

Subgenus TIARA Swainson, 1831

MITRA (TIARA) SILICATA Dall

1890. *Mitra (mississippiensis* Conrad, var.?) *silicata* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 93, pl. 4, fig. 11.
1915. *Mitra silicata* Dall, U. S. Nat. Mus. Bull. 90, p. 60, pl. 14, fig. 2.

Dall described this species in 1890 as follows:

"This shell recalls *M. mississippiensis* as described by Conrad, from which it differs by having one more plait on the columella, and by the appressed suture. The pseudomorph in this case is imperfect, and probably the shell was worn before it was fossilized, so that the absence of the transverse striation, called for by the diagnosis of *mississippiensis* and absent on our fossil, is not significant.

"Our shell is elegantly fusiform, slender, with gently rounded whorls, appressed suture and faint incremental lines, or none; sculpture of sharp-edged, revolving ridges, four between the sutures, and on the last whorl an intercalary smaller thread; there are 14 or 15 nearly uniform primary ridges on the last whorl. Lon. of last whorl 23.2; of aperture 17.0; max. lat. of whorl 9.5 mm.

"Tampa silex beds, between Ballast Point and the town, Mr. Shepard."

Holotype: U. S. Nat. Mus. no. 112112.

The holotype is a defective specimen. A specimen somewhat better preserved (U. S. Nat. Mus. no. 165066) has also been collected from the "silex beds." *Mitra silicata* has a shallower suture than *M. metrodita* Gardner, Ms. from the Chipola formation. The sculpture on *M. silicata* is unlike that on *M. mississippiensis* Conrad.

Horizon: Tampa limestone, lower Miocene.

Other occurrence: An external mold of a specimen from station 11115, upper bed at Kendrick, Marion County, Fla., appears to be either *M. silicata* or a closely allied form.

MITRA CF. M. PRODROMA Gardner, Ms.

A poorly preserved external mold from station 12753, Cumner Lumber Company quarry at Kendrick, Marion County, Fla., appears to be closely related to "*M.*" *prodroma* Gardner Ms., from the Chipola formation of Florida.

Horizon: Tampa limestone, lower Miocene.

Genus VEXILLUM ("Bolten") Roeding, 1798

Subgenus UROMITRA Bellardi, 1887

VEXILLUM (UROMITRA) SYRUM (Dall)

1915. *Mitra syra* Dall, U. S. Nat. Mus. Bull. 90, p. 60, pl. 12, fig. 17.
1916. Not *Mitra syra* Dall, U. S. Nat. Mus. Proc., vol. 51, p. 505.

Dall described this species as follows:

"Shell small, slender, acute, with about 9 whorls separated by a distinct but not deep suture; nucleus smooth subglobular, the succeeding 3 whorls smooth, or very faintly axially striated, the sculptured whorls succeeding abruptly; axial sculpture of (on the penultimate whorl 17) narrow, slightly protractive, rounded ribs extending completely over the whorls to the base on the last whorl, with an inconspicuous constriction near the suture, but otherwise smooth and even, separated by much wider interspaces; spiral sculpture of (between the sutures about 7) flattened close-set cords, which do not override the ribs, and continue to the canal on the last whorl, where they are succeeded by four or five larger and more distant rounded spirals; aperture narrow, sublunate; outer lip simple, hardly thickened, not internally lirate; inner lip smooth; pillar with four plaits, the largest posterior, the others regularly diminishing forward, the most anterior not quite reaching the edge of the pillar; canal rather wide and deep, slightly recurved. Length of shell 15.5, of last whorl 9, of aperture 6, maximum diameter 4.5 mm.

"Tampa siliceous beds at Ballast Point, Tampa Bay, Florida.

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

Horizon: Tampa limestone, lower Miocene.

Although the holotype (a pseudomorph) shows no lirations on the inside of the outer lip, lirae may have been present on the original shell.

This species is related to *Vexillum (Uromitra) celluliferum* (Conrad) from the Oligocene (Byram Marl) of Mississippi, differing from the latter in having a little shorter canal and closer spaced and wider spiral bands.

VEXILLUM (UROMITRA) MYRUM (Dall)

1915. *Mitra myra* Dall, U. S. Nat. Mus. Bull. 90, p. 61, pl. 12, fig. 7.

Dall described this species as follows:

"Shell small, acute, with $6\frac{1}{2}$ whorls, of which the first 2 are smooth, subsequent whorls being sculptured with narrow rounded riblets (on the penultimate whorl 12) slightly protractive and with wider interspaces, which extend from suture to suture, making slight undulations in the sutural line where the ends of the riblets reach it; on the last whorl the riblets are carried over the periphery and become obsolete on the base; there is no spiral sculpture except on the canal, where there are 4 threads, the anterior pair close set, small, the third large with a marked sulcus on each side, and the fourth faint at the base of the whorl; the remainder of the surface is smooth; aperture narrow, less than half the length of the shell; outer lip (defective in the specimen); pillar strong, with three strong, oblique plaits decreasing in prominence forward; canal short, wide, very slightly recurved. Length of shell 8, of last whorl 5.8, maximum diameter 3.5 mm.

"Tampa siliceous beds at Ballast Point, Tampa Bay, Florida.

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

Horizon: Tampa limestone, lower Miocene.

This species is closely related to *Vexillum (Uromitra) ambliopleura* Gardner, Ms. from the Chipola formation.

Genus CONOMITRA Conrad, 1865

CONOMITRA ANGULATA (Heilprin)

1887. *Mitra (Conomitra) angulata* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 110, pl. 15, fig. 47.
1890. *Conomitra staminea* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 94 (in part), pl. 4, fig. 2 (not Conrad; 1848).
1915. *Conomitra staminea* Dall, U. S. Nat. Mus. Bull. 90, p. 62 (in part), pl. 10, fig. 2 (not Conrad, 1848).

Heilprin described this species in 1887 as follows:

"Shell ovately cylindriciform, longitudinally plicated; whorls of spire very convex, slightly angulated above; body-whorl more prominently angulated; revolving lines absent or obsolete, except from the base of the shell; aperture somewhat exceeding one-half the length of the shell; columellar folds four, the upper nearly oblique. Length .4 inch; width .17 inch."

Holotype probably one of three specimens labelled "*Conomitra staminea* Conrad" in the Wagner Free Institute of Science, Philadelphia.

Horizon: Tampa limestone, lower Miocene.

Conomitra angulata (Heilprin) differs from *Conomitra staminea* Conrad from the Oligocene of Vicksburg, Miss., in having more angulated whorls. *C. apalachee* Gardner Ms., from the Chipola formation, has a less slender shell which is sculptured with stronger spirals than on *C. angulata*. *C. angulata* is a rather common species in the "silex beds" of the Tampa limestone at Ballast Point, Tampa Bay, Fla. It also occurs in Sixmile Creek, near Orient station, Hillsborough County; at station 12292, Cherokee sink, Wakulla County, Fla.; and at station 13841, Aspalaga Bluff, Gadsden County.

Family XANCIDAE

Genus XANCUS Bolten, 1798

XANCUS POLYGONATUS (Heilprin)

Plate 3, Figure 8

1887. *Turbinella polygonata* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 108, pl. 15, fig. 43.
1900. *Turbinella polygonata* Heilprin. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 97. (In part, specimens from the Chipola formation at Alum Bluff, Fla., excluded.)
1915. *Xancus polygonatus* (Heilprin). Dall, U. S. Nat. Mus. Bull. 90, p. 63. (In part.)

Heilprin described this species in 1887 as follows:

"Shell elevated, turreted; whorls abruptly flattened on the shoulder—rendering the spire scalariform—the upper ones gently convex, obscurely noded or costated; body-whorl quadrangular, with a broad, flat shoulder; the costae obsolete, resolved into a number (about 8) of shoulder nodes which break the circumferential outline into a polygon; aperture greatly exceeding the spire in length;

columellar folds 3, transverse, situated immediately below the body of the shell; revolving lines of surface feebly defined, almost obsolete on the body-whorls, except on the siphonal tract, where they are well-marked, and of equal significance.

"Length (of fragment, lacking probably two-thirds of an inch below, and a third of an inch above) 1.8 inch; width, .8 inch."

Type locality: Ballast Point, Tampa Bay, Fla. Holotype in the collection of Wagner Free Institute of Science, Philadelphia.

Xancus polygonatus is closely related to *X. rex* Pilsbry and Johnson from Baitoa formation (lower Miocene) of the Dominican Republic.

Horizon: Tampa limestone, lower Miocene.

Occurrence: Rare at type locality; station 7358, Anclote River at Tarpon Springs, Pinellas County (quite common); station 12292, Cherokee sink, Wakulla County (molds); station 11115, upper bed at Kendrick, Marion County (mold of exterior, probably *X. polygonatus*).

XANCUS POLYGONATUS SUWANNENSIS Mansfield, n. subsp.

Plate 3, Figure 9

Shell rather large, turreted, with acute spire and large body whorl. Nucleus and earliest post-nuclear whorls not preserved. The earliest 2 or 3 preserved post-nuclear whorls are more slender than the following and show spiral sculpture. The following whorls rapidly enlarge, gently slope anteriorly from the suture, are strongly shouldered and bear at the periphery moderately strong nodules. Body whorl weakly concave in the area of anal fasciole, bears about 12 (estimated) nodules on the shoulder, constricted at the base and ornamented on the base and canal with spiral cords. The new subspecies is described from a cast taken of an exterior mold, which shows only the outline of the back of the original shell.

The dimensions of the preserved part of the mold (U. S. Nat. Mus. no. 495943) are: Length, 125 mm.; greatest diameter 65 mm.

Type locality: Station 12308, 1½ miles north of Live Oak, Suwannee County, Fla.

Horizon: Suwannee limestone, Oligocene.

The new subspecies appears most closely allied to *Xancus polygonatus* (Heilprin), differing from the latter in having a much larger shell and a relatively more acute spire. It appears to be more closely related to the Tampa species than to *X. wilsoni* Conrad, an Oligocene species.

A small specimen collected from the Blackwater River at the crossing of the S. A. L. Ry., Hillsborough County, by Miss Helen I. Tucker, may belong to this subspecies.

Genus VASUM Bolten, 1798

VASUM SUBCAPITELLUM Heilprin

1887. *Vasum subcapitellum* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 109, pl. 15, fig. 44.
1890. *Vasum subcapitellum* Heilprin. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 99, pl. 4, fig. 12.
1915. *Vasum subcapitellum* Heilprin. Dall, U. S. Nat. Mus. Bull. 90, p. 63, pl. 7, fig. 2.

Heilprin described this species as follows:

"Shell elevated, pagodaform; whorls of the spire about 7 in number, coronated and strongly costated, the concentric lines (2 or 3) below the shoulder prominent, those on the rugose shoulder less distinct; the coronary spines prominent, sharp, and directed outwardly; body whorl with a single row of sharp basal spines, about 6 in number, below which are 2 not very prominent lines, and above, some 7 sharply-defined concentric ridges, separated by interstitial finer lines; shoulder of whorls elevated; outer lip strongly lined internally; inner lip well expanded, but leaving a broadly-open umbilicus; columella plaits 3, transverse, the upper the largest; surface of shell covered with rugose lines of growth. Length 1.4 inch; width .7 inch.

Type locality: Ballast Point "silex beds," Tampa Bay, Fla.

Holotype deposited in the Wagner Free Institute of Science, Philadelphia.

Horizon: Tampa limestone, lower Miocene.

The shell of *Vasum subcapitellum* is smaller than *V. aedificatum* (Guppy) from the Gurabo formation of the Dominican Republic but in other features appears to be closely related to it.

VASUM ENGONATUM Dall

1890. *Vasum haitense* Sowerby var. *engonatum* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 100. (In part.)
1915. *Vasum engonatum* Dall, U. S. Nat. Mus. Bull. 90, p. 63, pl. 11, figs. 2, 3. (? In part.)

In 1890, Dall wrote in part:

"*V. engonatum* differs from *V. muricatum* when adult in having the suture appressed closely to the angle of the preceding whorl; in its less prominent apex; in its finer and much more numerous spirals; in its larger, more prominent and conical spines, which are less by one or two in number, on the angle of the last whorl; in its single series of very large and conical spines anteriorly (*cestus*, *muricatum*, and *haitense* have two or even three series); in its more prominent siphonal fasciole enclosing a larger umbilical depression; and its

broader pillar and more triangular form. In *V. cestus* the spines are blunter and the spirals still coarser than in *V. muricatum*. Alt. of shell 96.0; diameter about 94.0; alt. of aperture 80.0 mm. There are 3 or 4 plaits on the pillar, the posterior plait much larger than the others."

Dall⁷³ writes: "An examination of the Haitian species leads to the conclusion that it is distinct from the present one" [*V. engonatum* Dall]. He gives⁷⁴ the occurrence of *V. engonatum* as follows:

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

Horizon: Tampa limestone, lower Miocene.

The holotype of *Vasum engonatum* is not a perfect specimen.

When this specimen is compared with the best but poorly preserved specimens from the Chipola formation certain differences are observed. The Chipola form has a lower spire with a more appressed suture and stronger spirals below the basal spines than the Tampa species. The two forms are closely related and may represent mutations of the same species.

Family FASCIOLARIIDAE

Genus FASCIOLARIA Lamarck, 1799

FASCIOLARIA PETROSA Dall

1915. *Fasciolaria petrosa* Dall, U. S. Nat. Mus. Bull. 90, p. 64, pl. 6, fig. 7.

Dall described this species as follows:

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

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

⁷³ Dall, W. H., U. S. Nat. Mus. Bull. 90, p. 63, 1915.

⁷⁴ Dall, W. H., *idem*, p. 63.

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

Horizon: Tampa limestone, lower Miocene.

This species has not been recognized outside of its type locality.

Genus LATIRUS Montfort, 1810

Key to species of *Latirus*

- Shell moderately slender, high spired, with a long canal; ribs 9 or 10; spiral sculpture composed of alternating coarser and finer threads*L. floridanus*
 Shell rather large and stout; ribs 10-11*L. multilineatus*
 Shell with acute spire and short canal*L. callimorphus*
 Shell sculptured with strong axials and widely spaced primary spirals intercalated with fine threads*L. rugatus*

LATIRUS FLORIDANUS Heilprin

1887. *Latirus floridanus* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 108, pl. 15, fig. 42.
 1890. *Latirus floridanus* Heilprin. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 106, pl. 8, fig. 2.
 1915. *Latirus floridanus* Heilprin. Dall, U. S. Nat. Mus. Bull. 90, p. 64, pl. 8, fig. 6.

Heilprin described this species in 1887 as follows:

"Shell fusiform, about equally tapering; whorls convex, subangulated superiorly, costated; about 10 obtuse costae on the body-whorl; aperture somewhat exceeding one-half the length of the shell, contracted into a gently-deflected, open canal of moderate length; outer lip striated internally; columellar folds feeble, one or two in number, somewhat oblique; surface of shell covered with rugose revolving lines, alternate in size. Length, 1.7 inch; width, .6 inch."

Holotype deposited in Wagner Free Institute of Science, Philadelphia.

Type locality: "silex beds" at Ballast Point, Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene.

The shell of *Latirus floridanus* is moderately slender, with a rather high spire and long canal. The primary and secondary spirals sculpture alternate in position. The last whorl has about 9 or 10 ribs.

Occurrence: Type locality common; station 12300, 1¼ miles north-east of Lloyd, Jefferson County, Fla.

Dall⁷⁵ records this species from the Eocene at Martin's Station, Fla. I have not seen this material but assume that it is another species.

LATIRUS MULTILINEATUS Dall

Plate 4, Figure 6

1890. *Latirus (floridanus var?) multilineatus* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 107.
 1915. *Latirus multilineatus* Dall, U. S. Nat. Mus. Bull. 90, p. 65.

⁷⁵ Dall, W. H., Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 106, 1900.

Dall wrote in 1890, of this species as follows:

"This form differs from the type [*L. floridanus*] in being larger and stouter, in having 10 or 11 costae on the last whorl, and in having two or three very fine spirals between every two coarse ones on the last whorl. The apex is shorter and very acute. Lon. 57.0; lat. 27.0 mm. It has 8 whorls like the type, and in other respects resembles it.

"Ballast Point silex beds."

Holotype, U. S. Nat. Mus. no. 112121.

Type locality: "silex beds, Ballast Point, Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene.

Latirus multilineatus is similar in most features to *L. floridanus*, differing from the latter in having a larger and stouter shell sculptured with one or two more ribs.

Occurrence: Found only at the type locality.

LATIRUS CALLIMORPHUS Dall

1890. *Latirus callimorphus* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 107, pl. 8, fig. 1.

1915. *Latirus callimorphus* Dall, U. S. Nat. Mus. Bull. 90, p. 65, pl. 7, fig. 8.

Dall described this species in 1890 as follows:

"Shell thin, stout, with 7 whorls; sculptured with 10 transverse costae or short riblets confined to the periphery, and close-set, prominent incremental lines; spirals close-set, alternate, of three sizes; the primaries and secondaries on the last whorl not very different in size, but simple, the tertiaries very fine and reticulated by the lines of growth; the tertiaries hardly visible on the upper whorls; suture appressed, the whorl flattened and sloping in front of it; pillar with two or three obscure plaits hidden within the aperture; there is no ridge on the body at the commissure; canal short, wide, recurved. Max. diam. 20.0; lon. 41.5; lon. of aperture, including the canal, 23.0 mm.

"A single specimen of this interesting species was collected by the writer. It is of the same type as the preceding forms from which it is at once distinguishable by its relatively shorter and wider canal and finer sculpture and generally stouter form. In a perfectly adult specimen there may be lirae on the body and within the inner lip as in the other specimens.

"Ballast Point silex beds, rare."

Holotype: U. S. Nat. Mus. no. 112122.

Horizon: Tampa limestone, lower Miocene.

Latirus callimorphus is like *L. floridanus* except in having a much shorter canal.

LATIRUS RUGATUS Dall

1890. *Latirus rugatus* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 107, pl. 8, fig. 7.

1915. *Latirus rugatus* Dall, U. S. Nat. Mus. Bull. 90, p. 65, pl. 8, fig. 2.

Dall described this species in 1890 as follows:

"Shell with 8 whorls and generally resembling *L. floridanus*, except in the following particulars: It is considerably smaller, with the same number of whorls; the whorls are more inflated and rounded instead of sloped to the suture behind them; on the early whorls (except the nucleus which is smooth) a prominent spiral marginates the suture; the costae are more prominent and extend farther either way from the periphery; the lines of growth are more prominent; the primary spirals are stronger and more distant, at the beginning of the last whorl there are 6 in *L. rugatus*, as against 12 in *L. floridanus*; the canal is more recurved and more constricted at its junction with the aperture; the lirae are stronger, and that at the posterior commissure on the body is much stronger, than in *L. floridanus*. Lon. 37.0; max. diam. 18.0; lon. of aperture 20.0 mm.

"Ballast Point silex beds, Dall and Burns."

Holotype: U. S. Nat. Mus. no. 112123.

Type locality: "silex beds" at Ballast Point, Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene.

Latirus rugatus has rather strong axials and spirals. The primary spirals are rather strong and widely spaced, whereas the secondary spirals are much weaker. I have not seen this species outside of its type locality.

LATIRUS? sp.

Plate 4, Figures 5, 7

External molds of specimens from three localities, station 12755a, bottom of a quarry at Brooksville, Hernando County; station 12746, Newland Spring, Suwannee County; station 11109, 1½ miles north of Live Oak, Suwannee County, appear to belong to the same species, but the genus to which they belong has not been determined. The sculpture consists of strong, widely spaced axials and alternating primary and secondary spiral threads.

Figured specimens: U. S. Nat. Mus. no. 496227, from station 12755a.

Horizon: Suwannee limestone, Oligocene.

Genus *FUSINUS* Rafinesque, 1815

FUSINUS BALLISTA Dall

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

1915. *Fusinus ballista* Dall, U. S. Nat. Mus. Bull. 90, p. 66, pl. 7, fig. 6.

Dall described this species in 1890 as follows:

"Shell of 6 or 7 whorls, with about 9 faint transverse ribs, crossed by low, weak spiral threads, with subequal interspaces; suture appressed, last whorl rather elongated; outer lip thin, simple; pillar slightly flexuous, smooth, with

little evidence of a fasciole; canal rather short, narrow. Max. lon. of shell 26.0; lat. about 11.0.

"The spiral sculpture is often badly preserved or obsolete on the siliceous pseudomorphs as an incident of their mineralization. The specimen figured was kindly lent for the purpose by a gentleman who had collected it for his private collection. The species is represented by several rather imperfect specimens in the national collection."

Horizon: Tampa limestone, lower Miocene.

Two imperfect specimens (U. S. Nat. Mus. no. 112052) were identified by Dall as *Fusus ballista* Dall. I have not seen the holotype.

Occurrence: Type locality, rare. Not seen outside of its type locality.

FUSINUS NEXILIS Dall

1890. *Fusus* (*Chrysodomus*?) *nexilis* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 128, pl. 8, fig. 6.

1915. *Fusinus nexilis* Dall, U. S. Nat. Mus. Bull. 90, p. 66, pl. 8, fig. 8.

Dall described this species in 1890 as follows:

"Shell small, with two nuclear and six subsequent whorls transversely ribbed and spirally threaded; nuclear whorls at first smooth, normally coiled, the second gradually acquiring close-set, concavely arched, transverse riblets; subsequent whorls showing between the sutures about 5 strong threads, with wider interspaces, overrunning 9 well-marked round ribs, extending from suture to suture; on the last whorl the ribs become more or less obscure, the spirals more numerous and less elevated, and the whorl shows a tendency to constriction in front of the suture; whorls rounded, suture appressed, undulated by the ribs; canal moderate, recurved, striated sparsely behind; aperture ovate, outer lip simple, sharp, without internal lirae, inner lip smooth, concave, not callous. Max. lon. of shell 12.0; of aperture 6.0; max. diam. of shell 5.0 mm.

"Silex beds at Ballast Point, rare."

Holotype: U. S. Nat. Mus. no. 112054.

Horizon: Tampa limestone, lower Miocene.

Dall states that the outer lip is without internal lirae. The figured holotype as well as other specimens possess internal lirae.

Occurrence: Type locality, rare. Not seen outside of its type locality.

Genus BUSYCON Bolten, 1798

BUSYCON TAMPAENSE Dall

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

1915. *Busycon* (*spiniger* var?) *tampaense* Dall, U. S. Nat. Mus. Bull. 90, p. 67, pl. 10, fig. 5.

Dall⁷⁶ wrote:

"Shell resembling the last [*B. spiniger burnsii* Dall] but with the spire more scalar, the top of the whorls more horizontal; the edge in front of the suture

⁷⁶ Dall, W. H., Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 111, 1890.

not thickened or pressed up on the preceding whorl, but with a narrow, smooth space between the suture and the first spiral in front of it; while in the varieties previously described the spirals are equal, or subequal and absent on the periphery, in this they alternate coarser and finer, uniformly over the shell; the lines of growth, too, are more prominent and give the sculpture a short appearance.

"This is the commoner form in the Tampa silex-beds, and probably that referred by Heilprin to *Spiniger* with doubt, from an imperfect specimen. It is generally about 45 mm. long, but fragments indicate that it reached a length of 3 or 4 inches, preserving the characters above mentioned."

Holotype: U. S. Nat. Mus. no. 165075 (specimen figured by Dall on plate 10, figure 5, U. S. Nat. Mus. Bull. 90, 1915).

Type locality: "silex beds" at Ballast Point, Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene.

Busycon tampaense Dall differs from *B. spiniger* Conrad, an Oligocene species, in having a larger nucleus, less appressed suture, coarser spiral sculpture, shorter spinose nodules, and in the absence of a nearly smooth revolving area at the base of the last whorl, which is present on *B. spiniger*.

BUSYCON TAMPAENSE PERIZONATUM Dall

Plate 4, Figures 8, 9

1890. *Fulgur spiniger perizonatum* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 111.

1915. *Busycon spiniger* var. *perizonatum* Dall, U. S. Nat. Mus. Bull. 90, p. 67.

Dall stated in 1890 that this form has a prominent thread in front of the sutural smooth band, which may be more or less excavated, forming a shallow or sometimes a very marked canaliculation; the internal lirae are strong; the keel may be tuberculate or spinose, the spire more or less scalar.

This subspecies is closely related to *B. tampaense* differing from the latter in having a stouter and more strongly tuberculate shell with the sutural excavation more strongly developed.

The specimens with U. S. Nat. Mus. no. 112126, cited by Dall as *perizonatum* in U. S. Nat. Mus. Bull. 90, are poorly preserved. A better preserved specimen (U. S. Nat. Mus. no. 112125) is chosen as the lectotype. This specimen also was identified by Dall as *B. perizonatum*.

The lectotype measures: Height, 27 mm.; greatest diameter, 18.5 mm.

Horizon: Tampa limestone, lower Miocene.

Occurrence: "silex beds" at Ballast Point, Tampa Bay (rare); Sixmile Creek near Orient Station (Miss Helen Tucker); station 7358, Anclote River at Tarpon Springs, Pinellas County (poor specimens and identification not fully established).

BUSYCON TAMPAENSE BALLASTENSE Mansfield, n. subsp.

1915. *Busycon spiniger* var. *nodulatum*, Dall (part, not of Conrad), U. S. Nat. Mus. Bull. 90, p. 67, pl. 9, fig. 5.

Shell small, rather stout, with a moderately low spire and long canal. Spire broadly conic. Suture appressed, undulating, and winding on the base of the tubercles. Spiral sculpture consisting of moderately strong, somewhat rounded, uniformly enlarging tubercles (13 on the last whorl) on the periphery of the whorl; and about 6 rounded cords, sometimes on the last whorl between the suture and the tubercles. These primary spirals with an occasional intermediate secondary thread, overrun the tubercles and extend forward to the end of the canal. Outer lip within ornamented with about 21 sharp lirations. Columella nearly straight. Anterior canal long.

Holotype (U. S. Nat. Mus. no. 165076) measures: Height, 36.2 mm.; greatest diameter, 20 mm.

Type locality: "silex beds" at Ballast Point, Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene.

Busycon tampaense ballastense has a broader shell, lower spire, shorter canal, and weaker tubercles than *B. tampaense*. *Busycon nodulatum* Conrad has a broader shell, fewer tubercles, and finer spiral sculpture than the new subspecies here described. The specimens from the Chipola formation referred to *Busycon spiniger nodulatum* appear to represent another species. It is not the same as the new subspecies here described.

Occurrence: Rare at the type locality.

BUSYCON STELLATUM Dall

1890. *Fulgur stellatum* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 114, pl. 4, fig. 9.
1915. *Busycon stellatum* Dall, U. S. Nat. Mus. Bull. 90, p. 67, pl. 10, figs. 7, 9.

Dall described this species in 1890 as follows:

"Shell thin, attaining about 8 whorls; nucleus large, smooth and swollen, of about two whorls, succeeding whorls encircled by a thin, round-edged keel, neatly divided in the early whorls into about a dozen even, subequal, triangular, flattened rays, with equal interspaces, stellate when viewed from above; the surface of the whorl behind the keel smooth, excavated moderately and rising at a low angle to the suture, which is not appressed, and is hidden under the

shadow of the keel of the preceding whorl; on the last whorl in the adult the keel between the radii is less pronounced, but the flat spines retain much of the same character; in front of the keel in the young, the whorl is sparsely spirally striated and somewhat constricted at its base; the adult has the periphery nearly smooth and the base of the whorl more rounded; the canal appears to be striated, very straight, rather stout, slightly callous, but not grooved; I find no trace of an infrasutural ridge or any internal lirae. The adult appears to reach a length of 85 and a diameter of over 50 mm.

"The adult specimen of this remarkable species is too imperfect to figure, though affording information for a diagnosis. I have figured a tip which shows the curious dish-like keel and swollen nucleus of the young. A fragment, including most of the canal, found with the adult, is referred to this species with some doubt. It is evidently a rare form, but offers very clearly characters to distinguish it from the other species."

Types: Holotype, U. S. Nat. Mus. no. 112076. Paratype, U. S. Nat. Mus. no. 165074 (Pl. 10, figs. 7, 9, U. S. Nat. Mus. Bull. 90).

Horizon: Tampa limestone, lower Miocene.

Occurrence: Type locality (rare). A poorly preserved specimen collected by Miss Helen I. Tucker, from Sixmile Creek, may be *Busycon stellatum* Dall.

Genus MELONGENA Schumacher, 1817

MELONGENA TURRICULA Dall

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

1915. *Melongena sculpturata turricula* Dall, U. S. Nat. Mus. Bull. 90, p. 68, pl. 8, fig. 7.

Dall described this species in 1890 as follows:

"In this variety the surface-sculpture is retained, but instead of a series of spines at the shoulder we have an undulate or even a simple keel, while the anterior series of spines is absent, the slope of the shoulder more nearly approaches the horizontal, the axis of the shell being regarded as vertical, while the suture is simple and destitute of imbrications. The result of these changes is that the shell has a more turreted spire and a very different appearance from that of the type, with which it is nevertheless united by imperceptible gradations. The specimen figured has lost its tip, which has been supplied from another in which that part was entire. The total length of the figured specimen is about 60.0 millimeters, with width of 32.0 millimeters.

"This form was found only in the silex beds though further search would doubtless have revealed it at Chipola. I have seen specimens from the Miocene of South Carolina."

Cotypes: U. S. Nat. Mus. no. 112045.

In 1915 Dall wrote:

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

Horizon: Tampa limestone, lower Miocene.

MELONGENA SCULPTURATA Dall?

1890. *Melongena sculpturata* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 118 (part?).

1915. *Melongena sculpturata* Dall, U. S. Nat. Mus. Bull. 90, p. 68 (part?).

The holotype of *Melongena sculpturata* Dall came from the Chipola formation and is figured on plate 11, figure 1,⁷⁷ of Dall's 1915 paper.

Poorly preserved specimens of *Melongena* from the "silex beds" of the Tampa limestone at Ballast Point, Tampa Bay, and from Six-mile Creek, near Orient Station, Fla., do not appear to be identical with *M. sculpturata*, but probably are closely related to it. Until better specimens are obtained from the "silex beds" for comparison with those from the Chipola formation, I have questioned the identity of the specimens at the two localities.

Genus SOLENOSTERIA Dall, 1890

SOLENOSTERIA? QUINQUESPINA (Dall)

1890. *Fusus? quinquespinus* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 128.

1915. *Fusinus quinquespinus* Dall, U. S. Nat. Mus. Bull. 90, p. 66, pl. 5, fig. 6.

In 1890, Dall wrote as follows:

"Shell bearing a singular resemblance in many of its characters to *Papillina dumosa* and the young of the spiny form of *Melongena sculpturata* and best described by comparison with them. It has not the apical whorls and large nucleus of *Papillina*; the whorls are not appressed at the suture as in *P. dumosa*; it has 5 spines instead of 7 on the last whorl; the pillar wants the thick layer of callus, and it has a wider, shorter and more curved canal than *P. dumosa*; the peripheral spines are continued to the tip, which, in my specimen, has lost the nucleus, which, however, was small. What remains has three and a half whorls, and there were originally at least five. It measures, including the spines, 35 x 21 mm. In other respects it closely resembles *P. dumosa*, and also the young of *Melongena sculpturata* except in the slope of the upper part of the whorls. I am much puzzled by this singular fragment, which seems distinct from anything else, and for the present will call it *Fusus*, though I am not certain that mature specimens would indicate its place to be with *Fusus* proper.

⁷⁷ Dall, Wm., U. S. Nat. Mus. Bull. 90, 1915.

"It was collected by me at Ballast Point from the marl of the silex beds, and impressions in the *Cerithium* limerock described by Heilprin, though not conclusive, indicate that it is represented also in that fauna."

Holotype: U. S. Nat. Mus. no. 112053.

Horizon: Tampa limestone, lower Miocene.

The holotype is a small specimen. A larger specimen was dredged from Hillsborough Bay (station no. 4604 and station no. 13848).

Solenosteria? quinquespina (Dall) is nearly related to *S. turbinelloides* Reeve, a living species of the west coast ranging from Todos Santos Bay to the Gulf of California.

Other occurrences: Station 12763, Anclote River at Tarpon Springs, Pinellas County; station 13841, Aspalaga Bluff, about 10 feet above a four-foot clay bed, Gadsden County; (?) station 13851, River Junction, 80 feet above sea level, Gadsden County.

Family COLUMBRARIIDAE

Genus PHOS Montfort, 1810

"PHOS" URSULA (Dall)

1915. *Alectrion ursula* Dall, U. S. Nat. Mus. Bull. 90, p. 69, pl. 12, fig. 13.

Dall described this species as follows:

"Shell small, fusiform, strongly sculptured, with about 5 whorls, the apex of the spire defective in the specimen; suture appressed, distinct; nucleus lost; subsequent whorls axially sculptured with (on the last whorl 10) rounded ribs, with wider interspaces, extending from suture to suture and, on the last whorl to the canal, incremental lines inconspicuous; spiral sculpture of (on the spire 3, on the last whorl 9) strong spiral, equal and equidistant spiral threads, with wider interspaces, and slightly swollen where they override the ribs; between these, in the interspaces, are two or more extremely fine intercalary threads, or striae; aperture sublunate; outer lip (in the specimen) thin, simple; body not callous; pillar short, keeled at the edge of the short canal; siphonal fasciole inconspicuous with no marked constriction behind it. Length 7.5, maximum diameter 4 mm.

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

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

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

Horizon: Tampa limestone, lower Miocene.

The holotype (U. S. Nat. Mus. no. 165081) is not very well preserved. Other specimens from the same locality as the holotype are better preserved. The lower columella is biplicate; a small chink lies behind the columella callus and the siphonal fasciole is fairly well developed. The inner margin of the outer lip bears about 7 entering

lirations. The species may belong to the same genus as "*Cancellaria*" *candei* D'Orbigny, which Woodring⁷⁸ made the type of his new subgenus *Antillophos*, but the specimens are too small to determine definitely.

An imperfect specimen collected by Miss Helen I. Tucker at Blackwater Creek at S. A. L. Ry. crossing, Hillsborough County, Fla., is closely related to "*Phos*" *ursula* (Dall) but may be another species.

Genus CANTHARUS Bolten, 1787

CANTHARUS PAUPER Dall

1890. *Tritonidea pauper* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 129, pl. 4, fig. 8c.
 1915. *Cantharus pauper* Dall, U. S. Nat. Mus. Bull. 90, p. 69, pl. 7, fig. 5; pl. 10, fig. 12.

Dall described this species in 1890 as follows:

"Shell small, with one and a half smooth nuclear, and about five subsequent whorls; transverse sculpture of numerous (11-16) broad, close-set, low, rounded riblets, which become obsolete in front of the periphery, are slightly concave in the direction of growth, and on the spire extend from suture to suture; spiral sculpture, on the early whorls, of three primary cords, one near the suture, the other two near the periphery, between which finer ones are gradually intercalated; these override the riblets and, at first, become rather nodulous at the intersections, but on the last whorl the spirals have become more numerous and cover the whole whorl without nodulation, and generally alternate in strength; canal short, recurved; apertural varix well marked; aperture subovate, outer lip internally dentate, with three especially marked anterior teeth (not well shown in the figure); inner lip reflected, more or less granulous; pillar keeled at its anterior end; the whorls are moderately rounded and the suture very distinct. Max. lon. of shell 9.5; of aperture 5.0; max. lat. of shell 5.0 mm.

"Miocene of Ballast Point, in the siliceous beds, rare.

"This pretty little species belongs to the group of which, among recent forms, *T. orbigny* Payr. is an example."

Holotype, U. S. Nat. Mus. no. 112055.

Horizon: Tampa limestone, lower Miocene.

This species appears to be confined to its type locality.

Family ALECTRIONIDAE

Genus ALECTRION Montfort, 1810

ALECTION ETHELINDA Dall

1915. *Alectrion ethelinda* Dall, U. S. Nat. Mus. Bull. 90, p. 70, pl. 13, fig. 17.

Dall described this species as follows:

"Shell small, subtorreted, thin, of about $5\frac{1}{2}$ whorls separated by a deep but not channeled suture; whorls prominently rounded, the shoulder marked

⁷⁸ Woodring, W. P., Carnegie Inst. Washington Pub. 385, p. 259, 1928.

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

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

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

Horizon: Tampa limestone, lower Miocene.

Other occurrence: Sixmile Creek, near Orient, Hillsborough County, H. I. Tucker.

ALECTRION sp. a

Plate 4, Figure 3

An imperfect external mold of a shell which appears to belong to the genus *Alectrion* was collected at station 11109, 1½ miles north of Live Oak, Suwannee County, Fla. The sculpture consists of strong, widely spaced ribs (probably about 12 on the last whorl) and rather closely spaced spirals which alternate in strength. The siphonal fasciole is rather strongly developed.

I am unable to find a similar form in the Oligocene (Vicksburg group).

The unidentified form appears to be related to *Alectrion gurabensis* Maury from the Miocene of Rio Gurabo at Los Quemados, Dominican Republic.

Horizon: Suwannee limestone, Oligocene.

ALECTRION sp. b, aff. **A. HARRISI** Maury

Plate 2, Figure 4

One imperfect specimen, collected at station 12753, upper bed in quarry at Kendrick, Marion County, Florida, appears to be closely related to *Alectrion harrisi* Maury, a species described from the Chipola formation of Florida. The specimen is slimmer and has a weaker subsutural band than the Chipola species but in other features discernible is very similar to it.

Horizon: Tampa limestone, lower Miocene.

Family COLUMBELLIDAE

Genus MITRELLA Risso, 1826

MITRELLA TURGIDULA (Dall)

Plate 5, Figures 1, 4

1900. *Astyris turgidula* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 5, p. 1196, pl. 40, fig. 12b.
1915. *Astyris turgidula* Dall, U. S. Nat. Mus. Bull. 90, p. 72, pl. 15, fig. 6.

Following is a description of this species, which appears not to have been described:

Shell small, stout, smooth except for the pillar, consisting of 7 whorls in all. Nucleus very small; following whorls weakly convex and rapidly enlarging. Suture more impressed on the later whorls than earlier. Pillar sculptured with about 10 spiral threads. Margin of outer lip thin, provided behind with a varix and within with entering lirations. Inner lip calloused. Anterior canal short and deflected to the left. The description is based upon two specimens: an immature specimen, the holotype; and a larger mature specimen, the paratype.

The holotype (U. S. Nat. Mus. no. 130350) measures: Height, 7.6 mm.; greatest diameter, 3.8 mm. Paratype (U. S. Nat. Mus. no. 214439): Height, 10 mm.; greatest diameter, 4.6 mm.

Type locality: "silex beds" at Ballast Point, Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene.

This species has not been recognized outside of its type locality.

MITRELLA ACANTHODES (Dall)

1915. *Astyris acanthodes* Dall, U. S. Nat. Mus. Bull. 90, p. 73, pl. 4, fig. 4.

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

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

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

Horizon: Tampa limestone, lower Miocene.

This species has not been recognized outside of its type locality.

MITRELLA ELUTHERA (Dall)

1915. *Astyris eluthera* Dall, U. S. Nat. Mus. Bull. 90, p. 72, pl. 12, fig. 12.

Dall described this species as follows:

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

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

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

Horizon: Tampa limestone, lower Miocene.

This species has not been recognized outside of its type locality.

MITRELLA? DICARIA (Dall)

1915. *Astyris dicaria* Dall, U. S. Nat. Mus. Bull. 90, p. 72, pl. 4, fig. 2.

Dall described this species as follows:

"Shell very small, smooth, short, with somewhat more than 4 whorls; suture very distinct, the whorls between moderately convex; last whorl much the largest, base attenuately rounded; aperture narrowly lunate, the outer lip slightly protractively arcuate, simple; inner lip smooth; canal short, wide slightly recurved; aperture obstructed by matrix, so that the existence of lirae on either lip is doubtful. Height of shell 4.3, of last whorl 3, maximum diameter 2 mm.

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

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

Horizon: Tampa limestone, lower Miocene.

The holotype and only specimen is not well preserved and the genus to which it belongs is somewhat in doubt.

Genus ANACHIS H. and A. Adams, 1853

ANACHIS? EUTHERIA Dall

1915. *Anachis eutheria* Dall, U. S. Nat. Mus. Bull. 90, p. 71, pl. 12, fig. 11.

Dall described this species as follows:

"Shell small, slender, attenuated, with a minute blunt tip of 2 smooth, inflated whorls, and about $6\frac{1}{2}$ subsequent reticulately sculptured whorls; suture well defined, but not appressed or channeled; sculpture of, on the penultimate whorl, about 16 rather sharp, uniform, axially directed lamellae, slightly concavely flexuous on the later whorls, and passing from the suture over the whole whorl to the canal without enlargement or nodulation; these are crossed be-

tween the sutures by 4 or 5, and on the last whorl by 13 narrow, equal revolving threads, flat-topped, and about equal to the lamellae on the spire; dividing the surface into rather deep rectangular reticulations; on the last whorl the lamellae assume the form of narrow ribs; there are a few spiral smaller threads on the short canal; aperture narrow, pointed behind, with a short, wide canal in front; pillar smooth, not callous, the anterior portion slightly twisted; outer lip (not fully mature?) thin, sharp, slightly arcuate behind. Length of shell 9 mm.; of last whorl 5 mm.; maximum diameter 3 mm.

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

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

Horizon: Tampa limestone, lower Miocene.

The holotype appears to be an immature specimen. Two or three plications are faintly indicated on the columella. This species may not belong to the genus *Anachis*. It has not been recognized outside of its type locality.

Family MURICIDAE

Genus MUREX *Linnaeus*, 1758

MUREX TRITONOPSIS Heilprin

1887. *Murex tritonopsis* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 107 pl. 15, fig. 39.
1890. *Murex mississippiensis* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 139 (part, not Conrad, 1848).
1915. *Murex mississippiensis* Dall, U. S. Nat. Mus. Bull. 90, pl. 5, fig. 10 (part, not Conrad, 1848).
1915. *Alectrion gardnerae* Dall, U. S. Nat. Mus. Bull. 90, p. 70.

Heilprin described this species in 1887 as follows:

"Shell consisting of about six regularly-convex whorls, varices, three on each whorl, profoundly convex and entirely destitute of spines or lamellar processes; two more or less nodulose costae between each pair of varices; aperture exceeding one-half the length of shell, the canal deflected, very narrow; surface of shell covered with closely placed, elevated revolving lines, which regularly alternate in size. Length 1.2 inch; width .7 inch.

"This species very closely resembles *Murex mississippiensis* Conrad, from the Vicksburg beds, but may be distinguished by the presence of two sharply-defined costae between each pair of varices, and in the character of the revolving striae, which are very much finer and more crowded in the Mississippi fossil."

Murex tritonopsis Heilprin also differs from *M. mississippiensis* Conrad in having a smaller nucleus; more axials, especially on the early whorls; and in lacking a tendency of having spinose structures on the varices.

Holotype deposited in Wagner Free Institute of Science, Philadelphia.

Horizon: Tampa limestone, lower Miocene.

Occurrence: "silex beds" at Ballast Point, Tampa Bay (common); station 12292, Cherokee Sink, Wakulla County.

MUREX TROPHONIFORMIS Heilprin

1887. *Murex trophoniformis* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 107, pl. 15, fig. 40.
1890. *Murex trophoniformis* Heilprin. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 140 (part, Shoal River form excluded).
1915. *Murex trophoniformis* Heilprin. Dall, U. S. Nat. Mus. Bull. 90, p. 74, pl. 9, fig. 7 (part, Shoal River form, U. S. N. M. 115771, excluded).

Heilprin described this species in 1887 as follows:

"Shell having the form of *Trophon*; whorls about six, subangulated superiorly, very convex; varices placed at irregular intervals, four on the body-whorl, the intervariceal spaces with one, or two, or even three secondary costae; aperture about two-thirds the length of the shell, contracted into a short, sharply deflected, and open canal; surface of shell covered with numerous alternating, elevated lines. Length 1.2 inch; width .8 inch."

Holotype deposited in the Wagner Free Institute of Science, Philadelphia.

Murex trophoniformis Heilprin has more convex and angulated whorls, coarser sculpture on the earlier whorls; finer and more numerous secondary spirals than *M. tritonopsis* Heilprin.

Horizon: Tampa limestone, lower Miocene.

Occurrence: "silex beds" at Ballast Point, Tampa Bay; type locality, quite common; station 5000, Sixmile Creek near Orient Station, Hillsborough County (specimen imperfect, identification questioned); station 12763, Anclote River at Tarpon Springs, Pinellas County; station 11115, upper bed in quarry at Kendrick, Marion County; station 7353, midway between Anthony and Martin, Marion County.

Subgenus **CHICOREUS** Montfort, 1810

MUREX (CHICOREUS) LARVAECOSTA Heilprin

Plate 5, Figure 9

1887. *Murex larvaecosta* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 106, pl. 15, fig. 37.
1890. *Murex (Chicoreus) larvaecosta* Heilprin. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 140.
1915. *Chicoreus larvaecosta* Heilprin. Dall, U. S. Nat. Mus. Bull. 90, p. 75

Heilprin described this species in 1887 as follows:

"Shell angulated, obscurely scalariform; varices 7 to 8 in number, obtusely rounded, direct; whorls moderately angulated on the shoulder, crossed by numerous elevated revolving lines, about 10 of which on the body-whorl are much more prominent than the remainder, and show a tendency to become lamellar,

especially toward the base of the shell; the spaces between the more prominent lines covered with numerous finer (tertiary) lines, and a median secondary line; aperture somewhat more than one-half the length of the shell, the (slightly-deflected) canal about one-half the length of the aperture. Length, 1.6 inch; width .9 inch."

Holotype deposited in the Wagner Free Institute of Science, Philadelphia.

Horizon: Tampa limestone, lower Miocene.

Occurrence: "silex beds" at Ballast Point, Tampa Bay, Fla. (rare).

MUREX (CHICOREUS) BURNSII Whitfield?

An immature shell from the "silex beds" of the Tampa limestone at Ballast Point, Tampa Bay, Fla., was identified by Dall⁷⁰ as *Murex* (*Chicoreus*?) *burnsii* Whitfield, a species described from the Miocene marls near Shiloh, N. J. The holotype of "*Murex*" *burnsii* has most of the spire missing. Although the two forms show considerable resemblance, I am uncertain that they are the same species and have questioned the identity of the form from the "silex beds" with that from New Jersey.

MUREX (CHICOREUS) CRISPANGULA Heilprin

1887. *Murex crispangula* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 107, pl. 15, fig. 38.

1890. *Murex* (*Chicoreus*) *crispangula* Heilprin. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 140.

1915. *Chicoreus crispangula* Heilprin. Dall, U. S. Nat. Mus. Bull. 90, p. 75, pl. 5, fig. 14.

Heilprin described this species in 1887 as follows:

"Shell strongly angulated, markedly rugose; spire elevated, of about 5 volutions; varices 6 (on the body-whorl), sharp, deflected obliquely toward the base of the shell; surface of shell very strongly lined, the lines of 3 series, primary, secondary, and tertiary; those of the first series about 10 on the body-whorl, very prominently elevated on the varices, becoming spinose toward the base of the shell and on the apertural varix; aperture slightly exceeding one-half the length of the shell, the very narrowly-contracted canal gently deflected. Length, 1.6 inch; width .7 inch.

"This species may be readily distinguished from *M. larvaccosta*, which it somewhat resembles, by its narrower outline, the smaller number of and greater sharpness of its obliquely directed varices, and its generally rugose surface."

Holotype deposited in the Wagner Free Institute of Science, Philadelphia.

Horizon: Tampa limestone, lower Miocene.

Occurrence: "silex beds" at Ballast Point, Tampa Bay, Fla.

⁷⁰ Dall, W. H., Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 141, 1890.

Genus PURPURA Martyn, 1784

Subgenus PTEROPURPURA Jousseaume, 1880

PURPURA (PTEROPURPURA) POSTI Dall

1895. *Pteropurpura postii* Dall, Proc. U. S. Nat. Mus., vol. 18, p. 44.
1900. *Pteropurpura postii* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 5, p. 1199, pl. 43, fig. 7.
1915. *Purpura (Pteropurpura) posti* Dall, U. S. Nat. Mus. Bull. 90, p. 76, pl. 7, fig. 9.

Dall described this species in 1895 as follows:

"Shell of moderate size, with 5 whorls, beside the (decolate) nucleus, with 3 sharp, continuous varices extending down the spire and a single prominent intervarical nodule on the interspaces of the whorls; the last varix broader than any of the others, with a posterior angle, the front sculptured with fine crenulate imbricated lamellae, the back smooth, except for the ends of the spiral ribbing; spiral sculpture of (about 15 on the last whorl) low spiral ribs most prominent on the varices and on the intervarical nodules, the rather wide interspaces finely spirally striate; aperture small, subovate, the outer lip with about 7 strong teeth; the body with a thin, smooth callus; suture appressed, obscure; canal open, narrow, not quite as long as the aperture; on the siphonal fasciole a single projecting remnant of an earlier canal is visible. Length, 38; of last whorl, 28; of aperture, 14; diameter of shell, 20 mm.

"*Habitat*.—Ballast Point, Tampa, old Miocene silex beds, a single specimen collected by E. J. Post."

Holotype: U. S. Nat. Mus. no. 130349.

Horizon: Tampa limestone, lower Miocene.

Purpura posti Dall belongs to the same genus as *Purpura (Pteropurpura) dryas* Gardner Ms., from the Chipola formation, but it has a relatively longer shell than the latter.

PURPURA (PTEROPURPURA) PROPEPOSTI Mansfield, n. sp.

Plate 5, Figures 8, 10

Shell elongate, with a rather high, turreted spire and long canal. Nucleus poorly preserved. Axial sculpture of three strong, sharp, continuous, marginally broken varices which are spinose at the periphery of the spire whorls and at the shoulder of the body whorl. A rather strong rib lies midway between the varices and an elongate nodule is on either side of this nodule. Body whorl and canal sculptured with about 17 rather strong primaries usually alternating with one secondary spiral. The margin of the outer lip probably is broken away; inner margin of outer lip with 7 strong, rounded entering denticles. Inner lip provided with a callus; canal long and deflected anteriorly; aperture ovate; anterior siphonal canal nearly closed.

The holotype (U. S. Nat. Mus. no. 495945) measures: Height, 43 mm.; greatest diameter, 21 mm.

Type locality: Blackwater Creek at crossing of S. A. L. Ry., Hillsborough County, Fla. H. I. Tucker, collector.

Purpura propeposti is very closely related to *Purpura posti* Dall and may prove, if better specimens are collected, to be a varietal form of that species; however, it differs from the Tampa species in having stronger and more spinose spirals.

Horizon: Suwannee limestone?; Oligocene?

Occurrence: Type locality (rare); station 11109, 1½ miles north of Live Oak, Suwannee County, Fla. (an external mold which appears to be the same as the holotype).

Genus MURICIDEA (Swainson) Mörch, 1852

"MURICIDEA" HEILPRINI Cossmann

1887. *Murex spinulosa* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 108, pl. 15, fig. 41 (not of Deshayes).
 1890. *Muricidea spinulosa* Heilprin. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 149, pl. 8, fig. 9.
 1903. *Muricidea heilprini* Cossmann, Essais Pal., vol. 5, p. 34, 1903.
 1915. *Muricidea heilprini* Cossmann. Dall, U. S. Nat. Mus. Bull. 90, p. 76, pl. 7, fig. 4.

Heilprin described this species in 1887 as follows:

"Shell elevated, elongated, about equally attenuated to both extremities: whorls strongly angulated superiorly, bearing short, outwardly directed spines on the shoulder angulation; a row of similar (supra-basal) spines in the siphonal region; aperture about one-half the length of shell, the canalicular portion the longest; umbilicus long and open; surface of shell below the shoulder with a limited number of prominent revolving lines, four on the body-whorl.

"Length slightly exceeding one inch; width, half-inch. This species somewhat resembles the recent *M. (Urosalpinx) fusiformis* of Adams."

Type locality: "silex beds" at Ballast Point, Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene.

Occurrence: Type locality (quite common).

Genus EUPLEURA H. and A. Adams, 1853

EUPLEURA SEXANGULA (Dall)

1915. *Murex sexangula* Dall, U. S. Nat. Mus. Bull. 90, p. 74, pl. 13, fig. 11.

Dall described this species as follows:

"Shell small, stout, rather short, with about 6 whorls of which the nuclear one and a half are smooth and rounded, the subsequent whorls subtabulate, with 6 well-developed varices; suture deep, distinct; whorls rather abruptly shouldered, but not keeled; varices continuous and somewhat retractive, the line ascending the spire making about a quarter turn; spiral sculpture of about five rounded ridges, one behind the shoulder, subequally spaced, the two near the periphery

closest, which are most prominent on the back of the varices and obsolete in the spaces between the varices; besides these there are numerous spiral grooves with wider, flattened interspaces which cover the whole surface and end in minor crenulations on the recurved edges of the varices; axial sculpture only of incremental lines and the varices, which are thick, recurved, longitudinally striate in front, finely crenulate at the recurved edge, with about five projections corresponding to the ends of the spiral ridges, of which the most prominent is at the shoulder; aperture rounded, the outer lip with six or eight feeble lirations internally; inner lip smooth, continuous, partly free from the body whorl, canal rather wide, open, with a strong siphonal fasciole; a very narrow umbilical chink present. Length of shell (canal slightly defective) 22, of aperture 6.5, maximum diameter 14 mm.

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

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

Horizon: Tampa limestone, lower Miocene.

Genus UROSALPINX Stimpson, 1865

UROSALPINX? INORNATA (Dall)

1890. *Solenosteria inornata* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 123.
1892. *Solenosteria inornata* Dall, idem, pt. 2, p. 234, pl. 20, fig. 17.
1915. *Solenosteria inornata* Dall, U. S. Nat. Mus. Bull. 90, p. 68.

Dall described this species from gutta percha casts of molds in 1890, as follows:

"Shell with a rather elevated spire and 6 or 7 rapidly enlarging whorls, nucleus small, apparently smooth, blunt, with about one turn; subsequent whorls spirally sculptured with fine, low, even threads with equal or wider interspaces, on the last whorl more or less alternated in strength; transverse sculpture of 8 or 9 rounded ribs, most prominent at the periphery, feeble in front of the suture, and on the last whorl not unlike those of *Latirus floridanus*; whorls strongly appressed at the suture and somewhat constricted in front of it and at the base; suture distinct, sometimes with a corded anterior margin; canal short, wide, stout, the posterior edge of the siphonal fasciole keeled; aperture ovate, outer lip arched forward, posterior commissure narrow; pillar smooth, reflected in front so as to nearly cover a moderate umbilical chink; canal wide, rather deep, spirally sculptured like the rest of the shell; the casts indicate that on the periphery of the whorls one of these threads may be a little more prominent than any of the rest. Approximate measurements 36 x 20.

"This is a modest-looking species, having, as far as specific characters go, much the same aspect as *Latirus floridanus* Heilprin.

"The rock from which the casts were taken was collected by Mr. Wilcox. There are no signs of any lirae in the throat, but the general form of the aperture and base lead me to refer it without much doubt to the present group."

Dall⁶⁰ cites the species from the Oligocene limestone at Ballast Point, Tampa Bay, Florida, from the "Cerithium rock" of Heilprin,

⁶⁰ Dall, W. H., U. S. Nat. Mus. Bull. 90, p. 68, 1915.

immediately over the "silex bed" horizon; and from the bed of the Hillsboro River above Tampa, U. S. Nat. Mus. no. 112050. The figure above cited was made from gutta percha casts taken from molds of the species in the lime rock. Also collected by W. C. Mansfield and F. S. MacNeil at station 13848, dredgings from a depth of 32-36 feet at Hooker Point, Hillsborough Bay.

This species appears nearer the genus *Urosalpinx* than the genus *Solenosteria*.

Horizon: Tampa limestone, lower Miocene.

Other occurrences: One fragment consisting of the spire of a shell, which appears to be this species, was collected at station 12763, Anclote River at Tarpon Springs, Pinellas County, Fla.

UROSALPINX? HILLSBOROENSIS Mansfield, n. sp.

Plate 5, Figures 5, 7

Shell rather large, solid, more strongly sculptured axially than spirally, with a rather high spire and short canal, and with about 6 remaining whorls; nucleus lost. Whorls rounded in general outline, early whorls more strongly shouldered than later and rapidly enlarging. Suture rather deep, weakly appressed and undulating. Sculpture of 4 early whorls consisting of strong closely spaced rounded axials, weakly subdued posteriorly; on the fifth whorl there are 2 or 3 axials. Body whorl with about 8 strong axials; those on the face of the whorl are very strong and closely spaced whereas the others are slightly weaker and more widely spaced. Growth lines are intercalated between the strong ribs and on the posterior slope and canal form with the spirals a reticulate ornamentation. Spiral sculpture on the spire whorls consisting of two paired fine threads below the suture and 4 similar threads on the posterior slope and about 5 below, the spiral at the upper and lower shoulder being a little stronger than the others. The spirals on the body whorl and canal usually alternate in strength. Aperture subovate; margin of outer lip broken, interior concealed by matrix. Columella apparently smooth, lower half with a heavy wash of callus. A small chink lies between this callus and the strong, scabrous siphonal fasciole. Anterior canal short, wide and emarginate. The surface of the shell is partly concealed by matrix.

Holotype (U. S. Nat. Mus. no. 495944) measures: Height, 56 mm; greatest diameter, 31 mm.; length of aperture, 30 mm.

Type locality: Sixmile Creek near highway bridge at Orient Station, Hillsborough County. Collected by Helen I. Tucker.

Horizon: Tampa limestone, lower Miocene.

This species is related to *Urosalpinx cinerius* (Say), a living species, but it has a much larger shell than that species. As the character of the inside of the outer lip is not revealed, the genus to which it belongs remains somewhat in doubt.

Genus TRITONALIA Fleming, 1828

"TRITONALIA" SCABROSA Dall

1915. *Tritonalia scabrosa* Dall, U. S. Nat. Mus. Bull. 90, p. 77, pl. 5, fig. 15.

Dall described this species as follows:

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

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

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

Horizon: Tampa limestone, lower Miocene.

Genus TYPHIS Montfort, 1810

TYPHIS SIPHONIFERA Dall

1915. *Typhis siphonifera* Dall, U. S. Nat. Mus. Bull. 90, p. 77, pl. 13, fig. 9.

Dall described this species as follows:

"Shell small, short, stout-conic, of four whorls, of which the first is smooth and rounded, the others, rapidly enlarging, smooth, angulated by four varices, about midway between which, on a subangular shoulder of the whorl, intervene stout tubes slightly backwardly and apically directed, entire and with subcircular orifices, one tube being situated in each interspace; suture distinct, deep, the whorl in front of it to the shoulder subtabulate, the shoulder rounded carinate, the whorl in front rapidly, flattishly attenuated; varices thin, recurved, between the shoulder and the canal with eight or nine crenulations, between which and the margin of the aperture the front of the varix is somewhat convex and smooth; aperture rounded-ovate, with an entire thin, projecting free margin;

canal closed, short, stout, wide, slightly curved to the right and backward; siphonal fasciole with three projecting imbrications; the umbilical region deeply grooved, but not perforate. Length of shell 10.5, of last whorl 8, of the aperture 2.7, maximum diameter 6.5 mm.

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

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

Horizon: Tampa limestone, lower Miocene.

Genus RAPANA Schumacher, 1817

RAPANA TAMPAENSIS Dall

1890. *Rapana tampaensis* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 153.

1904. Not *Rapana tampaensis* Dall, Martin, Maryland Geol. Survey, Miocene, p. 210, pl. 52, fig. 9 (*Rapana ecclesiastica* Dall).

1915. *Rapana tampaensis* Dall, U. S. Nat. Mus. Bull. 90, p. 78, pl. 13, fig. 8 (part, Maryland species excluded).

Dall described the species in 1890 as follows:

"Shell rather small, short spired; last whorl much the largest, spiral sculpture of 8 or 9 primary ridges, elevated and square-sided, of which one is near the suture, two others (a little larger) with subequal interspaces in front of the first, then an interspace of greater width with the strongest spiral in front of it, then the peripheral interspace, twice as wide as the strongest spiral, then another strong spiral followed by a narrower channel, and 3 more basal spirals with diminishing interspaces on the base, and 3 or 4 rather obscure and less elevated spiral cords on the canal; of secondary spirals much smaller than the primaries, there are one or two in the wide peripheral channel, and sometimes a single one elsewhere; lastly the whole surface is more or less sculptured by fine, incised spiral lines. The transverse sculpture is of fine wrinkles, in harmony with the incremental lines, which cover most of the shell; the ribs are slightly but irregularly undulated in some places; aperture ovate, pillar lip with a thin, smooth callus; edge of the outer lip undulated by the sculpture, the interior lirate, with about 10 sharp, prominent lirae disposed somewhat in pairs; canal very narrow and deep, shorter than the aperture; umbilicus flaring, variable in diameter, deep, bounded by the rounded edge of the fasciole, within axially striated, but not otherwise sculptured.

"Lon. of shell—?, of last whorl from the suture at the aperture forward 20.0; diam. of last whorl 21.5; of the umbilicus in two specimens 5.0 and 6.5 mm. respectively.

"Having only two imperfect last whorls of this species at present, I defer figuring it in the hope of receiving better material."

Horizon: Tampa limestone, lower Miocene.

Dall based his description of *R. tampaensis* on two imperfect last whorls (U. S. Nat. Mus. no. 112068) neither of which was figured. A better specimen (U. S. Nat. Mus. no. 165096) was figured on plate 13, figure 8, of U. S. Nat. Mus. Bull. 90, 1915. The last whorl con-

stitutes the greater part of the shell. The nucleus is small, smooth and naticoid. The penultimate whorl, as well as the earlier whorls, has a strong, thin, elevated, laterally depressed peripheral spiral; two weaker spirals on the sloping area above and two spirals similar to those above the periphery but a little weaker on the nearly vertical area below. *Rapana tampaensis* differs from *R. ecclesiastica* Dall in having a strong peripheral spiral, a much larger umbilicus and a longer siphonal canal. The elevated spirals and the large umbilicus on *R. tampaensis* are somewhat similar to those on "*Ecphora*" *tricostata* Martin from the Calvert formation of the Chesapeake group of Maryland.

Rapana tampaensis also occurs at Sixmile Creek.

RAPANA BICONICA Dall

1915. *Rapana biconica* Dall, U. S. Nat. Mus. Bull. 90, p. 79, pl. 13, fig. 10.

Dall described this species as follows:

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

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

Horizon: Tampa limestone, lower Miocene.

RAPANA VAUGHANI Mansfield, n. sp.

Plate 5, Figure 6

Shell rather small, with a broadly conic spire and a rather long canal; the last whorl comprising most of the shell. Spirally sculptured on spire whorls with two weakly nodulous cords below the suture and two stronger nodulous cords below, one being situated at the middle of the whorl and the other at the base. Above and below

the median spiral there are three fine spiral threads. Body whorl below the shoulder and on the canal spirally sculptured with primary lines intercalated with secondary threads. Axial sculpture of weak axials which are more strongly developed at the periphery of the whorls. Pillar provided with a callus. A small chink lies between the pillar callus and the siphonal fasciole. The holotype consists of an external mold in a matrix with *Cyrena*. No spiral ridge is observed on the columella of the paratypes.

The holotype (U. S. Nat. Mus. no. 495946) measures: Height, about 25 mm.; greatest diameter, about 18 mm.

Type locality: Station 7175, west of the railroad station at River Junction, 9 to 10 feet below the level of the railroad tracks, Gadsden County, Fla., collected by T. W. Vaughan.

Horizon: Tampa limestone, lower Miocene; Trent marl, lower Miocene.

Occurrence: Type locality (represented only by the holotype); station 7358, Tarpon Springs, Pinellas County (two small specimens); station 3403, Wyley Landing, Ga.; Trent marl, Silverdale, N. C.

Family CORALLIOPHILIDAE

Genus CORALLIOPHILA H. and A. Adams, 1853

CORALLIOPHILA MAGNA Dall

1890. *Coralliophila magna* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 155, pl. 11, figs. 11, 12.
1915. *Coralliophila magna* Dall, U. S. Nat. Mus. Bull. 90, p. 78, pl. 7, fig. 7; pl. 10, fig. 6.

Dall described this species in 1890 as follows:

"Adult shell large, stout, with 8 or 9 whorls, a short spire, rasp-like surface and flaring umbilicus; nucleus small, smooth; subsequent whorls transversely sculptured, with 7 or 8 more or less prominent, rounded ribs, which continue clear across the whorl, and with low, very thin, sharp, imbricated lamellae corresponding to the incremental lines covering the whole shell, but most elevated and strong in front of the suture; spiral sculpture of numerous rounded threads, with about equal interspaces, which on the last whorl of the adult are sharper on the summits of the ribs and more distant, but in the young evenly overrun the ribs and surface without becoming nodulous or enlarged; aperture in the young ovate, rounded behind, with a few rather obscure teeth inside the outer lip, the inner lip with a smooth callus; the canal narrow, with a strong imbricated fasciole and a well-defined umbilical chink; in the adult the suture is more and more appressed until there is frequently a sort of narrow channel at the posterior end of the aperture; the callus on the inner lip is heavier and the umbilical pit wider and deeper, almost like that of *Rapana*, but less deep; the

canal in such cases is strongly recurved and the exterior spirals angulated at the summit. Max. length of adult specimen 60.0; diam. 30.0 mm.

"Ballast Point silex-beds, Dall and Burns."

Smaller cotype: U. S. Nat. Mus. no. 112069.

Horizon: Tampa limestone, lower Miocene.

Occurrences: Type locality (common); Blackwater Creek at S. A. L. Ry. crossing, Hillsborough County, H. I. Tucker, collector; station 12292, Cherokee Sink, Wakulla County; station 12285, quarry half mile south of River Junction, Gadsden County (imperfect specimens and identification not verified).

Suborder STREPTODONTA
Superfamily GYMNOGLOSSA
Family MELANELLIDAE

Dall⁸¹ identified a *Melanella* as *M. conoidea* Kurtz and Stimpson (pl. 3, fig. 13) and described a new species of *Eulina*, *E. bowdichi* (pl. 12, fig. 14) from the "silex beds" of the Tampa limestone at Ballast Point, Tampa Bay, Fla.

These species have not been compared with outside fossil or Recent species.

Family PYRAMIDELLIDAE

Dall⁸² identified a *Pyramidella* as *P. (Longchaeus) crenulata* Holmes (pl. 13, fig. 4); an *Odostomia* as *O. (Menesto) impressa* Say; and described a new species of *Turbonilla*, *T. (Ptycheulimella) ethelina* (pl. 12, fig. 20) from the "silex beds" at Ballast Point, Tampa Bay, Fla. These species have not been compared with outside fossil or Recent species.

Suborder PECTINIBRANCHIATA
Superfamily TAENIOGLOSSA
Family CYPRAEIDAE

Genus CYPRAEA Linnaeus, 1758

CYPRAEA TUMULUS Heilprin

- 1887. *Cypraea tumulus* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 111, pl. 16, figs. 49, 49a.
- 1890. *Cypraea pinguis* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, pl. 11, figs. 1, 1a (Part, not *C. pinguis* Conrad, 1854).
- 1890. Not *Cypraea heilprinii* Dall, Wagner Free Inst. Sci. Philadelphia Trans., vol. 3, pt. 1, pl. 11, figs. 2, 2a (a figured specimen, the holotype from the Chipola formation, U. S. Nat. Mus. No. 114103).

⁸¹ Dall, W. H., U. S. Nat. Mus. Bull. 90, p. 82, 1915.

⁸² Dall, W. H., U. S. Nat. Mus. Bull. 90, pp. 83, 84, 1915.

1915. *Cypraea tumulus* Heilprin. Dall, U. S. Nat. Mus. Bull. 90, pl. 3, figs. 1, 12. (The figured specimen appears to have come from the Tampa siliceous beds.)

Heilprin described this species in 1887 as follows:

"Shell completely involute, inflated, very convex, the greatest elevation being immediately back of the apex; the dome abruptly truncated posteriorly, sloping more gradually in the direction of the anterior extremity; aperture narrow, subcentral, slightly flexuous, directed obliquely over the apex; outer lip produced somewhat beyond the inner lip posteriorly, with about 25 evenly placed dental plications; columellar surface flattened, the teeth less prominent; surface of the shell covered with very fine revolving lines, which, however, (in the specimens before me) are only visible in immediate proximity to the aperture; base gently convex. Length 1.6 inch; width, one inch; greatest elevation, .9 inch."

Holotype deposited in the Wagner Free Institute of Science, Philadelphia.

Type locality: "siliceous beds" at Ballast Point, Tampa Bay, Fla.

Cypraea tumulus Heilprin differs from *C. pinguis* Conrad in having a much larger and thicker shell and in young specimens a less ovate and relatively longer shell with a longer anterior canal. Dall⁸³ states that the transverse lines on the base of Professor Heilprin's specimen appear to be due to the process of mineralization or of weathering before the pseudomorph was formed.

Horizon: Tampa limestone, lower Miocene.

Occurrences: Type locality (common); station 13839, Sixmile Creek, Orient, Hillsborough County; station 12300, 1¼ miles northeast of Lloyd, Jefferson County; station 12292, Cherokee sink, Wakulla County (internal molds, identification not confirmed); station 12285, old quarry half mile south of River Junction at an elevation around 150 feet above sea level, Gadsden County.

CYPRAEA TUMULUS BALLISTA Dall

1915. *Cypraea ballista* Dall, U. S. Nat. Mus. Bull. 90, p. 85, pl. 6, figs. 9, 10, 11.

Dall described this form as follows:

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

⁸³ Dall, W. H., Wagner Free Inst. Sci. Philadelphia Trans., vol. 3, pt. 1, p. 165, 1890.

curved upward, anterior sinus direct. Length 27, maximum width 19, height 16 mm.

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

Horizon: Tampa limestone, lower Miocene.

This form is more cylindrical and less inflated than *Cypraea tumulus* Heilprin. It is closely related to *C. heilprinii* Dall, a species from the Chipola formation.

Family CASSIDIDAE

Genus MORUM (Bolten) Röding, 1798

MORUM CHIPOLANUM TAMPANUM Mansfield, n. subsp.

1915. *Morum domingense* Dall, U. S. Nat. Mus. Bull. 90, p. 85, pl. 12, fig. 28 (not *Morum domingense* Sowerby, 1849).

Two specimens, one of which was figured by Dall, from the "silex beds" at Ballast Point, Tampa Bay, Fla., are more closely related to *Morum chipolanum* Dall Ms. than to *M. domingense* Sowerby.

The specimens have a rather low, sloping spire and a large body whorl. The suture is appressed and extends nearly to the periphery of the preceding whorl. Only about two spiral lines are visible between the suture and the forward shoulder. The last whorl has about 11 ribs, counting the strong lip varix. From 4 to 8 growth lines lie between these ribs. Margin of outer lip with about 14 entering lirations. Inner lip callus provided with elongate pustules.

Holotype (U. S. Nat. Mus. no. 165095) measures: Height, 25 mm.; greatest diameter, 17 mm.

Horizon: Tampa limestone, lower Miocene.

This new subspecies differs from *Morum domingense* Sowerby in having a shorter shell with a lower and a less tabulated spire; fewer and coarser spirals on the early part of the whorl and between the primary spirals on the body whorl; and coarser growth lines.

Other occurrences: Station 13847, Gadsden Point, 4 miles south of Ballast Point; station 12727, in limestone on the right bank of the Chipola River at Willis bridge, Calhoun County Fla. (an external mold of the last whorls which appears to be the same as the "silex bed" species).

MORUM cf. M. CHIPOLANUM Dall, Ms.

1915. *Morum domingense* Dall, U. S. Nat. Mus. Bull. 90, p. 85 (not *M. domingense* Sowerby, 1849).

One immature, silicified specimen from the "silex beds" at Ballast Point, Tampa Bay, Fla., appears to be closely related to or the same

species as *Morum chipolanum* Dall Ms. from the Chipola formation, Florida.

The specimen consists of 5 turreted whorls—one smooth nuclear whorl and 4 sculptured post-nuclear whorls. The spiral sculpture on the early whorls consists of a subsutural line; a faint thread midway between the suture and the periphery; a heavier thread at the periphery; and one or two threads on the vertical area below the periphery. The body whorl has about 10 rather strong spirals and about 17 lamellar-like ribs. From 4 to 5 growth lines lie between the ribs.

This form differs from *Morum domingense* Sowerby in having fewer and coarser spirals on the early part of the shell and coarser and fewer lines of growth.

Horizon: Tampa limestone, lower Miocene; (?) Chipola formation.

Genus CASSIS Scopoli, 1777

CASSIS sp.

An internal mold of a specimen belonging to the genus *Cassis* was collected at station 12322, quarry three-fourths mile southwest of Brooksville, Hernando County. As no sculpture markings are preserved on the specimen, the species to which it belongs is indeterminate.

Horizon: Suwannee limestone, Oligocene.

Family STROMBIDAE

Genus ORTHAULAX Gabb, 1872

ORTHAULAX INORNATUS Gabb

- 1873. *Orthaulax inornatus* Gabb, Acad. Nat. Sci. Philadelphia, Proc., vol. 24, p. 272, pl. 9, figs. 3, 4; Am. Philos. Soc. Trans., new ser., vol. 15, p. 234.
- 1876. *Orthaulax inornata* Gabb. Guppy, Geol. Soc. London, Quart. Jour., vol. 32, p. 520, pl. 28, fig. 8.
- 1915. *Orthaulax inornatus* Gabb. Dall, U. S. Nat. Mus. Bull. 90, p. 86, pl. 11, fig. 4.
- 1916. *Orthaulax inornatus* Gabb. Dall, U. S. Nat. Mus. Proc., vol. 51, p. 509, pl. 88, fig. 9 (part, only fig. included).
- 1917. *Orthaulax inornatus* Gabb. Maury, Am. Paleontology, vol. 5, p. 285, pl. 47, fig. 11.
- 1921. *Orthaulax inornatus* Gabb. Cooke, U. S. Geol. Survey Prof. Paper 129-B, p. 28, pl. 2, figs. 2-6.
- 1922. *Orthaulax inornatus* Gabb. Pilsbry, Acad. Nat. Sci. Philadelphia, Proc., vol. 73, p. 368, pl. 30, figs. 13-15.

Gabb described this species in 1873 as follows:

"Shell broadly rounded-fusiform. Young shell with the spire a little shorter than the aperture, suture impressed, whorls numerous, nuclear whorls three, the subsequent ones showing faint traces of occasional thickenings disposed like

the varices of *Triton*; surface smooth; anterior end of body whorl marked by a few faint revolving lines, on posterior canal. Adult shell more distinctly fusiform, the spire covered by a longitudinally striated incrustation covering the sutures and extending to the extreme apex. Aperture elongated, acute behind and prolonged into a very narrow posterior canal running straight to the apex; in advance it is gradually narrowed, the anterior notch broad and shallow; inner lip thinly incrustated; outer lip thin in all my specimens, and apparently thin, straight, and entire in the perfect adult. Size of largest specimen, length 3.75 inches, width 1.5 inches."

Holotype: Deposited in the Academy of Natural Sciences of Philadelphia.

Occurrence in Florida: "silex bed" of the Tampa limestone, Ballast Point, Tampa Bay, Fla. (U. S. Nat. Mus. no. 165099).

Other occurrence: Upper part of bluff of Rio Yaque del Norte at Baitoa, Province of Santiago, Dominican Republic (station 8668).

Horizon: Tampa limestone, lower Miocene; Baitoa formation, lower Miocene.

ORTHAULAX PUGNAX (Heilprin) Dall

1887. *Wagneria pugnax* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 106, pl. 15, figs. 36, 36a.
1890. *Orthaulax pugnax* (Heilprin). Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 170, pl. 8, figs. 5, 8.
1915. *Orthaulax pugnax* (Heilprin). Dall, U. S. Nat. Mus. Bull. 90, p. 87, pl. 15, figs. 5, 10 (part).
1919. *Orthaulax pugnax* Heilprin. Cooke, Carnegie Inst. Washington Pub. 291, p. 115, pl. 2, fig. 4 (part, fig. 3 excluded fidé Cooke).
1921. *Orthaulax pugnax* (Heilprin) Dall. Cooke, U. S. Geol. Survey Prof. Paper 129-B, pp. 28, 29, pl. 2, figs. 7, 8(?); pl. 3, figs. 1a-4 (part, specimens at Geneva, Ala., station 8867, excluded).

Heilprin wrote:

"Shell irregularly oval, obconical, flattened, the flattened appearance being due to three irregular swellings or knobs, one of which immediately adjoins the anteriorly directed fissure of the aperture; aperture narrow, projected forward (in its upper course) as a closely compressed fissure, which in a crescential curve ascends to within a comparatively short distance of the apex of the spire; outer lip? (broken in specimen); inner lip largely developed, completely concealing the whorls of the spire, and duplicating for a considerable extent the outer lip; spire freely enclosed in a pointed superstructure, or dome, built over it by an extension of the mantle; surface covered with longitudinal lines of growth, which extend continuously from the apex to the base.

"Length (of imperfect specimens, lacking probably upward of an inch), 2.7 inches; width, 1.75 inches.

"What the precise relationship of the genus represented by this species may be I am not prepared to say.

"Zittel (Handbuch der Palaeontologie, I, part ii, p. 260) unites *Orthaulax* with *Hippochrenes*, but in doing so this eminent paleontologist appears to have

been misled by the rather imperfect diagnosis of the fossil given by Gabb. That its position is near to that genus I believe there can be no doubt."

Paratypes deposited in Wagner Free Institute of Science, Philadelphia.

Occurrence, Florida: Tampa limestone, lower Miocene "silex bed"; station 7080, old quarry half mile south of River Junction at an elevation around 150 feet above sea level (fragment; determination not confirmed); station 12763, Anclote River at Tarpon Springs, Pinellas County; Baileys Mill Creek sink, three-fourths mile northeast of Lloyd, Jefferson County (U. S. Nat. Mus. no. 112521); station 12292, Cherokee sink, Wakulla County.

Georgia: Flint River formation, Oligocene, stations 7074 and 3383, Hale Landing, Flint River, 7 miles below Bainbridge; station 2573, Blue Springs, Flint River, 4 miles below Bainbridge. There is a possibility that the specimens from the Flint River formation should be referred to the subspecies *hernandoensis*.

Antigua: Upper Oligocene—U. S. Nat. Mus. no. 166984.

ORTHAULAX PUGNAX HERNANDOENSIS Mansfield, n. subsp.

Plate 6, Figures 5, 6

- 1915. *Orthaulax pugnax* (Heilprin). Dall, U. S. Nat. Mus. Bull. 90, p. 87 (part?).
- 1921. *Orthaulax pugnax* (Heilprin). Cooke, U. S. Geol. Survey Prof. Paper 129-B, p. 28 (part).
- 1929. *Orthaulax pugnax* (Heilprin). Cooke and Mossom, Geology of Florida, Florida State Geol. Survey 20th Ann. Rept., pl. 7, fig. 6.

Specimens of the genus *Orthaulax* from localities in Florida and Alabama appear to be somewhat different from *O. pugnax* (Heilprin) and are referred to a new subspecies *hernandoensis*, although this inference cannot be fully confirmed. The differences appear to be that the specimens have a higher spire than *O. pugnax* (Heilprin) and that there is no positive indication that the outer lip enveloped the spire. The outer lip may have been very thin and consequently absorbed in the change of mineralization or destroyed in some other way. The exterior molds of *O. pugnax* are more ovate than the exterior molds of the new subspecies. The specimens usually have three irregular swellings or knobs which give the shell a triangular shape. This subspecies appears to be as closely related to *Orthaulax gabbi* Dall, a Chipola formation species, as to *O. pugnax* (Heilprin).

Cotypes: U. S. Nat. Mus. no. 495947.

Type locality: Station 12758, Camp Concrete Rock quarry, about 5 miles northeast of Brooksville, Hernando County.

Occurrence: Florida: Suwannee limestone, Oligocene—station 11116, Blackwater Creek at crossing of Seaboard Air Line Railway, Hillsborough County; station 12761, 2 miles north of Hudson, Pasco County; station 7356, 1 mile north of Hudson; station 12322, quarry, three-fourths of a mile southwest of Brooksville, Hernando County; station 12758, rock quarry 5 miles northeast of Brooksville (type locality); station 12321, quarry 3 miles east of Brooksville; station 6774, three-fourths of a mile above White Springs, Columbia County. Flint River formation, Oligocene—station 10104, half a mile south of state line on road from Geneva, Ala., to Westville, Fla., Holmes County, Fla.

Alabama: Flint River formation, Oligocene; station 8867, 1 mile southwest of Geneva, Geneva County; station 10103, three-fourths of a mile north of Goodman, Coffee County.

Genus STROMBUS Linnaeus, 1758

STROMBUS LIOCYCLUS Dall

1915. *Strombus liocyclus* Dall, U. S. Nat. Mus. Bull. 90, p. 88, pl. 13, figs. 6, 7.
1915. *Strombus chipolanus* Dall, idem, p. 87 (part, not *S. chipolanus* Dall, a species from the Chipola marl).

Dall described this species as follows:

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

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

Strombus liocyclus has a more slender shell than the two species from the Chipola marl, *S. aldrichi* Dall and *S. chipolanus* Dall.

Horizon: Tampa limestone, lower Miocene.

Other occurrences in Florida: Sixmile Creek, near Orient Station, Hillsborough County, H. I. Tucker, collector; station 12763, Tarpon Springs, Pinellas County; station 12292, Cherokee sink, Wakulla County; station 13840, 1½ miles northeast of Lloyd, Jefferson County; ?station 13847, 4 miles south of Ballast Point.

Genus *TEREBELLUM* Lamarck, 1799

***TEREBELLUM HERNANDOENSIS* Mansfield, n. sp.**

Plate 5, Figures 2, 3

The mold is medium-sized, slender, with about 5 whorls; the apical end is blunt and the last whorl comprising most of the shell. Earliest whorl rather small with an immersed tip; following whorl much larger and rounded; subsequent whorls nearly flat and successively increasing in height. Suture of body whorl much more oblique than preceding ones. Anterior end of pillar reflected.

Holotype (U. S. Nat. Mus. no. 495948) measures: Height, 31.4 mm.; greatest diameter, 9.5 mm. Other broken molds represent larger shells than the holotype.

Type locality: Station 12318, abandoned pit on Florida State Road no. 15, 5 miles west of Brooksville, Hernando County, Fla.

Horizon: Suwannee limestone, Oligocene.

Terebellum subdistortum Trechman,⁸⁴ an Eocene species, has a slimmer shell, with more oblique and more distant sutures. "*Seraphis*" *andersoni* Dickerson,⁸⁵ an Oligocene species from Washington State, may have some relationship to the new species.

The living Indo-Pacific species, *Terebellum subulatum* Lamarck, the genotype of *Terebellum* is somewhat similar to the new species here described.

Family CERITHIOPSIDAE

Genus *CERITHOPSIS* Forbes and Hanley, 1851

***CERITHOPSIS SILICATA* Dall**

1915. *Cerithopsis silicata* Dall, U. S. Nat. Mus. Bull. 90, p. 93, pl. 12, fig. 19.

Dall described this species as follows:

"Shell small with an acute apex, later becoming subcylindrical; nucleus lost, the next 2 or 3 whorls with 2 elevated spiral threads and no axial sculpture, followed by whorls with 3, gradually increasing to four straplike spirals over-

⁸⁴ Trechmann, C. T., The yellow limestone of Jamaica: Geol. Mag. London, vol. 60, no. 8, p. 349, pl. 18, figs. 8, 9, 1923.

⁸⁵ Dickerson, R. E., California Acad. Sci. Proc., 4th ser., vol. 7, p. 180, pl. 31, figs. 9a, 9b, 1917.

riding numerous axial stouter rounded ribs with equal interspaces extending nearly from suture to suture, and forming nearly square deep equal pits by their intersections; suture close, but the elevated spirals on each side of it give it a deeply channelled aspect; there are three spirals on the rather convex base diminishing in size forward, but only incremental axial sculpture; aperture defective, but without lirae; remaining whorls in all, 10. Height, 6.5; maximum diameter, 2 mm.

"Tampa silex beds at Ballast Point, Tampa Bay, Florida; Dall, U. S. Nat. Mus. No. 165111."

Horizon: Tampa limestone, lower Miocene.

This species has not been recognized outside of its type locality.

Family CERITHIIDAE

Genus BITTIUM ("Leach") Gray, 1847

BITTIUM PRISCUM Dall

1890. *Bittium priscum*, Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 189, pl. 11, fig. 6.
1892. *Bittium* (*Styliferina*?) *priscum* Dall, idem, pt. 2, p. 275.
1915. *Bittium priscum* Dall, U. S. Nat. Mus. Bull. 90, p. 88, pl. 8, fig. 3.

Dall described this species in 1892 as follows:

"Shell small, slender, the specimens decollate; the remainder shows seven rounded whorls with a distinct suture, two or three raised spirals on the whorls and three or more on the base. These are crossed by a variable number of slightly arched riblets, which are frequently nodulous at the intersections; in the perfect state these nodules were sometimes very prominent; aperture short, rounded, with an obsolete canal, reflected inner lip with a chink behind it; a short and obscure pillar and a short, thin, sigmoid outer lip without lirae. Lon. of shell figured 7.0; max. diam. 2.75 mm."

The nucleus consists of about 3 rounded whorls, the initial turn being small. The following whorls have two spirals, the anterior one being the stronger and on the later whorls forms the periphery. A small spiral is usually present at the base of each whorl. The ribs extend across the whorl and are overrun by the spirals.

Holotype: U. S. Nat. Mus. no. 112522.

Type locality: "silex bed," at Ballast Point, Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene.

This species has not been recognized outside of its type locality.

BITTIUM (PRISCUM var?) SORA Dall

1915. *Bittium* (*priscum* var?) *sora*, n. var., Dall, U. S. Nat. Mus. Bull. 90, p. 89,

"A shell which may be a variety of *B. priscum* and is only represented by a single specimen has been received too late for figuring. It has 11 whorls and an acute apex; the whorls in front of the suture are excavated and plain; at

the periphery there is one strong spiral thread separated by an interval from two closely adjacent threads in front of it, and in the later whorls a still stronger thread just behind the suture and on the last whorl marginating the base; the base is flattish, with four or five fine spiral threads and the canal obsolete. The axial sculpture is of numerous obscure riblets which slightly undulate the spirals. Height 8.75; of last whorl 3.5; maximum diameter 3.0 mm.

"Tampa silex beds, collected by E. J. Post, U. S. Nat. Mus. No. 214740."

Horizon: Tampa limestone, lower Miocene.

Only one specimen, the holotype, is in the U. S. National Museum collection.

BITTIUM ADELA Dall

1915. *Bittium adela* Dall, U. S. Nat. Mus. Bull. 90, p. 89, pl. 13, fig. 16.

Dall described this species as follows:

"Shell small, thin, with 8 rather rapidly increasing whorls; spire conic, apex acute; suture distinct, not channeled; axial sculpture of (on the penultimate whorl eleven), short nodular ribs, conspicuous on the periphery, obsolete toward the sutures; behind the periphery the whorl slopes flatly toward the preceding suture, the anterior slope is much shorter and terminates at a carina in front of which the next suture is laid; on this slope there is spiral sculpture of four or more fine close-set revolving threads; the posterior slope is similarly sculptured, and on the periphery there are indications of a slightly stronger but similar single thread; the sculpture is essentially the same over the whole spire; base of the shell limited by the post sutural carina before mentioned; flattish; sculptured with about nine revolving little elevated threads, with slightly wider interspaces; canal short, distinct; outer lip thin, defective, not internally lirate; aperture subquadrate. Length 8.5, maximum diameter 4.5 mm.

"Tampa silex beds, Ballast Point, Tampa Bay, Florida. One specimen, possibly immature, from the Post collection, U. S. Nat. Mus. No. 165104."

Horizon: Tampa limestone, lower Miocene.

Bittium adela Dall is closely related to *Bittium cossmanni* Dall, a species from the Chipola formation, differing from the latter in having a relatively wider shell and fewer and shorter ribs.

The holotype is an immature specimen, a much larger specimen has been collected at "Wacissa," Jefferson County, Fla.

Genus CERITHIUM Bruguière, 1792

CERITHIUM PRAECURSOR Heilprin

- 1887. *Cerithium praecursor* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 114, pl. 16, fig. 58.
- 1892. *Cerithium praecursor* Heilprin. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 285.
- 1915. *Cerithium praecursor* Heilprin. Dall, U. S. Nat. Mus. Bull. 90, p. 90, pl. 5, fig. 5; pl. 12, fig. 26.

Heilprin described this species in 1887 as follows:

"Shell small, slender, of the general habit of the recent *C. muscarum*; whorls about 10, longitudinally plicated and concentrically ridged, the ridges or lines about 3 on each of the whorls of the spire, 5 on the body-whorl, which in some specimens exhibits one or more irregular excrescences. Aperture oval, oblique, produced into a short canal. Length .6 inch."

Dall redescribed this species in 1915 as follows:

"Shell small, thin, slender, with about 9 sculptured whorls, the nucleus defective; suture distinct; axial sculpture of (on the penultimate whorl 11) small rounded riblets, with wider interspaces, not continuous over the spire and slightly retractive, they practically become obsolete at the periphery; besides these the axial sculpture comprises only rather marked incremental lines and the usual varices at the beginning of the second half of the last whorl, and at the aperture; spiral sculpture of (on the spire 3 and on the last whorl 6) primary spiral threads with wider, nearly equal interspaces, the threads equal and slightly swollen where they cross the axial riblets; between these, in the interspaces, are two or three much finer equal threads (hardly apparent in the figure) equally spaced, and on the back of the canal 5 or 6 close-set coarser threads; aperture sublunate with a narrow sulcus between a subsutural nodule, and the outer lip behind; inner lip continuous, with a smooth free edge; outer lip smooth internally with a slight varical thickening behind; canal wide, very short, slightly recurved, with no sulcus at the base of the whorl behind it. Length 12 mm., maximum diameter 4.5 mm.

"Tampa silex beds at Ballast Point, Tampa Bay, Florida. Various collectors. U. S. Nat. Mus. Nos. 112523 and 165106.

"This seems to have been an ancestor of such forms as *C. muscarum* Say. It has also been found in the shape of molds in the limestone of Wakulla County, northwest Florida, near Wakulla."

The holotype is deposited in the Wagner Free Institute of Science, Philadelphia.

Horizon: Tampa limestone, lower Miocene.

Other occurrences: "Wacissa," Jefferson County; a fragment of a specimen larger than the other specimens referred to this species was collected at Tarpon Springs, Pinellas County; station 3420, 15 miles south of Tallahassee, Wakulla County, Fla.; ?station 13841, Aspalaga Bluff, Apalachicola River, bed 10 feet above a clay bed.

CERITHIUM PLECTRUM Dall

1915. *Cerithium plectrum* Dall, U. S. Nat. Mus. Bull. 90, p. 90, pl. 9, fig. 3.

Dall described this species as follows:

"Shell small, solid, comprising about 5 whorls without the (decollate) nucleus which seems to have been smooth; spiral sculpture: on the two succeeding whorls 1, on the next whorl 3, on the fourth whorl 4, and on the last whorl 8 spiral ridges, crossing about 16 axial ribs and slightly nodulous at the

intersections, interstitial reticulations looking like squarish pits; the whorls are slightly turreted by the sculpture and the suture very distinct; the aperture ovate, the outer lip thickened and outwardly denticulated by the ends of the spirals; a thick layer of callus on the body; the anterior sulcus distinct, the whorls under the sculpture well rounded; length of shell 5.2, of last whorl 3, maximum diameter 2.3 mm.

"Tampa silex beds at Ballast Point, Tampa Bay, Florida. One specimen U. S. Nat. Mus. No. 166105.

"This species is nearest to *C. milium* Dall, of the Pleistocene and recent fauna at Colon, Panama."

Horizon: Tampa limestone, lower Miocene.

The species has not been recognized outside of its type locality.

CERITHIUM aff. C. GEORGIANUM Lyell and Sowerby

Plate 7, Figures 1, 7

1945. *Cerithium georgianum* Lyell and Sowerby, Geol. Soc. London Quart. Jour., vol. 1, p. 439, figs. a, b.

Dall⁵⁶ identified two specimens (U. S. Nat. Mus. no. 165105) from the "silex bed" at Ballast Point, Fla., as *Cerithium georgianum* Lyell and Sowerby. Although the Tampa specimens are closely related to *C. georgianum* and may represent the same species, there appears to be certain differences and I am not certain that they are the same. The Tampa form, when compared with a poor specimen from Jacksonboro, has a deeper suture and probably differs in other respects.

Horizon: Tampa limestone, lower Miocene.

Occurrence of specimens like the Tampa form: station 2610, N. E. ¼, N. E. ¼, sec. 11, T. 4 S., R. 11 E., Lafayette County, Fla.; station 12292, Cherokee Sink, Wakulla County.

CERITHIUM HERNANDOENSIS Mansfield, n. sp.

Plate 6, Figure 3; Plate 7, Figure 8

Shell large, moderately slender and with a nearly flat base. Sculpture consisting of 4 nearly equal sized, nodular spirals intercalated, except between the posterior first and second spire, with a finer spiral. Suture shallow. Base not showing any spiral sculpture.

Holotype (U. S. Nat. Mus. no. 495950) measures: Greatest diameter, 35 mm.

Type locality: Station 12757, from upper part of Florida Portland Cement quarry, 10.2 miles northwest of Brooksville, Hernando County, Fla.

⁵⁶ Dall, W. H., Wagner Free Inst. Sci. Trans., vol 3, pt. 2, p. 278, 1892.

Horizon: Suwannee limestone, Oligocene.

Cerithium hernandoensis is closely related to *C. halense* Dall from Hale Landing, 7 miles southeast of Bainbridge, Ga., differing from the latter in having a more slender shell and a more uniform spiral sculpture.

Other occurrences: Station 12321, quarry 3 miles east of Brooksville, Hernando County; station 12758, 5.9 miles northeast of Brooksville (a smaller shell with about one more spiral than the large holotype but probably belongs to the same species); station 12301, 10 miles east of Wacissa, Jefferson County, (fragment; determination not fully established).

CERITHIUM HERNANDOENSIS BLACKWATERENSIS Mansfield, n. subsp.

Plate 6, Figures 1, 2, 4

An external mold representing a large shell appears to have a slightly different sculpture than *Cerithium hernandoensis*, and is here placed under a new subspecies. The shell has four rather strong crenulated spiral bands, the posterior one being a little stronger than the others. There appears to be no fine intercalated finer spirals. A silicified specimen revealing the early part of the shell was collected by Miss Helen I. Tucker from the same locality as the larger specimen. The early whorls are slender and very gradually expand whereas the later whorls expand more rapidly.

Paratype (U. S. Nat. Mus. no. 496577) measures: Greatest diameter, 34.0 mm. The silicified holotype (U. S. Nat. Mus. no. 494951) measures: Height, 50 mm.; greatest diameter, 20 mm.

Type locality: Station 12766, Blackwater River at Seaboard Air Line Railway crossing, Hillsborough County, Fla.

Horizon: Suwannee limestone, Oligocene.

Cerithium hernandoensis blackwaterensis is closely related to *C. vughani* Dall, from station 7074, Flint River, 7 miles southwest of Bainbridge, Ga.

CERITHIUM BROOKSVILLENSIS Mansfield, n. sp.

Plate 7, Figures 3, 5

Shell small, slender, consisting of about 10 whorls in all. Suture depressed. Sculpture on first 7 whorls different from that on the succeeding whorls. Sculpture on early whorls consisting of about 10 strong ribs, 2 of which are varices; the varices extending posteriorly to the suture while the ribs fall short of reaching it. Spiral sculpture of 2 medial, somewhat plicate lines becoming stronger in ascending

the whorl. On the three anterior whorls, the sculpture consists of 2 elevated lamellar, weakly marginally undulated spirals. Body whorl with 5 strong spirals. Aperture not well preserved.

Holotype (U. S. Nat. Mus. no. 495952) measures: Height, 26.2 mm.; greatest diameter, 8.5 mm.

Type locality: Station 11113, quarry half a mile south of Brooksville, Hernando County, Fla.

Horizon: Suwannee limestone, Oligocene.

Occurrence: Type locality (common); station 12322, quarry at Brooksville, Hernando County; station 12758, rock quarry 5.9 miles northeast of Brooksville; station 12318, 5 miles west of Brooksville; station 12317, 10.2 miles northwest of Brooksville; station 12761, highway 2 miles north of Hudson, Pasco County.

CERITHIUM PASCOENSIS Mansfield, n. sp.

Plate 7, Figure 4

Shell rather large, moderately slender; nucleus decollate. Suture deep. Sculpture of early whorls consisting of two weak medial spirals, increasing in number on later whorls to 3 stronger ones and to 4 on the penultimate whorl. Fine spirals are intercalated between the primary ones. No axials are present. Diagonally placed deep pits are on the posterior shoulder slope. Aperture not preserved.

Holotype (U. S. Nat. Mus. no. 495954) measures: Height, 44.5 mm.; greatest diameter, 13.7 mm.

Type locality: Station 12762, prospect pits of Florida Trap Rock mpany, $2\frac{3}{4}$ miles south of Zephyrhills, Pasco County, Fla.

Horizon: Suwannee limestone, Oligocene.

Other occurrences: Blackwater River at crossing of Seaboard Air Line Railway (Tucker); station 12322, quarry at Brooksville, Hernando County; (?) station 11109, $1\frac{1}{2}$ miles north of Live Oak, Suwannee County.

Cerithium pascoensis is related to *C. vaginatum* Dall from the Flint River formation at station 7075, $10\frac{1}{2}$ miles below Bainbridge, Ga., but it has a much larger shell than Dall's species.

CERITHIUM SUWANNEENSIS Mansfield, n. sp.

Plate 7, Figure 2

Shell slender with deep sutures and moderately inflated whorls and sculptured with rather strong axials and spirals. Varices strong. Spiral sculpture consisting of 2 primary lines on the posterior shoulder slope intercalated with a finer spiral; 3 nearly equal-sized and mod-

erately strong spirals on the raised part of the whorl; and usually a weaker spiral at the base of the whorl. All spirals on the spire whorls are crenulated at the intersection with the ribs. Body whorl with 8 spirals; those on the base strong and lamellar and without nodules. Ribs arcuate, separated by a little wider interspaces and extending across the whorl.

Holotype (U. S. Nat. Mus. no. 495953) measures: Height, 35 mm.; greatest diameter, 9 mm.

Type locality: Station 6825, 3 miles west of Live Oak, Suwannee County.

Horizon: Suwannee limestone, Oligocene.

Other occurrence: Station 12308, 1½ miles north of Live Oak, Suwannee County.

CERITHIUM LIVEOAKENSIS Mansfield, n. sp.

Plate 8, Figures 2, 3

Shell rather small, moderately slender; whorls weakly inflated; suture appressed; varices strong. Whorls depressed below the spiral bordering the suture. The sculpture below the depression consisting of 3 to 4 beaded, primary spirals, all intercalated with finer spirals. Base with 4 smooth, strong spirals intercalated with 3 or 4 spiral threads. Axials rather weak, arcuate and separated by narrower interspaces.

Silicified holotype (U. S. Nat. Mus. no. 495947) measures: Height, 27.5 mm.; greatest diameter, 13.5 mm.

Type locality: Station 11109, 1½ miles north of Live Oak, Suwannee County, Fla.

Horizon: Suwannee limestone, Oligocene.

Cerithium liveoakensis is closely related to *C. suwanneensis*, differing from the latter in having a less depressed suture and sculptured with more spirals.

Other occurrence: Station 12299, Walker Spring, Jefferson County.

CERITHIUM aff. C. VAGINATUM Dall

Plate 8, Figure 4

Two imperfect internal molds, one collected at station 12321, quarry 3 miles east of Brooksville, Hernando County, and the other at station 12746, Newland Spring, Suwannee County, appear to belong to the same species and are closely related to *C. vaginatum* Dall from the Flint River formation, 10½ miles below Bainbridge, Ga. The

early whorls on *C. vaginatum* have stronger spirals than the unnamed species but in other features the two are very similar.

The unnamed species is also closely related to an unnamed species (U. S. Nat. Mus. no. 115746) from Blue Springs, Flint River.

Figured specimen: U. S. National Museum no. 495961.

Horizon: Suwannee limestone, Oligocene.

CERITHIUM sp.

Plate 7, Figure 6

An external mold of a *Cerithium* that reveals the posterior end of the spire was collected from the limestone at Willis bridge, Chipola River, Calhoun County, Fla. (station 12727). This mold may represent a new species but not enough of the form of the original shell is known to describe it fully.

The 4 earliest preserved whorls are medially carinated, strongly ribbed, and spirally sculptured with very fine threads which overrun the ribs and the interspaces. On the later whorls, a nodulous spiral appears below and adjacent to the suture and 3 other spirals lie at and below the periphery. *Cerithium burnsi* Dall, a species from the Chipola formation of Florida, has carinated early whorls, but the spiral sculpture on it is much coarser than on the unnamed species.

Figured specimen: U. S. National Museum no. 496228.

Horizon: Tampa limestone, lower Miocene.

Genus POTAMIDES Brongniart, 1810
Subgenus LAMPANELLA Mörch, 1876

POTAMIDES (LAMPANELLA) TRANSECTA Dall

- 1890. *Potamides (Lampanella) transecta* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 189, pl. 11, fig. 7.
- 1892. *Potamides (Lampanella) transecta* Dall, idem, pt. 2, p. 287.
- 1915. *Potamides (Lampanella) transecta* Dall, U. S. Nat. Mus. Bull. 90, p. 91, pl. 14, fig. 3.

Dall described this species in 1890 as follows:

"Shell with an extremely acute tip, which is usually lost, two or three minute, smooth nuclear whorls and about twelve subsequent sharply sculptured whorls; spiral sculpture, between the distinct but not channelled sutures, of four subequal straplike spirals separated by nearly equal channelled interspaces, overriding 17 or 18 narrow, rounded, somewhat flexuous transverse riblets which cross the whorls; the intersections are prominent, but not nodulous, the base is similiary sculptured without riblets; on the later whorls smaller intercalary spiral lines begin to appear; there is a single varix at the end of the first half of the last whorl, but it is not very prominent; the pillar is short and simple, the canal truncate, well defined; the outer lip is slightly thickened, expanded

and internally grooved in harmony with the sculpture; the body has a small subsutural ridge and a thin, reflected callus. Lon. of figured specimen 17.5; max. diam. 8.5 mm.

"This neat little specimen seems not uncommon in the silex beds."

Holotype: U. S. National Museum no. 112525.

Horizon: Tampa limestone, lower Miocene.

Occurrence: Common at the type locality; Sixmile Creek, near Orient (Tucker); station 12300, $1\frac{1}{4}$ miles northeast of Lloyd, Jefferson County; station 12292, Cherokee Sink, Wakulla County; station 12294, 2.5 miles south of Crawfordville, Wakulla County, (much larger specimens than the others and may be a varietal form).

POTAMIDES HILLSBOROENSIS (Heilprin)

1887. *Cerithium hillsboroensis* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 124, pl. 8, fig. 67.
1892. *Potamides hillsboroensis* Heilprin. Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 2, p. 286, pl. 15, fig. 12.
1915. *Potamides hillsboroensis* Heilprin. Dall, U. S. Nat. Mus. Bull. 90, p. 91, pl. 8, fig. 5.

Heilprin described this species in 1887 as follows:

"Shell elevated, of ten or more volutions; suture impressed; whorls ornamented with four clearly defined lines of granulations, the granulations of the top series very large, prominent, and somewhat in the form of tubercles; those of the second line very minute; moniliform and nearly equal on the third and fourth lines, in some cases those of the third line most prominent, in other cases the reverse; surface covered with longitudinal curved creases; base depressed, with some four or five revolving lines; aperture? Length 1.5 inch."

Horizon: Tampa limestone, lower Miocene.

Dall⁸⁷ reports this species from the "silex bed" and also in the overlying limestone; on Chattahoochee River near the railway bridge at Chattahoochee, northwest Florida and in the limestone in Wakulla County. Collected by W. C. Mansfield and F. S. MacNeil from dredgings taken at a depth of 32-36 feet below water level at Hooker Point, upper Hillsborough Bay (station 13848).

I have not seen this species in the limestone in Wakulla County or in the area of Chattahoochee.

The specimens deposited in the U. S. National Museum are as follows: Tampa limestone of Dall (U. S. Nat. Mus. no. 165142), E. J. Post, collector; station 2286, quarry for paving material, near waterworks, Tampa, W. H. Dall, collector; Tampa limestone of Dall gutta-percha impressions of the original mold collected by Heilprin (U. S.

⁸⁷ Dall, W. H., U. S. Nat. Mus. Bull. 90, p. 91, 1915.

Nat. Mus. no. 113370); channel near Ballast Point, Tampa Bay (U. S. Nat. Mus. no. 164700), E. J. Post, collector; external impressions from *Cerithium* rock of Heilprin, Tampa, collected by Joseph Wilcox (U. S. Nat. Mus. no. 112401). The *Cerithium* rock also contains *Potamides cornutus* (Heilprin).

Cerithium "herculeanum" Cooke, a species from Crocus Bay, Anguilla, is very closely related to *P. hillsboroensis* (Heilprin) and perhaps should be considered a subspecies of the latter.

POTAMIDES ASPALAGENSIS Mansfield, n. sp.

Plate 8, Figure 1

Shell rather small, stout, nucleus decollate, with about 10 remaining whorls. Suture appressed against the basal spiral of the preceding whorl. Sculpture of three primary spirals, the posterior two being strongly granulose. The second spiral forms the periphery of the whorl and the basal one on the earlier whorls is nearly concealed by the appressed suture. A spiral thread lies above and below the peripheral spiral. Weak axials, which are retractive above the periphery and protractive below, connect the granules and cross the whorls. Base and aperture not revealed.

Holotype (U. S. Nat. Mus. no. 495962) measures: Height, 21 mm.; greatest diameter, about 13 mm.

Type locality: Station 13841, Aspalaga Bluff, Apalachicola River about 10 feet above a 4-foot clay bed.

Horizon: Tampa limestone, lower Miocene.

Potamides aspalagensis is very closely related to *P. hillsboroensis* (Heilprin) but the latter species has much stronger granules on the spirals.

Subgenus PYRAZISINUS Heilprin, 1887

POTAMIDES (PYRAZISINUS) CAMPANULATUS Heilprin

- 1887. *Potamides (Pyrazisinus) campanulatus* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 115, pl. 16, fig. 59.
- 1890. *Pyrazus (Pyrazisinus) campanulatus* Heilprin. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 189, pl. 11, figs. 10 10a.
- 1892. *Potamides (Pyrazisinus) campanulatus* Heilprin. Dall, idem, pt. 2, p. 288, pl. 15, figs. 2, 6, 10.
- 1915. *Potamides (Pyrazisinus) campanulatus* Heilprin. Dall, U. S. Nat. Mus. Bull. 90, p. 92, pl. 13, figs. 15, 18.

Heilprin described this species in 1887 as follows:

"Shell elevated, rapidly tapering; whorls of spire about 10, convex, obliquely costated, concentrically striated, appearing generally rugose; costae nearly obsolete on the body whorl, which is disfigured by one or more(?) prominent

excrescences or knobs; outer lip effuse, broadly-thickened on the border, with a deep, nearly parallel-sided, sinus; basal border of labrum extending completely over to the columellar surface, enclosing a round siphonal aperture: Length, nearly two inches; width of base, one inch."

Dall⁸⁸ states that:

"This species varies very much in adult size and also in the strength of its transverse sculpture; at the junction of the outer lip with the body it is prolonged upward, callosified and faintly grooved in the middle of the callus, in fully mature specimens. The principal varix is at the end of the first half of the last whorl, and it is often very prominent. The spiral grooving tends to be strongest in front of the suture."

Type locality: "silex beds" at Ballast Point, Tampa Bay, Fla.

Holotype deposited in the Wagner Free Institute of Science, Philadelphia.

Horizon: Tampa limestone, lower Miocene.

Other occurrences: Station 13848, Hooker Point, dredged at 32 to 36 feet; station 13847, Gadsden Point, 4 miles below Ballast Point; station 5000, Sixmile Creek near Orient, Hillsborough County (common); station 12763, Anclote River at Tarpon Springs, Pinellas County; station 12300, 1¼ miles northeast of Lloyd, Jefferson County; station 3420, 15 miles south of Tallahassee, Wakulla County; station 12732, 3.7 miles south of Wakulla Station, Wakulla County; station 12292, Cherokee Sink, Wakulla County; station 13844, Old Chattahoochee Landing, 37 feet above the echinoderm bed.

POTAMIDES (PYRAZISINUS) CORNUTUS Heilprin

- 1887. *Cerithium cornutum* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 124, pl. 8, fig. 68.
- 1892. *Potamides (Pyrazisinus) cornutus* Heilprin. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 288, pl. 15, fig. 3.
- 1915. *Potamides (Pyrazisinus) cornutus* Heilprin. Dall, U. S. Nat. Mus. Bull. 90, p. 92, pl. 8, fig. 1.

Heilprin described this species in 1887 as follows:

"Shell elevated, rapidly tapering, of about 10-12 volutions; whorls convex, strongly costated, the costae (about 7 on the penultimate whorl) oblique and somewhat sigmoidal; body with two (or three?) broadly-spreading prominences or horns, one of which is situated obliquely over the aperture, partially bounding the posterior siphonal canal; aperture oblique, terminating in a short deflected canal; inner lip broadly reflected, partially ensheathing the apertural horn. Length (of imperfect specimen, lacking probably a half-inch or more) 1.8 inch; diameter of base .8 inch; length of horn .3 inch.

"From the Oligocene? formation of the Pithlachascootie River, a short distance above the mouth of that stream; obtained by Mr. Wilcox."

⁸⁸ Dall, W. H. Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 288, 1892.

Holotype deposited in the Wagner Free Institute of Science, Philadelphia.

Horizon: Tampa limestone, lower Miocene.

Other occurrences: Station 7358, Tarpon Springs, Pinellas County; station 12760, half mile west of New Port Richey, Pasco County; station 7361, $3\frac{1}{2}$ miles west of Brooksville, Hernando County (poor specimen, identification uncertain, Suwannee limestone); station 3420, 15 miles south of Tallahassee, Wakulla County.

POTAMIDES (PYRAZISINUS) ACUTUS Dall

1892. *Potamides (Pyrazisinus) acutus* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 289, pl. 22, fig. 19.

1915. *Potamides (Pyrazisinus) acutus* Dall, U. S. Nat. Mus. Bull. 90, p. 92.

Dall described this species in 1892 as follows:

"Shell stout, with an acute spire and 10 or more convex whorls; suture distinct, not deep; nuclear whorls about 3 in number, smooth, subsequent whorls finely spirally striate; transverse sculpture of 12 or more little-elevated, sharpish ribs with much wider interspaces, most prominent near the periphery and obsolete toward the sutures; lines of growth flexuous, not prominent; last half of the last whorl beginning with a strong varix; aperture large, pillar short stout, outer lip exhibiting a prominent callosity where it is attached to the body then receding, then patulous and projecting in front, then sweeping round much prolonged until it touches the varix; inside of the lip smooth or obscurely striated. Alt. 40; max. diam. about 23 mm.

"This remarkable form occurred as a mold in the soft limestone of the Hillsborough River. By sacrificing this mold a tolerable cast of the shell in guttapercha was secured from which the drawing was prepared. It is readily distinguished from the other species of this group by its acute spire and the prolonged sweep of the outer lip."

Horizon: Tampa limestone, lower Miocene.

Holotype: U. S. National Museum no. 112534.

This species has not been recognized outside of its type locality.

Family MODULIDAE

Genus MODULUS Gray, 1847

MODULUS TURBINATUS (Heilprin)

1887. *Pseudotrochus turbinatus* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 114, pl. 16, fig. 57.

1892. *Modulus turbinatus* Heilprin. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 294, pl. 18, fig. 12.

1915. *Modulus turbinatus* Heilprin. Dall, U. S. Nat. Mus. Bull. 90, p. 94, pl. 15, fig. 7.

Heilprin described this species in 1887, as follows:

"Shell doubly turbinate, sloping about equally to base and apex; whorls of the spire crenulated on the angulation immediately above the suture, concentrically

striated; body-whorl sharply angulated and sub-carinated in the middle, the crenulations appearing as pseudocostulations, which are crossed by several transverse lines; base of shell pyramidally convex, concentrically ridged and lined; aperture subrotund, canaliculate; inner lip raised, and forming a border to the umbilical sulcus. Length .8 inch; greatest width, .8 inch."

The holotype is deposited in the Wagner Free Institute of Science, Philadelphia, Pa.

Type locality: "silex bed" at Ballast Point, Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene.

This species has not been recognized outside of its type locality.

MODULUS LIVEOAKENSIS Mansfield, n. sp.

Plate 8, Figure 8

Shell rather small, with a broadly conic spire and a subconic and full base. Nucleus poorly preserved but apparently consisting of one smooth, rather broadly coiled whorl. Suture on postnuclear whorls depressed. Spire sculpture on the penultimate whorl consisting of 8 moderately strong, spiral lines, the posterior two and the three basal ones more closely spaced than the others; and of undulations or short ribs which are strongest at the periphery and much weaker or obsolete on the posterior part of the whorl. Base with about 5 rather widely spaced spirals connected by faint growth structures.

Holotype (U. S. Nat. Mus. no. 495955) measures: Height, 18 mm.; greatest diameter, 15 mm.

Type locality: Station 11109, old Lyle quarry, 1½ miles north of Live Oak, Suwannee County, Fla.

Horizon: Suwannee limestone, Oligocene.

The holotype and all specimens consist of impressions taken from molds of the outside of the shell. The aperture is not preserved.

Modulus liveoakensis shows some relationship to *Modulus tamanensis* Maury from the lower Miocene of Trinidad, B. W. I., but differs from the latter species in lacking the strong posterior spiral.

Family CAECIDAE

Genus CAECUM Fleming, 1813

CAECUM, species indeterminable

Dall⁸⁹ referred a small, corroded specimen (U. S. Nat. Mus. no. 113396) from Ballast Point, Tampa Bay, Florida, to *Caecum solitarium* O. Meyer. The specimen is too poorly preserved to determine the species with any certainty.

⁸⁹ Dall, W. H., U. S. Nat. Mus. Bull. 90, p. 95, 1915.

Family VERMETIDAE
Genus SERPULORBIS Sassi, 1827

SERPULORBIS BALLISTAE Dall

1892. *Serpulorbis (granifera* var.?) *ballistae* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 304, pl. 22, fig. 21.
1915. *Serpulorbis ballistae* Dall, U. S. Nat. Mus. Bull. 90, p. 95, pl. 14, fig. 4.

Dall described this species in 1892 as follows:

"Shell thin, rather rapidly enlarging, adherent, but with nearly circular section; sculpture of incremental lines and longitudinal riblets, of which the primaries are larger and granulated as in *granifera*, but instead of having the secondaries granulated and alternate, there are between each pair of primaries four or five simple secondary or smaller and subequal threads. A specimen about 60 mm. long has a diameter at the aperture of 8 mm."

Holotype: U. S. Nat. Mus. no. 112579.

Type locality: "silex bed" at Ballast Point, Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene.

SERPULORBIS GRANIFERA (Say)?

Dall⁹⁰ referred one specimen (U. S. Nat. Mus. no. 165113) from the "silex bed" at Ballast Point, Tampa Bay, Fla., to *Serpulorbis granifera* (Say). *Serpulorbis granifera* (Say) was reported to have come from Maryland, but no specific locality was given; therefore, the formation in the Chesapeake group from which the type was obtained is unknown. The specimens usually referred to *Serpulorbis granifera* (Say) have primary, secondary, and tertiary longitudinal sculpture. The Tampa specimen has incremental lines of growth and very fine longitudinal threads, a sculpture unlike that on *S. granifera* (Say). Another specimen (U. S. Nat. Mus. no. 112578) from the "silex bed" is fairly well preserved. The sculpture on this specimen is somewhat like that on *S. granifera* (Say) and may be that species.

A fragment belonging to the genus *Serpulorbis*, collected at station 12763, Anclote River, at Tarpon Springs, Pinellas County, appears to be the same as the specimen from Ballast Point questionably referred to *Serpulorbis granifera* Say.

Horizon: Tampa limestone, lower Miocene.

Genus PETATOCONCHUS H. C. Lea, 1845

PETATOCONCHUS VARIANS D'Orbigny?

Dall⁹¹ referred corroded specimens (U. S. Nat. Mus. no. 112581) from the "silex bed" of the Tampa limestone at Ballast Point, Tampa Bay, Florida, to *Petatoconchus varians* D'Orbigny. The Tampa spec-

⁹⁰ Dall, W. H., U. S. Nat. Mus. Bull. 90, p. 95, 1915.

⁹¹ Dall, W. H., U. S. Nat. Mus. Bull. 90, p. 96, 1915.

imens somewhat resemble *P. varians* D'Orbigny and may be that species, but I am uncertain of Dall's identification.

Genus *SILICUARIA* Lamarck, 1799

***SILICUARIA TAMPENSIS* Mansfield, n. sp.**

Plate 8, Figures 5, 6, 7

1892. *Silicuarina vitis* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 307 (part, not *S. vitis* Conrad, 1833).
1915. *Silicuarina vitis* Dall, U. S. Nat. Mus. Bull. 90, p. 97 (part, not *S. vitis* Conrad, 1833).
1915. *Serpulorbis decussatus* Dall, idem, p. 96 (not *S. decussatus* Gmelin).

Silicuarina tampensis differs from *S. vitis*, a species from the Eocene, Claiborne group, in having a much thinner shell, and more closely spaced longitudinal sculpture on the early part of the shell. Young specimens of the new species have fine longitudinal lines on the inside of the coil and about 8 stronger ones on the outside. The longitudinal lines are somewhat granular and may have originally borne short spines. So far as known, the Tampa specimens never attained the length of the Eocene species.

Cotypes: U. S. National Museum no. 165112.

Type locality: "silex beds" at Ballast Point, Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene.

Other occurrence: One specimen preserved as a siliceous pseudomorph and collected from an abandoned quarry, one half mile south of River Junction at an elevation around 150 feet above sea level, Gadsden County, Fla., belongs to the genus *Silicuarina* and may be the same as the new species here described.

Family TURRITELLIDAE

Genus *TURRITELLA* Lamarck, 1799

***TURRITELLA TAMPAE* Heilprin**

1887. *Turritella tampae* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 113, pl. 8, fig. 53.
1892. *Turritella tampae* Heilprin. Dall, Wagner Free Inst. Trans., vol. 3, pt. 2, p. 309, pl. 17, fig. 3.
1915. *Turritella tampae* Heilprin. Dall, U. S. Nat. Mus. Bull. 90, p. 97, pl. 14, fig. 1.

Heilprin described this species in 1887 as follows:

"Shell moderately elevated, the whorl flattened, slightly impressed in the middle, and becoming discontinuous at about a distance of an inch and a half below the apex; revolving lines distinct on the upper whorls, becoming more or less obsolete on the basal ones, except those in the medial impressed furrow, where they remain distinct, appearing somewhat crowded, and alternate in degree of coarseness; aperture subquadrangular, base convex. Length?"

Holotype deposited in the Wagner Free Institute of Science, Philadelphia.

Dall⁹² in discussing *T. tampae* Heilprin writes:

"In good condition the species may be recognized by the separation at the suture of the later whorls and by the following sculpture: At the base of the whorl two little-elevated primary threads about a millimeter apart, the interspace sharply spirally striated; behind the posterior primary the whorl is constricted, and covered thence to the suture by about six to eight spiral primaries with narrower, deep interspaces, the whole finely, evenly undulated by fine, regular, sometimes almost imbricated lines of growth. The posterior margin of the suture, when not discontinuous, is slightly more prominent. The base is flattish and spirally striate. The dimensions are 75 by 16 mm."

In *T. tampae* the second spiral from the base is usually stronger than the basal one in the earlier whorls.

Type locality: "silex beds," Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene.

Occurrence: Type locality (common); station 2470, one mile west of Bartow, Polk County; Sixmile Creek, near Orient, Hillsborough County; station 11115, upper bed at Kendrick, Marion County; station 11186, midway between Lowell and Sparr, Marion County; station 7353, midway between Anthony and Martin, Marion County; station 12732, 3.7 miles south of Wakulla, Wakulla County; station 3406, lowest bed at Aspalaga Bluff, Gadsden County; station 12292, Cherokee Sink, Wakulla County; station 12735, 11 miles south of Tallahassee, Leon County.

TURRITELLA TAMPAE MEDICONSTRICTA Dall

1915. *Turritella (tampae* var.?) *mediconstricta* Dall, U. S. Nat. Mus. Bull, 90, p. 98, pl. 13, fig. 3.

Dall described this subspecies as follows:

"Shell slender, acute, with age showing a tendency to loose coiling of the whorls, which are then constricted in the middle; number of the whorls in the figured specimen, 16, the nucleus lost, the subsequent whorls rounding to the suture, with two low spiral keels, each about one-fourth of the axial width of the whorl, from the most adjacent suture; between these the whorl is excavated and shows at first one (the number gradually increasing to five on the last whorl) small rounded closely adjacent spiral threads, separated only by a narrower groove; aperture with a wide rounded excavation of the outer lip, the deepest part of which is slightly above the middle of the whorl; the basal portion of the lip is also moderately excavated, and between the two the portion at the anterior keel of the whorl projects most prominently, though distally rounded

⁹² Dall, W. H., Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 309, 1892.

off. Length of shell 59, axial length of last whorl 11, maximum diameter 15 mm.

"Tampa silex beds at Ballast Point, Tampa Bay, Florida, E. J. Post. U. S. Nat. Mus. No. 165122."

This form is very similar to *T. tampae* Heilprin, differing from the latter in having the two basal spiral cords very weak or nearly obsolete, especially on the later whorls, instead of more strongly developed as on *T. tampae*.

Horizon: Tampa limestone, lower Miocene.

Occurrence: Type locality (rare); not recognized outside of its type locality.

TURRITELLA PAGODAEFORMIS Heilprin

1887. *Turritella pagodaeformis* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 112, pl. 8, fig. 52.

1892. *Turritella tampae pagodaeformis* Heilprin. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 310, pl. 17, fig. 9 (fidé Dall).

1915. *Turritella tampae pagodaeformis* Heilprin. Dall, U. S. Nat. Mus. Bull. 90, p. 98, pl. 14, fig. 8 (fidé Dall).

1915. *Turritella systoliata* Dall, U. S. Nat. Mus. Bull. 90, p. 99, pl. 9, fig. 6.

Heilprin described this species in 1887 as follows:

"Shell gently elevated, gradually tapering; whorls numerous, hollowed medially, with an expanded base, which projects considerably beyond the boundary of the whorl upon which it rests, and forms a series of well marked carinations, a secondary carination above the basal one, followed (in the direction of the apex) by two prominent, faintly beaded, lines and several less prominent ones in the hollow of the whorl, and these again by several alternately placed lines of less value; aperture quadrangular; base flat. Length of longest fragment, three inches; greatest width .7 inch."

Holotype is deposited in Wagner Free Institute of Science, Philadelphia.

Type locality: "silex beds," Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene.

In this species the basal spiral is strongest throughout.

Occurrence: Type locality, common; station 12293, Wakulla Railroad Station, Wakulla County; station 7169, Old Chattahoochee Landing at elevation 122.5-124 feet above sea level (mold of one whorl, identification not fully determined).

TURRITELLA MEGALOBASIS Dall

Plate 9, Figure 8

1892. *Turritella megalobasis* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 310, pl. 17, fig. 11.

1915. *Turritella megalobasis* Dall, U. S. Nat. Mus. Bull. 90, p. 98, pl. 14, fig. 6.

Dall described this species in 1892 as follows:

"Shell large, broad at the base, conical, with rather faint sculpture and slightly overhanging, not discontinuous, whorls; whorls (decollate) nine or more, compact covered with fine, dense, uniform, often wavy or vermiculate, nearly microscopic sculpture; whorls broadest at the base, where the margin overhangs the suture and presents a prominent rounded, rib-like edge; behind this, at not less than a third of the width of the whorl, are from three to eight little-elevated primary spirals irregularly spaced, and slightly undulated by the incremental lines; suture distinct, not channelled; sculpture fainter on the upper whorls; base flattish, slightly concave near the edge, spirally striate; aperture subquadrate with a moderate equatorial sinus. Lon. of specimen figured 64 mm.; max. diam. of base 28 mm.

"The young have the base extremity concave and the pillar thin, arcuate, and so short that the aperture seems subtriangular. The full grown shell is the widest species in proportion to its height that I know of, recent or fossil. It seems to be quite rare in the silex beds."

Holotype: U. S. National Museum no. 112596.

Type locality: "silex beds" at Ballast Point, Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene.

Other occurrence: Station 12300, 1¼ miles northeast of Lloyd. Jefferson County; station 7080, half mile south of River Junction at an elevation around 150 feet above sea level; station 12292, Cherokee Sink, Wakulla County (poor specimen, identification not confirmed).

TURRITELLA MEGALOBASIS TRIPARTITA Dall

1892. *Turritella tampac tripartita* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 309.
1915. *Turritella tampac tripartita* Dall, U. S. Nat. Mus. Bull. 90, p. 97, pl. 5, fig. 1.

Dall described this form in 1892 as follows:

"Shell with the equatorial constriction marginate on both sides with a primary, and one marginating the suture behind; the other primaries obsolete, the fine spiral striation remaining. The surface of the whorl is thus divided into three equal striated bands separated by two prominent threads.

"Two specimens were found among those collected at Ballast Point."

The dimensions of the holotype (U. S. Nat. Mus. no. 112588) are: Length, 43 mm.; greatest diameter, 11 mm.

Type locality: "silex beds" at Ballast Point, Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene.

T. tripartita is closely related to *T. megalobasis* Dall, differing from the latter in having a slimmer shell.

TURRITELLA LITHARIA Dall

1915. *Turritella litharia* Dall, U. S. Nat. Mus. Bull. 90, p. 99, pl. 13, fig. 2.

Dall described this species as follows:

"Shell small, slender, the type-specimen with 9 whorls, the apex being decollate; sculpture of the early whorls composed of lines of growth crossed by two spiral ridges equidistant from the suture and each other; the anterior margin of the whorls at the suture is angulate, gradually becomes prominent and finally functions as a third spiral ridge; all these ridges are closely, minutely beaded with the interspaces nearly smooth; on the last whorl there is a small beaded thread close behind the posterior spiral; base flattish or even somewhat excavated and nearly smooth; aperture defective, the sulcus of the outer lip rounded, deepest near the posterior spiral ridge. Length 19, maximum diameter 4.5 mm.

"Tampa silex beds at Ballast Point, Tampa Bay, Florida, one specimen. U. S. Nat. Mus. No. 165118.

"This is doubtless a young shell, but it differs from the young of any of the species yet known from this horizon."

Horizon: Tampa limestone, lower Miocene.

This species also occurs at Bartow, Polk County.

TURRITELLA ATACTA Dall

1892. *Turritella gatunensis* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 310, pl. 17, fig. 10 (not of Conrad).

1915. *Turritella atacta* Dall, U. S. Nat. Mus. Bull. 90, p. 100, pl. 14, fig. 5.

Dall described this species in 1915 as follows:

"This species resembles rather closely Conrad's description of *T. uvasana* (but not his figure, which is a mere caricature) and the Costa Rica species recently named *tristis* by Brown and Pilsbry, which was figured by Gabb in 1878, under the name *gatunensis*. A careful review of the available material leads to the belief that it is distinct from either. Anyone who will compare either of Gabb's figures with the original diagnosis of *T. uvasana* will certainly find them irreconcilable. The figure on plate 13 [fig. 5] represents what may be a variety.

"The shell is slender (13 whorls to 26 mm.) with a rather indistinct suture. The top of the whorls flattish or slightly excavated with 3 or 4 medium spiral threads with a much finer thread in the interspaces; the rest of the whorl with 3 prominent major threads, equidistant and with 2 or 3 smaller threads in the intervals; the base slightly convex with 1 major and numerous minor spiral threads; aperture subquadrate, the outer lip somewhat flexuous; length of type-specimen [pl. 14, fig. 5] (13 whorls) 26 mm., breadth 6 mm.

"Tampa silex beds at Ballast Point, Tampa Bay, Florida, U. S. Nat. Mus. No. 165123 [Pl. 13, fig. 5].

"The shell figured as *T. uvasana* by Gabb in the Palaeontology of California has rather prominently rounded whorls with 5 or more subequal, equally distributed spiral threads, and there is a California species with these characters, but the diagnosis of *T. uvasana* calls for quite different characters. *T. gatunensis*

Conrad has been shown by Pilsbry to be quite distinct. The *tristis* of Pilsbry and Brown should be carefully compared with *uvasana* Gabb not Conrad.

"*T. atacta* belongs in the group with *T. acropora* Dall of the Pliocene."

Holotype: U. S. National Museum no. 165117.

Type locality: "silex beds" at Ballast Point, Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene.

Other occurrence: Sixmile Creek, near Orient Station, Hillsborough County, Fla. (Tucker).

TURRITELLA TARPONENSIS Mansfield, n. sp.

Plate 9, Figures 1, 2

Shell of medium size, rather slender; nuclear whorls on all specimens missing. Whorls medially depressed; suture rather deep. The sculpture on the earlier whorls consisting of 5 beaded spirals; the spiral in the medial depression being the weaker; the posterior spiral and the fourth are about the same strength; the second and basal spiral are about equal in strength and stronger than the others. On the later whorls a weak spiral comes in between the basal spirals and one or more comes in on either side of this medial spiral.

Cotypes: U. S. National Museum no. 495957.

Type locality : Station 12763, Anclote River at Tarpon Springs, Pinellas County, Fla.

Horizon: Tampa limestone, lower Miocene.

This species is related to *T. tampae* Heilprin but the two posterior spirals on the early whorls are more strongly developed than on *T. tampae*.

The specimen identified by Cooke⁹³ as *Turritella ceibana* Cooke from Antigua is closely related to *T. tarponensis*.

TURRITELLA BOWENAE Mansfield, n. sp.

Plate 9, Figure 3

Shell of moderate size, rather stout, consisting of about 15 whorls; nucleus decollate. Whorls nearly straight; suture lowly depressed. Sculpture of penultimate whorl, beginning at the base, consisting of two equal sized primary spirals about 1 mm. apart, the lower one marginating the suture; a smaller spiral at the upper third and two smaller spirals above and below this spiral. Primary and secondary spirals and interspaces are overrun by tertiary spiral threadlets. The narrow area below the suture is marked only with tertiary threadlets. A very

⁹³ Cooke, C. W., U. S. Nat. Mus. Proc., vol. 73 Art. 10, p. 7, 1928.

low depression is behind the lower pair of primaries. In ascending the whorl, two spirals, one at the upper third and the other at the lower third of the whorl persist with a shallow depression between them.

Holotype (U. S. Nat. Mus. no. 495956) measures: Height, 60 mm.; greatest diameter, 19 mm.

Type locality: Blackwater Creek at Seaboard Air Line Railway crossing, Hillsborough County, Fla. Probably from the lower part of the section.

Horizon: Suwannee limestone, Oligocene.

This species differs from *Turritella tampae* in having a narrower and shallower equatorial constriction which is ornamented with much finer spirals. *Turritella tripartita* Dall has a much weaker spiral above the basal one and a more concave equatorial area. The new species is closely related to *T. halensis* Dall from Hale Landing, Flint River, differing from the latter in having a less depressed equatorial area.

Occurrence: Station 7356, one mile north of Hudson, Pasco County; station 12761, 2 miles north of Hudson, Pasco County; station 13853, 14.5 miles nearly west of Brooksville; station 12322, quarry at Brooksville, Hernando County; station 12318, 5 miles west of Brooksville; station 12758, 5.9 miles northeast of Brooksville; station 12318, 2 miles south of Brooksville; station 12321, 3 miles east of Brooksville; station 12762, $2\frac{3}{4}$ miles south of Zephyrhills, Pasco County.

The species is named in honor of Miss Nell L. Bowen of the U. S. Geol. Survey.

TURRITELLA HILLSBOROENSIS Mansfield, n. sp.

Plate 9, Figure 4

Shell slender, small, with 6 remaining whorls; early whorls missing. Whorls nearly flat; suture shallowly depressed. Sculpture on the penultimate whorl of five narrow spiral threads, the posterior two being a little weaker and more closely placed. There are about two secondary spirals below the suture and two to four between the primary spirals. Base sculptured only with secondary spirals. Aperture imperfect.

The holotype (U. S. Nat. Mus. no. 495959) measures: Height, 23 mm.; greatest diameter, 6 mm.

Type locality: Blackwater Creek at Seaboard Air Line Railway crossing, Hillsborough County, Fla. Helen I. Tucker, collector.

Horizon: ?Tampa limestone, lower Miocene.

Turritella hillsboroensis differs from *T. atacta* Dall in having one or two more primary threads. It somewhat resembles *T. forresti* Brown from Antigua.

TURRITELLA BLACKWATERENSIS Mansfield, n. sp.

Plate 9, Figure 5

Shell small, moderately slender, with 8 remaining whorls; nucleus decollate. Suture depressed; whorls weakly inflated. Earliest whorls medially carinated. Later whorls sculptured with two sharp equal-sized spirals, the upper one located at the middle of the whorl and the other near the base; and closely spaced fine spirals between the primaries and over the rest of the whorl. Base and aperture not well preserved.

Holotype (U. S. Nat. Mus. no. 495958) measures: Height, 16 mm.; greatest diameter, 4.7 mm.

Type locality: Blackwater Creek at crossing of Seaboard Air Line Railway, Hillsborough County, Fla.

Horizon: ?Tampa limestone, lower Miocene.

TURRITELLA cf. T. HALENSIS Dall

Plate 9, Figure 6

An external mold collected at station 11109, 1½ miles north of Live Oak, Suwannee County, Fla., compares with *T. halensis* Dall, a species described from Hale Landing on the west bank of Flint River, 7 miles southeast of Bainbridge, Ga. The equatorial area is deeper than on specimens referred to *T. bowenae*, n. sp.

Turritella anguillana Cooke, from Crocus Bay, Anguilla, appears to be closely related to the undetermined species.

Figured specimen: U. S. National Museum no. 496230.

Horizon: Suwannee limestone, Oligocene.

Family ASSIMINIIDAE

Genus ASSIMINEA (Leach Ms.) Fleming, 1828

ASSIMINEA ALDRA Dall

1915. *Assiminea aldra* Dall, U. S. Nat. Mus. Bull. 90, p. 101, pl. 5, fig. 9.

Dall described this species as follows:

"Shell minute, of about 5 moderately rounded whorls with a distinct suture; spire tapering evenly to a somewhat blunt apex; surface smooth; last whorl more than half the length of the shell; aperture rounded ovate, peristome mod-

erately thickened not reflected, a well marked layer of callus on the body; umbilical region imperforate. Height 2, maximum diameter 1 mm.

"Tampa silex beds, at Ballast Point, Tampa Bay, Florida. One specimen, E. J. Post, U. S. Nat. Mus. No. 166106.

"This is perhaps the oldest member of the genus which is reported from the Pliocene or Pleistocene only, as far as I can ascertain."

Horizon: Tampa limestone, lower Miocene.

This species has not been recognized outside of its type locality.

Family RISSOINIDAE

Genus RISSOINA D'Orbigny, 1840

RISSOINA SUPRALAEVIGATA Dall

1915. *Rissoina supralaevigata* Dall, U. S. Nat. Mus. Bull. 90, p. 101, pl. 13, fig. 1.

Dall described this species as follows:

"Shell small, smooth, subacute, with about 7 flattish whorls separated by a feebly defined suture; nuclear whorl defective, the remainder gradually increasing; last whorl rounded on the base, with a thick pillar lip; outer lip protractively arcuate, markedly receding toward the suture, slightly thickened; body with no perceptible callus in the specimen. Length 5.5 mm., maximum diameter 2 mm.

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

"Type-specimen from the Post collection, U. S. Nat. Mus. No. 165125."

Horizon: Tampa limestone, lower Miocene.

This species has not been recognized outside of its type locality.

Genus AMNICOLA Gould and Haldeman, 1841

AMNICOLA ADESTA Dall

1915. *Amnicola adesta* Dall, U. S. Nat. Mus. Bull. 90, p. 102, pl. 1, fig. 7.

Dall described this species as follows:

"Shell minute, smooth with 5 whorls; nucleus minute not differentiated from the succeeding whorls, rather blunt; whorls plumply rounded with a deep suture between them; at the end of the penultimate whorl is a constriction marking the place of a former resting stage; aperture sublunate, peritreme complete, simple, slightly thickened, pillar lip slightly separated from the body whorls with a chink behind it, extending across the body to the posterior sutural commissure of the aperture; base rounded. Height 3.2, maximum diameter 1.7 mm.

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

"One specimen from the Post collection, U. S. Nat. Mus. No. 165023."

Horizon: Tampa limestone, lower Miocene.

This species has not been recognized outside of its type locality.

Family CALYPTRAEIDAE

Genus CRUCIBULUM Schumacher, 1817

CRUCIBULUM CONSTRICTUM (Conrad)?

Dall⁹⁴ identified two small, corroded specimens (U. S. Nat. Mus. no. 112597) from the "silex beds" of the Tampa limestone at Ballast Point, Tampa Bay, Fla., as *Crucibulum (Dispotaea) constrictum* (Conrad).

Crucibulum constrictum (Conrad) has rather coarse radiating ribs, especially prominent on the upper part of the shell. About half of the margin of the inner cup adheres to the wall. The type locality of the species is Hance's Landing, Calvert Cliffs, Md.

The Tampa specimens may belong to *C. constrictum* (Conrad), but I think the identification should be questioned until better specimens from this locality are obtained.

Genus CALYPTRAEA Lamarck, 1799

CALYPTRAEA TROCHIFORMIS Lamarck?

Two imperfect specimens (U. S. Nat. Mus. no. 112598) from the "silex bed" of the Tampa limestone at Ballast Point, Tampa Bay, Fla., were identified by Dall⁹⁵ as *Calyptrea trochiformis* Lamarck. These specimens may be correctly identified, but I think the identification should be questioned until better specimens are obtained from this locality. Specimens mainly preserved as internal molds and belonging to the genus *Calyptrea*, which may or may not belong to the same species as the Tampa specimens, have been collected from the following localities in Florida: Tampa limestone, station 2470, 1 mile north of Bartow, Polk County (large specimens); station 12763, Anclote River at Tarpon Springs, Pinellas County; station 12753, upper bed at Kendrick, Marion County; station 12292, Cherokee sink, Wakulla County; station 12726, 2.2 miles north of Willis bridge, Calhoun County; station 3414, vicinity of River Junction, Gadsden County; station 12285, quarry one-half mile south of River Junction at an elevation around 150 feet above sea level. Suwannee limestone, station 10513, 7 miles north of Brooksville, Hernando County; station 11109, 1½ miles north of Live Oak, Suwannee County; station 6827, Bass, Columbia County.

⁹⁴ Dall, W. H., U. S. Nat. Mus. Bull. 90, p. 102, 1915.

⁹⁵ Dall, W. H., U. S. Nat. Mus. Bull. 90, p. 103, 1915.

Family HIPPONICIDAE

Genus HIPPONIX deFrance, 1819

HIPPONIX WILLCOXII Dall

1892. *Amalthea willcoxii* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 359, pl. 17, fig. 6.
1915. *Hipponix willcoxii* Dall, U. S. Nat. Mus. Bull. 90, p. 104, pl. 16, fig. 7.

Dall described this species in 1892 as follows:

"Shell small conical (the nucleus lost), slightly dextrally twisted, sculptured with numerous regular concentric ridges over which radiating riblets proceed from near the apex to the base, becoming somewhat tubercular at the intersections; apex in the posterior fourth, elevated; base oval; margin slightly crenulated by the sculpture or simple; muscular impressions as usual in the genus. Alt. of shell 5.5; transverse diam. of base 6.0; long. of base 9.0 mm.

"This very pretty little species is quite distinct from any of the other species recent or fossil of the region. It is perhaps nearest to *A. subrufa* (Lam.) Cpr. of the Antilles. I refer it to *Amalthea* rather than *Capulus*, on account of the irregularities of the basal margin and the bluntness of the apex which agree better with the former genus than with the latter."

Holotype: U. S. National Museum no. 112603.

Type locality: "silex beds" at Ballast Point, Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene.

This species, as pointed out by Dall, is nearest *Hipponix subrufa* Lamarck, a living species from the West Indies and Florida.

HIPPONIX TAMPENSIS Mansfield, n. sp.

1915. *Hipponix pygmaeus* Dall, U. S. Nat. Mus. Bull. 90, p. 104, pl. 13, figs. 12-14. (In part, not *Hipponix pygmaeus* Lea, 1833.)

Dall described the specimen from the Tampa "silex beds" at Ballast Point, Tampa Bay, Fla., as follows:

"Shell small, solid, convex, with a deeply incurved posterior apex forming a little more than one whorl; nucleus smooth, the remainder of the shell radially sculptured with numerous flattened threads, which project slightly at the margin and the various resting stages and are separated by slightly wider interspaces, most of which contain a single, much finer intercalary thread; the radial sculpture is crossed by numerous subimbricating incremental lines or resting stages, which in the earlier portion of the shell are rather regularly spaced and produce a reticulated effect; base rounded ovate with a thick margin, more or less crenulated by the radial sculpture. Length of shell 9.2, of aperture 7, height 5, maximum breadth 7 mm.

"Eocene of Claiborne, Alabama, Lea; Oligocene of Tampa silex beds, Ballast Point, Tampa Bay, Florida.

"Figured specimen from the Post collection, U. S. Nat. Mus. No. 165127.

Horizon: Tampa limestone, lower Miocene.

Hipponix pygmaeus Lea from sands in the Claiborne group of Eocene age is much smaller and has much finer radial sculpture than

Hipponix tampensis. *H. tampensis* more closely resembles *H. subrufa* Lamarck, a living species, than the Eocene species.

Outside of the type locality one specimen of the new species has been collected from "Wacissa," Jefferson County, Fla.

Family XENOPHORIDAE

Genus XENOPHORA Fischer de Waldheim, 1807

XENOPHORA CONCHYLIPHORA Born?

Xenophora conchyliphora Born, a living West Indian species, was reported by Dall⁹⁶ from the "silex bed" at Ballast Point, Tampa Bay, Fla. The sculpture on the base of the best preserved specimen from the "silex bed" appears to be very similar to that on living shells. A synonymy is omitted.

Poorly preserved specimens belonging to the genus *Xenophora* occur in the Suwannee limestone (Oligocene) at the following localities in Florida: Station 12322, quarry at Brooksville, Hernando County; station 12757, quarry 10.2 miles northwest of Brooksville; station 12318, 5 miles west of Brooksville; station 12758, 5.9 miles northeast of Brooksville; station 6825, 3 miles west of Live Oak, Suwannee County; station 11109, 1½ miles north of Live Oak.

Family NATICIDAE

Genus POLINICES Montfort, 1810

Subgenus EUSPIRA Agassiz, 1842

POLINICES (?EUSPIRA) HEMICRYPTUS Gabb

- 1860. *Natica hemicrypta* Gabb, Acad. Nat. Sci. Philadelphia Jour., vol. 4, 2d ser., p. 375, pl. 67, fig. 5.
- 1894. *Natica (Lunatia) hemicrypta* Gabb. Whitfield, U. S. Geol. Survey Mon., vol. 24, p. 118, pl. 22, figs. 1-5.
- 1915. *Polinices (Euspira) hemicryptus* Gabb. Dall, U. S. Nat. Mus. Bull. 90, p. 106, pl. 9, fig. 9 (part, specimens from the Chipola formation excluded).

Gabb described this species in 1860 as follows:

"Globose; whorls four, rounded; spire elevated, suture faint; mouth rounded; callosity small, partly covers the umbilicus, which is deep, surface smooth."

The type locality of this species is near Shiloh, Cumberland County, N. J.

The form from the Chipola formation which Dall united with *Polinices hemicryptus* has an ascending sulcus and an obscure rib on the umbilicus.

⁹⁶ Dall, W. H., U. S. Nat. Mus. Bull. 90, p. 105, pl. 15, figs. 1, 3, 1915.

Other occurrences: Calvert formation and Choptank formation (zone 17) of Maryland (Martin). "Silex bed," Ballast Point, Tampa Bay, Fla. (Tampa limestone, lower Miocene).

Genus *TECTONATICA* Sacco, 1890

***TECTONATICA? FLORIDANA* Dall**

1892. *Natica* (*Cryptonatica*) *floridana* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 366, pl. 17, fig. 5 (part, specimens from the Chipola formation excluded).
1915. *Natica* (*Cryptonatica*) *floridana* Dall, U. S. Nat. Mus. Bull. 90, p. 106, pl. 16, fig. 3 (part, specimens from the Chipola formation excluded).

The shell is small, low-spined and consists of $3\frac{1}{2}$ whorls in all. Suture appressed. Shell smooth except for incremental growth lines. Body whorl rounded above and below and composes most of the shell. Aperture hemicircular, widest above; columellar side nearly straight. Umbilicus rather wide, nearly filled with a rather heavy callus which rounds into a small chink on the left side and extends backward, externally, to the commissure of the outer lip and internally over the body wall.

Holotype (U. S. Nat. Mus. no. 112857) measures: Height 8.0 mm.; greatest diameter, 6.5 mm.

Type locality: Station 2084, "silex bed," Ballast Point, Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene.

The description given by Dall for "*Natica*" *floridana* apparently was based on specimens from the "silex bed," although the dimensions given for this shell (height, 16.5 mm. and diam. 17.0 mm.) are about twice that of the holotype. The species is here referred tentatively to the genus *Tectonatica* Sacco, though it is larger than forms usually referred to this genus.

Tectonatica? floridana Dall differs from the Chipola form that Dall united with it in having a more rounded shoulder and base.

This species has not been recognized outside of its type locality.

Genus *PACHYCROMMIUM* Woodring, 1928

***PACHYCROMMIUM FLORIDANA* (Dall) (= *P. guppyi* (Gabb)?)**

1887. *Amaura guppyi* (Gabb). Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 112 (? not *P. Guppyi* Gabb, 1873).
1892. *Polinices* (*Amauropsis*) (*guppyi* Gabb var.?) *floridana* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 378.
1915. *Amauropsis floridana* Dall, U. S. Nat. Mus. Bull. 90, p. 108, pl. 5, fig. 11.

Dall⁹⁷ wrote:

"In the Florida shell, all the specimens examined have the whorl in front of the suture distinctly flattened, and the spire averages about one-half of the length of the mouth."

The writer sees no difference between the specimens from the "silex bed" at Ballast Point, Tampa Bay, Fla., named by Dall as *P. floridana* and the West Indian specimens referred to *P. guppyi* (Gabb). However, I have retained Dall's name for the present, though it may later prove to be a synonym of Gabb's species.

Woodring⁹⁸ gives the geologic range of *P. guppyi* (Gabb) as Lower Miocene (Baitoa formation) into middle Miocene (Gurabo formation).

Occurrence elsewhere in Florida: Sixmile Creek, near Orient, Hillsborough County (H. I. Tucker).

Genus AMPULLINA Bowdich, 1822

AMPULLINA FLINTENSIS Mansfield, n. sp.

Plate 10, Figure 3

1916. *Ampullina solidula* Dall, U. S. Nat. Mus. Proc., vol. 51, p. 518, pl. 85, fig. 9 (not *A. solidula* Dall, 1892).

Shell rather solid, subovate, with a moderately low spire consisting of about 5 whorls in all. Suture depressed and rather wide, but not square-bottomed. Body whorl rounded. Aperture semi-circular, wider below; outer margin arched, inner margin nearly straight. Inner lip provided with a rather heavy callus. Umbilicus open and rather large, the siphonal fasciole extends backward a short distance behind the umbilicus on the base of the whorl and the outer margin on the left side runs nearly parallel with the edge of the outer lip.

The character of the umbilicus is similar to *Ampullina depressa* Lamarck, an Eocene species from the Paris Basin, but the spire is higher and the suture is much deeper than the Eocene species.

Holotype (U. S. Nat. Mus. no. 166795) measures: Height, 40.1 mm.; greatest diameter, 31.3 mm.

Type locality: Station 3295, Russell Spring, Flint River, 4 miles south of Bainbridge, Decatur County, Ga.

Horizon: Georgia, Flint River formation, Oligocene; Florida, Suwannee limestone, Oligocene.

⁹⁷ Dall, W. H., Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 378, 1892.

⁹⁸ Woodring, W. P. Miocene mollusks from Bowden, Jamaica, pt. 2: Carnegie Inst. Wash. p. 394, 1928.

Occurrences in Georgia: Type locality, common; station 3388, upper bed at Red Bluff, 7 miles above Bainbridge, Decatur County; station 7075, east bank of Flint River, just above Lambert's Island, 10½ miles below Bainbridge.

Occurrences in Florida: Station 6774, Rock Island, half a mile above White Springs, Columbia County; station 11109, 1½ miles north of Live Oak, Suwannee County; Blackwater Creek at crossing of Seaboard Air Line Railway, Hillsborough County (H. I. Tucker).

Specimens preserved as internal molds, collected at and in the vicinity of Brooksville, Hernando County, may belong to the new species here described.

Subgenus AMPULLINOPSIS Conrad, 1865

AMPULLINA (AMPULLINOPSIS) AMPHORA (Heilprin)

1887. *Natica amphora* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 112, pl. 16, fig. 50.
1892. *Ampullina (Ampullinopsis) amphora* Heilprin. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pl. 2, p. 375.
1915. *Ampullina amphora* Heilprin, U. S. Nat. Mus. Bull. 90, p. 108, pl. 11, fig. 5.

Heilprin described this species in 1887 as follows:

Shell semi-globular, depressed on the basal surface; spire elevated; of about 4 volutions, all the whorls deeply channeled along the suture line; body-whorl about three-fourths the size of the entire shell; aperture semi-lunate, contracted above, effuse below; inner (columellar) border of aperture direct, diagonal; deposit of callus considerable, leaving a long, narrow umbilical fissure; base of shell subcarinated; surface smooth. Length, about 4 inches; greatest width, across the center of aperture, 3.7 inches."

Type locality: "silex bed" at Ballast Point, Tampa Bay, Fla.

Holotype is deposited in the Wagner Free Institute of Science, Philadelphia.

Horizon: Tampa limestone, lower Miocene.

Occurrence: Station 13848, dredged at a depth of 32-36 feet at Hooker Point, upper Hillsborough Bay; station 5000, Sixmile Creek, near Orient Station, Hillsborough County; station 12763, Anclote River, at Tarpon Springs, Pinellas County; station 3420, 15 miles south of Tallahassee, Wakulla County; station 12093, Cherokee Sink, Wakulla County; station 12732, 3.7 miles south of Wakulla; station 13841, Aspalaga Bluff, Gadsden County.

This species probably does not occur in the Chipola formation.

Ampullina spenceri Cooke from Antigua, Leeward Island, is closely related to *A. amphora* (Heilprin) differing from it in having a rela-

tively broader shell. In this respect *A. spenceri* shows relationship to the Vicksburg species, *A. mississippiensis* Conrad. However, the large shell of *A. spenceri* and the concentric ornamentation on it suggests a closer relationship to the Tampa species.

Genus GLOBULARIA Swainson, 1840

GLOBULARIA STREPTOSTOMA (Heilprin)

1887. *Natica streptostoma* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 112, pl. 16, fig. 51.
 1892. *Ampullina streptostoma* Heilprin. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 374.
 1915. *Ampullina streptostoma* Heilprin. Dall, U. S. Nat. Mus. Bull. 90, p. 107, pl. 12, fig. 27.
 ?1916. *Ampullina streptostoma* Heilprin. Dall, U. S. Nat. Mus. Proc., vol. 51, p. 519, pl. 85, fig. 11.

Heilprin described this species in 1887 as follows:

"Shell depressed, oblique, with the spire almost concealed; aperture very large, sigaretiform, the border flattened on the columellar side, and folded over into a pseudo-carina, which passes beneath the labium as the outer bounding-line of the umbilicus; umbilicus narrow, vertical; surface smooth. Length (height), one inch; greatest width, diagonally across the aperture, 1.2 inch. May be readily identified by the large, oblique aperture, and the basal carina."

Type locality: "silex bed," Ballast Point, Tampa Bay, Fla.

The holotype is deposited in the Wagner Free Institute of Science, Philadelphia.

Horizon: Tampa limestone, lower Miocene.

The specimens identified by Dall as *Ampullina streptostoma* Heilprin from the Flint River above and below Bainbridge, Ga., are preserved as internal molds and the identity with the specimens in the Tampa "silex bed" is questioned. *Globularia streptostoma* (Heilprin) is more oblique than *G. fisheri* Dall, a Chipola species.

Other occurrences: Station 12765, Sixmile Creek, near Orient Station, Hillsborough County; station 12292, Cherokee Sink, Wakulla County (mainly internal molds, identification not fully established); station 12285, quarry half mile south of River Junction, Gadsden County, at an elevation around 150 feet above sea level.

GLOBULARIA SOLIDULA Dall (?variety of *Globularia streptostoma* [Heilprin])

1892. *Ampullina solidula* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 376, pl. 22, fig. 31.
 1915. *Ampullina solidula* Dall, U. S. Nat. Mus. Bull. 90, p. 108, pl. 3, fig. 10.
 1916. Not *Globularia solidula* (Dall), U. S. Nat. Mus. Proc., vol. 51, p. 518, pl. 85, fig. 9.

Dall described his species in 1892 as follows:

"Shell small, thick, of about 6 nearly smooth whorls, marked only by lines of growth; apex small, pointed; suture distinct; the whorls flattened for a short distance in front of it, then amply rounded; base convex; umbilicus moderate, deep, bounded by an elevated, narrow rib, inside of which the surface is striated in harmony with the lines of growth; aperture rounded in front, the pillar-lip thin, emarginate opposite the umbilicus, not reflected; body with little or no callus; outer lip oblique, arched internally, thickened and slightly expanded at the extreme edge. Alt. of shell 16; max. diam. 17 mm.

"Older Miocene of Ballast Point, Tampa Bay, in the *Orthaulax* bed, Dall."

Horizon: Tampa limestone, lower Miocene.

Globularia solidula Dall differs from *A. amphora* Heilprin in having a less depressed suture, more rounded whorls, stronger growth lines, no trace of spiral lines, and apparently a different (though corroded) umbilicus. The spire closely resembles *Globularia streptostoma* (Heilprin) and perhaps *G. solidula* should be regarded as a varietal form of this species, though it appears to have a more solid shell and a larger umbilical opening. *Globularia anguillana* (Cooke) from Crocus Bay, Anguilla, is closely related to *G. solidula* Dall but has a much larger shell than the latter species.

Occurrence: "silex bed" (one specimen, the holotype); station 12763, Anclote River at Tarpon Springs, Pinellas County.

Genus AMAUOPSIS Mörch, 1857

"AMAUOPSIS" aff. A. BURNSII MERIDIONALIS Pilsbry

Plate 9, Figure 7

1916. *Amauopsis ocalana* Dall, U. S. Nat. Mus. Proc., vol. 51, p. 519, pl. 88, fig. 11 (part, not *A. ocalana* Dall, 1892, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 377, an Eocene, Ocala limestone species).

The name "*ocalana*" is a *nomen dubium*. The specimen to which Dall applied this name was not described or figured. A specimen deposited in the U. S. National Museum under catalogue no. 112952, collected from the Ocala limestone, is labelled *A. ocalana* Dall.

The specimen (U. S. Nat. Mus. no. 166797) referred by Dall to *A. ocalana*⁹⁰ has lost its shell but the mold indicates that it does not belong to the same species as the form from the Ocala limestone. It differs from the Ocala specimen in having a channeled suture. However, the specimen from the Flint River locality is not well enough preserved to fully describe.

⁹⁰ U. S. Nat. Mus. Proc., vol. 51, p. 519, pl. 88, fig. 11, 1916.

The unnamed species apparently belongs to the same group as *A. burnsii* Dall from the Chipola formation (lower Miocene), and *A. burnsii meridionalis* Pilsbry (apparently the form identified as *A. ocalanus* by Dall) from the Miocene of the Dominican Republic, but it has a larger shell than either *A. burnsii* or the variety *meridionalis*.

Horizon: Flint River formation, Georgia, Oligocene: Suwannee limestone, Florida, Oligocene.

Occurrences in Georgia of specimens that are related to *Amaurop-sis burnsii meridionalis* Pilsbry: Station 7095, Bainbridge (specimen U. S. Nat. Mus. no. 166797 figured from this locality); station 7074, Hale Landing, Flint River, 7 miles southwest of Bainbridge; station 7079, Mascot Point, below mouth of Blue Spring Branch, 4 miles below Bainbridge; Jacksonboro, Decatur County (identical with specimens from station 7095).

Occurrences in Florida: Specimens preserved as internal molds, somewhat smaller than the Georgia specimens but appearing very closely related to them, have been collected from the Suwannee limestone, at station 12755, quarry three-fourths mile southwest of Brooksville, Hernando County; station 12321, 3 miles east of Brooksville; station 12758, 5.9 miles northeast of Brooksville; station 12298, 1½ miles east-southeast of Flint Rock, Jefferson County.

Genus SINUM ("Bolten") Roeding, 1798

SINUM IMPERFORATUM Dall

1915. *Sinum imperforatum* Dall, U. S. Nat. Mus. Bull. 90, p. 109, pl. 5, fig. 8.

Dall described this species as follows:

"Shell small, elevated, solid, of about 5 whorls, of which the nuclear 2½ appear smooth; subsequent whorls sharply densely grooved, the grooves having a tendency to pair, and the interspaces flattened; both grooves and interspaces are minutely zigzagged by the intersection with them of the incremental lines; spire moderately elevated, suture distinct; aperture oblique, the outer lip joining the body above the periphery of the preceding whorls; inner or pillar lip thickened, with a slight depression behind it, but no umbilical chink. Height of shell 13.2, of aperture 11.7, maximum diameter 11 mm.

"Tampa silex beds from the vicinity of the Hillsboro river, Florida, collected by E. J. Post. U. S. Nat. Mus. No. 166107.

"This species has some resemblance to *S. fragile* Conrad, but is much more solid and the characters of the sculpture and of the umbilical region differ."

Horizon: Tampa limestone, lower Miocene.

Other occurrence: A poorly preserved specimen from station 7358, Tarpon Springs, Pinellas County, Fla., may belong to this species.

SINUM CHIPOLANUM SILICATUM Mansfield, n. subsp.

1892. *Sigaretus chipolanus* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 379, pl. 17, fig. 7 (part, specimens from the Chipola marl excluded).
1915. *Sinum chipolanum* Dall, U. S. Nat. Mus. 90, p. 109, pl. 12, fig. 29; pl. 16, fig. 1 (part, specimens from the Chipola marl excluded).

Dall identified the specimens from the "silex bed" and from the Chipola formation as the same species; however, there appears to be a subspecific difference between the two forms.

The specimen from the Chipola formation (U. S. Nat. Mus. no. 112967) is here regarded as the holotype of *S. chipolanum* (Dall), whereas the specimen from the "silex bed" (U. S. Nat. Mus. no. 165135) is regarded as a new subspecies, *S. chipolanum silicatum*.

The figured specimens of both the original description and Bulletin 90, are from the "silex bed"; however, the dimensions ("Max. lon. of adult 33; diam. 27 mm.") given in the original description are those of a Chipola specimen.

Sinum chipolanum silicatum differs from *S. chipolanum* in having a smaller shell, a relatively higher spire, a less appressed suture, a less uniform spiral ornamentation and a more open umbilicus. On the new subspecies the spirals for a short distance below the suture are closely spaced but anteriorly and over most of the volutions are more widely spaced, whereas the spirals on *S. chipolanum* are more evenly spaced over the volutions.

Sinum imperforatum Dall has a smaller shell than *S. chipolanum silicatum*.

Type locality: "silex bed" at Ballast Point, Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene.

SINUM aff. SINUM IMPERFORATUM Dall

Imperfect specimens from a few localities in Florida are related to *Sinum imperforatum* Dall but may not be this species, though the holotype of *S. imperforatum* is somewhat corroded and the exact character of the ornamentation is not clearly revealed.

The unidentified specimens have depressed sutures and are ornamented with narrow spiral lines intercalated with from one to three very fine spirals. A small umbilical chink lies behind the inner lip. The spiral sculpture is finer and the umbilical chink deeper than in *S. imperforatum* Dall. The umbilical opening is about the same size as that of *S. bilir* Conrad, a species of the Vicksburg group.

Specimens from the following localities in Florida appear to represent the same unnamed species: Blackwater Creek at crossing of

Seaboard Air Line Railway, Hillsborough County (Tucker); station 11113, Brooksville, Hernando County; station 11109, 1½ miles north of Live Oak, Suwannee County.

The specimen from station 7075, Flint River, 10½ miles below Bainbridge, Ga., identified by Dall¹⁰⁰ as *S. imperforatum*, is partly imbedded in a quartz matrix. The exposed part appears to be more closely related to the unnamed form than to the form from the "silex bed" of the Tampa limestone.

Horizon: Suwannee limestone, Oligocene.

Order ASPIDOBANCHIA
Superfamily RHIPIDOGLOSSA
Family PHASIANELLIDAE
Genus TRICOLIA Risso, 1826
Subgenus TRICOLIA

TRICOLIA (TRICOLIA) PRECURSOR (Dall)

1915. *Lacuna precursor* Dall, U. S. Nat. Mus. Bull. 90, p. 94, pl. 12, fig. 5.

Dall described this species as follows:

"Shell small, smooth, turbinate-conic, with about 4 well rounded whorls separated by a deep suture; apical whorl very small and flattened above, the others almost inflated, regularly increasing, with no visible sculpture; base rounded to the angular margin of a narrow flatly excavated groove behind the inner lip; aperture ovate, retractively oblique, entire, the margin crossing the body with a band of callus; outer lip thin, entire; inner lip a little thickened behind, passing evenly into the outer lip in front. Height 5.75, maximum diameter 3.5 mm.

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

"One specimen in the Post collection, U. S. Nat. Mus. No. 165124."

Horizon Tampa limestone, lower Miocene.

Only one specimen, the holotype is at hand. The coloration, if originally present, has been lost. The species is related to *Tricolia concinna* (C. B. Adams), a Recent species ranging from Florida to Jamaica.

Family TURBINIDAE
Genus TURBO Linnaeus, 1758
Subgenus SENECTUS Swainson, 1840

TURBO (SENECTUS) CRENORUGATUS Heilprin

Plate 9, Figures 9, 10

1887. *Turbo crenorugatus* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 113, pl. 16, fig. 54.

1892. *Turbo (Senectus) crenorugatus* Heilprin. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 382.

¹⁰⁰ Dall, W. H., U. S. Nat. Mus. Proc., vol. 51, p. 520, 1916.

1915. *Turbo (Senectus) crenorugatus* Heilprin. Dall, U. S. Nat. Mus. Bull. 90, p. 110.

Heilprin described this species in 1887 as follows:

"Shell moderately elevated, the whorls regularly convex, ornamented with coarse concentric beaded or "roped" lines, which are of unequal sizes, the third and fifth lines below the suture finer than those between which they are placed; the beads or crenulations are oblique (inclining downward to the left) becoming very coarse and irregular toward the aperture, and scaly or imbricated on the base; the basal lines of nearly equal width, except the one immediately adjoining the labium, which is of about twice the normal width; umbilicus covered; aperture oval; base convex. Length (height) 1.2 inch; width of base, 1.4 inch. Most nearly resembles the recent *T. crenulatus*."

Type locality: "silex bed" at Ballast Point, Tampa Bay, Fla.

The holotype is deposited in the Wagner Free Institute of Science, Philadelphia.

Horizon: Tampa limestone, lower Miocene.

Turbo crenorugatus, as pointed out by Heilprin, most nearly resembles the living species, *T. crenulatus* Gmelin.

Family TROCHIDAE

Genus TEGULA Lesson, 1834.

Subgenus OMPHALIUS Philippi

TEGULA (OMPHALIUS) EXOLETA (Conrad)

1843. *Monodonta exoluta* (sic) Conrad, Acad. Nat. Sci. Philadelphia Proc., vol. 1, p. 309 (typogr. error for *exoleta*).
1856. (?) *Monodonta kiazahensis* Tuomey and Holmes, Pleiocene fossils of South Carolina, p. 116, pl. 26, fig. 1.
1863. *Monilia (Monodonta) exoluta* Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 569.
1887. *Turbo heliciformis* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 113, pl. 16, fig. 55.
1892. *Chlorostoma (Omphalius) exoletum* (Conrad). Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 388, pl. 17, figs. 4, 4a.
1903. *Chlorostoma exoletum* Conrad. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1601. In list from Duplin and Cape Fear River, N. C.)
1915. *Tegula (Omphalius) exoleta* (Conrad). Dall, U. S. Nat. Museum Bull. 90, p. 111, pl. 16, figs. 15, 16.
1919. *Chlorostoma (Omphalius) exoleta* Conrad. Gardner and Aldrich, Acad. Nat. Sci. Philadelphia Proc., vol. 71, p. 18. (In list of fossils from 5 miles S. E. of Mayesville, S. C.)
1929. *Tegula exoleta* (Conrad). Cooke and Mossom, Florida Geol. Survey 20th Ann. Rept., pl. 16, fig. 9.
1930. *Tegula (Omphalius) exoleta* (Conrad). Mansfield, Florida Geol. Survey Bull. 3, p. 131, pl. 17, figs. 9a, 9b.

The type locality of this species is unknown.

The sculpture consists of spiral lines or narrow bands intercalated by closely-set threads. The lower columella is provided with two teeth, which are separated by a rather deep pit. The inner margin

of the aperture has a single series of elongate denticles. On the narrow spiral bands are broken brownish color-markings.

Occurrence: Lower Miocene, "silex bed," Tampa limestone, Florida; upper Miocene, Virginia, Carolinas, and Florida.

Genus *CALLIOSTOMA* Swainson, 1840

***CALLIOSTOMA TAMPICUM* Dall**

1915. *Calliostoma tampicum* Dall, U. S. Nat. Mus. Bull. 90, p. 111, pl. 4, fig. 1.

1915. *Calliostoma metrium* Dall, U. S. Nat. Bull. 90, p. 111 (part, not *C. metrium* Dall, 1892, a Chipola marl species).

Dall described this species as follows:

"Shell small, with 7 flattened whorls, an inconspicuous suture, and flattish base; the nucleus is smooth and projects perceptibly upward; the subsequent whorls show 5 subequal and equally spaced spiral ridges more or less distinctly beaded; on the last whorl and a half these ridges become reduced to small thread-like proportions, hardly rising above the surface of the whorl, not beaded, and separated by wide interspaces with occasional still smaller intercalary threadlets; the periphery of the whorl is bluntly rounded and produced backward; the base is flattened and spirally sculptured with 10 or 12 obscure spirals which might be regarded as flattened threads separated by narrow striae, the whole more or less obsolescent; (the aperture is obscured by matrix and the end of the pillar broken off). Height of shell 10.5, maximum diameter of base 10, minimum diameter of base 9 mm.

"Tampa silex beds, at Ballast Point, Tampa Bay, Florida. U. S. Nat. Mus. No. 166108.

"This shell has, in miniature, some resemblance to *C. grammicum* Dall, of the Chipola beds; but the latter is a much larger species."

Horizon: Tampa limestone, lower Miocene.

This species has not been recognized outside of its type locality.

Subgenus *EUTROCHUS* A. Adams, 1863

***CALLIOSTOMA (EUTROCHUS) SILICATUM* Mansfield, n. sp.**

Plate 10, Figures 1, 5

Shell of medium size, and moderately slender with a conical spire and flat base. Whorls weakly turreted, the base slightly overhanging the suture. Suture winds against the base of the preceding whorl. Sculpture of spire whorls consisting of fine close-set and uniformly placed spiral threads. Base umbilicate, sculptured with about 10 strong raised spiral lines that become stronger toward the umbilicus. Umbilicus perforate. Aperture broken.

Larger cotype (U. S. Nat. Mus. no. 495960) measures: Greatest diameter 20 mm.; height ?mm.

Type locality: Station 12745, small island in Suwannee River, $\frac{3}{4}$ mile above White Springs, Columbia County, Fla.

Horizon: Suwannee limestone, Oligocene.

Other occurrences: An external mold showing the base of the shell from station 12321, 3 miles east of Brooksville, and an external mold from lowest bed in a quarry at Brooksville, Hernando County, may belong to the new species.

Genus MARGARITES Leach, 1819

MARGARITES TAMPAENSIS Dall

1892. *Margarita tampaensis* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 406, pl. 18, fig. 5.
1915. *Margarites tampaensis* Dall, U. S. Nat. Mus. Bull. 90, p. 112, pl. 3, fig. 11.

Dall described this species in 1892 as follows:

"Shell small, thin, of much the form and size of *Margarita helicina*, but with the earlier whorls alternately striate, the striae becoming finer and at last obsolete on the terminal whorl; suture distinct, whorls rounded above and below; umbilicus small, funicular, aperture expanded, oblique; body with a thin callus. Alt. 7.0; max. diam. 8.0 mm.

"Older Miocene of the *Orthaulax* bed, Ballast Point, Tampa Bay, Florida. Dall and Burns."

Horizon: Tampa limestone, lower Miocene.

Family LIOTIIDAE

Genus LIOTIA Gray, 1840

Subgenus ARENE H. and A. Adams, 1854

LIOTIA (ARENE) SOLARIELLA Heilprin

1887. *Delphinula*(?) *solariella* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 113, pl. 16, fig. 56.
1892. *Liotia* (*Arene*) *solariella* Heilprin. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 408, pl. 17, figs. 1, 1a.
1915. *Liotia* (*Arene*) *solariella* Heilprin. Dall, U. S. Nat. Mus. Bull. 90, p. 112, pl. 16, figs. 4, 5.

Heilprin described this species in 1887 as follows:

"Shell turbate, moderately umbilicated; whorls subangular, channelled on the basal margin, ornamented with about 5 concentric beaded lines, the beads largest on the upper lines; base of shell flattened, indistinctly rayed, with an equal number of revolving beaded lines, the beads most prominent on the umbilical line; aperture orbicular, the border nearly continuous; umbilicus deep. Length (height), .18 inch; width of base, .2 inch."

Type locality: "silex bed," at Ballast Point, Tampa Bay, Fla.

The holotype is deposited in the Wagner Free Institute of Science, Philadelphia, Pa.

Horizon: Tampa limestone, lower Miocene.

This species appears to be confined to the area of its type locality.

LIOTIA (ARENE) CORONATA Dall

1892. *Liotia (Arene) coronata* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 409, pl. 17, figs. 2, 2a.
 1915. *Liotia (Arene) coronata* Dall, U. S. Nat. Mus. Bull. 90, p. 112, pl. 16, figs. 6, 17.

Dall described this species in 1892 as follows:

"Shell small, stout, turbiniform, of four whorls; suture running just below the peripheral keel; shell spirally striate, with three moderately prominent, plain keels, separated by wider striated interspaces, toward the periphery; summit of the whorls regularly wrinkled at the suture, the wrinkles stronger on the earlier whorls, varying from mere beads to more elongated waves in different specimens, but obsolete on most of the last whorl; base rounded, spirally striate, the umbilicus subcylindrical, small and deep, marginated with a stout, rounded rib; aperture subcircular, margin simple. Alt. of shell 4.0; max. diam 5.0 mm.

"Older Miocene of the Orthaulax bed, Ballast Point, Tampa Bay, Fla.

Holotype (U. S. Nat. Mus. no. 112575) is deposited in the U. S. National Museum.

Horizon: Tampa limestone, lower Miocene.

This species has not been found outside of its type locality.

Family HELICINIDAE

Genus HELICINA Lamarck, 1799

Key to the species of *Helicina*

- Whorls slightly flattened above, sculptured with faint impressed spirals *H. ballista*
 Whorls slightly flatter above than *H. ballista* and shell smaller; generally smooth *H. ballista* var. *tampae*
 Shell larger than *H. ballista* or var. *tampae*; spiral lines faint *H. posti*

HELICINA BALLISTA Dall

1890. *Helicina ballista* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 3, pl. 1, figs. 2, 2a.
 1915. *Helicina ballista* Dall, U. S. Nat. Mus. Bull. 90, p. 113, pl. 15, figs. 9, 11.

Holotype: U. S. National Museum no. 111939.

Type locality: "silex beds," Ballast Point, Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene.

Other occurrence: Internal molds from station 12300, 1¼ miles northeast of Lloyd, Jefferson County, may belong to *Helicina ballista*.

HELICINA BALLISTA var. *tampae* Dall

1890. *Helicina ballista* var. *tampae* Dall, Wagner Free Inst. Sci. Trans., vol 3, pt. 1, p. 4.
 1915. *Helicina ballista* var. *tampae* Dall, U. S. Nat. Mus. Bull. 90, p. 113.

Holotype: U. S. National Museum, no. 111943.

Type locality: "silex bed," Ballast Point, Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene.

Dall states that the variety *tampae* is similar to the typical form, but differs from it in being smaller, generally smoother, and slightly flatter on the spire.

Other occurrence: Sixmile Creek, near Orient, Hillsborough County, Fla.

HELICINA POSTI Dall

1915. *Helicina posti* Dall, U. S. Nat. Mus. Bull. 90, p. 113, pl. 5, fig. 7.

Holotype: U. S. National Museum no. 166093.

Type locality: "silex bed," Ballast Point, Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene.

This species is larger than *H. ballista* or the variety *tampae*. The spiral sculpture is very obscure.

The species is very rare and known only at the type locality.

Family NERITIDAE

Genus NERITA Linné, 1758

NERITA TAMPAENSIS Dall

1892. *Nerita tampaensis* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 421, pl. 17, fig. 3.

1915. *Nerita tampaensis* Dall, U. S. Nat. Mus. Bull. 90, p. 114, pl. 16, fig. 2.

Dall described this species in 1892 as follows:

"Shell rather small, with a depressed spire and three whorls; surface varying from nearly smooth with obsolete spiral sculpture to strongly irregularly spirally ribbed with narrow rounded ribs separated by wider interspaces and crossed by more or less conspicuous lines of growth; there is no fine striation and the ribs are extremely irregular in size when strong, and become almost entirely obsolete in some specimens; they are more sparse on the upper surface than on the periphery; aperture half-moon shaped, outer lip thickened, but not dentate; inner lip with a broad, rather thin callus with obscure tubercles on the lower portion; pillar thin, with a few obscure denticles near the middle. Alt. 10.0; max. lon. 12.5 mm.

"Older Miocene of the Orthaulax bed, Tampa Bay, Florida, and of the Tampa limestone at La Penotière's Hammock, on Six-Mile Creek, a mile and a half south of Orient Station, six miles eastward from Tampa City, Florida.

"The specimen figured happens to be nearly smooth; on the spire there are some obscure wrinkles. The specimen from the hammock [station 2116] shows strong, irregular ribbing, of which there are only traces seen on the one figured. All the specimens obtained at Ballast Point, where it seems rare, seem to have been more or less worn before being fossilized."

The holotype (U. S. Nat. Mus. no. 112663) came from Ballast Point, Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene.

This species was also collected by Miss Helen I. Tucker from Sixmile Creek, near Orient Station, Fla.

Superfamily ZYGobranchia

Family Fissurellidae

Genus *Diodora* Gray, 1821

***Diodora chipolana* (Dall)**

1892. *Fissuridea chipolana* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 426, pl. 23, fig. 21.
1915. *Fissuridea chipolana* Dall, U. S. Nat. Mus. Bull. 90, p. 114.

The holotype of *Diodora chipolana* (Dall) came from the Chipola formation of Florida. The two specimens which Dall identified as "*Fissuridea*" *chipolana* from the "silex bed" at Ballast Point (U. S. Nat. Mus. no. 165140) are small. These specimens have a little weaker radials than the Chipola specimens but in other features are very similar. External molds of much larger specimens have been collected from station 2470, 1 mile west of Bartow, Polk County, Fla. These also may belong to *Diodora chipolana* (Dall). An external mold of a specimen collected from the Suwannee limestone at station 12321, 3 miles east of Brooksville, Hernando County, Fla., appears to be related to *Diodora chipolana* (Dall) but may be another species.

Horizon: Tampa limestone, lower Miocene; Chipola formation, lower Miocene.

***Diodora ceryx* (Dall)**

1915. *Fissurella* (*Cremides*) *ceryx* Dall, U. S. Nat. Mus. Bull. 90, p. 115, pl. 1, figs. 10, 11.

Dall described this species as follows:

"Shell small, thin, subconic, basal outline rounded quadrate, the anterior portion slightly wider; apex within the posterior third of the length; apical opening narrow, centrally slightly widened; sculpture of flattish radial riblets (about three to a millimeter) with subequal interspaces, in most of which there are traces of a single much finer radial thread; concentric sculpture of rather marked incremental lines, which are not close set and which feebly imbricate the riblets in passing over them; base (in the type) slightly arcuate, the ends more produced than the central portions; interior smooth except for a faint, muscular impression, the aperture not showing any callus on the interior margin; basal margin feebly crenulated by the ends of the riblets. Length 9.5 mm., height 4 mm., maximum diameter 7.1 mm.; the posterior margin of the aperture in front of the posterior end of the shell 2 mm.

"Tampa silex beds, Ballast Point, Tampa Bay, Florida; one specimen collected by E. J. Post. U. S. Nat. Mus. No. 165109."

Horizon: Tampa limestone, lower Miocene.

The holotype is the only specimen of this species so far known.

Class PELECYPODA
Order PRIONDESMACEA
Superfamily NUCULACEA
Family NUCULIDAE
Genus NUCULA Lamarck, 1799

NUCULA TAMPÆ (Dall)

1915. *Nucula tampæ* Dall, U. S. Nat. Mus. Bull. 90, p. 116, pl. 21, figs. 13, 14.

Following is Dall's description of this species:

"Shell small, rounded trigonal, solid, very inequilateral; beaks low, adjacent; anterior end produced, rounded, with the dorsal margin flattened, but no circumscribed lunule; posterior end short, subtruncate, with a flattened ill-defined area, but no distinct escutcheon; ligament rather large for the size of the shell and situated internally directly behind the beaks; surface concentrically finely rugose, the sculpture crossed by fine radial striae, with wider interspaces (too fine to be shown in the figures); margins finely crenulate internally. Length 7.3 mm., height 6 mm., maximum diameter 4.75 mm.

"Tampa silex beds, Ballast Point, Tampa Bay, Fla. Collected by Dall, Burns, and Post. Type-specimen: U. S. Nat. Mus. No. 165169, from the Post collection.

"The sculpture in some of the pseudomorphs is so faint that the valves appear nearly smooth, but this is probably only an incident of fossilization."

This species has not been found outside of its type locality.

NUCULA GADSDENENSIS Mansfield, n. sp.

Plate 10, Figures 8, 10, 12

Shell small, trigonal, solid, thick, equivalve, and inequilateral. Beaks rather low, adjacent. Posterior end short, subtruncate with a nearly flat area behind the beaks but with no distinct escutcheon; anterior end much longer than posterior, subtruncate dorsally, and weakly depressed in front of the beaks. Sculpture of rather coarse concentric imbricated lamellae.

Only two small specimens, which are pseudomorphs, are available.

Cotypes (U. S. Nat. Mus. no. 495964) measure: Unbroken cotype, length, 3.0 millimeters; height, 2.9 millimeters; diameter, 1.9 millimeters. Slightly broken cotype, length, 3.0 millimeters; height, 2.6 millimeters; diameter, 1.8 millimeters.

Type locality: Station 12285, abandoned quarry about half a mile south of River Junction, Gadsden County, Fla. Collected from an

indurated one-foot bed at an elevation of about 150 feet above sea level. W. C. Mansfield and G. M. Ponton, collectors. April 3, 1931.

Horizon: Tampa limestone, lower Miocene.

The new species although apparently related to *Nucula tampae* Dall differs from it in having a less inequilateral shell and more distinct concentric sculpture.

Family NUCULANIDAE
Genus NUCULANA Link, 1807

NUCULANA POSTI (Dall)

1915. *Leda posti* Dall, U. S. Nat. Mus. Bull. 90, p. 117, pl. 21, figs. 6, 9.

Dall described this species as follows:

"Shell small, thin, equivalve, inequilateral, slender, rounded in front, attenuated and bluntly pointed behind; basal profile gently arcuate, anterior dorsal slope slightly convex, posterior slope nearly direct; beaks low, much incurved; opisthocelous; no distinct lunule, but a narrow impressed space in front; behind the beaks a long narrow escutcheon extending to the end of the valve with the cardinal margins pouting; sculpture of incremental lines more prominent near the beaks and base, nearly obsolete on the middle of the valve; near the base these become sparse and sublamellose in the type specimen; interior smooth; the muscular scars small, not thickened; hinge with about 20 anterior and 19 posterior V-shaped small teeth separated by a well-marked subtriangular resilifer, wholly internal and just below the beaks. Length of valve 14 mm., of posterior end 8 mm., height 6.7 mm., maximum diameter 5 mm.

"Tampa 'silex beds,' Ballast Point, Tampa Bay, Florida. Type specimen from the Post collection. U. S. Nat. Mus. No. 165171."

Horizon: Tampa limestone, lower Miocene.

This species is closely related to *N. flexuosa* (Heilprin). The holotype, a right valve, differs from *N. flexuosa* in being nearly smooth instead of marked with rather strong concentric lines and in having a less pointed posterior extremity. The holotype is deposited in the U. S. National Museum.

NUCULANA FLEXUOSA (Heilprin)

1887. *Leda flexuosa* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 119, pl. 16, fig. 66.

1898. *Leda flexuosa* Heilprin. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 4, p. 589.

1900. *Leda flexuosa* Heilprin. Dall, idem, pt. 5, pl. 38, figs. 5, 5a.

1915. *Leda flexuosa* Heilprin. Dall, U. S. Nat. Mus. Bull. 90, p. 117, pl. 23, figs. 8, 10.

Heilprin described this species in 1887, as follows:

"Shell subsequal, the posterior portion somewhat the longest; basal margin evenly rounded, not sinuous; posterior or ligamental slope feebly arched, nearly

direct; teeth crowded, v-shaped; external surface covered with concentric, not very fine, lines, which are gently angulated and flexed on the posterior slope.

"Length, .55 inch; height, .25 inch."

Horizon: Tampa limestone, lower Miocene.

Occurrence: Dall reports this species in the "silex beds"¹⁰¹ and from his Tampa limestone¹⁰² at Ballast Point, Tampa Bay, Fla.

An external mold of one valve collected at station 12292, Cherokee Sink, Wakulla County, Fla., by G. M. Ponton and the writer appears in all features discernible to be *N. flexuosa*.

Location of type: Not found.

Genus YOLDIA Möller, 1842

YOLDIA cf. Y. FRATER Dall

1915. *Yoldia frater* Dall, U. S. Nat. Mus. Bull. 90, p. 117, pl. 4, fig 5(?). (Fig. 5 may be a specimen from the "silex beds.")

There are five valves of *Yoldia* under the U. S. National Museum Catalogue no. 165172 from the "silex beds" of the Tampa limestone, Ballast Point, Fla. In referring to these specimens Dall¹⁰³ writes:

"A small *Yoldia* obtained at Ballast Point from the Tampa silex beds appears to be the young of this species [*Yoldia frater* Dall]."

Also collected by Miss Helen Tucker from Sixmile Creek near Orient. Gardner¹⁰⁴ reports the occurrence of *Yoldia frater* Dall in the Chipola formation, Oak Grove sand, and Shoal River formation of Florida.

Superfamily ARCACEA

Family ARCIDAE

Subfamily PECTUNCULINAE

Genus GLYCYMERIS Da Costa, 1778

GLYCYMERIS LAMYI Dall

1915. *Glycymeris lamyi* Dall, U. S. Nat. Mus. Bull. 90, p. 122, pl. 20, figs. 11, 13.

Dall described this species as follows:

"Shell small, solid, moderately convex, equivalve, and nearly equilateral; beaks small, low, pointed, median, separated by a narrow diamond-shaped area with about half a dozen ligamentary grooves divaricating from a central imaginary line perpendicular to the beak in each valve; external sculpture of about 20 low, slightly convex, primary radiating riblets, with from one to three smaller intercalary close-set threads in the interspaces; the primary ribs extend over

¹⁰¹ Dall, W. H., U. S. Nat. Mus. Bull. 90, p. 117, 1915.

¹⁰² Dall, W. H., Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1572, 1903.

¹⁰³ Dall, W. H., U. S. Nat. Mus. Bull. 90, p. 117, 1915.

¹⁰⁴ Gardner, Julia, U. S. Geol. Survey Prof. Paper 142-A, p. 21, 1926.

the anterior and middle portions of the shell, but cease near the posterior end, which is sculptured on the posterior area only by threads of the secondary type of which there are about a dozen; these radial ribs are crossed by concentric lines, sometimes rather pronounced, in harmony with the lines of growth and better developed near the margin; profile slightly attenuated toward the beaks and at the lower end of the posterior dorsal area slightly subangular; interior smooth, the margin crenulate as figured; muscular impressions small, distinct; disk smooth; hinge with about 10 teeth on each side of the median line, symmetrically arranged. Height 16.5 mm., breadth 17.5 mm., diameter 8 mm."

The primary ribs on the holotype, a right valve, are medially incised at their distal ends. On the ventral half of the shell there is one secondary riblet between the primaries on the middle portion and two or three on the anterior portion. The ribs over the umbonal area are rounded but become slightly angulated distally anterior to their incision. All the ribs are closely spaced. The sculpture and convexity of the left valve is similar to that of the right valve.

The holotype is deposited in the U. S. National Museum.

Horizon: Tampa limestone, lower Miocene.

Other occurrences: Station 12728, 1½ miles below Willis Bridge, Calhoun County, Fla.; Sixmile Creek, Hillsborough County (Tucker); ?station 12292, Cherokee Sink, Wakulla County; ?station 13840, 1¼ miles northeast of Lloyd, Jefferson County.

GLYCYMERIS LAMYI TAMPAE Mansfield, n. subsp.

Plate 10, Figures 4, 6, 7

1915. *Glycymeris lamyi* Dall (part), U. S. Nat. Mus. Bull. 90, p. 122.

There are a few valves among the specimens referred to *Glycymeris lamyi* Dall that differ from the holotype of that species. These differ from *G. lamyi* in having a lower and more rounded shell, a longer hinge-line, weaker primary radials, and more teeth. The holotype of *G. lamyi* has 10 teeth on each side of the medial line, whereas the right valve of the new subspecies has 12 on each side, and the left valve has 12 on the posterior side and 14 on the anterior side.

Cotypes (U. S. National Museum, no. 495965) measure: Right valve, length, 18 mm.; height, 16.5 mm.; diameter, 4 mm. Left valve, length, 19 mm.; height, 17.8 mm.; diameter, 4 mm.

Type locality: "silex beds" at Ballast Point, Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene.

GLYCYMERIS TUCKERAE Mansfield, n. sp.

Plate 11, Figures 5, 6

Shell small, rather solid, moderately inflated, equivalve and nearly equilateral, the posterior side being more produced. Holotype, a right valve, has 21 subrounded ribs; the ribs on the sides are moderately weak, whereas those over the middle of disk are rather wide and separated by spaces nearly as wide as the ribs. No interradials are visible on the holotype. Holotype measures: Length, 11.2 mm.; height, 10.8 mm.; convexity, 3.0 mm.

Type locality: Blackwater River at Seaboard Air Line Railway crossing, Hillsborough County, Fla.

The holotype (U. S. National Museum, no. 495968) was collected by Miss H. I. Tucker; the paratype, a left valve, was collected by C. W. Cooke, of the U. S. Geological Survey (station 11116), and is deposited in the U. S. National Museum.

Horizon: Suwannee limestone, Oligocene.

G. tuckerae differs from *G. lamyi* Dall and *G. hillsboroughensis* in having fewer, wider spaced, and more rounded ribs.

Other occurrence: Specimens preserved either as external or internal molds that agree with *G. tuckerae* were found at station 11109, 1½ miles north of Live Oak, Suwannee County; station 12298, 1½ miles east-southeast of Flint Rock, Jefferson County; station 6825, 3 miles west of Live Oak, Suwannee County; station 12755a, lowest part of quarry at Brooksville, Hernando County.

GLYCYMERIS GADSDENENSIS Mansfield, n. sp.

Plate 11, Figures 1, 3, 7

Shell small, moderately inflated, nearly equilateral, and equivalve. Beaks rather low and approximate. Sculpture consists of about 26 weakly angulated, rather wide, and closely spaced ribs which have about the same strength over all parts of the shell. No secondary riblets are present. Very faint concentric lines overrun the interspaces and crests of the radials. Cardinal area narrow, marked with three to four arched ligamentary grooves. Hinge teeth large, about six in number on each side of the medial line.

Cotype (U. S. National Museum, no. 495966), right valve, measures: Length, 10 mm.; height, 10 mm.; diameter, 3.5 mm.

Type locality: Station 12285, abandoned quarry, about half a mile south of River Junction, Gadsden County, Fla. From an indurated 1-foot bed at an elevation of about 150 feet above sea level, collected

by G. M. Ponton and W. C. Mansfield, 1931. Same place and horizon as station 7080, T. W. Vaughan, C. W. Cooke, W. C. Mansfield, 1914.

Horizon: Tampa limestone, lower Miocene.

G. gadsdenensis, new species, most closely resembles *G. lamyi* Dall, from which it differs in having wider and more angulated ribs and no secondary riblets.

Known only from the type locality.

GLYCYMERIS HILLSBOROUGHENSIS Mansfield, n. sp.

Plate 10, Figures 9, 11

Shell small, rather solid, nearly equilateral, the posterior side being more produced. Right valve of holotype sculptured over the middle and sides with about 32 narrow, angular riblets which are separated by interspaces slightly wider than the riblets. The riblets over the posterior and anterior sides are similar to those over the middle part of the shell except they are weaker and more closely spaced. Ribs overrun by concentric threads.

Holotype, a right valve (U. S. National Museum, no. 495967), measures: Length, 10 mm.; height, 9.2 mm.; convexity, 2.6 mm.

Type locality: Station 12766, Blackwater River at S. A. L. Ry. crossing, Hillsborough County.

Horizon: Suwannee limestone, Oligocene.

The description is mainly based on a small and fairly well-preserved specimen.

G. hillsboroughensis differs from *G. lamyi* Dall in having sharper ribs which are separated by much wider interspaces. It closely resembles *G. acuticostata plaisa* Woodring, from Bowden, Jamaica, though it is much smaller.

Other occurrence: Specimens, preserved as molds, from station 6828, Newland Spring, Suwannee County, appear to be the same as or are closely related to *G. hillsboroughensis*.

GLYCYMERIS SUWANNENSIS Mansfield, n. sp.

Plate 10, Figures 2, 14

Shell of moderate size, inflated, circular in outline. Beaks rather low. Sides rounded, not keeled. Sculpture consisting of fine, even, closely spaced radial threads of about the same strength over the whole shell and fine concentric growth lines, producing with the radials a faint cancellate ornamentation. Cardinal area narrow. Hinge teeth rather strong, about 10 on each side of medial line.

Cotypes (U. S. National Museum, no. 495969) measure: Larger valve showing outline of shell but with external surface corroded: Length, 22 mm.; height, 21.8 mm.; diameter, 12.5 mm. Smaller valve revealing external sculpture, but with ventral portion of shell missing: Length, about 17 mm.; diameter, 9 mm.

Type locality: Station 6774, rock island, in Suwannee River, about half a mile above highway bridge at White Springs, Fla. T. W. Vaughan and C. W. Cooke, collectors.

Horizon: Suwannee limestone, Oligocene.

None of the specimens from the type locality are perfect.

G. suwannensis differs from *G. jamaicensis* Dall in lacking the weak keel on the posterior side and the shallow depression in front of it, and in having much finer radial threads on the umbonal area.

Other occurrences: Station 12762, $2\frac{3}{4}$ miles south of Zephyrhills, Pasco County, Fla.; station 11109, $1\frac{1}{2}$ miles north of Live Oak, Suwannee County, Fla.; station 12766, Blackwater Creek at crossing of Seaboard Air Line Railway, Hillsborough County.

GLYCYMERIS sp. = GLYCYMERIS SUWANNENSIS Mansfield?

A number of poorly preserved specimens at station 12314 (upper bed at Cummer Lumber Co. lime pit, Kendrick, Marion County) and at station 11186 (midway between Lowell and Sparr, Marion County), though closely related to *G. suwannensis* Mansfield, appear to be slightly different from that species. These have larger and higher shells than *Glycymeris suwannensis* and are sculptured with more widely spaced radials over the umbonal areas. In other features revealed there appears to be no difference.

Horizon: Tampa limestone, lower Miocene.

Subfamily ARCINAE

Genus ARCA Linnaeus, 1758

Subgenus ARCA, s. s.

ARCA (ARCA) UMBONATA Lamarck

1819. *Arca umbonata* Lamarck, Histoire naturelle des animaux sans vertébrés, vol. 6, p. 37.
1835. *Arca umbonata* Lamarck, idem, 2nd ed., vol. 6, p. 462. (Synonymy in part excluded.)
1847. *Arca umbonata* Lamarck. Philippi, Abbildungen und Beschreibungen Conchylien, vol. 3, p. 14, pl. 4, figs. 3a-c.
1873. *Barbatia bonaczyi* Gabb, Geology of Santo Domingo: Am. Philos. Soc. Trans., vol. 15, p. 254.
1887. *Arca imbricata* Bruguière. Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 118.

1887. *Arca listeri*? Philippi. Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 118.
 1889. *Arca imbricata* Bruguière. Dall, U. S. Nat. Mus. Bull. 37, p. 40.
 1915. *Arca umbonata* Lamarck. Dall, U. S. Nat. Mus. Bull. 90, p. 118, pl. 17, figs. 6, 8.
 1917. *Arca umbonata* Lamarck. Sheldon, Palaeontographica Americana, vol. 1, no. 1, p. 8, pl. 1, figs. 12-17.
 1917. *Arca umbonata* Lamarck. Maury, Bull. Am. Paleontology, vol. 5, no. 29, p. 163, pl. 30, fig. 11.

The shell of *Arca umbonata* is rather large and irregular in outline. The posterior end is more expanded than the anterior. The byssal opening occupies more than half of the ventral margin. The posterior keel is prominent. The area in front of the keel is slightly inflated forward to the byssal construction and behind medially depressed. The beaks are widely separated by the concave cardinal area and placed at the anterior third of the hinge line. The sculpture is composed of rather closely spaced radials over the disk and anterior slope and of fewer and stronger radials over the posterior slope. Concentric growth lines form imbricated denticles on the radials. On the disk one or more finer radials intercalate the primaries.

Occurrence: "silex bed" at Ballast Point, Tampa Bay (U. S. National Museum, no. 165174); Sixmile Creek, near Orient Station, Hillsborough County (Tucker); station 12292, Cherokee Sink, Wakulla County; station 7338, Tarpon Springs, Pinellas County; station 7080, old quarry, half a mile south of River Junction (rather large and imperfect specimen and identification uncertain); station 13851, River Junction, 80 feet above sea level; (?), Old Chattahoochee Landing, echinoderm bed.

Other occurrences: This species has been reported in time from the lower Miocene to the Recent. Dall¹⁰⁵ writes:

"This is a very widespread species, both in time and geographical distribution at the present day. It seems to have retreated from Florida waters to warmer regions during the Miocene and returned there at about the end of the Pliocene epoch."

ARCA (ARCA) GRAMMATODONTA Dall

1915. *Arca grammatodonta* Dall, U. S. Nat. Mus. Bull. 90, p. 118, pl. 20, figs. 1, 2; pl. 22, fig. 3.

Dall described this species as follows:

"Shell resembling *Arca paratina*, but more inflated, relatively wider, with the anterior end of the shell projecting before the angle where the hinge line ends, and with the latter rounded off; the posterior angle is similarly less conspicuous and the posterior truncation of *A. paratina* is replaced by a rounded-lanceolate profile; the area of the present species is relatively wider, and the

¹⁰⁵ Dall, W. H., U. S. Nat. Museum Bull. 90, p. 118, 1915.

triangle formed by the resiliary grooves is shorter and more equilateral; the anterior radial sculpture is alternated, the stronger ribs conspicuously beaded, while in *A. paratina* they are nearly plain, and a similar difference characterizes all the radial sculpture; the most marked difference occurs in the hinge teeth, which in the present species are sharply grooved vertically, while the teeth of *A. paratina* are smooth and rather smaller; length of figured specimen 35, height 15, maximum diameter 20 mm.

"Tampa silex beds at Ballast Point, Tampa Bay, Florida; E. J. Post. U. S. Nat. Mus. No. 165175.

"Like the other typical Arks this species has a marked byssal gape, and being a nestler shows more or less individual variation of form due to *situs*."

The shell of this species is less inflated and relatively longer than that of *A. umbonata* Lamarck and has weaker radials on the posterior slope. The sculpture over the disk and anterior slope closely resembles that on *A. umbonata*.

Horizon: Tampa limestone, lower Miocene.

Occurrence: "silex beds" at Tampa Bay; station 12292, Cherokee Sink, Wakulla County.

ARCA (ARCA) PARATINA TAMPAE Mansfield, n. subsp.

Plate 11, Figures 2, 4

1915. *Arca paratina* Dall, U. S. Nat. Mus. Bull. 90, p. 119 (part).

Dall referred specimens from the "silex beds" at Ballast Point, Tampa Bay, Fla., under the U. S. National Museum no. 165177, to *Arca paratina* Dall, a species described from the Chipola formation. These specimens differ from *A. paratina* in a number of features. Following is a description of the "silex beds" fossil:

Shell small, thin, elongate, and slightly more expanded at the posterior end than anterior. Beaks low, medially depressed, and situated 7 millimeters from the anterior margin. Anterior margin narrowly rounded; ventral margin very broadly rounded except at the byssal foramen where it is weakly arched beakward; posterior margin fluted and nearly vertical with the hinge line. Back of shell weakly depressed from the beak to the byssal foramen; anterior side rounded; posterior end keeled and depressed between keel and posterior dorsal margin. Sculpture on posterior slope consists of 5 rounded, moderately strong radials; on the keel and forward to medial depression, of 13 closely spaced radials about equal in strength to those on the posterior slope; between the medial depression and anterior shoulder, of about 21 narrowly spaced and finer radials; and on anterior slope, of about 10 radials about the same strength as those on the posterior slope. The radials on the anterior slope are intercalated with finer

radials. Cardinal area narrow, concave, marked in each valve by two grooves which meet under the beak. Hinge line straight. Hinge teeth smaller at the center of the hinge line and nearly erect, whereas those at the ends are larger and oblique.

Holotype: Left valve measures in length, 23.5 mm.; height, 10.8 mm.; diameter, 5 mm.

Horizon: Tampa limestone, lower Miocene.

Arca paratina tampa differs from *A. paratina* Dall in having a shorter and relatively broader shell and in the nature of sculpture over the disk. The radials on the disk of the new subspecies are more uniform in size than those on the disk of *A. paratina*. It is closely related to *A. grammatodonta* Dall, but it has a smaller, lower, and more delicately sculptured shell than that species.

ARCA(?) KENDRICKENSIS Mansfield, n. sp.

Plate 11, Figure 8

Shell rather large, subtrapezoidal in outline, and moderately inflated. Middle area of disk depressed; anterior side rounded; posterior side with a prominent ridge; in front of the ridge the area is weakly inflated and behind it the posterior slope is concave medially. Beak situated at anterior third of hinge-line. Sculpture on anterior shoulder and on anterior slope consists of incised radials with an occasional interradiar thread; in the depressed area of fine radials alternating with finer radials; and on the posterior side above and below the ridge of rather strong incised radials intercalated with finer radials. In general, the radial sculpture on the anterior slope, in front of the posterior ridge, and on the posterior slope is similar except that the radials on the posterior slope are stronger than the rest. The radials in the middle part of the disk are finer than on any other part of the shell. Fine concentric lines overrun the radials forming, especially in the center of the disk, a reticulate ornamentation.

The description is based on a gutta-percha squeeze.

Holotype, right valve (U. S. National Museum no. 495970) measures: Length, 45 mm.; height, 28 mm.; diameter, 11 mm.

Type locality: Station 11115, upper bed at Cummer Lumber Co. lime pit near Kendrick, Marion County, Fla. C. W. Cooke and D. S. Mossom.

Horizon: Tampa limestone, lower Miocene.

The new species apparently belongs in the same group as *Arca umbonata* Lamarck, but it is less elongate than that species and the sculpture on the anterior and posterior sides is different.

Genus BARBATIA Gray, 1842
Subgenus PLAGIARCA Conrad, 1875

BARBATIA (PLAGIARCA) MARYLANDICA Conrad

1840. *Byssarca marylandica* Conrad, Fossils of the medial Tertiary of the United States, p. 54, pl. 29, fig. 1.
1863. *Barbatia (Byssarca) marylandica* Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 580.
1864. *Barbatia marylandica* Conrad. Meek, Check list of the invertebrate fossils of North America; Smithsonian Misc. Coll., No. 183, p. 6.
1894. *Barbatia marylandica* Conrad. Whitfield, U. S. Geol. Survey Mon. 24, p. 48, pl. 7, figs. 2-4.
1898. *Barbatia (Calloarca) marylandica* Conrad. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 4, p. 623.
1904. *Arca (Barbatia) marylandica* Conrad. Glenn, Maryland Geol. Survey, Miocene, p. 392, pl. 106, fig. 7.
1915. *Barbatia (Calloarca) marylandica* Conrad. Dall, U. S. Nat. Mus. Bull. 90, p. 119, pl. 4, fig. 3.
1917. *Arca marylandica* Conrad. Sheldon, Palaeontographica Americana, vol. 1, pt. 1, p. 14, pl. 3, figs. 5-7.
1926. *Barbatia (Plagiarca) marylandica* Conrad. Gardner, U. S. Geol. Survey Prof. Paper 142-A, p. 26.

Conrad described this species in 1840 as follows:

"Shell oblong, compressed, thin, with very numerous radiating granulated striae; beaks not prominent; base much contracted or emarginate anterior to the middle; posterior side dilated, the superior margin very oblique and emarginate; extremity angulated, and situated nearer to the line of the hinge than to that of the base; cardinal teeth minute, except towards the extremities of the cardinal line, where they are comparatively very large and oblique; inner margin entire."

The type locality, as recorded by Conrad in 1840, is "Cliffs of Calvert," Md.

The type is deposited at the Academy of Natural Sciences, Philadelphia.

The specimens from the Calvert formation of Maryland are transversely constricted anterior to middle of the shell. The posterior extremity is more expanded than anterior end. The form from the "silex beds" of the Tampa limestone that has been referred to *Barbatia (Plagiarca) marylandica* is smaller, and the disk is less depressed than the Maryland form, but in other features it is very similar to the Maryland form.

Occurrence: Tampa limestone, lower Miocene, "silex beds," Tampa Bay; Sixmile Creek, Hillsborough County (Tucker); stations 12285 and 7080, quarry half a mile south of River Junction, Gadsden County. Suwannee limestone, Oligocene, station 11113, Brooksville, Hernando County; station 12308, 1½ miles north of Live Oak, Suwannee County.

(The specimens from stations 11113, 12308, 12285, are poorly preserved and the determination of the species is not conclusive.)

Occurrence elsewhere: Florida, Chipola formation, Oak Grove sand, and Shoal River formation (Gardner); Maryland, Calvert formation; New Jersey, the marls of Jericho, Cumberland County.

BARBATIA (PLAGIARCA) ARCULA Heilprin

1887. *Arca arcula* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 118, pl. 16, fig. 65.
 1898. *Barbatia (Calloarca) arcula* Heilprin. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 4, p. 624, pl. 33, fig. 4.
 1915. *Barbatia (Calloarca) arcula* Heilprin. Dall, U. S. Nat. Mus. Bull. 90, p. 120, pl. 17, fig. 5.
 1917. *Arca arcula* Heilprin. Sheldon, Palaeontographica Americana, vol. 1, No. 1, pp. 15, 16, pl. 3, figs. 8, 9.

Heilprin described this species in 1887 as follows:

"Shell moderately elongated, sharply angulated on the posterior slope, the dorsal and vertical borders nearly straight and parallel with one another; dorsal (hinge) line not much more than half the length of shell; anterior border projecting forward basally; posterior border acutely angulated with the base; beaks anterior, not very prominent, nor very widely separated; ligamental area narrow; teeth almost obsolete in the middle of the hinge-line, becoming oblique toward either extremity; interior of shell deep; external surface closely ribbed, the ribs strongly imbricated by the rugose lines of growth; ribs most prominent on the posterior slope, where they are echinated.

"Length, 1.7 inch; height to top of umbo, one inch."

Dall redescribed this species in 1898 and figured a right valve (U. S. National Museum no. 107718) from the "silex beds," Ballast Point, Tampa Bay. Dall's description is as follows:

"Shell subovate, thin, inflated, the beaks low and prosogyrous; the cardinal area narrow and very closely and minutely furrowed longitudinally, the furrows showing a slight angle behind the beaks; sculpture of close-set, fine radial ribs, rather regularly imbricated at successive lines of growth; on the posterior dorsal slope are six or eight nodulous larger ribs; the beaks are situated a little behind the anterior third; byssal foramen narrow, very anterior; hinge with a few large A-shaped teeth at the ends, the middle teeth vertical, small, or even obsolete mesially; margins of the valve slightly or not at all crenulated by the sculpture. Length of shell 47, of hinge-line 30, height 31, diameter 26 mm.

"This species is very evenly and regularly fluted at the imbrications, differing in that respect from any of the other species mentioned here. It is notable also for its inflated and thin valves and the bluntly truncate posterior end, though the latter may be abnormal."

Holotype deposited in the Wagner Free Institute of Science, Philadelphia.

Horizon: Tampa limestone, lower Miocene.

Occurrence: Ballast Point "silex beds," Tampa Bay, Fla., type locality; station 12292, Cherokee Sink, Wakulla County, Fla. (an external mold of part of one valve).

Subgenus ACAR Gray, 1842

BARBATIA (ACAR) DOMINGENSIS (Lamarck)

Plate 10, Figure 13

1819. *Arca domingensis* Lamarck, Histoire nat. des animaux sans vertèbres, vol. 6, p. 40.

Woodring¹⁰⁶ has given a full synonymy of this species and evidence that Gmelin's name, *Arca reticulata*, is not available for this common West Indian species.

The living shell is subrhomboidal in outline, heavy, and sharply rostrate posteriorly. The anterior slope is steep. The beaks are broad, proximate, weakly depressed medially, and situated near the anterior end. The sculpture consists of strong concentric ridges or laminae, crossed by closely spaced radials which tend to nodulate the concentric ridges. The cardinal area is very narrow, slightly wider in front, and scored by a few grooves running nearly parallel to hinge-line.

Occurrence: "silex beds" of the Tampa limestone; station 12284, Old Chattahoochee Landing about halfway up the bluff, Gadsden County; station 6830, near Lloyd, Jefferson County. (The specimens at stations 6830 and 12284 are poorly preserved but appear to be *Barbatia domingensis*.)

Barbatia domingensis, in outside localities, has been reported from the lower Miocene to the Recent. Its occurrence in the Eocene is questionable.

Genus ARCOPSIS von Koenen, 1885

ARCOPSIS ADAMSI (Dall) Reinhart

1845. *Arca coelata* Conrad, Fossils of the medial Tertiary of the United States, p. 61, pl. 32, fig. 2. (Not *Arca coelata* Reeve, 1844.)
 1863. *Barbatia (Acar) coelata* Conrad (not Reeve). Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, vol. 14, p. 580.
 1886. *Arca adamsi* Shuttleworth. Dall, Harvard Coll. Mus. Comp. Zoology Bull., vol. 12, p. 243.
 1890. *Arca (Acar) adamsii* Shuttleworth Ms.? Smith, E. A., Linnæan Soc. London Jour., Zoology, vol. 20, p. 499, pl. 30, figs. 6, 6a.
 1898. *Barbatia (Fossularca) adamsi* (Shuttleworth) Smith. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 4, p. 629.
 1915. *Barbatia (Fossularca) adamsi* E. H. Smith. Dall, U. S. Nat. Mus. Bull. 90, p. 121.

¹⁰⁶ Woodring, W. P., Carnegie Inst. Washington Pub. 366, pp. 36, 37, 1925.

1917. *Arca adamsi* (Shuttleworth) Smith. Sheldon, Palaeontographica Americana, vol. 1, no. 1, p. 22, pl. 4, figs. 16-18; pl. 5, fig. 1.
1919. *Arca (Barbatia) adamsi* (Shuttleworth). Gardner and Aldrich, Acad. Nat. Sci. Philadelphia Proc., vol. 71, p. 18.
1925. *Fossularca (Fossularca) adamsi sawkinsi* Woodring, Carnegie Inst. Washington Pub. 366, p. 51, pl. 5, figs. 16, 17. (Subspecific name *sawkinsi* suppressed, Carnegie Inst. Washington Pub. 385, p. 18, 1928.)
1926. *Barbatia (Fossularca) adamsi* (Shuttleworth Ms.) Dall. Gardner, U. S. Geol. Survey Prof. Paper 142-A, p. 28, pl. 5, figs. 1-4.
1932. *Arca (Fossularca) adamsi* (Shuttleworth Ms.) Dall. Mansfield, Florida Geol. Survey Bull. 8, p. 45, pl. 7, figs. 1-3.
1935. *Arcopsis adamsi* (Smith). Reinhart, Bulletin du Musée royal d'Histoire Naturelle de Belgique, Tome XI, no. 13, pp. 31, 32.

This species is recognized by its trapezoidal outline, the emarginate ventral margin, its cancellate and denticulate sculpture, and its diamond-shaped muscular impression beneath the beaks.

Three poorly preserved shells, identified as "*Barbatia adamsi*" by Dall, are in the collection of the U. S. National Museum (no. 165179) from the "silex beds" of the Tampa limestone at Ballast Point, Fla. All these specimens are corroded and the sculpture is only faintly indicated. These may belong to *Arcopsis adamsi*.

This species has been reported from the lower Miocene to the Recent. In the Recent, it ranges from Cape Hatteras to Brazil, in 10 to 35 fathoms.

Genus ANADARA Gray, 1847

ANADARA LATIDENTATA BALLISTA Mansfield, n. subsp.

Plate 12, Figures 3, 5

1898. *Scapharca (Scapharca) latidentata* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 4, p. 638 (part).
1915. *Scapharca latidentata* Dall, U. S. Nat. Mus. Bull. 90, p. 121 (part).
1917. *Arca latidentata* Dall. Sheldon, Palaeontographica Americana, vol. 1, pt. 1, pp. 33, 34 (part).

Shell small, subtrapezoidal, moderately convex and twisted. Beak rather low, prosogyrate, sulcate anterior to middle, and situated 3 millimeters from anterior margin. Middle, anterior side, and posterior side of shell rounded; ventral margin arched beakward in posterior region. Sculpture consists of 24 strongly beaded, evenly spaced, moderately strong ribs separated by spaces about the width of the ribs. Cardinal area narrow, nearly smooth, faintly marked by three angled grooves. Hinge line nearly straight, provided with about 37 somewhat broken, nearly erect teeth.

Holotype, left valve (U. S. National Museum no. 149010) measures: Length, 15 mm.; height, 10.2 mm.; diameter, 5.2 mm.

Type locality: Ballast Point, Tampa Bay, Fla.

Horizon: Tampa limestone; lower Miocene.

The new subspecies has a more twisted shell than *Anadara latidentata* (Dall) and is sculptured by wider, more strongly beaded, and fewer ribs by six. It closely resembles "*Barbatia (Diluvarca)*" *perplura* Woodring, a species from the Bowden marl of Jamaica.

Only one well preserved shell is available and this constitutes the holotype.

ANADARA HYPOMELA (Dall)

1898. *Scapharca (Scapharca) hypomela* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 4, p. 637, pl. 33, fig. 1.
1915. *Scapharca hypomela* Dall, U. S. Nat. Mus. Bull. 90, p. 121, pl. 17, fig. 7.
1917. *Arca hypomela* Dall, Sheldon, Palaeontographica Americana, vol. 1, pt. 1, p. 34, pl. 7, figs. 22-25.
1926. *Diluvarca (Diluvarca) hypomela* (Dall). Gardner, U. S. Geol. Survey Prof. Paper 142-A, p. 29, pl. 5, fig. 12.

Dall described this species as follows:

"Shell of moderate size, long, inflated, with rather low, mesially compressed, prosogyrate beaks; left valve with about forty-three deeply channeled, flat-topped ribs with fine, regular, concentric beading, except on the posterior slope, where the ribs are lower, flatter, and obsoletely channeled; near the margin some of the ribs have a second set of finer grooves; hinge-line straight, anterior end descending vertically, then obliquely rounded into the base, which is nearly parallel with the hinge-line; the posterior end descends more obliquely and the basal angle is prolonged a little and rounded; the interspaces between the ribs in both valves are very narrow, and on the right valve the beading is less conspicuous; the cardinal area is somewhat concave, flattish, with three or four concentric grooves in lozenge form; teeth of the hinge similar, numerous, not interrupted, short, vertical, the distal teeth a little longer and more oblique; margin of the valves fluted, the right valve slightly smaller than the other. Lon. 50, alt. 25, diam. 20 mm.

Holotype: U. S. National Museum no. 114800.

Type locality: Station 2212, Tennile Creek, 1 mile west of Baileys Ferry, Calhoun County, Fla.

A number of small specimens preserved as silicious pseudomorphs (U. S. National Museum no. 165180), collected from the "silex beds" at Ballast Point, Tampa, Fla., appear to be the same as specimens of *Anadara hypomela* of the same size from the Chipola formation.

Occurrence elsewhere: Sixmile Creek, Hillsborough County. Specimens preserved as external molds that appear to belong to *Anadara hypomela* (Dall) at station 12292, Cherokee Sink, Wakulla County; station 12735, 11 miles slightly southwest of Tallahassee, Leon County; station 4998, railroad bridge over Sixmile Creek, Hillsborough County.

ANADARA HYPOMELA SILICATA Mansfield, n. subsp.

Plate 12, Figures 1, 4

1898. *Scapharca* (*Scapharca*) *hypomela* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 4, p. 637 (part).
1915. *Scapharca hypomela* Dall, U. S. Nat. Museum Bull. 90, p. 121, pl. 21, figs. 17, 18 (exclude reference to Chipola marls and fig. 7 on pl. 17).

A number of larger specimens from "silex beds" at Ballast Point that Dall identified as "*Scapharca*" *hypomela* differ from specimens from the Chipola formation, the type locality of the species, in having more inflated and shorter shells with a more truncate posterior end.

The figured holotype of the new subspecies, a left valve, has 37 ribs. The figured paratype, a right valve, has 37 moderately incised ribs.

The holotype (U. S. National Museum no. 165181) measures: Length, 29 mm.; height, 18 mm.; diameter, 9.2 mm. The figured paratype, a right valve, measures: Length, 21 mm.; height, 15 mm.; diameter, 7.4 mm.

Type locality: "silex beds" at Ballast Point, Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene.

ANADARA TARPONENSIS Mansfield, n. sp.

Plate 12, Figures 2, 6, 7

Shell small, semiquadrate, strongly inflated, inequilateral and equi-valve. Beaks high, somewhat flattened, and situated near the anterior third of length of hinge-line. Posterior side very steep and weakly concave medially; middle of disk slightly rounded; anterior slope evenly and narrowly rounded. The sculpture consists of 21 to 24 rounded, weakly nodulous on better preserved specimens, nearly equal-sized ribs separated by interspaces about as wide as the ribs. The ribs on and in front of the posterior ridge are a little stronger than the others. There are five to six ribs on the posterior slope. Cardinal area marked with about five arched grooves. Hinge-line nearly straight. Character of teeth not clearly revealed.

Cotype, right valve (U. S. National Museum no. 495971) measures: Length, 15 mm.; height, 13 mm.; diameter, 9.5 mm. One specimen is a little larger than the larger cotype.

Type locality: Station 7358, right bank of Anclote River, about 300 yards above wagon bridge at Tarpon Springs, Pinellas County, Fla.

Horizon: Tampa limestone, lower Miocene.

Other occurrence: One poorly preserved specimen collected at station 7176, River Junction, at an elevation of 74 feet above sea level, may belong to the new species.

Anadara tarponensis appears to be related to "*Arca (Scapharca)*" *silverdalensis* Kellum from the Trent marl of North Carolina.

Superfamily OSTRACEA

Family OSTREIDAE

Genus OSTREA Linnaeus, 1758

OSTREA VAUGHANI Dall

1915. *Ostrea vauhani* Dall, U. S. Nat. Museum Bull. 90, p. 123, pl. 19, fig. 6.

Following is Dall's description of this species:

"Shell solid, heavy, with the external sculpture of both valves similar, composed of closely adjacent concentric imbrications or overlapping lamellae corresponding to the incremental lines, with no trace of any radial sculpture; upper valve [right] moderately convex; beak strongly recurved, with a deep wide medial ligamentary sulcus [on left valve]; the inner margins of the valves near the hinge, with a sparse denticulation, especially on the anterior margin. Length 120, width 85, depth of paired valves 60 mm.

"Ballast Point, Tampa Bay, either from the silex beds or the limestone immediately above them; E. J. Post, U. S. Nat. Mus. No. 166092."

The anterior side of each valve is thicker and externally higher than the posterior.

Horizon: Tampa limestone, lower Miocene.

This species was collected in 1936 at station 13848, from dredgings taken at a depth of 32 to 36 feet below water level at Hooker Point, upper Hillsborough Bay.

Other occurrences: Station 12293, Wakulla Railway Station, Wakulla County, Fla.; station 12300, 1¼ miles northeast of Lloyd, Jefferson County, Fla.

OSTREA RUGIFERA Dall?

1898. *Ostrea sellaeformis* var. *rugifera* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 4, p. 678.

1915. *Ostrea sellaeformis* var. *rugifera* Dall, U. S. Nat. Museum Bull. 90, p. 123.

1926. *Ostrea rugifera* Dall. Gardner, U. S. Geol. Survey Prof. Paper 142-A, p. 41, pl. 10, figs. 1, 2.

Two small specimens, collected from station 2115, "silex beds" of the Tampa limestone, Ballast Point (U. S. National Museum no. 153875) appear to belong to *O. rugifera* Dall, a species occurring abundantly in the Chipola formation at its type locality. Specimens collected at station 10111, bed no. 2 at Falling Water, Washington County, appear closely related to *O. rugifera*, but are too small to determine definitely their relationship.

OSTREA NORMALIS CADUCAQUA Mansfield, n. subsp.

Plate 12, Figure 8; Plate 13, Figure 6

Holotype, right valve, of medium size, very thick and heavy, externally arched and within weakly concave. Beak and early part of shell corroded, but middle and ventral area sculptured with rather closely spaced concentric imbrications. Ligament area strongly arched medially and moderately long; muscle scar deep. The description is based on a single right valve. A number of young specimens collected from the same bed as the holotype, which may or may not be the same species, have an undulating surface without visible radials.

Holotype (U. S. National Museum no. 495972) measures: Length, 65 mm.; height, 96 mm.; convexity, 40 mm.

Type locality: Station 7244, Falling Water (NW.¼ sec. 27, T. 4 N., R. 13 W.), 4 miles south of Chipley, Washington County, no. 2 of section. C. W. Cooke and W. C. Mansfield.

Horizon: Tampa limestone, lower Miocene.

Ostrea normalis caducaqua differs from *O. normalis* Dall in having a much thicker shell and more closely spaced concentric lamellae. *O. normalis* Dall probably is a descendant of *O. normalis caducaqua*.

OSTREA aff. O. ANTIGUENSIS Brown

A number of internal molds of the genus *Ostrea* have been collected from the echinoderm bed at Old Chattahoochee Landing, Gadsden County, at an elevation 77.4 to 78.4 feet above sea level, which cannot be specifically determined. The molds represent mainly thin-shelled, high lower valves with 5 to 7 strong radials. The form suggests a relationship to both *O. vicksburgensis* Conrad, an Oligocene species, and *O. antiguensis* Brown, a common species in the Antigua formation. The number of ribs appears to be fewer than on most specimens of *O. vicksburgensis*.

Internal molds, closely resembling those at Old Chattahoochee Landing, have been collected at Arredonda, near Gainesville, Fla., and questionably referred to *O. vicksburgensis*. One small valve collected from the Suwannee limestone at station 11113 at Brooksville, Hernando County, and another from station 12298, 1½ miles east-southeast of Flint Rock, Fla., may be closely related to the form at Old Chattahoochee Landing.

Horizon: Tampa limestone (basal part), lower Miocene.

Superfamily PECTINACEA

Family PECTINIDAE

Genus CHLAMYS Bolten, 1798

Section CHLAMYS s. s.

CHLAMYS (CHLAMYS) CROCUS Cooke

Plate 13, Figure 3

1919. *Pecten crocus* Cooke, Carnegie Inst. Washington Pub. 291, p. 135, pl. 9, figs. 2a, 2b; pl. 11, fig. 9(?).
1934. *Chlamys (Chlamys) crocus* Cooke. Tucker, Am. Midland Naturalist, vol. 15, p. 614, pl. 25, fig. 3.

The following is the original description of this species:

"Shell equivalve, inequilateral, moderately convex; about 22 round ribs, separated by slightly narrower interspaces; surface of the ribs with curved imbricating spines, convex towards the umbones, and with very faint radiating striae; interspaces with sculpture of fine, close-set, concentric striae; near the ventral margin a small thread appears in each interspace; submargins depressed, ornamented with small radial threads and fine concentric striae; ears moderately large, subequal, with radial, nodose riblets.

"Alt., 39 mm.; lat., 36 mm.; diam., 14 mm.

"*Locality*.—Roadside, descent to Crocus Bay, Anguilla, station 6893, also 6894 and 6965, Vaughan.

"*Geologic horizon*.—Oligocene.

"*Type*.—U. S. Nat. Mus. No. 167079."

Occurrence in Florida: Tampa limestone, lower Miocene, station 2470, 1 mile west of Bartow, Polk County; station 11117, Orient Station, Sixmile Creek, Hillsborough County; station 12753 (Ponton and Mansfield), station 11115 (Cooke and Mossom), upper bed at Cummer Lumber Company quarry, near Kendrick, Marion County; station 12292, Cherokee Sink, Wakulla County; station 12293, Wakulla R. R. Station, Wakulla County; station 12300, 1½ miles northeast of Lloyd, Jefferson County; station 12725, Baileys old ferry, Calhoun County; station 10111, station 7244, Falling Water, Washington County, bed no. 2 of section; station 12282 (Ponton and Mansfield), station 2565 (Dall), station 3405 (Vaughan), Old Chattahoochee Landing, echinoderm bed, elevation 77.4 to 78.4 feet above sea level; station 7177, Old Chattahoochee Landing, bed no. 3, elevation 80-90 feet above sea level (Vaughan); station 7169, Old Chattahoochee Landing, bed no. 6, elevation 122.5 to 124 feet above sea level (Vaughan); station 12283, Old Chattahoochee Landing, elevation 155 to 165 feet above sea level (Ponton and Mansfield).

The specimens collected at Old Chattahoochee Landing are preserved mainly as external molds of the original shells. The impres-

sions taken from these molds appear to represent the same species as actual shells collected elsewhere.

Some of the specimens appear to be as closely allied to *Chlamys clevei* Cooke as to *Chlamys crocus* Cooke. As both *C. clevei* and *C. crocus* occur at the same station they may be only varietal forms of the same species.

CHLAMYS (CHLAMYS) ANGUILLENSIS Guppy

Plate 14, Figure 6

- 1867. *Pecten anguillensis* Guppy, Sci. Assoc. Trinidad, Proc., p. 175.
- 1874. *Pecten anguillensis* Guppy, Geol. Magazine, Dec. 2, vol. 1, p. 446, pl. 18, fig. 24.
- 1898. *Pecten (Chlamys) anguillensis* Guppy. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 4, p. 715.
- 1913. *Pecten (Chlamys) anguillensis* Guppy. Brown, Acad. Nat. Sci. Philadelphia, Proc., vol. 65, p. 602, pl. 18, figs. 4, 6, 7, 8.
- 1919. *Pecten (Chlamys) anguillensis* Guppy. Cooke, Carnegie Inst. Washington Pub. 291. p. 132, pl. 10, figs. 1a, b, 2.
- 1929. *Pecten anguillensis* Guppy. Cooke and Mossom, Florida State Geol. Survey Twentieth Ann. Rept., pp. 70, 96.

The following is Guppy's original description of this species:

"Shell fan-shaped, ornamented with radiate muricate striae, and about 10 or 11 prominent rounded ribs, which are crossed by concentric striae, the concave interspaces broader than the ribs. Upper valve nearly flat, lower one gently concave.

"Miocene of Anguilla, allied to *P. pectens* Tuomey and Holmes, North America."

Only one imperfect right valve, collected at station 10111, Falling Water, 4 miles south of Chipley, Washington County, Fla., is accessible. The dorsal area has been broken off. This specimen has 14 ribs, which are ornamented on their summits with 3 radials, the middle radial occupying the middle of the rib. The Florida specimen resembles more closely specimens from the lower bed at Hodges Bluff, Antigua, than those from the upper bed at that locality. It differs slightly, however, from the Antigua specimens in having narrower and more numerous ribs by 3.

Section AEQUIPECTEN Fisher, 1887

CHLAMYS (AEQUIPECTEN?) FLINTENSIS Mansfield, n. sp.

Plate 14, Figures 1, 3

- 1898. *Pecten (Lyropecten)* sp. indet. a Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 4, p. 725.

Dall¹⁰⁷ in 1916 described and figured a specimen (U. S. National Museum no. 166711) from station 7075, east bank of Flint River,

¹⁰⁷ Dall, W. H., U. S. Nat. Mus. Proc., vol. 51, no. 2162, p. 492, pl. 84, fig. 9. 1916.

about $10\frac{1}{2}$ miles below Bainbridge and just above Lambert Island, Ga., and named it *Pecten* (*Lyropecten*?) *alpha*. Dall included in the species also a formerly undetermined specimen from Suwannee Sulphur Springs, Suwannee River, Suwannee County, Fla (U. S. National Museum no. 137901). The specimen from Flint River is regarded here as the holotype of *P. alpha* Dall. Better preserved specimens of the form from Suwannee River, including both valves, collected in 1930-31, prove to be different from *P. alpha* Dall and are here referred to a new species, *Chlamys* (*Aequipecten*?) *flintensis*, with the following description:

Shell of moderate size, slightly longer than high, thin, suborbicular in outline, nearly equilateral and nearly equivalve, weakly compressed over the umbonal area and moderately convex over the middle part of the disk. Right valve with 12 ribs; those over middle of the disk are strong, while those on the sides gradually diminish in strength. The anterior rib is thread-like and situated at the upper border of the submargin and the posterior rib is slightly stronger than the anterior and situated at the upper border of the submargin. The ribs barely or faintly reach the beak. The ribs are rounded, widely spaced, and are nearly smooth except for a very fine, medial raised thread and weak concentric undulations. Submargins smooth. Ears large, the right being a little longer than the left. Right ear with a deep byssal notch and marked with 5 strong, scaly radials; left ear without radials. Left valve with same number and similarly arranged ribs as right valve; ears large and without visible radials.

Dimensions: Cotypes (U. S. National Museum no. 495973). Right valve: Length, 41.5 mm.; height, 37.5 mm.; convexity, 7 mm. Left valve: Length, 46 mm.; height, 41 mm.

Type locality: Station 12298, $1\frac{1}{2}$ miles east-southeast of Flint Rock, Jefferson County, Fla.

Horizon: Suwannee limestone, Oligocene.

Chlamys flintensis differs from *Pecten alpha* Dall in the absence of radials on the disk of the shell and on the posterior ear of the right valve and also in having a flatter umbonal area. It belongs to the same group as *Pecten vaun* Cooke, a species collected at Crocus Bay, Anguilla, and is similar to it in a number of features, but differs from it in having a flatter umbonal area and fewer and stronger ribs. Perhaps the new species is more closely related to *Pecten vaun wythei* Hertlein, a variety from La Cruz and Santiago, Cuba, but it has fewer ribs by 3 than that variety and apparently lacks the striations on the anterior ear of the left valve that the variety *wythei* possesses. It is

also related to *Chlamys* (*Aequipecten*) *phrygium* Dall, a living species ranging from Cape Cod to the West Indies. The section to which the new species belongs has not been fully determined. It is questionably placed in the section *Aequipecten*.

Occurrence: Station 11110, Suwannee Sulphur Springs, Suwannee County; stations 11109 and 12308, 1½ miles north of Live Oak, Suwannee County; station 3672, Wacissa swamp, Jefferson County; station 12299, Walker Spring, Jefferson County; station 12737, 7.9 miles west of Perry, Taylor County.

CHLAMYS (AEQUIPECTEN) aff. C. VAUN WYTHEI Hertlein

Plate 13, Figure 1

A moderately large specimen (Fla. no. 3745) collected at Lyles old quarry, 1½ miles north of Live Oak, Suwannee County, Fla., by the Florida Geological Survey, may be related to a form originally identified as "*P. vaun* var. *flabellum*" Cooke,¹⁰⁸ a species from the "Oligocene" at La Cruz and Santiago, Cuba.

The Florida specimen, a right valve, is not perfect; the umbonal area and the lower anterior margin have been broken off. The specimen is nearly equivalve, depressed in the umbonal area and weakly inflated over the middle part of the disk. Ribs 16 in number, mainly rounded, apparently smooth, and separated by slightly narrower interspaces. The ribs over the disk are nearly of the same size except those on the anterior side which are weaker. The rib at the upper edge of the anterior submargin is very small. The Florida specimen, though much larger than the Cuban specimens, measuring about 50 millimeters in length and about 45 in height, agrees with them in all features discernible and may belong to the same species.

Horizon: Suwannee limestone, Oligocene.

Section LYROPECTEN Conrad, 1863

CHLAMYS (LYROPECTEN) BROOKSVILLENSIS Mansfield, n. sp.

Plate 13, Figures 2, 4, 5

Shell of moderate size, slightly inequilateral, the posterior side being slightly produced, both valves inflated, the left weakly and the right more strongly. Both valves with about 20 similarly sculptured ribs. Ribs a little narrower than interspaces, strong, rather wide, nearly square in outline, weakly undercut on the sides and sculptured mainly on top with an incised longitudinal line and occasionally on

¹⁰⁸ Cooke, C. W., Tertiary mollusks from the Leeward Islands and Cuba: Carnegie Institute of Washington Pub. No. 291, p. 134, pl. 8, figs. 6a, b, 7, 1919.

the marginal ribs by two weakly incised lines. Interspaces with one strong medial thread on the distal part of the disk but not present over the beak or early part of the shell. Whole surface of disk concentrically sculptured with marginally raised, rather coarse, scabrous lamellae. There are about 4 of these lamellae to a millimeter on the early part of the shell and 2 to a millimeter on the distal ends of the larger shells. Submargins without any distinct radials but with scabrous concentric sculpture. Right auricle on right valve with a rather deep byssal notch and sculptured with 3 or 4 rather strong scabrous radials. Left auricle raised along dorsal margin and sculptured with about 5 weaker scabrous radials. Auricles on left valve sculptured with scabrous radials.

Dimensions: Holotype, left valve (U. S. National Museum no. 495974), length, 40 mm.; height, 40 mm. Paratype, right valve (U. S. National Museum no. 496234), length, 44 mm.; height, 42 mm.

Holotype locality: Station 12322, quarry three-fourths mile southwest of Brooksville, Hernando County. Paratype locality: Station 12758, 5.9 miles northeast of Brooksville.

Horizon: Suwannee limestone, Oligocene.

Occurrence: Station 12318, 5 miles west of Brooksville, Hernando County; station 12757, 10.2 miles northeast of Brooksville, Hernando County; station 12758, 5.9 miles northeast of Brooksville; station 12321, 3 miles east of Brooksville; station 11116, Blackwater River at Seaboard Air Line Ry. crossing, Hillsborough County; station 10116, bed no. 1 of section at Falling Water, Washington County. (Fragments, identification uncertain.)

Chlamys brooksvillensis is similar to *C. gabbi* Dall, a species reported from Antigua and Anguilla Islands, in the character of sculpture and number of ribs but differs from that species in having more inflated and less oblique shell. An unnamed species from Cedar Grove (station 10046) and from 2½ miles south by east of Chipley (station 7240), Washington County, Fla., is very closely related to *C. brooksvillensis*. This species appears to be nearer "*Pecten*" *estrellanus* Conrad, the genotype of the section *Lyropecten*, than to "*Pecten*" *ventricosus* Sowerby, the genotype of the section *Plagioctenium*.

CHLAMYS (LYROPECTEN) LIVEOAKENSIS Mansfield, n. sp.

Plate 16, Figures 1, 8

Shell of moderate size, subequilateral, both valves about equally inflated, with 19 to 21 ribs. Ribs narrowly rounded on early part of disk and broadly rounded at distal ends. Ribs without radial sculp-

ture on early part of disk but are weakly tricarinate at distal ends. Interspaces with one weak radial thread at the distal end. Whole shell concentrically sculptured with rather coarse marginally erect lamellae. Sculpture on right auricle of right valve not distinctly indicated. Posterior auricle of left valve marked with faint scabrous radial threads. The description is based mainly upon the left valve, as only one poorly preserved right valve is available.

Dimensions: Larger cotype, left valve (U. S. National Museum no. 495975): Length, 35 mm.; height, 34+ mm.

Type locality: Station 12308, old Lyle quarry, 1½ miles north of Live Oak, Suwannee County.

Horizon: Suwannee limestone, Oligocene.

This species differs from *Chlamys brooksvillensis* and *Chlamys liveoakensis wannensis* in having more closely spaced ribs.

Other occurrences: Station 12766, Blackwater Creek, at Seaboard Air Line Ry. crossing, Hillsborough County; station 12318, 5 miles west of Brooksville, Hernando County; station 12317, 10.2 miles west of Brooksville, Hernando County. The specimens from near Brooksville and from Blackwater River are poorly preserved and appear to have slightly narrower ribs than specimens from the type locality and may be a varietal form.

CHLAMYS (LYROPECTEN) LIVEOAKENSIS WANNENSIS Mansfield, n. subsp.

Plate 14, Figures 2, 5

Shell rather large, subequilateral, right valve slightly more inflated than left, with 17 to 18 ribs. Ribs about as wide as interspaces, moderately high, rounded. Each rib marked at the distal end by a shallow medial sulcus. Interspaces sculptured with about 3 faint radials, the medial one being a little stronger. Surface concentrically sculptured with coarse lamellae. Ears large and marked with 7 or 8 finely scabrous radials.

Dimensions: Holotype (U. S. National Museum no. 154228), small left valve, length, 26 mm.; height, 29 mm.

Type locality: Station 2308, 3 miles west of Live Oak, Suwannee County.

Other occurrence: Station 12308, 1½ miles north of Live Oak, Suwannee County.

Horizon: Suwannee limestone, Oligocene.

The species is closely related to *Chlamys brooksvillensis*, but differs from that species in having higher ribs which lack the deep medial sulcation on their summits.

CHLAMYS (LYROPECTEN) MARIONENSIS Mansfield, n. sp.

Plate 15, Figures 2, 7

Shell rather small, nearly equilateral and weakly inflated. Sculptured with 19 rounded, scabrous ribs which are a little wider than the interspaces. The margins of the ribs have a weak longitudinal thread with a shallow sulcus above suggesting a tricarinate arrangement. Interspaces ornamented with one low medial radial thread and an occasional weaker thread on either side. Anterior auricle on right valve moderately large and with a rather deep byssal notch and sculptured with six moderately strong scabrous radials. Left auricle of right valve smaller than right but ornamented with same number of radials. Submargins without any visible radials.

Dimensions: Holotype (right valve) (U. S. National Museum no. 495976): Length, 27 mm.; height, 26 mm.

Type locality: Station 7353, midway between Anthony and Martin, Marion County.

Horizon: Tampa limestone, lower Miocene.

Chlamys marionensis differs from *Chlamys brooksvillensis* in having a less inflated shell, closer spaced ribs, and in lacking the strong interradiial thread. The right valve of *Chlamys chipolanus* Dall has fewer and squarer ribs.

Occurrence: Type locality; stations 12314, 12753, 11115, upper bed at Kendrick, Marion County.

CHLAMYS (LYROPECTEN) BURNETTI Tucker

Plate 15, Figures 1, 3

1934. *Chlamys (Acquipten) burnetti* Tucker, Am. Midland Naturalist, vol. 15, p. 616, pl. 25, fig. 2.

Miss Tucker describes this species as follows:

"Shell equilateral; radial sculpture well developed; the valves somewhat flat, the left the more convex. The right valve has sixteen ribs; the left, fifteen somewhat sharper ribs. A sulcus appears on the summits of the ribs 10 to 15 mm. from the ventral margin. A single intercostal appears on the right valve 3 or 4 mm. before the groove on the primary ribs. On the left valve there is one, rarely two, smaller intercostals. Interspaces on the left valve much the wider. Concentric lamellae stronger on the left valve. Submargins plain. Auricles of left valve lamellated; 4 to 5 radial threads; right anterior auricle has 3 radial threads, posterior, 5. Very wide byssal fasciole. Ctenolium present. Interior ribbed. Dimensions: Height 33, width 27 mm. This species is named in honor of Dr. Burnett Smith.

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

"*Occurrence*.—Tampa Miocene. Six Mile Creek (type) and Black Water Creek, Florida.

"*Holotype*.—A right valve. Collection H. I. Tucker."

Horizon: Tampa limestone, lower Miocene.

Chlamys burnetti is closely related to *Chlamys acanikos* Gardner, a Chipola species, but differs from that species in having wider and more rounded ribs and more and stronger threads in the interrarial spaces. The imbrications on the threads of the new species are also more closely spaced than on *Chlamys acanikos*. *Chlamys* ("*Aequipecten*") *canalis* Brown and Pilsbry from the lower Miocene, Emperor limestone, Panama Canal zone, has finer striations on the ribs than *Chlamys burnetti*.

Occurrence: Type locality; station 11115, upper bed at Kendrick, Marion County; station 11186, midway between Lowell and Sparr, Marion County; station 7353, midway between Anthony and Martin, Marion County. Specimens from the following localities are preserved as external molds and may belong to *Chlamys burnetti*: Station 2470, 1 mile west of Bartow, Polk County; station 12292, Cherokee Sink, Wakulla County; station 12727, Willis bridge, Chipola River, Calhoun County; station 12283, Old Chattahoochee Landing, Gadsden County, elevation 155-165 feet above sea level. Specimens at station 12290, Ponto Springs, highest bed (Alum Bluff group), Gadsden County, are very similar to *Chlamys burnetti* but differ in having the scabrous sculpture on the ribs more spinose and more distant. Miss Tucker reports this species from Blackwater Creek, but I have not seen it from there.

Section PLAGIOCTENIUM Dall, 1898

CHLAMYS (PLAGIOCTENIUM?), CHIPOLANUS Dall, var.?

1915. *Pecten* (*Aequipecten*) *chipolanus* Dall (part?), U. S. Nat. Mus. Bull. 90, p. 124.

In 1915, Dall identified specimens from the "silex beds" at Ballast Point, Tampa Bay, Fla., as *Pecten* (*Aequipecten*) *chipolanus* Dall, a species described from the Chipola formation. There are a number of small and larger specimens in the U. S. National Museum under the nos. 154215 and 154216. Some of the smaller specimens are fairly well preserved, whereas the larger specimens are coated with an indurated matrix and are indeterminable.

Following is a comparison of the smaller Tampa specimens with specimens of *Chlamys chipolanus*: *C. chipolanus* has fewer by two ribs than the Tampa form and the surface on the top of some of the

ribs shows a slight tendency to be broken up by striations, whereas the surface of the Tampa form appears to be smooth. Both valves of the Chipola and Tampa forms appear to be similarly inflated and there may be only a varietal difference between them.

CHLAMYS (PLAGIOCTENIUM?) GARDNERAE Cooke

Plate 14, Figures 4, 7

1919. *Pecten gardnerae* Cooke, Tertiary mollusks from the Leeward Islands and Cuba: Carnegie Inst. Washington Pub. 291, p. 134, pl. 7, figs. 5, 6.
1929. *Pecten gardnerae* Cooke, Cooke and Mossom, Geology of Florida, Fla.: Florida Geol. Survey 20th Ann. Rept., p. 96 (in list of fossils at Falling Water, Fla.).

Following is the original description of this species:

"Right valve inflated, with 15 round ribs a little wider than the interspaces; submargins slightly convex, steep; anterior ear with about 6 radiating riblets; byssal notch one-half the length of the ear; posterior ear large, nearly rectangular; sculpture of close, minute growth lines over entire shell.

"Alt. of right valve, 21 mm.; lat., 21.5 mm.

"Left valve flatter, with about 16 even, rounded ribs a little narrower than the interspaces; submargins convex, steep; anterior ear acutely oblique, with two or three very faint, broad, radiating riblets; posterior ear rectangular; concentric sculpture of minute, elevated, very close-set lines extending over entire shell, but on the disk grouped into bands or growth stages about 0.3 mm. wide.

"Alt. of left valve, 22.6 mm.; lat., 22.3 mm."

The holotype (U. S. National Museum no. 167113) came from Santiago, Cuba.

Among the material collected at station 10111, Falling Water, 4 miles south of Chipley, Fla., there are three nearly perfect right valves of a pecten. One has 11 ribs and 2 have 14 ribs. I am not sure that the specimen with the smaller number of ribs is the same species as the other 2 specimens, but the 3 differ only in the number of ribs. The specimens with the greater number of ribs agree more closely with the right valve of "*Pecten*" *gardnerae*.

Only one nearly perfect, small left valve is in the collection from Falling Water. This has 14 slightly corroded ribs. In all features discernible it agrees with all characters of the left valve of "*P.*" *gardnerae*.

CHLAMYS sp. n.

Specimens of *Chlamys* from four localities represent either the same or closely related species, but are too poorly preserved to name.

The best preserved specimen, probably a left valve, among this lot is from station 12292, Cherokee Sink, Wakulla County. The specimen is slightly oblique in outline and has 16 rounded, moderately narrow,

smooth ribs. The distal ends of the interspaces have a single low medial thread.

Horizon: Tampa limestone, lower Miocene.

Occurrence: Station 12283, Old Chattahoochee Landing, Gadsden County, elevation 155-165 feet above sea level; station 7080, old quarry, half a mile south of River Junction, Gadsden County; elevation, 147-159, above sea level; station 12293, 16 miles southwest of Tallahassee, Leon County.

CHLAMYS sp. b.

Specimens from 3 localities have similar characters and may represent the same species, but they are too poorly preserved to name. The original shell was oblique and sculptured with 12 or more narrow and widely spaced ribs. This form differs from *Chlamys* sp. *a* in having narrower and more widely spaced ribs.

Horizon: Tampa limestone, lower Miocene.

Occurrence: Station 7177, Old Chattahoochee Landing, Gadsden County, bed no. 3, elevation 80-90 feet above sea level (Vaughan); station 2565, Old Chattahoochee Landing, echinoderm bed (Dall); station 3406, lowest bed at Aspalaga Bluff, Gadsden County.

CHLAMYS sp. c.

Poorly preserved specimens from station 11113, Brooksville, Hernando County; station 6774, island three-fourths mile above White Springs, Columbia County; and station 12298, 1½ miles east-southeast of Flint Rock, Jefferson County, appear to be closely related and may represent one species. A small left valve from station 11113 has 24 narrow and rather sharp ribs with slightly wider interspaces. The ribs and interspaces are sculptured with slightly raised concentric lamellae. The left ear has six radials crossed by fine threads. The ribs on a small right valve from station 6774 are sharper than on specimens from the other two localities.

Horizon: Suwannee limestone, Oligocene.

Genus *AMUSIUM* Bolten, 1798

AMUSIUM sp.

A fragment of a shell belonging to the genus *Amusium*, collected at station 12763, Anclote River at Tarpon Springs, Pinellas County, Fla., shows insufficient characters to determine the species. Only the umbonal area and an impression of the inside of the shell are preserved.

The umbonal area shows faint radials and the impression of the inside of the shell shows a number of ribs.

Horizon: Tampa limestone, lower Miocene.

Family SPONDYLIDAE

Genus SPONDYLUS Linnaeus, 1758

SPONDYLUS CHIPOLANUS TAMPENSIS Mansfield, n. subsp.

1915. *Spondylus bostrychites* Dall (not Guppy), U. S. Nat. Mus. Bull. 90, p. 124, pl. 19, fig. 4.

In 1915 Dall identified specimens from "silex beds" at Ballast Point, Tampa Bay, Fla., as *Spondylus bostrychites* Guppy. Two right valves are in the collection at the U. S. National Museum under the catalogue numbers 154247 and 165182, the latter figured by Dall.¹⁰⁹ These specimens are not perfect; the surfaces of the umbonal areas have been worn away and much of the surfaces of the disks is either corroded or covered with matrix.

Shell obliquely ovate, the lower posterior side being more produced; height greater than the length; strongly inflated. Beak produced. Hinge line short. Sculpture of moderately fine, closely spaced narrow ribs with shallow interspaces. The second or third rib is stronger than the others and bears upon its crest weak spines. Occasionally one or two fine scabrous threads lie near the spinose ribs. Whole surface is concentrically sculptured with moderately coarse lamellae.

Dimensions: Holotype, right valve (U. S. National Museum no. 165182), Length, 47 mm.; height 59 mm.; diameter, 23 mm.

Horizon: Tampa limestone, lower Miocene.

Spondylus chipolanus tampensis differs, so far as can be observed, from *S. chipolanus* in having less strongly developed primary ribs; fewer, more closely spaced, and coarser radials between the primary ribs; and stronger concentric lamellae. Compared with *S. bostrychites* Guppy, *S. chipolanus tampensis* has a much narrower hinge-line, weaker ribs with narrower interspaces, fewer ribs bearing spines, and apparently lacks numerous fine spinose radials.

The specimen figured by Dall¹¹⁰ came from the Chipola River and is the holotype of *S. chipolanus* Dall.

Occurrence: "silex beds" of the Tampa limestone, Tampa Bay; station 2470, 1 mile west of Bartow, Polk County Fla.

¹⁰⁹ Dall, W. H., U. S. Nat. Mus. Bull. 90, pl. 19, fig. 4, 1915.

¹¹⁰ Dall, W. H., U. S. Nat. Museum Bull. 90, pl. 19, fig. 1, 1915.

Genus *PLICATULA* Lamarck, 1801***PLICATULA DENSATA* Conrad**

1843. *Plicatula densata* Conrad, Acad. Nat. Sci. Philadelphia Proc., vol. 1, p. 311.
1845. *Plicatula densata* Conrad, Fossils of the Tertiary formations of the United States, p. 75, pl. 43, fig. 6.
1863. *Plicatula densata* Conrad, Acad. Nat. Sci. Philadelphia Proc., for 1862, p. 582.
1894. *Plicatula densata* Conrad. Whitfield, U. S. Geol. Survey Mon. 24, p. 35, pl. 5, figs. 3, 8.
1898. *Plicatula densata* Conrad. Dall, Wagner Free Inst. Sci. Trans., vol 3, pt. 4, p. 763 (part).
1904. *Plicatula densata* Conrad. Glenn, Maryland Geol. Survey, Miocene, p. 371, pl. 98, figs. 7, 9.
1915. *Plicatula densata* Conrad. Dall, U. S. Nat. Museum Bull. 90, p. 125 (part, Eocene eliminated).
1919. *Plicatula densata* Conrad. Cooke, Carnegie Inst. Washington Pub. 291, p. 145, pl. 11, figs. 12a, 12b.
1926. *Plicatula densata* Conrad. Gardner, U. S. Geol. Survey Prof. Paper 142-A, pp. 51-52, pl. 13, figs. 1-3.

Conrad described this species in 1843 as follows:

"Ovate, thick, profoundly and irregularly plicated; inferior valve ventricose, its ribs acute, with arched spiriform scales; cardinal teeth large, curved, laterally striated, crenulated on the margins; larger cardinal tooth in each valve slightly bifid, broad; muscular impressions prominent. Length $1\frac{1}{8}$ inches.

"Locality: Cumberland County, New Jersey.

"The valves have about 10 folds and the lower valve closely resembles a variety of *Ostrea virginica*."

Three valves, two small and the other a larger specimen covered with matrix, in the collections of the U. S. National Museum from the "silex beds" at Ballast Point, Tampa Bay, Fla., were referred by Dall to *Plicatula densata* Conrad.

Four valves, three left and one right, were collected at station 12763, Anclote River, at Tarpon Springs, Pinellas County, Fla. These are closely allied to *P. densata*, if not the same species. The left valve is nearly flat, obliquely ovate in outline and sculptured with about eight strong ribs over the middle and sides; the ribs over the middle of the disk branch, forming near the ventral margin two or three ribs. The beaks appear to be nearly smooth. The right valve is narrow and has an elongate beak. The early part of the shell has four ribs, but in the lower part of the disk these branch, forming about ten moderately sharp ribs. The ribs are concentrically undulated by coarse lamellae. The teeth are rather small and more elongate than in *P. densata* from its type locality.

Other occurrences: Marls of Cumberland County, N. J., at Shiloh and Jericho; Calvert formation, Maryland; Chipola formation and Oak Grove sand, Fla.; Santiago, Cuba.

The occurrence of *P. densata*, as reported by Dall¹¹¹ at Archer and Ocala, Fla., is probably incorrect as these specimens have finer concentric sculpture than *P. densata* and apparently came from the Eocene at these localities.

Family LIMIDAE

Genus LIMA Bruguière, 1797

LIMA HALENSIS Dall

1916. *Lima halensis* Dall, U. S. Nat. Mus. Proc., vol. 51, p. 493, pl. 83, figs. 1, 7, 8.

Dall described this species as follows:

"Shell ovate, moderately thin, with a short hinge line and inconspicuous auricles; sculpture of about 16 strong, nearly smooth radial ribs with subequal channelled interspaces, the ribs near the submargins obsolescent and the submargins and auricles sculptured only with rather conspicuous incremental lines. The ribs are themselves sculptured with more or less obsolete minute radial striations most distinct toward the middle of the disk; concentric sculpture confined to more or less prominent incremental lines not rising into scales or imbrications; beaks narrow; anterior gape small with its bounding valve-margins thickened and slightly reflected; hinge area small, flat, with no crural callosities, the ligamentary pit large, equilaterally triangular, shallow; valves subequal, and moderately convex. Height, 52; breadth of shell, 37; of hinge-line, 16; diameter, 14 mm.

"Locality. Station 7074, at Hale landing on west bank of Flint River, 7 miles southeast of Bainbridge, Decatur County, Ga.

Horizon: Flint River formation, Oligocene, and Suwannee limestone, Oligocene.

Occurrence in Florida: Station 12762, $2\frac{3}{4}$ miles southeast of Zephyrhills, Pasco County.

Superfamily MYTILACEA

Family MYTILIDAE

Genus MODIOLUS Lamarck, 1799

Section MODIOLUS s. s.

MODIOLUS SILICATUS Dall

1898. *Modiolus silicatus* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 4, p. 793, pl. 27, fig. 28.
1898. *Modiolus tampaensis* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 4, p. 922, by inadvertence.
1915. *Modiolus silicatus* Dall, U. S. Nat. Museum Bull. 90, p. 127, pl. 24, fig. 11.

Dall described this species in 1898 as follows:

"Upper Oligocene of the silex beds at Ballast Point, Tampa Bay, Florida; Willcox and Dall.

¹¹¹ Dall, W. H., U. S. Nat. Mus. Bull. 90, p. 125, 1915.

"Shell small, smooth, short, broad, moderately convex, with a few incremental striae; beaks low, anterior end very short, posterior margin elevated, rounded, anterior margin slightly impressed; basal end rounded; inner margin smooth, with an unusually deep ligamental sulcus. Alt. 22, max. lat. 16, diam. 9 mm.

"This is somewhat like the Miocene *M. inflatus* T. and H., but a much smaller shell, with a less impressed lateral area and less sinuous anterior margin."

Holotype: U. S. National Museum no. 154349.

Type locality: "silex beds," Ballast Point, Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene; Suwannee limestone, Oligocene.

Other occurrences in Florida: Suwannee limestone, station 12762, 2¾ miles south of Zephyrhills, Pasco County; station 6820, Bass, Columbia County; station 6818, one-fourth mile southeast of Fort White, Columbia County, Fla.

MODIOLUS BLANDUS Dall

1915. *Modiolus blandus* Dall, U. S. Nat. Mus. Bull. 90, p. 127, pl. 20, figs. 3, 6, 12.

Dall described this species as follows:

"Shell of moderate size, thin, rounded in front and behind, dorsally sub-
alate, margins entire with hardly any byssal gape; valves inflated, surface smooth except for incremental lines.

"Length 44, height 23, maximum diameter 21 mm.

"Ballast Point, Tampa Bay, Florida; E. J. Post, probably from the limestone overlying the silex beds. U. S. Nat. Mus., No. 165226 [holotype].

"The specimen is a well preserved internal cast."

The shape of the holotype of *Modiolus blandus* is very similar to that of the living species *Modiolus tulipus* Lamarck, but as the outer shell of the holotype has not been preserved, no other comparisons can be made. Specimens collected at station 12282, echinoderm bed, at Old Chattahoochee Landing, Gadsden County, which agree in outline with the holotype of *M. blandus* Dall, show concentric lamellae.

This species was collected by W. C. Mansfield and F. S. MacNeil in 1936, at station 13848, dredgings at a depth of 32-36 feet below water level off Hooker Point; upper Hillsborough Bay.

Occurrences elsewhere in Florida: Tampa limestone, station 3405, echinoderm bed (stratum no. 1) (T. W. Vaughan); station 4836, echinoderm bed, bed no. 3 (F. G. Clapp and others); station 7177, bed no. 3, elevation 80 to 90 feet above sea level (T. W. Vaughan and others); station 12282, echinoderm bed, elevation 77.4 feet above sea level (Ponton and Mansfield), Old Chattahoochee Landing, Gadsden

County. Station 12292, Cherokee Sink, Wakulla County (fragment, specific identification uncertain); station 7244, Falling Water, 4 miles south of Chipley, Washington County, no. 2 of section; Sixmile Creek, Hillsborough County (Tucker). Suwannee limestone, station 12758, Camp Concrete Rock Quarry, 5.9 miles northeast of Brooksville, Hernando County (one specimen). Blackwater Creek at crossing of Seaboard Air Line Railway, Hillsborough County (Tucker) (may have come from the Tampa limestone).

Section BRACHYDONTES Swanson, 1840

MODIOLUS (BRACHYDONTES) GRAMMATUS Dall

1898. *Modiolus (Brachydontes) grammatus* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 4, p. 794, pl. 30, fig. 2.
 1915. *Modiolus (Brachydontes) grammatus* Dall, U. S. Nat. Museum Bull. 90, p. 127, pl. 26, fig. 4.
 1916. ?*Modiolus (Brachydontes) grammatus* Dall, U. S. Nat. Museum Proc., vol. 51, p. 494.

Dall described this species in 1898 as follows:

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

"Shell small, thin, slender, delicately dichotomously radially ribbed; anterior end extremely short, barely exceeding the beaks; posterior margin angulated; front margin nearly straight, basal end rounded; inner margin delicately crenulate. Alt. 20, max. lat. 8.5, diam. 6.5 mm.

"This is closely related to the recent *M. citrinus* Bolt., but is more attenuated towards the beaks and has the dorsal angulation and crenulations of the margin less pronounced."

Gardner¹¹² raised *Modiolus grammatus* var. *curtulus* Dall,¹¹³ the Chipola form, to a specific rank.

Holotype: U. S. National Museum no. 154370.

Type locality: "silex beds," Ballast Point, Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene; Suwannee limestone, Oligocene.

Other occurrences in Florida: Suwannee limestone, station 6825, 3 miles west of Live Oak, Suwannee County (internal mold, identification uncertain); stations 12308 and 11109, old Lyle quarry, 1½ miles north of Live Oak, Suwannee County; station 6774, Rock Island, Suwannee River, half a mile above White Springs, Hamilton County; station 12303, Suwannee Sulphur Springs, Hamilton County (internal mold, identification uncertain); station 6818, one-fourth mile south-east of Fort White, Columbia County; station 6827, 300 feet south of Bass, Columbia County (internal mold, identification uncertain);

¹¹² Gardner, Julia, U. S. Geol. Survey Prof. Paper 142-A, p. 58, 1926.

¹¹³ Dall, W. H., Wagner Free Inst. Sci. Trans., vol. 3, pt. 4, p. 794, 1898.

station 12736, Florida Portland Cement quarry, 10.2 miles northwest of Brooksville, Hernando County (internal mold, specific determination uncertain); station 12766, Blackwater River, at crossing of Seaboard Air Line Railway, Hillsborough County (internal mold, identification not certain).

The specimens from station 12308 have slightly finer radials over the shell than most of the specimens from the type locality but in other features appear to be identical.

The specimen from station 7096, Red Bluff, on the west bank of Flint River, 7 miles above Bainbridge, Decatur County, Ga., identified as *M. grammatus* by Dall,¹⁴⁴ is higher and wider than the specimens from the type locality of the species and probably represents another species.

Section GREGARIELLA Monterosato, 1884

MODIOLUS (GREGARIELLA) MINIMUS Dall

1898. *Modiolus (Gregariella) minimus* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 4, p. 797, pl. 35, fig. 26.
1915. *Modiolus (Gregariella) minimus* Dall, U. S. Nat. Museum Bull. 90, p. 128, pl. 24, fig. 6.

Dall described this species in 1898 as follows:

"Shell small, broad, with turgid umbones in front, more or less attenuated behind; hinge-line arcuate, convex, the opposite margin nearly parallel and concave, surface as in *M. opifex* Say. Alt. 8, lat. 3.5, diam. 4 mm.

"This little shell is represented by a siliceous pseudomorph, retaining but little of the external surface, from the Oligocene silex beds of Ballast Point, Tampa Bay, Florida; the form is, however, unmistakable, and affords the opportunity of recording this group from that horizon."

Holotype: U. S. National Museum no. 154364.

Only a silicified fragment of the original shell is preserved on one beak of the holotype.

The shell appears to be closely related to young specimens referred to *Modiolus cinnamomeus* Lamarck, but Dall's name, *minimus*, is retained for the present.

The species has not been found outside of its type locality.

Section BOTULA Mörch, 1853

MODIOLUS (BOTULA) CINNAMOMEUS (Lamarck)

1785. *Mytilus cinnamominus* Chemnitz, Conchylien Cabinet, vol. 8, p. 152, pl. 82, fig. 731.
1819. *Modiola cinnamomea* Lamarck, Historia naturelle des animaux sans vertèbres, vol. 6, p. 114.

¹⁴⁴ Dall, W. H., U. S. Nat. Mus. Proc., vol. 51, p. 494, 1916.

1898. *Modiolus (Botula) cinnamomeus* Lamarck. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 4, p. 797.
1901. *Modiolus cinnamomeus* Lamarck. Dall and Simpson, Mollusca of Porto Rico: U. S. Fish Com. Bull. 1, p. 470.
1915. *Modiolus (Botula) cinnamomeus* Lamarck. Dall, U. S. Nat. Museum Bull. 90, p. 128.
1919. *Modiolus (Botula) cinnamomeus* Lamarck. Cooke, Carengie Inst. Washington Pub. 291, p. 145, pl. 14, figs. 4, 5.
1926. *?Modiolus (Botula) cinnamomeus* Lamarck. Gardner, U. S. Geol. Survey Prof. Paper 142-A, p. 58.

Lamarck described this species in 1819 as follows:

"*M. testa* subcylindrica, ventricosa, arcuata, utraque extremitate retusa; natibus subprominulis."

Dall and Simpson described this species in 1901 as follows:

"Shell small, nearly smooth, subrhomboidally and somewhat elongated, slightly arcuate, inflated, with a thick, dark chestnut epidermis, which shows distinct, often dark, rest periods, and is darker colored at the posterior end and anterior base; beaks full and high, placed at the upper anterior extremity of the shell and projecting in front of the anterior end; hinge line curved, the line extending around to the anterior base in an unbroken curve.

"Length, 10; height, 5; diameter, 6 mm.

"Mayaguez Harbor, Porto Rico, one shell."

There has been some disagreement relative to the type locality of *Modiolus cinnamomeus* Lamarck. Dall¹¹⁵ wrote:

"I am not able to determine whether the East Indian shell usually called *M. fuscus* Gmelin is the same or distinct specifically. The distribution of boring species is often very wide. It is certain, however, that Chemnitz's specimens, on which Lamarck founded the species, were West Indian."

Gardner¹¹⁶ gives the type locality of *M. cinnamomeus* Lamarck as "Off Nicobar, East Indies." However, Chemnitz does not state definitely the locality of his figured specimen. He considered the specimens in the Spengler collection from the shores of Nicobar Island, East Indies, the same species as those in his collection from the West Indies.

Inasmuch as the Recent form of the West Indies, as well as the fossil form has usually been referred to *M. cinnamomeus* Lamarck, I have retained that name.

Occurrence in Florida: "silex beds" of the Tampa limestone at Ballast Point; Sixmile Creek, Hillsborough County (Tucker); station 12281, western end of Victory Bridge, Jackson County, at elevation of 93.5 feet above sea level; station 7169, Old Chattahoochee Landing,

¹¹⁵ Dall, W. H., Wagner Free Inst. Sci. Trans., vol. 3, pt. 4, p. 797, 1898.

¹¹⁶ Gardner, Julia, U. S. Geol. Survey Prof. Paper 142-A, p. 59, 1926.

Gadsden County, bed no. 6 of section, elevation 122.5 to 124 feet above sea level (Vaughan); station 7172, outskirts of River Junction, Gadsden County; station 7080, half a mile south of River Junction, Gadsden County, at an elevation of 147 to 159 feet above sea level; station 13841, Aspalaga Bluff, 10 feet above a four-foot clay bed; station 12293, Wakulla R. R. station, Wakulla County; station 12292, Cherokee Sink, Wakulla County.

In Cuba: Stations 3192 and 5255, near Santiago.

The specimens from the "silex beds" are fairly well preserved and appear identical with the living form from the West Indies. The specimens from the other localities are preserved as internal molds, but in shape and general appearance are the same as the Tampa specimens.

This species has been reported from the Pliocene Caloosahatchee marl, of Florida, and living in the warmer waters of the United States and the West Indies.

Genus LITHOPHAGA Bolten, 1819

LITHOPHAGA ANTILLARUM (D'Orbigny)

- 1845, 1847. *Lithodomus antillarum* D'Orbigny, Moll. Cubana, vol. 2, p. 332, pl. 28, figs. 12, 13, 1847; Spanish edition, with atlas, 1845.
1898. *Lithophaga antillarum* D'Orbigny. Dall, Wagner Free Inst. Sci., Trans., vol. 3, pt. 4, p. 799.
1915. *Lithophaga antillarum* D'Orbigny. Dall, U. S. Nat. Museum Bull. 90, p. 129.
1917. *Lithophaga antillarum* D'Orbigny. Maury, Bull. Am. Paleontology, vol. 5, p. 357.

The living shell is characterized by its fawn color and transverse striae. Concentric stages of growth are usually well indicated. The transverse striae are finer behind the beaks near the dorsal area, and become stronger and divaricated posteriorly. The living species, *L. nigra* D'Orbigny, is smaller, darker colored, and without transverse striae near the dorsal margin. *L. antillarum* ranges in the Recent from Florida southward throughout the Antilles, usually as a borer in corals.

One shell fragment, preserved as a siliceous pseudomorph and identified by Dall as *L. antillarum* (U. S. National Museum no 154361), was collected at Ballast Point, Tampa Bay. This specimen has sculpture similar to that of living specimens.

A number of specimens have been collected in the area of Old Chattahoochee Landing and River Junction. These represent large shells, have the general outline and sculpture of *L. antillarum*, and were associated with corals. They were collected at the following

stations: Station 12281, western end of Victory Bridge, Jackson County, elevation 93.5 feet above sea level; station 7169, Old Chatahoochee Landing, Gadsden County, bed no. 6 of section, elevation 122.5 to 124 feet above sea level (Vaughan); station 7080, quarry half a mile south of River Junction, Gadsden County, elevation about 150 feet above sea level (very abundant at this elevation); station 13841, Aspalaga Bluff, 10 feet above a four-foot bed, Gadsden County.

LITHOPHAGA NIGRA (D'Orbigny)

- 1845-1847. *Lithodomus niger* D'Orbigny, Moll. Cubana, vol. 2, p. 331, pl. 28, figs. 10, 11, 1847, French edition; Spanish edition and atlas, 1845.
1898. *Lithophaga nigra* D'Orbigny. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 4, p. 799.
1915. *Lithophaga nigra* D'Orbigny. Dall, U. S. Nat. Museum Bull. 90, p. 129.
1917. *Lithophaga nigra* D'Orbigny. Maury, Bull. Am. Paleontology, vol. 5, p. 358.
1919. *Lithophaga nigra* (D'Orbigny). Cooke, Carnegie Inst. Washington Pub. 291, p. 146, pl. 14, fig. 6.

One incomplete specimen (U. S. National Museum no. 154360) from the "silex beds" of the Tampa limestone at Ballast Point, Tampa Bay, Fla., was identified as *Lithophaga nigra* D'Orbigny by Dall. This specimen represents the middle and anterior end of the shell. Only a portion of the original shell is preserved. This shows traces of transverse striae near the posterior end of the fragment.

Lithophaga nigra has been reported by Cooke from Antigua, Leeward Islands. The species is now living in the Antillean region and adjacent seas.

LITHOPHAGA DALLI Mansfield, n. sp.

1898. *Lithophaga nuda* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 4, p. 800 (in part), pl. 35, fig. 27.
1915. *Lithophaga* Dall, U. S. Nat. Mus. Bull. 90, p. 129 (in part), pl. 26, fig. 7.

In 1898, Dall described this species as follows:

"Shell large, thin, closely resembling *L. nigra*, but from which it may be instantly discriminated by the absence of all transverse or radial striation. Alt. 17?, lat. 50, diam. 15.7 mm. Oligocene silex beds at Ballast Point, Tampa Bay, Florida."

Horizon: Tampa limestone, lower Miocene.

Inasmuch as Brown¹¹⁷ used the name *Celliforma nuda* (Dall) Brown to designate specimens from the "silex beds" which he interprets as fillings of chambers originally made by Hymenoptera, a new specific

¹¹⁷ Brown, R. W., Washington Acad. Sci. Jour., vol. 25, p. 527, 1935.

name, *Lithophaga dalli*, is proposed to designate the form now under discussion.

The species is named in honor of the late Dr. Wm. H. Dall.

Section MYOFORCEPS Fischer, 1886

LITHOPHAGA (MYOFORCEPS) ARISTATA Dillwyn?

- 1817. *Mytilus aristatus* (Solander Ms.) Dillwyn, Catalogue of Recent shells, vol. 1, p. 303.
- 1898. *Lithophaga (Myoforceps) aristata* Dillwyn. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 4, p. 800.
- 1915. *Lithophaga (Myoforceps) aristata* Dillwyn. Dall, U. S. Nat. Museum Bull. 90, p. 130.

Dall¹¹⁸ writes:

"Only fragments probably referable to this form were obtained at Ballast Point, but its wide distribution, evidently antedating the present conformation of Central American and Mediterranean lands, is much in favor of its antiquity."

One specimen (U. S. National Museum no. 165188) from the "silex beds" at Ballast Point, labeled *L. aristata* Dillwyn, has lost some of its original shell and its identity with the Recent species cannot be fully confirmed.

Section DIBERUS Dall, 1898

LITHOPHAGA (DIBERUS) BISULCATA D'Orbigny

- 1845, 1847. *Lithophaga (Diberus) bisulcata* D'Orbigny, Moll. Cubana, vol. 2, p. 333, pl. 28, figs. 14-16, 1847; Spanish edition and Atlas. 1845.
- 1898. *Lithophaga (Diberus) bisulcata* D'Orbigny. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 4, p. 801.
- 1915. *Lithophaga (Diberus) bisulcata* D'Orbigny. Dall, U. S. Nat. Museum Bull. 90, p. 130.

This species has two deep radial sulci extending backward from the beaks.

The species occurs in the "silex beds" of the Tampa limestone, Ballast Point, Tampa Bay, Fla. (U. S. National Museum no. 154362) and at station 12763, Anclote River, at Tarpon Springs, Pinellas County; station 13844, Old Chattahoochee Landing, 37 feet above echinoderm bed and station 13846, 74 feet above echinoderm bed. The specimen from station 12763 does not show as deep radial sulci as some of the Recent specimens or the better preserved specimens from the "silex bed" but in other features is inseparable. The species is living from South Carolina south to Rio Janiero and throughout the West Indies.

¹¹⁸ Dall, W. H., Wagner Free Inst. Sci. Trans., vol. 3, pt. 4, p. 800, 1898.

Genus CELLIFORMA Brown, 1935

CELLIFORMA NUDA (Dall) Brown

Plate 15, Figure 6

1890. *Lithophagus* (cast of a burrow) Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, pl. 11, fig. 8.
 1898. *Lithophaga nuda* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 4, p. 800 (in part).
 1915. *Lithophaga nuda* Dall, U. S. Nat. Mus. Bull. 90, p. 129 (in part), pl. 24, fig. 4.
 1934. *Celliforma spirifer* Brown, Washington Acad. Sci. Jour., vol. 24, p. 532 (in part), fig. 1, p. 534.
 1935. *Celliforma nuda* (Dall) Brown, Washington Acad. Sci. Jour., vol. 25, p. 526.

In 1898, Dall considered this unique form to represent a burrow of a bivalve mollusk which he assigned to the genus *Lithophaga*. Brown¹¹⁹ advanced the opinion that the form having a spiral apex represents a fossil larval chamber of a mining bee. He writes:¹²⁰

"It is my opinion that the bee chambers here concerned were originally located in a sea-cliff, stream bank, or elevated mud flat near the coast. Weathering out of the cliff and falling into the water, or with subsidence of the area, they were buried together with marine and fresh-water debris, the whole forming what is now known as the Tampa limestone. It is quite possible that calcite first filled the unbroken chambers, but that later, with the elevation of the strata above the sea level, it was replaced by silica, an exchange that seems even now in progress among the fossils in the upper layers of the formation."

Brown writes:¹²¹

"I therefore propose that the term *Celliforma* be the generic name to include all fossil fillings of chambers purporting to have been made originally by unknown mining Hymenoptera and I designate *Celliforma spirifer* Brown, from the Bridger formation of Wyoming, as the genotype. The specimens from the "silex beds" of the Tampa limestone of Florida may be known as *Celliforma nuda* (Dall) Brown * * *."

Celliforma nuda (Dall)¹²² is cylindrical in general outline, rounded at one end and showing a low spire at the other. The specimen appears to be only partially silicified. Other specimens from the "silex beds" having the same outline as the above but completely silicified were sectioned and found to have cavities shaped somewhat like the exterior of the specimen. Some specimens of this species are small, being about one-fourth the size of the specimen originally figured by Dall. A specimen which may belong to *C. nuda* (Dall) was collected from the Tampa limestone at Wakulla railroad station, Wakulla County,

¹¹⁹ Brown, R. W., *Celliforma spirifer*, the fossil larval chambers of mining bees: Washington Acad. Sci. Jour., vol. 24, pp. 532-533, 1934.

¹²⁰ Idem, p. 538.

¹²¹ Brown, R. W., Further notes on fossil larval chambers of mining bees: Washington Acad. Sci. Jour., vol. 25, p. 527, 1935.

¹²² Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, pl. 11, fig. 8, 1890.

Florida. This specimen is cylindrical in outline, rounded at one end but without any visible spire at the other end. It is solid throughout and contains Foraminifera.

The specimen (pl. 15, fig. 6) has no spirals at its apical end, being more elongate in this area. If this specimen belongs to *C. nuda* (Dall), which it apparently does, the larval organism escaped after breaking its seal.

The circumstantial evidence produced by Brown for identification of these peculiar fossil forms as larval chambers of mining bees is very convincing. His identification may be correct.

If they do represent fossil larvae of some kind of an insect, they should be excluded from this paper on Mollusca. However, I have tentatively included them under Mytilacea, more as a matter of convenience.

So far as known, *Celliforma nuda* (Dall) occurs only in the Tampa limestone. In addition to the places mentioned above, it occurs at Sixmile Creek, Hillsborough County.

Order ANOMALODESMACEA

Superfamily ANATINACEA

Family THRACIIDAE

Genus THRACIA (Leach Ms.) DeBlainville, 1824

Subgenus CYATHODONTA Conrad, 1849

THRACIA (CYATHODONTA) VICKSBURGIANA HERNANDOENSIS
Mansfield, n. subsp.

Plate 16, Figures 2, 4, 5

Right valve elongate and moderately convex. Anterior end shorter and more evenly rounded to margin than posterior end; posterior end steeply sloping behind the rounded posterior ridge and slightly raised at the dorsal margin. Sculptured over the disk and anterior slope with strong rounded elevated subequal ripples. The crests of these ripples are about 1.5 mm. apart over the middle part of the shell. The ripples fade out behind the posterior ridge. Left valve (one specimen) less inflated than right valve.

Dimensions: Holotype, right valve (U. S. National Museum no. 495977), length, 42 mm.; height, 29 mm.; diameter, about 10 mm.; length of anterior end, about 20 mm. Paratype, right valve (U. S. National Museum no. 495978), length, 52 mm.; height, 34 mm.; diameter, about 13 mm.; length of anterior end, about 25 mm. Paratype, left valve (U. S. National Museum no. 496311), length, 40 mm.; height, 24 mm.

Holotype locality: station 12758, Camp Concrete rock quarry, 5.9 miles northeast of Brooksville, Hernando County.

Paratype localities: station 12322, quarry three-fourths mile southwest of Brooksville, Hernando County; station 12758, 5.9 miles northeast of Brooksville.

Horizon: Suwannee limestone, Oligocene.

Thracia vicksburgiana hernandoensis, n. subsp., appears to be very closely related to *Thracia vicksburgiana* Dall,¹²³ a species from Vicksburg, Miss. (U. S. National Museum no. 5176). The holotype of *Thracia vicksburgiana* is not a complete specimen; the posterior extremity and the ventral margin are broken away. The original shell has been dissolved away and only the impression of the shell is left. Slightly better preserved specimens, identified as *T. vicksburgiana*, have been collected at or in the vicinity of Vicksburg, Miss., and are from the two following localities: Station 6450, indurated ledge forming a high waterfall at Mint Springs Bayou, below National Cemetery; station 7373a, Gulf and Ship Island R. R., 7½ miles south of Jackson and 1½ miles south of Plain, bed no. 1 of section.

The holotype and other specimens of *T. vicksburgiana*, from Vicksburg, Miss., and vicinity, are poorly preserved and their relationship with better preserved specimens that I have named the new subspecies *hernandoensis* is a little uncertain. However, the subspecies appears to differ from *T. vicksburgiana* in having a shell about twice as large, stronger concentric ripples, and a slightly more equilateral shell.

Occurrence: Station 12321, quarry 3 miles east of Brooksville; station 12757, quarry 10.2 miles northwest of Brooksville; station 12718, quarry 5 miles west of Brooksville; station 12761, two miles north of Hudson, Pasco County.

Family PHOLADOMYACIDAE

Genus PHOLADOMYA Sowerby, 1823

PHOLADOMYA sp.

One poorly preserved internal mold belonging to the genus *Pholadomya* was collected at station 12292, Cherokee Sink, Wakulla County, Florida.

The mold is of medium size, oblong, inequivalve and ventricose. The radial and concentric sculpture is rather strongly developed. The exact relationship to other fossil species of this genus is difficult to determine because of the poor preservation of the specimen in hand

¹²³ Dall, W. H., Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1526, pl. 57, fig. 27, 1903.

but it appears to be related to the several described species, *Pholadomya walli* Maury¹²⁴ and *P. sawkinsi* Maury,¹²⁵ reported from the Machapoorie Miocene (lower Miocene) of Trinidad; *P. falconensis* F. and H. Hodson,¹²⁶ a species reported from the Miocene in the State of Falcon, Venezuela.

Horizon: Tampa limestone, lower Miocene.

Order TELODESDESMACEA
Superfamily CYPRICARDIACEA
Family PLEUROPHORIDAE
Genus CORALLIOPHAGA Blainville, 1825

CORALLIOPHAGA ELEGANTULA Dall

1898. *Coralliophaga elegans* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 4, p. 920, pl. 25, figs. 2, 2a (not of Deshayes, Coq. Fos. Bass, Paris, 1824).
1903. *Coralliophaga elegantula* Dall, idem, pt. 6, p. 1499.
1915. *Coralliophaga elegantula* Dall, U. S. Nat. Museum Bull. 90, p. 131, pl. 23, figs. 11, 13.

Dall described this species in 1903 as follows:

"Shell ovate, as figured; thin, sculptured only by faint incremental lines; interior filled with a hard matrix by which it is obscured. Alt. 11.5, lat. 19.5, diam. 7.0 mm.

"This species somewhat recalls the *C. lithophagella* Lamarck, of the Mediterranean, but is of more elegant shape. From any other American species it can be distinguished by its smooth surface. The specific name first chosen cannot be retained, as it has already been used for different fossil species by DeFrance, Deshayes, and others."

The holotype (U. S. National Museum no. 155720) came from the "silex bed" at Ballast Point, Tampa Bay, Fla. Although Dall reports this species in the Chipola formation, I have not seen it from that locality.

Horizon: Tampa limestone, lower Miocene.

Superfamily ASTARTACEA
Family CRASSATELLITIDAE
Genus CRASSATELLA Lamarck, 1799

CRASSATELLA DEFORMIS Heilprin

1887. *Crassatella deformis* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 117, pl. 16, fig. 63.
1903. *Crassatellites* (*Scambula*) *deformis* (Heilprin). Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1471.

¹²⁴ Maury, C. J., Bull. Am. Paleontology, vol. 10, p. 332, pl. 42, figs. 8, 11, 1925.

¹²⁵ Idem, p. 333, pl. 42, fig. 10.

¹²⁶ Hodson, Floyd, and Hodson, Helen K., Bull. Am. Paleontology, vol. 13, p. 44, pl. 26, fig. 6; pl. 27, figs. 1, 2, 1927.

1915. *Crassatellites (Scambula) deformis* (Heilprin). Dall, U. S. Nat. Mus. Bull. 90, p. 131, pl. 22, figs. 6, 7.

Heilprin described this species in 1887 as follows:

"Shell thick in substance, obliquely-oval, the beaks well anterior; anterior border, beginning at the beaks, evenly rounded; posterior border abruptly truncated; basal margin evenly rounded, not flexuous, crenulated; external surface profoundly sulcated, the sulci not extending beyond the angulation of the broad posterior slope, which is slightly hollowed, and only shows the lines of growth."

"Length, nearly three inches; height to summit of umbo, 1.7 inch.

"This species can be readily recognized by its oblique form, the broad posterior slope, and the prominence of the sulcation."

Location of type: Wagner Free Institute of Science, Philadelphia.

Horizon: Tampa limestone, lower Miocene.

Occurrence: "silex beds," Tampa Bay; station 2470, one mile west of Bartow, Polk County; station 12736, 1¼ miles northeast of Lloyd, Jefferson County; station 12293, 16 miles south of Tallahassee, Wakulla County. Only one valve, preserved as an external mold, has been collected at 12293; it has stronger concentric ribbing than the typical form of *C. deformis* and may represent a varietal form of this species.

Superfamily CYRENACEA

Family CYRENIDAE

Genus CYRENA Lamarck, 1818

Subgenus POLYMESODA Rafinesque, 1820

CYRENA (POLYMESODA?) POMPHOLYX Dall

1900. *Cyrena pompholyx* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 5, pl. 38, figs. 7, 8.
1903. *Cyrena pompholyx* Dall, idem, pt. 6, p. 1445.
1915. *Cyrena (Polymesoda?) pompholyx* Dall, U. S. Nat. Mus. Bull. 90, p. 134, pl. 22, figs. 4, 5, 8.

Dall described this species in 1903 as follows:

"Shell thin, obliquely trigonal, feebly, irregularly, concentrically striated; beaks high, full, somewhat prosogyrate, situated near the anterior fourth of the shell; anterior end short, rounded; posterior slope rapidly descending, long, the end of the shell substrate; one or two faint, shallow sulci extend from the beaks to the posterior extreme; a very small subcordate impressed area in front of the beaks may represent a lunule; hinge normal, the anterior right and posterior left cardinals slender, entire, the others larger and bifid; the anterior laterals short, low, adjacent, smooth; the posterior laterals longer and distant from the cardinals; nymphs rather long, their opposing surfaces smooth; muscular impressions small and rather high in the shell; pallial line obscure, but probably only slightly subtruncate behind and without a sinus; margins of shell thin and smooth. Length 40, height 36, diameter 27 mm.

"This species is rather peculiar in the thinness of its shell and the closely adjacent anterior lateral, but these characters do not appear to be more than specific, and are paralleled in some of the oriental forms and, especially the hinge character, in some of the European fossils."

This species may belong to the subgenus *Polymesoda* of which *Polymesoda caroliniana* (Bosc) is the type. In *P. caroliniana* the left anterior lateral is at a greater distance from the cardinal than in *C. pompholyx*. The habitat of the subgenus *Polymesoda* according to Dall¹²⁷ "In streams of America in the warmer regions."

Horizon: Tampa limestone, lower Miocene.

Occurrence: Rather common in the "silex beds" at Ballast Point, Tampa Bay, Fla.; station 5000, Sixmile Creek, Hillsborough County; station 12732, 3.7 miles south of Wakulla, Wakulla County.

CYRENA FLORIDANA (Dall)

1900. *Vellorita floridana* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 5, p. 1199, pl. 43, figs. 8, 13.
1903. *Villorita floridana* Dall, idem, pt. 6, p. 1452.
1915. *Villorita floridana* Dall, U. S. Nat. Mus. Bull. 90, p. 134, pl. 17, figs. 9, 10; pl. 18, figs. 8, 10, 11.

Dall described this species in 1903 as follows:

"Shell large, heavy, elevated, plump, with high prosogyrate beaks and broad hinge-plate; surface concentrically striated; lunule and escutcheon not defined; hinge with one obscure and two large anterior cardinals, a distant posterior lateral, short and smooth; a very short arcuate socket for an anterior adjacent lateral above a pustular tooth equivalent to the right lamina in the right valve. The interior is obscured by silicious rock. Length 65, height 70, diameter (double) 50 mm."

This species belongs to the same genus as *Cyrena pompholyx* Dall, the principal differences between the two species is that *C. floridana* (Dall) has a larger shell, a relatively higher beak, a thicker shell and stronger teeth.

Although the dental arrangement is similar in most respects to *Villorita cyprinoidea* (Wood) of Asia, the genotype of *Villorita*, there are certain differences. In *C. floridana* the elevation below the socket in the right anterior extends posteriorly to the middle cardinal, whereas in *V. cyprinoidea* this ridge terminates opposite or slightly in front of the anterior cardinal. In this character *C. pompholyx* agrees with *C. floridana* (Dall).

C. floridana may be the ancestor of the living species, *Polymesoda caroliniana* (Bosc).

¹²⁷ Dall, W. H., Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1444, 1903.

Holotype: U. S. National Museum no. 107737.

Horizon: Tampa limestone, lower Miocene.

Occurrence: Dredged out of ship canal off Ballast Point, Tampa Bay, Fla.; station 7338, Anclote River at Tarpon Springs, Pinellas County, Fla.; station 12300, 1¼ miles northeast of Lloyd, Jefferson County; station 13848, from dredgings at a depth of 32 to 36 feet below water level off Hooker Point, upper Hillsborough Bay.

Internal molds of shells collected at the following localities may belong to *C. floridana* (Dall): Stations 3407, 7174, and 7175, vicinity of River Junction, Gadsden County, 8 to 10 feet below level of railroad tracks; station 3406, Aspalaga Bluff, Apalachicola River, Gadsden County; station 13841, Aspalaga Bluff, 10 feet above a four-foot clay bed.

Superfamily CARDITACEA

Family CARDITIDAE

Genus CARDITA (Bruguière) Lamarck, 1799

Subgenus CARDITAMERA Conrad, 1833

CARDITA (CARDITAMERA) TEGEA Dall

1903. *Cardita (Carditamera) tegea* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1412 (part).
1915. *Cardita (Carditamera) tegea* Dall, U. S. Nat. Mus. Bull. 90, p. 133, pl. 17, fig. 1.

Dall considered the Tampa specimens identical with the Chipola specimens. His description of *C. tegea* was made for the most part from specimens from the Chipola River, whereas the locality of the holotype of his species is Ballast Point. Gardner¹²⁸ considered the Chipola form different from the Tampa species and named it *C. apo-tegea*. Following is a description of *C. tegea* Dall:

Shell small, low, thin, elongate; dorsal margin shorter than ventral margin and nearly parallel with it; anterior margin rounded; ventral margin with a slight insinuation medially; posterior margin obliquely angled with the dorsal margin. Externally, the anterior half of the shell gradually slopes to the margins; posterior ridge not prominent; posterior dorsal slope gradually declining to the margins. Ribs 19 in number, smaller, relatively more widely spaced and more nodose on the anterior side than elsewhere; gradually increasing in strength and sharpness posteriorly to the shoulder where they are rather strongly developed. Ribs on posterior dorsal slope rather strong except the third from the dorsal margin, which is weaker than the others. The two posterior ribs bear imbricated structures.

¹²⁸ Gardner, Julia, U. S. Geol. Survey Prof. Paper 142-B, p. 88, pl. 17, figs. 1-2, 1926.

Holotype (right valve): U. S. National Museum no. 135125.

Dimensions: Length, 33 mm.; height, 16 mm.; diameter, 5.5 mm.

Type locality: "silex beds" at Ballast Point, Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene.

Other occurrence: Sixmile Creek, near Orient Station, Hillsborough County (Tucker).

Cardita tegea is larger, thinner, relatively more elongate and lower than the Chipola species, *C. apotegea* Gardner.

CARDITA (CARDITAMERA) SHEPARDI Dall

1915. *Cardita shepardi* Dall, U. S. Nat. Mus. Bull. 90, p. 133, pl. 21, figs. 10, 12.

Dall described this species as follows:

"Shell small, inflated, solid, subquadrate; beaks moderately elevated, situated in the anterior third of the shell; sculpture of (on the left valve about 21) elevated rounded ribs with deep, equal, or wider channeled interspaces; the ribs are ornamented with numerous prominent nodules rather sparsely distributed and on the posterior slope becoming more prominent and imbricated; anterior end rounded, posterior subtruncate; base medially compressed; hinge as usual in the genus, rather delicate; inner margins of the valves crenulated by the sculpture. Length 9.75, height 6, diameter 6 mm.

"Tampa silex beds at Ballast Point, Tampa Bay, Florida. Post collection, U. S. Nat. Mus. No. 165193 [holotype].

"This little species is closely related to the recent *C. domingensis* of the West Indies."

Horizon: Tampa limestone, lower Miocene.

Cardita shepardi has a more quadrate shell and weaker radials over the posterior ridge than the young specimens of *C. apotegea* Gardner, a Chipola marl species.

The specimens identified by Dall¹²⁹ as *Cardita* (*Carditamera*) *shepardi* Dall from station 7075, east bank of the Flint River, about 10½ miles below Bainbridge, Ga., are closely related to *Venericardia serricosta brooksvillensis*.

CARDITA (CARDITAMERA) ANCLOTENSIS Mansfield, n. sp.

Plate 16, Figure 3

Shell small, slightly obliquely elongate and weakly depressed. Beaks moderately high and medially flattened. Posterior slope steep; anterior slope less steeply inclined than the posterior; posterior shoulder prominent and forms the highest part of the shell. Ribs about 15 in number, rounded, nodulous on the anterior side and separated by interspaces as wide as the ribs but posteriorly becoming stronger, less

¹²⁹ Dall, W. H., U. S. Nat. Mus. Proc., vol. 51, no. 2162, p. 496, 1916.

closely spaced and sharper. Posterior dorsal slope ornamented with 4 ribs, the second from the dorsal margin weak, while the others are nearly as strong as those on the shoulder. Hinge partly concealed by matrix; however, two right valves faintly indicate the anterior lateral socket.

Dimensions: Holotype, right valve (U. S. National Museum no. 495980), length, 20 mm.; height, 15 mm.; diameter, 6 mm.

Type locality: Station 12763. Anclote River at Tarpon Springs, Pinellas County, Fla.

Horizon: Tampa limestone, lower Miocene.

Cardita ancloensis n. sp. differs from *C. tegea* Dall in having a shorter and relatively higher shell and from *C. shepardi* Dall in having a larger shell with fewer ribs.

Occurrence: Known only from the type locality.

CARDITA (CARDITAMERA) LIVEOAKENSIS Mansfield, n. sp.

Plate 15, Figures 4, 5

Shell small, thick, low and subquadrate in outline. Beaks low and rounded. Disk slightly higher in the area of the posterior shoulder and nearly flat over the middle area below the beaks. Anterior side rounded to margins; posterior slope rather steep; posterior shoulder rather low. Sculptured with about 22 weakly nodulous ribs; ribs over anterior region of uniform size, narrow and separated by interspaces wider than ribs; ribs on posterior side a little stronger and more closely spaced than on anterior side. There are five radials on the posterior slope; these are nearly as strong as those on the posterior shoulder.

Dimensions: Cotypes (U. S. National Museum no. 495981). Right valve, length, 15.5 mm.; height, 11.5 mm.; diameter, 5 mm. Smaller left valve, length, 11 mm.; height, 7.8 mm.; diameter, 4 mm.

Type locality: Station 11109, 1½ miles north of Live Oak, Suwannee County, Fla.

Horizon: Suwannee limestone, Oligocene.

Cardita liveoakensis is relatively longer than *C. shepardi* Dall, has more uniformly sized and differently sculptured ribs, and two more in number than that species. However, it appears more closely related to *C. shepardi* than to *C. tegea* Dall.

Occurrence: Type locality, six valves in all; station 12303, Suwannee River at Suwannee Sulphur Springs (an external mold of a much larger specimen than the holotype which may be *C. liveoakensis*, but identity questioned).

Genus VENERICARDIA Lamarck, 1801

VENERICARDIA SERRICOSTA (Heilprin)

1887. *Cardita (Carditamera) serricosta* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 117, pl. 16, fig. 64.
1900. *Cardita serricosta* Heilprin. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 5, p. 1194, pl. 38, fig. 9.
1903. *Venericardia serricosta* (Heilprin). Dall, Idem, pt. 6, p. 1428, pl. 28, fig. 9.
1915. *Venericardia serricosta* (Heilprin). Dall, U. S. Nat. Mus. Bull. 90, p. 132, pl. 26, fig. 6.
1915. *Venericardia himerta* Dall, idem, p. 132 (not *V. himerta* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 5, p. 1196, pl. 40, fig. 16, 1900, an Oak Grove species).

Heilprin described this species in 1887 as follows:

"Shell ventricose, obliquely-oval, highest in the anterior region; umbones well anterior, very prominent, overlooking a deeply impressed, cordiform lunule; hinge-tooth (in right valve) an elongated lamellar plate, which advances beneath the lunular depression (where it is thickened), and is received into a corresponding sulcus in the left valve; external surface radiately ribbed; the ribs about sixteen in number, profoundly elevated, narrow—much narrower than the interspaces—and strongly knobbed or serrated, those of the posterior slope irregular in size; base crenocarinated. Length, 1.3 inch; height to top of umbo, one inch."

Holotype deposited in the collection of the Wagner Free Institute of Science, Philadelphia.

Type locality: "silex beds" at Ballast Point, Tampa Bay, Fla.

Collected in 1936 at station 13847, Gadsden Point, 4 miles south of Ballast Point.

Horizon: Tampa limestone, lower Miocene; ?Suwannee limestone, Oligocene.

Venericardia serricosta (Heilprin) is distinguished from *V. hadra* Dall, a Chipola species, and from *V. himerta* Dall, an Oak Grove sand species, by its smaller size, relatively more elongate shell, and narrower ribs. The number of ribs on the three species are about the same; the Tampa species having 16 to 19 ribs; the Chipola species having 18-21 ribs; and the Oak Grove species having 18 to 20 ribs.

Other occurrence in Florida: Tampa limestone, station 2470, one mile west of Bartow, Polk County; station 12765, Orient Station, Six-mile Creek, Hillsborough County; station 12300, 1¼ miles northeast of Lloyd, Jefferson County; station 12292, Cherokee Sink, Wakulla County; station 12293, Wakulla R. R. Station, Wakulla County (mold, determination questioned); station 12735, 11 miles nearly south of Tallahassee, Leon County (mold, identification questioned); station 12725, Baileys old ferry, Calhoun County (mold, identification ques-

tioned); station 12727, Willis bridge, Chipola River, Calhoun County; station 7080, quarry one-half mile south of River Junction, Gadsden County; elevation about 150 feet above sea level. Suwannee limestone, station 6774, half mile above White Springs, Hamilton County (fragment identification questioned); station 12739, Noble ferry bridge, Suwannee River, Hamilton County (identification questioned).

The specimens referred to *V. serricosta* from some localities outside of the type locality are preserved mainly as molds of the exterior of the shells and therefore do not show the teeth and for this reason there is some uncertainty as to their specific identifications.

VENERICARDIA SERRICOSTA BROOKSVILLENSIS Mansfield, n. subsp.

Plate 17, Figures 1, 9

Shell similar to *Venericardia serricosta* (Heilprin) in number of ribs, and character of the ribs on the anterior side and middle part of the shell; but differing from that species in the character of the ribs on the posterior dorsal slope. On *V. serricosta*, the fourth rib and sometimes the fifth rib from the dorsal margin, is threadlike and much weaker than the others, whereas on the new subspecies the ribs over this area are all about the same strength. The new subspecies also has a relatively more elongate shell than *V. serricosta*.

Dimensions: Holotype, impression of mold of right valve (U. S. Nat. Mus. no. 495979), length, 23 mm.; height, 19 mm.; diameter about 8 mm.

Type locality: Station 11113, Brooksville, Hernando County, Fla.

Horizon: Suwannee limestone, Oligocene.

Other occurrences: Station 12321, 3 miles east of Brooksville, Hernando County; station 12758, 5.9 miles northeast of Brooksville, Hernando County; station 12308, 1½ miles north of Live Oak, Suwannee County (molds, identification questioned); station 12766, Blackwater River, at S. A. L. Ry. crossing, Hillsborough County.

Specimens identified by Dall¹³⁰ as *Cardita* (*Carditamera*) *shepardi* Dall from station 7075, east bank of Flint River, about 10½ miles below Bainbridge, Ga., appear to be closely related to or the same form as the subspecies *brooksvillensis* here described.

¹³⁰ Dall, W. H., U. S. Nat. Mus. Proc., vol. 51, no. 2162, p. 496, 1916.

VENERICARDIA NODIFERA Kellum

1926. *Venericardia nodifera* Kellum, U. S. Geol. Survey Prof. Paper 143, pp. 36, 37, pl. 9, figs. 1-3.

Kellum described this species as follows:

"Shell solid, robust, obliquely oblong, the beaks full, prominent, prosogyrate, and nearly anterior; anterior side short, bluntly rounded, posterior side longer, slightly compressed, roundly truncate behind; sculpture of 19 to 22 radial ribs, of which the posterior five or six are smaller and less elevated than the others; anterior ribs stout, the summit articulated with small, squarish, transverse nodules; interspaces subequal to the ribs; lunule rather small and deeply incised; hinge normal; the anterior cardinal pustular, the interior margins with coarse flutings. Length, 32 mm.; height, 29 mm.; depth of right valve, 12 mm. * * *.

"Locality: Silverdale, Onslow County, N. C.

"Geologic horizon: Trent marl, of lower Miocene age."

Other occurrences: The specimens from the following Tampa limestone localities in Florida, appear to be *Venericardia nodifera* Kellum: Station 11115, Kendrick, upper bed, Marion County, Fla.; ?station 7353, midway between Anthony and Martin, Marion County, Fla. (poor specimen); ?station 11186, midway between Lowell and Sparr, Marion County (small mold).

Superfamily CHAMACEA**Family CHAMIDAE**

Genus CHAMA (Linnaeus), 1758

CHAMA TAMPAENSIS Dall

1903. *Chama tampaensis* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1398, pl. 54, fig. 6.
1915. *Chama tampaensis* Dall, U. S. Nat. Mus. Bull. 90, p. 135, pl. 24, fig. 1.

Dall described this species in 1903 as follows:

"Shell rather small, irregular, attached by the left valve; sculpture of concentric lamellae, on the attached valve sparse and irregular, not fluted or crenulated, on the right valve rather more evenly spaced, though sometimes crowded, usually somewhat distant, smooth, or faintly radially striated, except at the extreme margin, where there are obsolete flutings on one or two of the outermost lamellae, if any; internal margins of the valves smooth; average diameter about twenty millimeters.

"Oligocene 'silex beds' at Ballast Point, Tampa Bay, Florida; Dall and Burns."

Holotype: Right valve, U. S. National Museum no. 109248.

Horizon: Tampa limestone, lower Miocene.

As a result of an extensive study of the Chamidae Odhner¹³¹ subdivided the Recent species into two genera, the distinguishing characters of which he gives (p. 75) as follows:

"Shell with the apices twisted to the right and the left valve attached to the substratum; nepionic shell very small (about 0.5 mm.), with concentric and radial sculpture; lateral teeth persistent; no marginal teeth of the adult shell; * * * *Chama* Linne, 1758.

"Shell with the apices twisted to the left and the right valve attached; nepionic shell distinct; adult shell with a left marginal tooth. * * * *Pseudochama* n. gen."

The shells of *Chama tampaensis* Dall as well as *C. chipolana* Dall, a Chipola species, are attached by their left valves and according to the above classification would fall under the genus *Chama*. "*Chama*" *draconis* Dall, a species described from the Chipola formation, which is attached by the right valve, would fall under the genus, *Pseudochama*. *Chama tampaensis* is readily distinguished from *C. chipolana* by its widely spaced, strong concentric lamellae and the absence of rounded radials.

Horizon: Tampa limestone, lower Miocene; ?Suwannee limestone, Oligocene.

Occurrence: Tampa limestone, type locality, and Sixmile Creek, Hillsborough County (Tucker). ?Suwannee limestone, Oligocene: Blackwater Creek at crossing of S. A. L. Ry., Hillsborough County (Tucker); a much larger specimen than those from the Tampa limestone.

CHAMA HILLSBOROUGHENSIS Mansfield, n. sp.

Plate 16, Figures 6, 7

Shell rather small, irregularly rounded in outline; lower (left valve) deep, upper valve shallow. Attached by the left valve. Both valves with a radial sulcus extending along the posterior side from the beak to the ventral margin. Sculpture on disk of right valve consists of rather closely spaced, elevated lamellae which, for the most part, terminate with vaulted spinose structures that are somewhat radially disposed. Beak of right valve weakly swollen and nearly smooth. Left valve with a strongly twisted beak in larger specimens but only slightly prosogyrate in young specimens. Sculpture of left valve consists of closely set, crenulated, somewhat radially arranged lamellae over the early part of the shell, becoming stronger and more

¹³¹ Odhner, Nils H. J., K. svenska Vet.-Akad. Handl., Band 52, No. 16, 1917; Band 59, No. 3, 1919.

widely spaced and marginally spinose over the rest of the valve. Rounded radials ornament most of the surface of the left valve.

Dimensions: Cotypes (U. S. Nat. Mus. no. 495982). Larger cotype, left valve, length, 20.5 mm.; height, 23.5 mm.; diameter, 11 mm. Smaller cotype, right valve, length, 15 mm.; height, 18 mm.; diameter, 5 mm.

Type locality: Station 2084, "silex beds," Tampa Bay, Hillsborough County, Fla.

Horizon: Tampa limestone, lower Miocene.

Chama hillsboroughensis differs from *C. tampaensis* Dall in having a posterior radial sulcus on each valve; more closely spaced, spinose lamellae; and radial sculpture.

Occurrence: Known only from the type locality.

Genus PSEUDOCHEMA Odhner, 1917

PSEUDOCHEMA DRACONIS Dall

1903. *Chama draconis* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1399, pl. 56, figs. 17, 18.
1915. *Chama chipolana* Dall, U. S. Nat. Mus. Bull. 90, p. 135 (part, not pl. 25, figs. 9, 11).
1926. *Chama draconis* Dall. Gardner, Julia, U. S. Geol. Survey Prof. Paper 142-B, p. 92, pl. 17, figs. 7, 8.

Dall described this species in 1903 as follows:

"Shell irregular, attached by the anterior end of the right valve, which usually acquires a trigonal or semicircular outline; sculptured on the right valve with a curious, blistered verruculation not unlike convex scales of a saurian or Gila monster, and also at the margin of the attachment with broad, irregular, concentrically striated foliations; on the posterior slope there is a tendency to form two or three radial series of small, rather distant foliations, which, or part of them, are often obsolete; near the posterior dorsal margin is a well-marked radial sulcus and often another parallel to it but much more feeble; left valve much flatter, irregularly concentrically lamellose, the lamellae rising into foliations in two or three radial series behind, the foliations and most of the surface with fine vermicular or partly divaricate radial fluting or threading; adductor scars small; internal margins finely crenulate. Average diameter 25 millimeters.

"This is a rather common species with a surface recalling that of *Echinochama*."

Cotype: U. S. Nat. Mus. no. 114724.

Type locality: Station 2213, one mile below Baileys Ferry, Chipola River, Fla.

Horizon: Tampa limestone, lower Miocene; Chipola formation, lower Miocene.

A few specimens from the "silex beds," Tampa Bay, Florida, appear to be identical with *Pseudochama draconis* Dall. Some of these specimens were referred to *Chama chipolana* by Dall.

CHAMA or PSEUDOCHEMA sp. a

A number of large specimens, preserved as internal molds, were collected from a few localities. These may represent only one species but this can not be determined on account of the condition of preservation.

Horizon: Suwannee limestone, Oligocene.

Occurrence: Station 11109, $1\frac{1}{2}$ miles north of Live Oak, Suwannee County; station 12322, $\frac{3}{4}$ mile, southwest of Brooksville, Hernando County; station 12321, 3 miles east of Brooksville; station 12757, 10.2 miles northwest of Brooksville; station 12762, $2\frac{3}{4}$ miles south of Zephyrhills, Pasco County.

CHAMA or PSEUDOCHEMA sp. b

A number of rather small specimens, preserved as internal molds, were collected from a few localities. These may represent only one species but this cannot be determined on account of the condition of preservation.

Horizon: Tampa limestone, lower Miocene.

Occurrence: Station 12314, upper bed at Kendrick, Marion County; station 12292, Cherokee Sink, Wakulla County; station 12293, Wakulla railroad station, Wakulla County; station 12727, Willis bridge, Chipola River, Calhoun County; station 12726, 2.2 miles above Willis bridge.

Superfamily LUCINACEA

Family LUCINIDAE

Genus CODAKIA Scopoli, 1777

Section JAGONIA Récluz, 1869

CODAKIA (JAGONIA) SCURRA Dall

1915. *Codakia (Jagonia) scurra* Dall, U. S. Nat. Mus. Bull. 90, p. 136, pl. 21, figs. 15, 16.

The following is the original description of this species:

"Shell small, rounded quadrate, moderately inflated, with low beaks nearly at the posterior third; a short lanceolate lunule and longer sulcus for the ligament; sculpture of numerous rounded close-set radial ribs, crossed by incremental lines, which rise to low arched imbrications where they override the ribs, especially distally; interior closed by matrix. Length, 12, height 8, maximum diameter, 6 mm.

"Tampa silix beds, at Ballast Point, Tampa Bay, Florida. U. S. Nat. Mus. No. 165198 [holotype].

"This has much the same sculpture as several of the recent species, though most of the Chipola Jagonias are much smoother and more rounded in shape."

This species is known only from its type locality.

Horizon: Tampa limestone, lower Miocene.

Genus LUCINA Lamarck, 1799

LUCINA, one or more species

Large globose Lucinas, preserved mainly as internal molds of the original shell and exhibiting few characteristics suitable for specific discrimination, were collected at a few localities. Most of the molds represent larger shells than *Lucina corpulenta* Dall, a species confined to the Chipola formation of Florida. The largest specimen in hand, collected from the upper bed at Kendrick, Marion County, (station 12314), is nearly as large as undetermined specimens of this genus from Crocus Bay, Anguilla, mentioned by Cooke.¹³²

Horizon: Tampa limestone, lower Miocene.

Occurrence: Station 12314, upper bed at Kendrick, Marion County; station 12293, Wakulla R. R. station, Wakulla County; station 12296, "The Swirl," 3½ miles southeast of Crawfordville, Wakulla County; station 3406, lowest bed at Aspalaga Bluff, Gadsden County; station 12285, quarry one-half mile south of River Junction at an elevation about 150 feet above sea level, Gadsden County; station 12283, Old Chattahoochee Landing at an elevation of 155-165 feet above sea level; station 12282, Old Chattahoochee Landing, echinoderm bed, at an elevation of 77.4-78.4 feet above sea level. The specimens from the echinoderm bed, or lowest bed exposed at Old Chattahoochee Landing, are smaller than specimens at a higher elevation in the same bluff or those at an elevation around 150 feet one-half mile south of River Junction.

Genus PHACOIDES Blainville, 1825

Subgenus PHACOIDES ss.

PHACOIDES (PHACOIDES) cf. P. PECTINATUS Gmelin

A left valve (U. S. Nat. Mus. no. 157640) referred by Dall¹³³ to *Phacoides domingensis* Dall and reported as occurring in the "silix beds" of the Tampa limestone at Ballast Point, Tampa Bay, appears

¹³² Cooke, C. W., Tertiary mollusks from the Leeward Islands and Cuba: Carnegie Inst. Washington Pub. No. 291, p. 148, 1919.

¹³³ Dall, W. H., Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1363, pl. 50, fig. 11, 1903 (also same figure reproduced in U. S. Nat. Mus. Bull. 90, pl. 23, fig. 9, 1915).

to be nearer *P. pectinatus* Gmelin (Pliocene to Recent) than to *P. domingensis*, the type of which came from beds of unknown age on an island in Lago de Henriquillo, Dominican Republic. The specimen is not silicified. No other specimens of this form have been collected from the Tampa limestone at its type locality, or from beds of the same age elsewhere, and its occurrence in the Tampa limestone is dubious.

Subgenus LINGA DeGregorio, 1884

PHACOIDES (LINGA) WACISSANUS Dall

1903. *Phacoides (Here) wacissanus* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1365, pl. 50, fig. 15.
1915. *Phacoides (Here) wacissanus* Dall, U. S. Nat. Mus. Bull. 90, p. 137, pl. 23, fig. 12.
1916. *Phacoides (Here)* cf. *wacissanus* Dall, U. S. Nat. Mus. Proc., vol. 51, no. 2162, p. 497.
1923. *Phacoides (Here) wacissanus* Dall. Cooke, U. S. Geol. Survey Prof. Paper 133, p. 5.

The following is the original description of this species:

"Shell much resembling in general appearance and solidity *P. cariniferus*, but having the beaks lower, the posterior dorsal area larger but not so deeply impressed, the anterior dorsal area less impressed, larger, and without the carina and marginal projection below it which occurs in that species; the shell is also rather longer and less high, and the hinge teeth are longer and heavier than in *P. cariniferus*. The margins are finely crenulate, and well-grown specimens often exhibit resting stages near the base, indicated by sulci. Alt. 15, lon. 16, diam. 12 mm. Large specimens attain a length of 20 mm."

The holotype (U. S. Nat. Mus. no. 157756) came from Ballast Point, Florida.

The external sculpture consists of rather widely spaced concentric imbrications. No radial striae are present. An undescribed species of *Phacoides* (Linga) from Crocus Bay, Anguilla, stations 6965 and 6894, as pointed out by Cooke,¹³⁴ is related to *P. wacissanus* Dall but differs from it in having a straighter dorsal margin and a more deeply impressed sulcus on the right valve.

Horizon: Tampa limestone, lower Miocene; Suwannee limestone and Flint River formation, Oligocene.

Occurrence: Florida, Tampa limestone, type locality common; station 4998, Sixmile Creek, near Orient, Hillsborough County; station 11115, Kendrick, upper bed, Marion County; station 12292, Cherokee Sink, Wakulla County (one specimen in lot rather large); station 7080, quarry half mile south of River Junction, Gadsden County, at eleva-

¹³⁴ Cooke, C. W., Tertiary mollusks from the Leeward Islands and Cuba: Carnegie Inst. Washington Pub. No. 291, p. 149, pl. 15, fig. 2, 1919.

tion about 150 feet above sea level; station 3406, lowest bed at Aspalaga Bluff, Gadsden County; station 13847, 4 miles south of Ballast Point. Suwannee limestone, station 12766, Blackwater Creek, at S. A. L. Ry. crossing, Hillsborough County; station 12321, 3 miles east of Brooksville, Hernando County (specimen larger than usual); station 7361, $3\frac{1}{2}$ miles west of Brooksville, Hernando County; station 12317, 10.2 miles northwest of Brooksville (specimen larger than usual); station 11109, $1\frac{1}{2}$ miles north of Live Oak, Suwannee County; ?station 6825, 3 miles west of Live Oak, Suwannee County; station 12742, Suwannee River, $2\frac{1}{2}$ miles above Ellaville, Suwannee County; ?station 6828, Falmouth, Suwannee County; station 12307, Bass, Columbia County; station 6774, rock island half mile above White Springs, Columbia County; station 12299, Walker Spring, Jefferson County (specimen larger than usual). Georgia, Flint River formation, station 7075, Flint River, about $10\frac{1}{2}$ miles below Bainbridge, Decatur County; station 7150a, from loose blocks of chert at Bainbridge.

Subgenus LUCINISCA Dall, 1901

PHACOIDES (LUCINISCA) SILICATUS Mansfield, n. sp.

Plate 17, Figures 4, 5, 6, 8

- 1915. *Myrtaca* (*Eulopia*) *vermiculata* Dall, U. S. Nat. Mus. Bull. 90, p. 136 (part, fig. 14, pl. 23, excluded, a Bowden marl species).
- 1915. *Phacoides domingensis* Dall, idem, p. 137 (part; not *P. domingensis* Dall, 1903).
- 1915. *Phacoides* (*Lucinisca*) *plesiolophus* Dall, idem, p. 138 (part; not *P. plesiolophus* Dall, 1903).
- 1915. *Phacoides* (*Lucinisca*) *calhounensis* Dall, idem, p. 139 (part; not *P. calhounensis* Dall, 1903, a Chipola species).
- 1926. *Phacoides* (*Lucinisca*) *plesiolophus* Dall. Gardner (part, not an Oak Grove species), Prof. Paper 142-F, p. 110.

Shell rather solid, suborbicular, moderately inflated. Beaks prosogyrate. Lunule excavated and plicated. Posterior dorsal area weakly depressed and marked off in front by a low ridge; a narrow and shallow sulcus is anterior to this ridge. Dorsal area rather narrow and weakly depressed. Concentric sculpture of marginally erect lamellae over the entire external surface of shell being a little wider spaced over the umbonal area than elsewhere. A few concentric threads (over the umbonal area) lie between the margins of these lamellae. Radial sculpture of fine to rather coarse threads on the disk but absent on the dorsal anterior and posterior areas. Inner margin finely crenulate.

The holotype (U. S. Nat. Mus. no. 165199) measures: Length, 12.7 mm.; height, 11.4 mm.; convexity, 3.9 mm.

The paratype (U. S. Nat. Mus. no. 495983) measures: Length, 10.5 mm.; height, 9.5 mm.; convexity, 3.9 mm.

The holotype, a right valve, was labelled with two other specimens (U. S. Nat. Mus. no. 165199) *Phacoides domingensis*. The same Museum number is given by Dall for this form (U. S. Nat. Mus. Bull. 90, p. 137). Only one valve is recorded under this number; consequently, I am uncertain which of the three specimens in the same vial was originally registered under this number.

Phacoides silicatus differs from *P. plesiolophus* Dall, an Oak Grove species, in having a smaller and more inflated shell; from *P. calhounensis*, a Chipola formation species, in having a less ornamental shell. *Myrtaea vermiculata* Dall, a species from the Bowden marl, Jamaica, has a type of radial sculpture different from that of *P. silicatus*.

Type locality: "silex beds," Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene.

Occurrence: Type locality (common); station 12735, 11 miles southwest of Tallahassee, Leon County (external mold); station 12725, from limestone at Baileys old ferry, Calhoun County (external mold); station 3406, lowest bed at Aspalaga Bluff, Gadsden County (external mold); stations 7080 and 12285, quarry one-half mile south of River Junction, Gadsden County, at an elevation about 150 feet above sea level (silicified specimens).

Specimens from some of the localities, as noted above, are molds and the determinations are based upon impressions taken of these molds.

Subgenus MILTHA H. and A. Adams, 1857

PHACOIDES (MILTHA) HILLSBOROENSIS (Heilprin)

1887. *Lucina hillsboroensis* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 117, pl. 16, fig. 62.
1915. *Phacoides (Miltha) hillsboroensis* Heilprin. Dall, U. S. Nat. Mus. Bull. 90, p. 139 (part; figure excluded).
1916. *Phacoides (Miltha) hillsboroensis* Heilprin. Dall, U. S. Nat. Mus. Proc., vol. 51, p. 498 (part, figure excluded).

Following is the original description of this species:

"Shell (known only by the left valve) disciform, suborbicular, evenly rounded anteriorly and basally, truncated posteriorly; beak pointed, sub-central; the preumbonal border rapidly declivous, direct; two oblique, fairly prominent, cardinal teeth; surface covered with numerous, regularly-placed, concentric and slightly flexuous, lamellae, about 18 to the inch, between which are seen finer lines.

"Length: 2.2 inches; height, the same."

The holotype is deposited in the Wagner Free Institute of Science, Philadelphia.

Type locality: Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene; ?Suwannee limestone, Oligocene.

Occurrence: Florida, Tampa limestone, Blackwater Creek at Seaboard Air Line Railway crossing, Hillsborough County (Tucker); station 12765, Sixmile Creek, near Orient Station, Hillsborough County; station 11115, upper bed at Kendrick, Marion County (external mold); station 12293, Wakulla R. R. Station, Wakulla County (internal molds). Suwannee limestone, ?station 12762, $2\frac{3}{4}$ miles south of Zephyrhills, Pasco County (one silicified valve; the determination not fully confirmed); station 12322, Brooksville, Hernando County (mainly internal molds); station 12321, 3 miles east of Brooksville (internal molds); station 12318, 5 miles west of Brooksville (internal molds); station 12757, 10.2 miles northwest of Brooksville (internal molds); station 12758, 5.9 miles northeast of Brooksville (internal mold); station 11109, $1\frac{1}{2}$ miles north of Live Oak, Suwannee County (molds); station 6828, Falmouth, Suwannee County (molds); station 6774, Rock Island, three-fourths mile above White Springs, Columbia County (molds); station 12298, $1\frac{1}{2}$ miles east-southwest of Flint Rock, Jefferson County (internal mold).

Georgia, Flint River formation, station 3381, fossil coral reef, 4 miles below Bainbridge (internal mold); station 7075, Flint River, $10\frac{1}{2}$ miles below Bainbridge (small silicified specimen).

Most of the above specimens from localities outside the type locality are molds and the determinations of these are not fully confirmed.

PHACOIDES (MILTHA) aff. P. CHIPOLANUS Dall

Dall¹³⁵ identified a poorly preserved specimen (U. S. Nat. Mus. no. 15770) as *Phacoides (Miltha) heracleus* Dall, a Chipola form. Gardner¹³⁶ placed *P. heracleus* Dall in synonymy with *P. chipolanus* Dall. The specimen from the "silex bed" shows a rather fine concentric sculpture like that on *P. chipolanus* but it is somewhat more inflated than the Chipola species and I am not certain that the two forms are specifically identical. An external mold, somewhat similar to the Tampa specimen, was collected from the Suwannee limestone at station 12317, 10.2 miles northwest of Brooksville, Hernando County, Florida. These two specimens may be closely related but are not well enough preserved to definitely determine their relationship.

¹³⁵ Dall, W. H., U. S. Nat. Mus. Bull. 90, p. 139, 1915.

¹³⁶ Gardner, Julia, U. S. Geol. Survey Prof. Paper 142-C, p. 111, 1926.

PHACOIDES (MILTHA?) HERNANDOENSIS Mansfield, n. sp.

Plate 17, Figures 2, 7

Shell rather small, left valve more inflated than right valve, nearly equilateral. Left valve evenly rounded over the middle of the disk and anterior side, and weakly depressed over the rather wide posterior dorsal area. Posterior dorsal area distinctly set off from the rest of the shell. Right valve not entire, but reveals a low valve with rather wide posterior dorsal area and a narrower, pitted anterior dorsal area. Sculpture of only smooth, weakly marginally raised concentric imbrications; the margins of which over the middle of the disk are about 1.5 mm. apart.

The larger cotype, a left valve (U. S. Nat. Mus. no. 495984), measures: Length, 30.9 mm.; height, 30.8 mm.; convexity, 13 mm.

Phacoides (Miltha) hillsboroensis (Heilprin) has a flatter left valve than that of the new species and shows fine concentric lines on the imbrications.

The larger specimen, a left valve of the new species, as noted above, is much more inflated than the smaller specimen, a right valve, but both have similar sculpture. There is a possibility that the specimens that I have referred to the new species may be related to rather large specimens in Hernando County that I have referred to *Phacoides (Linga) wacissanus* Dall; however, the specimens that I referred to *P. wacissanus* have both valves equally inflated.

Horizon: Suwannee limestone, Oligocene.

Type locality: Station 12758, Camp Concrete rock quarry, 5.9 miles northeast of Brooksville, Hernando County, Florida. G. M. Ponton and W. C. Mansfield.

Occurrence: Known only from the type locality.

Section BELLUCINA Dall, 1901

PHACOIDES (BELLUCINA) TAMPAENSIS Dall

1915. *Phacoides (Bellucina) tampaensis* Dall, U. S. Nat. Mus. Bull. 90, p. 138, pl. 21, figs. 1, 2.

The following is the original description of this species:

"Shell small, truncate-ovate, moderately plump, equivalve, slightly inequilateral, strongly sculptured; beaks small, low, closely adjacent, slightly prosocoealous; anterior dorsal slope excavated with a deeply impressed cordate lunule, smooth and large for the size of the shell; posterior slope direct, with a narrow, hardly depressed lanceolate escutcheon; posterior dorsal area compressed, bordered below by a shallow, wide sulcus which is indicated at the posterior margin by a shallow excavation; anterior end broadly rounded, posterior subtruncate, base evenly arcuate; beaks slightly nearer the posterior end of the shell; radial

sculpture of (on the type-specimen eleven) rather wide, low, convex, feeble ribs separated by narrower intervals, the ribs sometimes duplex and then narrower; concentric sculpture of low, elevated, narrow lamellae, more crowded on the beaks and near the base, more distant on the middle of the valves, overriding the ribs and intervals; interior of the valves with a strongly crenulate margin; the hinge inaccessible. Length of shell 5 mm., beaks behind the anterior end 2.7 mm., height 4 mm., diameter 2.5 mm. Tampa silex beds at Ballast Point, Tampa Bay, Florida. Type specimen from the Post collection, U. S. Nat. Mus. No. 165202."

This species has not been reported outside of its type locality.

Horizon: Tampa limestone, lower Miocene.

Genus *DIVARICELLA* Von Martens, 1880

Molds showing the presence of the genus *Divaricella* have been collected at the following localities: Suwannee limestone, station 12758, about 5 miles northeast of Brooksville, Hernando County; station 6826, 1½ miles north of Live Oak, Suwannee County. Tampa limestone, station 7168, from the echinoderm bed at Old Chattahoochee Landing, Gadsden County.

Although the impressions taken of the molds of the above specimens indicate similar characters, the exact relationship of these to each other and to other species of this genus is difficult to determine.

Family DIPLODONTIDAE

Genus DIPLODONTA Bronn, 1831

DIPLODONTA ALTA Dall

Plate 18, Figure 1

- 1890. *Diplodonta alta* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 189, pl. 11, figs. 9a, 9b.
- 1900. *Diplodonta alta* Dall, idem, pt. 5, p. 1183 (part, Chipola form, pl. 44, fig. 19 excluded).
- 1915. *Diplodonta alta* Dall, U. S. Nat. Mus. Bull. 90, p. 140 (part, Chipola form, pl. 24, fig. 8, excluded).

Gardner¹²⁷ separated the Chipola form, which Dall united with *D. alta*, from *D. alta*, the holotype of which came from the "silex beds," and named it *D. paralta*. The holotype of *D. alta* (U. S. Nat. Mus. no. 155745) is a broken internal mold of both valves, the right valve being a little better preserved than the left. A silicified specimen (U. S. Nat. Mus. no. 166181), collected by Dall at Ballast Point, is much better preserved than the holotype of *D. alta* but is regarded as belonging to the same species. *Diplodonta alta* Dall differs from *D.*

¹²⁷ Gardner, Julia, U. S. Geol. Survey Prof. Paper 142-C, p. 119, pl. 20, fig. 24, 1926.

paralta Gardner in having a smaller and more inflated shell, with a less rounded posterior and posterior ventral margins.

Horizon: Tampa limestone, lower Miocene.

DIPLODONTA ALTA ANCLTENSIS Mansfield, n. subsp.

Plate 17, Figure 3

Shell of medium size, suborbicular, equivalve, subequilateral, both valves strongly inflated. Beaks low, a little nearer anterior end than posterior. Sculpture of obscure, closely-spaced concentric lamellae.

The holotype, both valves intact (U. S. Nat. Mus. no. 495985) measures: Length, 18.5 mm.; height, 17.8 mm.; diameter, 12.5 mm.

The new subspecies is similar in outline to *Diplodonta alta* Dall but differs from it in having more inflated valves.

Type locality: Station 12763, right bank of Anclote River, about 300 yards above the highway bridge at Tarpon Springs, Pinellas County, Florida. Known only at the type locality.

Horizon: Tampa limestone, lower Miocene.

DIPLODONTA CATOPOTIUM Dall

1915. *Diplodonta catopotium* Dall, U. S. Nat. Mus. Bull. 90, p. 140, pl. 18, fig. 9.

1915. *Diplodonta* (*Phlyctiderma*) *puncturella* Dall (not *D. puncturella* Dall, 1900 = *D. gabbi* Dall).

The following is the original description of this species:

"Shell small, thin, almost spherical, smooth except for concentric incremental lines, which are irregular and rude; beaks almost central, low, smooth, with hardly any trace of a lunular depression in front of them and only a very narrow chink for the ligament behind them; interior inaccessible, but from what can be seen of the margins they are probably entire. Height of shell 8 mm., length 8 mm., diameter 7 mm.

"Tampa silex beds, one specimen, U. S. Nat. Mus. No. 166111. This species has much the form of *D. turgida* Conrad (not Verrill), but its beaks are lower and the impressed lunular area of *D. turgida* is wanting."

Horizon: Tampa limestone, lower Miocene.

Occurrence: "silex beds" (?one specimen); station 7081, quarry half a mile south of River Junction, Gadsden County, at an elevation about 150 feet above sea level (mold of a specimen a little larger than the holotype of *D. catopotium*, identification not certain).

Superfamily LEPTONACEA

Family LEPTONIDAE

Genus ERYCINA Lamarck, 1805

ERYCINA? INDECISA Dall

1915. *Erycina? indecisa* Dall, U. S. Nat. Mus. Bull. 90, p. 141, pl. 21, figs. 3, 8.

The following is the original description of this species:

"Shell small, smooth, inflated, somewhat recalling *Lasea rubra* in form but more elongate behind; anterior end shorter and more inflated than the longer portion behind the prominent beaks; interior obscured by matrix. Length 4, height 3, maximum diameter 2 mm.

"Tampa silex beds at Ballast Point, Tampa Bay, Florida, one specimen, U. S. Nat. Mus. No. 165197 [Holotype].

"This has the aspect of an *Erycina*, but from the fact that the interior and the hinge are unknown, its true relations must remain in doubt pending the receipt of more material."

Additional material has not been received to determine its true relationship.

Genus BORNIA Philippi, 1836

BORNIA TAMPAE Dall

1915. *Bornia tampae* Dall, U. S. Nat. Mus. Bull. 90, p. 141, pl. 18, fig. 6.

The following is the original description of this species:

"Shell small, rounded-quadrate, with low, nearly central umbones; the base gently arcuate, the ends subequally rounded, surface smooth, valves rather compressed, the interior inaccessible. Length of shell 6, height 5, maximum diameter 3 mm.

"Tampa silex beds, one specimen. U. S. Nat. Mus. No. 166112 [Holotype].

"This species recalls *B. triangula* (Lea) Dall, but is more rounded and has more prominent beaks."

Horizon: Tampa limestone, lower Miocene.

This species has not been found outside of its type locality.

Superfamily CARDIACEA

Family CARIIDAE

Genus CARDIUM Linnaeus, 1758

Subgenus ANTHOCARDIA Gray, 1851

CARDIUM (ANTHOCARDIA?) SUWANNENSE Mansfield, n. sp.

Plate 18, Figures 4, 6, 8

Shell small, elongate and inequilateral. Umbonal area moderately high; anterior and posterior sides rapidly declining from the middle of the disk. Sculptured mainly on the anterior and posterior slopes. Posterior-dorsal area sculptured with 3 or 4 fine radials; posterior

slope sculptured with 5 radials which increase in strength anteriorly; anterior slope sculptured with 11 widely spaced radials which decrease in strength anteriorly. Weak growth lines connect the radials. This is a peculiar type of *Cardium*; it may or may not belong with *Anthocardia*.

Cotypes (U. S. Nat. Mus. no. 495986) measure: Right valve, length about 20 mm.; height, about 16 mm. Left valve, length, about 23 mm.; height, about 18 mm.; convexity, about 10 mm.

Horizon: Suwannee limestone, Oligocene.

Type locality: Station 7339, upper bed at Suwannee Sulphur Springs, Suwannee River, Suwannee County, Fla.

Occurrence: Type locality (2 valves); station 6825, 3 miles west of Live Oak, Suwannee County, Fla.

Subgenus TRIGONIOCARDIA Dall, 1900

CARDIUM (TRIGONIOCARDIA) BERBERUM Dall

Plate 18, Figures 2, 3.

1915. *Cardium (Trigoniocardia) berberum* Dall, U. S. Nat. Mus. Bull. 90, p. 145.

Shell small, obliquely subtriangular, elevated, posteriorly strongly keeled, truncated behind and subrounded in front of the keel. Anterior margin rounding into ventral margin; ventral margin diverging posteriorly from hinge line; posterior margin nearly straight and forms with the ventral margin an acute angle. Posterior margin strongly denticulated; other margins weakly denticulated. Sculpture in front of keel of 14 closely spaced, rounded ribs and behind keel of about 10 nearly flat ribs. Interspaces and ribs crossed by fine, closely spaced threads.

Holotype, left valve (U. S. Nat. Mus. no. 166113) measures: Length, 8.7 mm.; height, 13.3 mm.; semidiameter, 4.5 mm.

Cardium berberum is closely related to *C. aliculum* Dall from the Chipola formation of Florida but differs from it in having a narrower and more sloping area at and behind the umbo and 3 to 4 more ribs in front of the posterior ridge. The outlines of the two species are similar.

Horizon: Tampa limestone, lower Miocene.

Type locality: "silex beds," Ballast Point, Tampa Bay, Fla.

Occurrence: Known only from the type locality.

CARDIUM (TRIGONIOCARDIA) cf. C. ALICULUM Dall

1900. *Cardium (Trigoniocardia) alicula* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 5, p. 1103 (part), pl. 40, fig. 12.
1915. *Cardium (Trigoniocardia) alicula* Dall, U. S. Nat. Mus. Bull. 90, p. 144, pl. 25, fig. 8.

Two valves from the "silex beds" of the Tampa limestone, Ballast Point, Tampa Bay, Fla., were identified as *Cardium aliculum* Dall, one a right valve (U. S. Nat. Mus. no. 157549) figured by Dall in 1900, and the other a left valve (U. S. Nat. Mus. no. 165209). Both valves are pseudomorphs and the original sculpture has not been fully preserved. The "silex beds" specimens when compared with specimens of *C. aliculum* Dall, a species described from the Chipola formation, reveal, so far as can be discerned, similar external sculpture but appear to differ from the Chipola species in having a narrower shell with a less produced posterior-ventral area.

CARDIUM (TRIGONIOCARDIA) GADSDENENSE Mansfield, n. sp.

Plate 18, Figures 5, 7, 9

Shell rather large, cordate, subequilateral, equivalve, and strongly sub-medially keeled. Area behind the keel subtruncate for about one-half its width, then rises and gently slopes to the dorsal line. Anterior side rather steeply sloping to the margins. Keel sharper over umbonal area than distally. Sculpture on posterior slope consists of about 7 closely spaced, wide, flat ribs followed by a shallow sulcus and then by 3 low, wider spaced radials. A narrow area in front of the dorsal line is marked only by growth lines. Sculpture of anterior slope of 15 wide, low, closely spaced ribs, the anterior 3 or 4 ribs being a little narrower and more widely spaced than the others and are weakly nodulous. Concentric growth lines overrun the shell, being more strongly developed near the margins.

Holotype, left valve (U. S. National Museum no. 495987) measures: Length, 24.3 mm.; height, 31.8 mm.; convexity, $12 \pm$ mm. Some paratypes are larger than the holotype.

Cardium (Trigoniocardia) gadsdenense has a much larger shell than *C. aliculum* Dall and has more ribs on the anterior slope than that species. It probably is more closely related to *C. berberum* Dall than to the Chipola species, but it is much larger than the "silex beds" form. The general outline of *Cardium gadsdenense* recalls *C. (Hemicardium) hemicardium* Linné, but the left anterior lateral of the former is nearer to the cardinals than in *C. hemicardium*.

Type locality: Station 12285, quarry half mile south of River Junction at an elevation of about 150 feet above sea level, Gadsden County, Fla., abundant.

Horizon: Tampa limestone, lower Miocene.

Other occurrences: Sixmile Creek, near Orient Station (Tucker), Hillsborough County; station 12300, $1\frac{1}{4}$ miles northeast of Lloyd, Jefferson County; station 12292, Cherokee Sink, Wakulla County; station 12735, 11 miles slightly southwest of Tallahassee, Leon County; station 3404, southeast of Old Chattahoochee Landing, Gadsden County; station 12282, Old Chattahoochee Landing, echinoderm bed, elevation 77.4-78.4 feet above sea level; station 12725, in limestone at Baileys old ferry, Calhoun County.

CARDIUM (TRIGONICARDIA) aff. C. GADSDENENSE Mansfield

Specimens which are mainly preserved as molds of the original shells, from a few localities in Florida, are related to *Cardium gadsdenense* Mansfield, but may prove, if better specimens are obtained, to be another species. These specimens differ from *C. gadsdenense* in having a more rounded keel and more widely spaced ribs.

Horizon: Suwannee limestone, Oligocene.

Occurrence: Station 12762, $2\frac{3}{4}$ miles south of Zephyrhills, Pasco County; station 7356, 1 mile north of Hudson, Pasco County; station 12319, 2 miles south of Brooksville, Hernando County; station 12318, 5 miles west of Brooksville; station 13853, $14\frac{1}{2}$ miles nearly west of Brooksville, Hernando County; station 12301, 10 miles east of Wacissa, Jefferson County.

Subgenus TRACHYCARDIUM Mörch, 1853

CARDIUM (TRACHYCARDIUM) DELPHICUM BALLASTUM
Mansfield, n. subsp.

1915. *Cardium (Trachycardium) cestum* Dall, U. S. Nat. Mus. Bull. 90, p. 142, pl. 4, fig. 13 (part, not *C. cestum* Dall, 1900).
1915. *Cardium (Trachycardium) delphicum* Dall, idem, p. 142 (part, not *C. delphicum* Dall, 1900).

Shell rather small, solid, inflated, slightly oblique, subequilateral, shorter than high. Beaks high and rounded. Posterior slope more precipitous than anterior slope. Sculpture of 28 ornamented ribs, triangular over the middle of the disk and posterior slope and squarer over the anterior slope. The 12 ribs on the posterior slope gradually weaken posteriorly and are intercalated by a subradial line which is medially placed on the posterior 8 but placed on the anterior slope of the upper 4 ribs. The ribs on the posterior slope bear oblique, closely

spaced, erect scales lying on the posterior slope of each rib. The 10 ribs on the middle of the disk are ornamented with inverted V-shaped structures which straddle the ribs while the ribs on the anterior slope bear structures that are less concave ventrally.

The holotype, a left valve (U. S. National Museum no. 165206) measures: Length, 23.5 mm.; height, 26.6 mm.; convexity, 10.3 mm.

Cardium cestum Dall, of the Chipola formation, has much thinner and higher ribs than the new subspecies, which is more closely related to *C. delphicum* Dall, of the Oak Grove sand. It differs from *C. delphicum* in having a smaller shell with 4 fewer ribs and in having less cup-like structures on the ribs over the anterior slope. The holotype of the new subspecies was referred by Dall to *C. cestum* Dall. Smaller specimens (U. S. National Museum no. 157526) which are referred to the new subspecies were also formerly referred to *C. delphicum* Dall.

Type locality: "silex beds" at Ballast Point, Tampa Bay, Fla.

Horizon: Tampa limestone, lower Miocene.

CARDIUM (TRACHYCARDIUM) PARILE Dall

1900. *Cardium (Trachycardium) parile* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 5, p. 1086, pl. 48, fig. 17.
1915. *Cardium (Trachycardium) parile* Dall, U. S. Nat. Mus. Bull. 90, p. 143, pl. 4, fig. 6.
1926. *Cardium (Trachycardium) parile* Dall. Gardner, U. S. Geol. Survey Prof. Paper 142-C, p. 136, pl. 23, fig. 2.

Dall described this species in 1900 as follows:

"Shell small, suborbicular, inflated, nearly equilateral, the posterior end slightly more attenuated and produced; beaks full but not high; sculptured with 25 ribs having in section the form of a truncated pyramid, separated by narrower channeled interspaces, elegantly concentrically closely striated; the anterior 10 ribs bear A-shaped projections, the anterior wing of the A being broad and produced, the posterior narrow and appressed; the 4 ribs next posterior have on their tops slender arcuate transverse rather sparse imbrications; behind these the projections shift to the posterior side of the summits of the ribs, gradually becoming more oblique, losing the anterior wing of the arch, and finally appearing as delicate spinules nearly parallel with the ribs; interior margin behind strongly serrate, below and in front fluted, the flutings continued to the umbonal cavity as shallow sulci; hinge normal, delicate; a narrow, smooth area between the most anterior rib and the hinge-margin. Alt. 15, lon. 15.5, diam. 10 mm.

"This little species appears to be rather abundant in the sands.

"Oligocene of the lower bed at Alum Bluff and on the Chipola River, Florida."

Horizon: Tampa limestone, lower Miocene; Chipola formation, lower Miocene.

Occurrence: "silex beds" at Ballast Point, Tampa Bay, Fla. (U. S. National Museum no. 165208, figured); station 3420, 15 miles south of Tallahassee, Wakulla County.

CARDIUM (TRACHYCARDIUM) SILICATUM Mansfield, n. sp.

Plate 19, Figure 3

1915. *Cardium (Trachycardium) bowdenense* Dall, U. S. Nat. Mus. Bull. 90, p. 143 (part, not *C. bowdenense* Dall, 1900).

Shell small, thin, suborbicular and slightly inequilateral. Beak moderately high and situated a little nearer the anterior side than the posterior. Margins rounded, posterior slightly more broadly rounded than the anterior. Middle of disk evenly rounded, anterior and posterior sides declining at about the same angle. Sculpture of 38 rounded ribs which are about as wide as the interspaces. The ribs on the anterior side bear short spines or elongate, sharp tubercles which are separated by spaces of about 0.6 millimeters. The ribs on the posterior slope are ornamented with oblique, erect, sharp scales situated on the posterior side of the rib. The ribs on the middle of the disk are nearly smooth.

The holotype, left valve (U. S. National Museum no. 165204) measures: Length, 14.5 mm.; height, 14.8 mm.; convexity, 5.5 mm.

Type locality: "silex beds" at Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene.

Cardium (Trachycardium) silicatum differs from *C. (Trachycardium) bowdenense* Dall, from the Bowden marl of Jamaica, in its shorter and more inflated shell, slightly wider ribs bearing a different type of ornamentation.

Occurrence: Known only from the type locality.

CARDIUM (TRACHYCARDIUM) PHLYCTAENA Dall

1900. *Cardium (Cerastoderma) phlyctaena* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 5, p. 1097, pl. 48, fig. 13.
1915. *Cardium (Cerastoderma) phlyctaena* Dall, U. S. Nat. Mus. Bull. 90, p. 144, pl. 25, fig. 10.
1915. *Cardium (Trachycardium) propeciliare* Dall, U. S. Nat. Mus. Bull. 90, p. 142, pl. 18, fig. 7 (part, not *C. propeciliare* Dall, 1900).
1915. *Cardium (Cerastoderma) taphrium* Dall, idem, p. 144 (part, not *C. taphrium* Dall, 1900).

The following is the original description of this species:

"Shell solid, squarish, with rather elevated beaks and convex valves; sculptured with 31 flattish, narrow radial ribs, the anterior half of which have the usual lepidote sculpture of this group, the posterior half being nearly smooth and all separated by somewhat narrower channelled interspaces; posterior area large,

nearly smooth, with sparse radial grooves along which are set minute distant pustular spines; a small pseudolunule is present; hinge normal, solid, internal margin in front and below with very short flutings. Alt. 27, lon. 25.5, diam. 18 mm. [Convexity 9.9 mm.].

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

Holotype: U. S. National Museum no. 157570.

Dall states that the number of ribs is 31; but the figured specimen has about 39 ribs in all, 8 on the posterior slope and 31 on the rest of the shell. The posterior area is subtruncate and is ornamented with wider and flatter ribs than on the disk, each of which bear on their anterior margin a single row of short spines.

Horizon: Tampa limestone, lower Miocene; ?Suwannee limestone, Oligocene.

Occurrence: Tampa limestone, "silex beds" at Ballast Point, Tampa Bay; station 12765, Sixmile Creek at S. A. L. Ry. crossing, Hillsborough County; station 12296, "The Swirl," $3\frac{1}{2}$ miles southeast of Crawfordville, Wakulla County; station 12292, Cherokee Sink, Wakulla County; station 3420, 15 miles south of Tallahassee, Wakulla County; ?Suwannee limestone, station 12766, Blackwater Creek at crossing of S. A. L. Ry., Hillsborough County; station 7356, one mile north of Hudson, Pasco County.

CARDIUM (TRACHYCARDIUM) BROOKSVILLENSE Mansfield, n. sp.

Plate 19, Figures 4, 5

Shell subovate and medium sized. Beaks high and narrow. Posterior side weakly compressed and truncate; middle part rounded high and narrow; anterior side narrowly rounded. Posterior slope sculptured with 7 low and weak ribs surmounted with small, transversely elongate beads, the beaded ribs alternating with rather sharp subradials; following 12 anterior ribs triangular in outline and ornamented with coarse apically inclined annulations. The ribs on the anterior slope are less triangular in outline than those on the disk; all of these except the anterior 3 bear the inclined annulations.

Holotype, impression of an external mold of a left valve (U. S. National Museum no. 495988) measures: Length, 26 mm.; height, about 26 mm.; convexity, about 13 mm.

Cardium brooksvillense differs from *C. phlyctaena* Dall in having fewer and more triangular ribs, which are ornamented over the middle part instead of being nearly smooth.

Horizon: Suwannee limestone, Oligocene.

Type locality: Station 11113, Brooksville, Hernando County, Fla.

Occurrence: Station 12321, 3 miles east of Brooksville, Hernando County; station 12758, 5.9 miles northeast of Brooksville, Hernando County; station 12318, 5 miles west of Brooksville; Blackwater Creek at S. A. L. Ry. crossing, Hillsborough County (Tucker); station 6178, small island in Suwannee River, three-fourths mile above White Springs, Columbia County.

CARDIUM (TRACHYCARDIUM) BROOKSVILLENSE CONJUNCTIONENSE
Mansfield, n. subsp.

Plate 20, Figures 1, 3, 5

Shell resembling *Cardium brooksvillense* in shape and general outline. Posterior side truncate; anterior side narrowly rounded. Sculpture with 28 to 29 ribs of which about 7 lie on the posterior slope; 13 on the disk; and 8 on the anterior slope. The ribs on the posterior slope, which probably were originally beaded, alternate with weaker radials; the ribs on posterior angle and the following 3 or 4 ribs in front of it, are subtriangular; the following ribs are more rounded in outline. The only visible concentric sculpture on the ribs is seen on those on the anterior side of the shell, which consists of beakward inclined annulations.

Cotypes: U. S. National Museum no. 495989.

C. brooksvillense conjunctionense differs from *C. brooksvillense* in having weaker sculpture on the ribs.

Type locality: Station 7080, quarry half a mile south of River Junction, Gadsden County, at an elevation of about 150 feet above sea level.

Horizon: Tampa limestone, lower Miocene.

Occurrence: Type locality, common; stations 3408 and 3414, vicinity of River Junction, Gadsden County (internal molds, larger than cotypes but have similar shape) (identification not fully confirmed).

CARDIUM (TRACHYCARDIUM) PRECURSOR Dall

1900. *Cardium (Trachycardium) precursor* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 5, p. 1086, pl. 48, fig. 10.

Dall described this species as follows:

"Shell small, moderately inflated, rather thin, nearly equilateral, the beaks small and slightly prosogyrate; sculpture of 37 to 38 strong, well-defined ribs, mostly of the triangular section, with narrower channeled interspaces; the ribs on the anterior face minutely nodulous, the posterior 10 flattened and more or less spinose with minute prickles; the whole shell finely concentrically striated,

so that in perfect specimens the summit of the ribs on the disk is probably minutely crenate; internal margin sharply fluted; hinge normal, strong. Alt. 22.5, lon. 22, diam. 14.5 mm.

"The single valve of this species in the National Collection appears distinct from any of those heretofore described from the Vicksburgan, and by its sculpture foreshadows the type to become so well-developed. Oligocene of Vicksburg, Mississippi; L. C. Johnson."

Horizon: Oligocene, Vicksburg, Miss.; Suwannee limestone?

Other occurrences: Station 12303, Suwannee Sulphur Springs, Suwannee River, Hamilton County, Fla., about 3 feet above river level; station 11109, 1½ miles north of Live Oak, Suwannee County, Fla. (common).

CARDIUM (TRACHYCARDIUM) ANCLOTENSE Mansfield, n. sp.

Plate 19, Figures 1, 2

Shell rather small, silicified, ventral margin missing. Posterior slope weakly depressed medially. Umbo rather high and rounded. Sculptured with 44 ribs (8 on the posterior slope and 36 on the rest of the shell), sharp and triangular, separated by narrower interspaces. Ribs on the anterior and posterior slopes are more widely spaced than those on the middle part of the shell. No ornamentation is visible on the tops of the ribs.

Holotype, right valve (U. S. National Museum no. 495990) measures: Length, 25.4 mm.; height, 23 mm.; convexity, 12 mm. *C. anclotense* shows some relationship to *C. cestum* Dall, a Chipola formation species, but differs from it in having more closely spaced ribs.

Type locality: Station 12763, Anclote River at Tarpon Springs, Pinellas County, Fla.

Horizon: Tampa limestone, lower Miocene.

Occurrence: Type locality, one specimen; station 2372, Wacissa Swamp, Jefferson County (poor specimen and identity with the holotype not confirmed).

CARDIUM (TRACHYCARDIUM) HERNANDOENSE Mansfield, n. sp.

Plate 19, Figure 8

Shell of medium size, subovate and inflated. Sculptured with about 50 ribs (12 on posterior slope and 38 on the rest of the shell), low, narrow, separated by spaces about as wide as the ribs. The ribs on the anterior slope are rounded and bear small, short spines or nodules; those on the disk are subtriangular in outline, especially those near the posterior angle, and on top nearly smooth except for the slight roughening by the concentric lines; the ribs on the posterior slope are

wider than those elsewhere on the shell and are medially depressed, indicating a bifurcation of the rib.

The holotype is a poorly preserved pseudomorph.

Holotype, left valve (U. S. National Museum no. 495991) measures: Length, about 26 mm.; height, 27.5 mm.; convexity, 16.5 mm.

C. (Trachycardium) hernandoense appears in some features to be related to *C. eversum* Conrad described from the vicinity of Vicksburg, Miss., but I find no specimens in the U. S. National Museum collections from the Vicksburg localities identical with the new species.

Horizon: Suwannee limestone, Oligocene; ?Tampa limestone, lower Miocene.

Type locality: Station 12321, Consolidated Rock Products Company quarry, 3 miles northwest of Brooksville, Hernando County, Fla.

Occurrence: The specimens, preserved as molds, from the following localities appear to be the same as, or closely allied to, *C. hernandoense*: Suwannee limestone, station 12322, Brooksville, Hernando County; station 12757, 10.2 miles northwest of Brooksville. Tampa limestone, station 12314, upper bed at Kendrick, Marion County; station 12292, Cherokee Sink, Wakulla County; station 3804, vicinity of River Junction, Gadsden County.

Subgenus DINOCARDIUM Dall, 1900

CARDIUM (DINOCARDIUM?) PINELLASENSE Mansfield, n. sp.

Plate 20, Figures 6, 9

Shell rather small, narrow and high. Beaks high, narrow, and full. Posterior side truncate; anterior side narrowly rounded. Posterior and anterior slopes somewhat corroded. No radial sculpture is revealed on the posterior slope and on the anterior part of the anterior slope. Disk and upper part of anterior slope sculptured with 14 to 16 wide, low, broadly rounded ribs separated by much narrower interspaces. The new species is described from two rather poorly preserved specimens.

Cotypes (U. S. National Museum no. 495992) measure: Larger cotype (left valve), length, 26 mm.; height, 25 mm. (ventral margin broken); convexity, 12 mm. Smaller cotype: length, 17 mm.; height, 17 mm.; convexity 7 mm.

Type locality: Station 7358, Anclote River at Tarpon Springs, Pinellas County, Fla.

Other occurrences: Tampa limestone of Dall, U. S. National Museum no. 165141, E. J. Post collection; station 13848, dredged at a

depth of 32 to 36 feet below water level off Hooker Point, upper Hillsborough Bay.

Horizon: Tampa limestone, lower Miocene.

Cardium pinellasense shows some relationship to *Cardium chipolanum alumen* Gardner, from the Chipola formation of Florida, but differs from the latter in having wider ribs.

PROTocardia sp.

Molds of fragments of the shells probably belonging to the genus *Protocardia* have been collected from a few localities. These molds may represent one or more species, but the exact relationship to other species cannot at present be fully determined. The material in hand shows that the shell was sculptured over the middle of the disk and slopes with rather fine radials and concentric lines overrunning the ribs and interspaces. The sculpture appears to resemble that on *Protocardia diversa* Conrad from the Oligocene, but the exact relationship to this species is not fully determined.

Occurrence: Tampa limestone, station 7168 (Vaughan) and station 12282 (Ponton and Mansfield), echinoderm bed at Old Chattahoochee Landing, Gadsden County; station 3414, vicinity of River Junction, Gadsden County. Suwannee limestone, station 6828, Falmouth, Suwannee County; station 12321, Consolidated Rock Products Company, 3 miles east of Brooksville, Hernando County.

Superfamily TRIDACNACEA

Family TRIDACNIDAE

Genus HIPPOPUS Lamarck, 1799

HIPPOPUS? GUNTERI Mansfield, n. sp.

Plate 20, Figures 2, 4

Most of the original shell substance has been changed by mineralization or is corroded, and the posterior extremities of the specimens are broken off. The anterior side is truncate, margined above by a high ridge and below by a flattened out area which is fluted or serrated along the margin. Four ribs running parallel with the anterior shoulder ridge are on the anterior truncation. The fluted margin below represents traces of other ribs. Back of shell with an elevated median rib or strong radial with depressions on either side of it. Within the depression in front of the median rib are two rather strong radials and behind it only one. Two radials lie on the posterior side, the anterior one being higher than the other. The posterior extremity has been broken away so its character is unknown. Finer radials are

faintly indicated over and between the primary ones. Hinge nearly all broken away except a thin lamellar-like plate on the inner margin behind the beak.

Only 6 poorly preserved left valves are at hand, one of which constitutes the holotype; however, sufficient characters are still preserved to assign the species questionably to the genus *Hippopus*.

Holotype (U. S. National Museum no. 495963) measures: Length, 40 mm.; height, 35 mm.; thickness, 14 mm.

Type locality: Station 12300, along the channel of a disappearing stream, 1½ miles northeast of Lloyd, Jefferson County, Fla. Collected by Herman Gunter (after whom it is named), F. S. MacNeil, and W. C. Mansfield.

Other occurrence: Fragments of a shell probably belonging to this species were collected at station 12285, quarry one-half mile south of River Junction at an elevation around 150 feet above sea level.

The genus *Hippopus* is now living in the Indo-Pacific region and should the specimens from the Tampa limestone prove to be this genus it would be the first record to my knowledge of its occurrence, fossil or living, on the Atlantic side of America. Until the nature of the dentition is known, the correct genus to which it belongs must await. It may be found to be nearer the genus *Verticordia* than the genus *Hippopus*.

Superfamily VENERACEA

Family VENERIDAE

Subfamily DOSINIINAE

Genus DOSINIA Scapoli, 1777

Section DOSINIDIA Dall, 1902

DOSINIA (DOSINIDIA) CHIPOLANA Dall

1903. *Dosinia (Dosinidia) chipolana* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1229, pl. 54, fig. 4.
1915. *Dosinia (Dosinidia) chipolana* Dall, U. S. Nat. Mus. Bull. 90, p. 145, pl. 24, fig. 10.
1926. *Dosinia (Dosinidia) chipolana* Dall. Gardner, U. S. Geol. Survey Prof. Paper 142-D, p. 153, pl. 24, fig. 1.
1927. *Dosinia (Dosinidia) chipolana* Dall. Palmer, Palaeontographica Americana, vol. 1, no. 5, p. 62.
1929. *Dosinia (Dosinidia) chipolana* Dall. Palmer, idem, pl. 17, figs. 4, 10, 15.

Dall described this species in 1903. as follows:

"Shell rather small and thin, suborbicular, moderately convex, with full, pointed beaks, with fine, sharp, concentric grooves having the distal side more abrupt, the interspaces flattish and hardly raised towards the ends of the shell; lunule lanceolate, impressed; beaks sculptured like the rest of the shell; anterior

dorsal margin convexly arched; hinge-plate rather short and wide; teeth normal; the adductor scars large; the pallial sinus ample, ascending, acute in front, terminating two-thirds the distance forward from the posterior to the anterior adductor. Height 37.5, length 40.0, diameter 17.0 mm.

"The nepionic young of this species have very much the form of the adult and are usually sculptured in much the same way.

"Oligocene of the Chipola horizon on the Chipola River, Calhoun County, Florida, at Alum Bluff and the "silex beds" at Ballast Point, Tampa Bay."

Two silicified valves (U. S. National Museum no. 214408) came from the "silex beds." One of these probably came from Ballast Point, Tampa Bay, and the other came from a sulphur spring near Tampa. The specimen from the sulphur spring is relatively shorter and a little higher than most of the Chipola specimens, but this may be only an individual variation. Unless other specimens that may be collected from the "silex beds" show this apparent variation to be constant, I think the Chipola specimens and those from the "silex beds" should be included under one species.

Horizon: Tampa limestone, lower Miocene; Chipola formation, lower Miocene.

Other occurrences: Specimens, preserved as internal or external molds, from the following localities in Florida may be the same as or closely related to *Dosinia chipolana* Dall: Station 11115, upper bed at Kendrick, Marion County; station 7353, just east of cross roads midway between Anthony and Martin, Marion County.

Subfamily MERETRICINAE Dall

Genus MACROCALLISTA Meek, 1876

Section PARADIONE Dall, 1909

MACROCALLISTA (PARADIONE) FLORIDANA (Conrad)

- 1846. *Cytherea floridana* Conrad, Amer. Jour. Sci. and Arts, vol. 2, 2d ser., p. 400, text figure.
- 1866. *Dione floridana* Conrad, Smith, Misc. Coll., vol. 7, no. 200, p. 7, no. 177.
- 1903. *Macrocallista acuminata* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1255 (part, not pl. 57, fig. 3).
- 1903. *Cytherea floridana* Conrad. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1257.
- 1915. *Macrocallista (Paradione) acuminata* Dall, U. S. Nat. Mus. Bull. 90, p. 146, pl. 20, figs. 8, 9, 10 (part, not pl. 24, fig. 2. Holotype of *M. acuminata* Dall, Chipola formation).
- 1927. *Callista (Callista) floridana* (Conrad). Palmer, Palaeontographica Americana, vol. 1, no. 5, p. 82 (part).
- 1929. *Callista (Callista) floridana* (Conrad). Palmer, idem, pl. 14, figs. 1, 3, 5, 10, 12, 19 (not fig. 9).

Conrad described this species in 1846 as follows:

"Oval, inequilateral, rounded at the ends; ligament margin slightly curved; basal margin rounded."

Macrocallista floridana (Conrad) differs from *M. acuminata* Dall, a species from the Chipola formation, in having a smaller, more inflated, relatively shorter shell, which is less compressed in front of the posterior shoulder.

Holotype: Deposited in the Academy of Natural Sciences, Philadelphia, Pa.

Horizon: Tampa limestone, lower Miocene.

Occurrence: "silex beds" at Ballast Point, Tampa Bay, Fla.; Six-mile Creek, near Orient Station, Hillsborough County.

MACROCALLISTA aff. M. ACUMINATA Dall

A poorly preserved specimen showing the general outline of the shell was collected at station 12753, upper bed at Kendrick, Marion County, Florida. The outline of the shell resembles that of *M. acuminata* Dall from the Chipola formation of Florida, but the identity with this specimen cannot at present be determined.

Genus CALLOCARDIA A. Adams, 1864

Subgenus AGRIOPOMA Dall, 1902

CALLOCARDIA (AGRIOPOMA) NUX Dall

1915. ?*Callocardia nux* Dall, U. S. Nat. Mus. Bull. 90, p. 147, pl. 18, fig. 3.

Dall described this species as follows:

"Shell small, equivalve, the beaks near the anterior third, moderately convex, short-ovate, the surface smooth except for faint incremental lines; beaks low, pointed, prosocoelous, a large lanceolate lunule in front of them which is not impressed but circumscribed by a sharply incised line; there is no es-cutcheon; anterior slope roundly descending, ends of the shell evenly rounded, base prominently arcuate; anterior [interior] inaccessible. Height of shell 12, length 14, diameter 7 mm.

"Tampa 'silex beds' at Ballast Point, Tampa Bay, Florida. U. S. Nat. Mus. No. 166115 [Holotype].

"This simple little shell has no pronounced characteristics but it is distinct from any other Veneridae known from this or adjacent formations."

Horizon: Tampa limestone, lower Miocene.

Callocardia nux Dall is not known for certain outside of its type locality. A small specimen collected by Miss H. I. Tucker from Sixmile Creek, near Orient Station, may belong to this species. Aside from the holotype, attached valves, there is a left valve from station 4604, dredged from a channel of Hillsborough Bay at Tampa; and a poorly preserved specimen with attached valves from Ballast Point (U. S. National Museum no. 163322), questionably identified on

the label as *C. sincera* Dall. The specimen at station 4604 is a little larger than the holotype, but appears to be identical with it, whereas the other specimen is questionably identified.

CALLOCARDIA (AGRIOPOMA) SILICATA Mansfield, n. sp.

Plate 19, Figures 6, 7

1915. *Callocardia (Agriopoma) sincera* Dall, U. S. Nat. Mus. Bull. 90, p. 146, (part, not fig. 7, pl. 25).

Shell small, thin, short, subquadrate, and inequilateral, the beak being near the anterior third. Posterior side longer than anterior; posterior slope slightly wider and more precipitous than anterior slope. Margins rounded. Lunule indistinct. Sculpture of faint concentric growth lines.

Holotype, right valve (U. S. National Museum no. 166114) measures: Length, 13 mm.; height, 12.5 mm.; convexity, 4.0 mm.

Type locality: Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene.

The description of the new species is based on a single silicified specimen which constitutes the holotype. The species is not known outside of its type locality.

Callocardia (Agriopoma) silicata is much shorter than *C. (Agriopoma) sincera* Dall, a species from the Chipola formation, and has a less distinct lunule.

CALLOCARDIA (AGRIOPOMA) ALBOFONTE Gardner

1926. *Callocardia (Agriopoma) albofonte* Gardner, U. S. Geol. Survey Prof. Paper 142-D, p. 163, pl. 25, figs. 17-18.

Gardner described this species as follows:

"Shell rather small, heavy, ovate-trigonal in outline, moderately compressed. Umbones obtuse, flattened, moderately conspicuous by reason of their position at the apex of an angle of a little more than 90°. Lunule rather wide, elongate cordate, defined by an incised line. Escutcheon not delimited. Anterior extremity of shell broadly rounded in front of the lunule. Posterior dorsal margin declining rather steeply, rounding quite sharply into the feebly arcuate base. Dorsal areas indicated by an obscure flattening of the shell posteriorly. External sculpture restricted to concentric lamellae, incremental in character. Ligament deeply inset. Hinge normal; in the right valve, laminar anterior and medial cardinals, a rather slender, cuneate, posterior cardinal and a deep socket for the reception of the left anterior lateral; in the left valve, the anterior and medial cardinals forming an acute V, a laminar posterior cardinal and a subacute, short, compressed anterior lateral. Muscle scars small but prominent, particularly the anterior. Pallial line distinct; pallial sinus broad, steeply ascending, produced

almost or quite to the median vertical, broadly rounded at its extremity. Inner margins smooth.

"Dimensions: Altitude, 13.5 mm.; latitude, 17.0 mm.; diameter, 3.5 mm.

"Type: U. S. Nat. Mus. No. 352555.

"Type locality: No. 6776, half a mile above White Springs, Suwannee River, Columbia County, Fla.

"The species is preserved chiefly in the form of casts that are compressed, and transversely elongated, with obtuse, slightly anterior umbones. There is usually a shallow medial depression which extends from the umbones nearly to the base, and the anterior muscle scar is prominently elevated.

"*Callocardia albofonte* is abundant in the environs of White Springs on Suwannee River, but it has not been recognized elsewhere. It is decidedly the smallest and most compressed of the Alum Bluff Callocardias and is remarkable for its similarity in external appearance to a small *Mulinia congesta*."

Horizon: Chipola formation and Tampa limestone.

Occurrence elsewhere: Tampa formation, station 11115, Cummer Lumber Company lime pit at Kendrick, Marion County, Florida (2 molds).

The specimens from White Springs, type locality, as well as those from Kendrick are preserved chiefly as molds and there is some doubt that the specimens from the two localities should be united under one species; however, from all characters observable they appear to be the same and are provisionally placed under the same name.

Genus PITARIA Römer, 1857

Section LAMELLICONCHA Dall, 1902

PITARIA (LAMELLICONCHA) HEILPRINI Mansfield, n. sp.

Plate 21, Figures 3, 6

Shell rather small, subovate, inequilateral, moderately inflated. Beak rather low, prosogyrate. Lunule wide, not distinctly delineated. Disk highest medially at upper third, rounded anteriorly, weakly depressed in front of and truncate behind the posterior shoulder. Sculpture over the whole shell of nearly erect, moderately thin, bluntly rounded, concentric lamellae about 0.5 mm. apart over the disk and more closely spaced on the beak. Left anterior lateral strong, longer than wide, pitted at base and situated about 1 mm. from the anterior cardinal; anterior cardinal thin; following cardinal stronger; posterior cardinal elongate.

Holotype, left valve (U. S. National Museum no. 495993) measures: Length, including broken end, 22.0 mm.; height, 18 mm.; convexity, 6.4 mm.

The holotype and two paratypes were collected from Blackwater Creek at S. A. L. Ry. crossing, Hillsborough County, by Miss Helen I. Tucker.

Horizon: ?Tampa limestone, lower Miocene.

The new species is most closely allied to *Pitaria harrisi* Maury, a species confined to the Chipola formation of Florida, but differs from the latter species in having a relatively longer shell and finer concentric lamellae. It also has finer concentric sculpture than *Pitaria astartiformis* (Conrad) from the Vicksburg group.

?PITARIA aff. P. IMITABILIS (Conrad)

External molds of specimens from a few localities appear to be related to *Pitaria imitabilis* (Conrad), an Oligocene species. As the dentition of the specimens in hand is not revealed, the genus remains in doubt. The concentric lamellae on the specimens in hand are somewhat thinner and more erect than those on the Oligocene species.

Horizon: Suwannee limestone, Oligocene.

Occurrence: Station 12766, Blackwater Creek at crossing of S. A. L. Ry., Hillsborough County; station 11113, Brooksville, Hernando County; station 12321, 3 miles east of Brooksville, Hernando County.

Genus ANTIGONA Schumacher, 1817

ANTIGONA TARQUINIA (Dall)

1887. *Venus magnifica* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 116; not of Sowerby, 1853.
1900. *Venus tarquinia* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 5, p. 1194, pl. 38, figs. 2, 2a.
1915. *Antigona tarquinia* (Dall), U. S. Nat. Mus. Bull. 90, p. 147, pl. 26, figs. 1, 2.

Following is a description of this species which does not appear to have been described:

Shell of moderate size, rather thin, subelliptical, moderately inflated, equivalve, inequilateral, the beaks being at the anterior fifth of the hinge line. Beaks low. Middle part of disk broadly rounded; anterior slope rounded and gradually declining to the margin; posterior slope broadly rounded at the upper shoulder and very weakly depressed behind the dorsal line. Anterior and ventral margins rounded; posterior margin more broadly rounded. Lunule elongate, cordate, defined by a deep sulcus; escutcheon long and narrow. Holotype sculptured with about 32 concentric lamellae, rather thin, low, erect, ventrally arched and undulating opposite the radials. These lamellae are about 2.5 mm. apart on the middle of the disk. Radially sculptured with

rather coarse, nearly flat riblets which strengthen distally. In the middle of the disk and near the ventral margin, these riblets are about 0.5 mm. wide and about the same distance apart. Inner margin finely crenulated. Left interior lateral small and situated near the anterior cardinal.

Holotype, left valve (U. S. National Museum no. 109233) measures: Length, 38 mm.; height, 44 mm.; convexity 14.3 mm.

Type locality: "silex beds" at Ballast Point, Tampa Bay, Hillsborough County, Florida.

Horizon: Tampa limestone, lower Miocene.

Antigona tarquinia Dall differs from *A. caesarina* (Dall), a species confined to the Chipola formation of Florida, in having a smaller, relatively shorter shell, with weaker and less ornamented concentric sculpture.

Other occurrences: Blackwater Creek at S. A. L. Ry. crossing, Hillsborough County (Tucker) (Suwannee limestone?); ?station 12753, upper bed at Kendrick, Marion County (fragment of external mold).

Section ARTENA Conrad, 1870

ANTIGONA (ARTENA) GLYPTOCONCHA Dall

1887. ?*Cytherea staminea* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 116 (not *C. staminea* Conrad, 1839).
 1903. *Cytherea (Artena) glyptoconcha* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1277, pl. 55, fig. 24.
 1915. *Antigona glyptoconcha* Dall, U. S. Nat. Mus. Bull. 90, p. 148, pl. 25, fig. 1.

Dall described this species in 1903 as follows:

"Shell variable in form from short to rather produced, trigonal with the posterior slope longer and the posterior end subrostrate; beaks (normally) pointed, moderately high, subcentral; lunule cordate, striated, impressed; anterior end below the lunule rounded; posterior slope nearly straight; a striated narrow area representing the escutcheon is bounded by a rapidly widening radial ridge, in front of which is a shallow sulcus, the whole forming at its intersection with the posterior border a short rostrum; sculpture of heavy, slightly recurved concentric ribs, somewhat expanded on the rostrum and covered with a fine secondary close, concentric striation; base arcuate; hinge heavy, normal, the anterior lateral small but distinct; basal margin minutely crenulate; pallial sinus small, triangular.

"Dimensions of varying forms:

	Length	Height	Diameter
Elongate	22.0	15.00	11.0 mm.
Normal	26.5	20.5	18.0 mm.
Short	18.0	16.5	13.0 mm.

"A few specimens show faint radial striation on the ventral side of the ribs nearest the base of the shell.

"This interesting species has the general aspect of *Lirophora*, the minute sculpture and hinge of *Artena*. It is one of the more abundant species in the siliceous beds."

Holotype (left valve): U. S. National Museum no. 163337.

Horizon: Tampa limestone, lower Miocene.

Other localities: Station 13847, Gadsden Point, 4 miles south of Ballast Point; station 2470, one mile west of Bartow, Polk County; station 4998, Sixmile Creek, near Orient Station; station 12292, Cherokee Sink, Wakulla County; station 12293, Wakulla R. R. Station, Wakulla County; station 3773, one mile from Florida-Georgia State line, Gadsden County; station 12728, 1½ miles below Willis bridge, Chipola River, Calhoun County.

ANTIGONA (ARTENA) SHEPARDI Dall

1903. *Cytherea (Artena) shepardi* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1278, pl. 55, fig. 16.
1915. *Antigona (Artena) shepardi* Dall, U. S. Nat. Mus. Bull. 90, p. 148, pl. 25, fig. 4.

Dall described this species in 1903 as follows:

"Shell small, solid, subtriangular, concentrically feebly waved, the waves more distinct near the beaks, the whole surface minutely, closely, concentrically striated; lunule narrow, lanceolate, defined by a sharply incised line, but feebly impressed; escutcheon narrow, striated, defined by a sharp radial keel beyond which the concentric waves do not pass; beaks small, pointed, prosogyrate; hinge normal, anterior lateral well developed; inner margins finely crenulate; pallial sinus small, triangular. Length 21.0, height 18.5, diameter 12.0 mm. This species recalls *C. ucuttana* in its sculpture, but it has the *Chione*-shape of *Artena* and an almost rostrate posterior end. It is nearest to *C. glyptoconcha* but it is less produced and wants the prominent ribbing.

"Oligocene of Hillsboro Bay and Ballast Point, near Tampa, Florida."

Holotype, left valve, U. S. National Museum no. 109236.

Horizon: Tampa limestone, lower Miocene.

Other occurrences: Sixmile Creek, near Orient Station, Hillsborough County (Tucker); station 12285, quarry half mile south of River Junction, Gadsden County, at an elevation about 150 feet above sea level (common); station 12727, Willis bridge, Chipola River, Calhoun County; station 7172, north side of creek, outskirts of River Junction (identification not verified); station 13851, River Junction, 80 feet above sea level; station 13844, Old Chattahoochee Landing, 37 feet above the echinoderm bed.

Genus CHIONE Megerle von Mühlfeld, 1811
Section LIROPHORA Conrad. 1863

CHIONE (LIROPHORA) BALLISTA Dall

1903. *Chione (Lirophora) ballista* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1295, pl. 55, fig. 23.
1915. *Chione (Lirophora) ballista* Dall, U. S. Nat. Mus. Bull. 90, p. 149, pl. 25, fig. 3.

Dall described this species in 1903 as follows:

"Shell rather small, arcuate-trigonal, with small, acute umbones, and from eight to ten heavy concentric recurved ribs, not confluent but bent backward and attenuated near the posterior dorsal border; lunule narrow, striated, small; also the escutcheon; obsolete radial striation sometimes visible on the ventral side of the larger ribs, but not in the interspaces; anterior and posterior ends often but not always pointed; base and posterior dorsal border arcuate; interior normal. Length 24.0, height 19.5, diameter 12.0 mm.

"This species is apt to be confounded with *Artena glyptoconcha*, of the same horizon, unless attention is called to the absence of the minute anterior lateral on the hinge, and of the fine concentric striation in the *Chione* * * *.

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

Holotype, left valve, U. S. National Museum no. 109238.

Horizon: Tampa limestone, lower Miocene.

This species has not been found outside of its type locality.

Section CHAMELEA Mörch, 1853

CHIONE (CHAMELEA) NUCIFORMIS (Heilprin)

1887. *Cythera nuciformis* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 116, pl. 16, fig. 61.
1903. *Chione (Chamelea) nuciformis* (Heilprin). Dall, Wagner Free Inst. Sci. Trans., vol. 3, pl. 6, p. 1300, pl. 55, fig. 9.
1915. *Chione (Chamelea) nuciformis* (Heilprin). Dall, U. S. Nat. Mus. Bull. 90, p. 149, pl. 25, fig. 5.

Heilprin described this species in 1887 as follows:

"Shell erect, sub-trigonal, moderately convex; base evenly rounded, posterior slope rapidly declining; beaks elevated; surface covered with fine concentric lines of growth, disposed in a somewhat interrupted series; teeth? Length, .8 inch; height, .7 inch.

"Several specimens which can be readily identified by their small size and erect outline."

Type locality: "silex beds," Ballast Point, Tampa Bay, Florida.

The holotype is deposited in the Wagner Free Institute of Science, Philadelphia.

Horizon: Tampa limestone, lower Miocene.

This species has not been found outside of its type locality.

CHIONE (CHAMELEA) SPADA Dall

1903. *Chione (Chamelea) spada* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1301, pl. 55, fig. 13.
1915. *Chione (Chamelea) spada* Dall, U. S. Nat. Mus. Bull. 90, p. 149, pl. 24, fig. 12.

Following is Dall's description of this species:

"Shell resembling *C. nuciformis* but more produced and pointed behind, with a distinct keel bordering the escutcheon, which is flat and smooth in the left valve; hinge normal, adductor scars subequal, pallial sinus small, angular; there is usually no radial striation, but the inner margins of both species are minutely crenulate. Length (elongate specimen) 29, height 23, diameter 14 mm.; of a short specimen, length 28, height 24, diameter 16 mm. Some specimens reach a length of 33 mm., and one of these shows a few obsolete radial striae on the anterior portion of the disk, but as these appear only on one valve they are probably pathological. Among some fifty other valves no other shows any medial sculpture.

"Oligocene of the silex beds of Ballast Point, Tampa Bay, Burns, Dall, and Crosby; and of Baileys Mill Creek sink, Florida, L. C. Johnson."

Holotype: U. S. National Museum no. 109400.

Horizon: Tampa limestone, lower Miocene.

Chione spada Dall is closely allied to *C. nuciformis* Heilprin and may be a varietal form of the latter. However, the holotype of *C. spada* is more elongate than specimens referred to *C. nuciformis* and for that reason it is left as a distinct species in accordance with Dall's determination.

Dall identified a specimen from a clay overlying a limestone at Baileys Mill Creek sink, three-fourths mile northeast of Lloyd, Jefferson County, Florida, as *Chione spada*. This specimen is not well preserved, but it may belong to the species to which Dall assigned it.

CHIONE (CHAMELEA) RHODIA Dall

1903. *Chione (Chamelea) rhodia* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1301, pl. 55, fig. 10 (part, specimens from the Oak Grove sands excluded).
1915. *Chione (Chamelea) rhodia* Dall, U. S. Nat. Mus. Bull. 90, p. 149, pl. 25, fig. 6 (part, specimens from the Oak Grove sands excluded).

Dall described this in 1903 as follows:

"Shell small, solid, inequilateral, the beaks at the anterior sixth, high, pointed, decurved, over an impressed, cordate, striated lunule of moderate size; escutcheon elongated, large, smooth in the left valve, bordered by a keel at which the concentric sculpture ceases; anterior slope short, concave, posterior arcuate, both ends bluntly rounded, base evenly arcuate; sculpture of concentric lamellae more elevated on the posterior slope, with wide, concentrically striated interspaces and no radial sculpture; hinge well developed, pallial sinus angular, nearly reaching

the middle of the shell, adductor scars subequal; inner margins minutely crenulate. Length 18, height 17, diameter 10 mm.

"Though this species is only represented by a small amount of material it seems a well-characterized form.

"Oligocene of Ballast Point silex beds near Tampa, Florida, Dall; and of the Oak Grove sands, Santa Rosa County, Florida, Burns."

This species is very rare at the type locality. The form from the Oak Grove sands referred by Dall¹²⁸ to *C. rhodia* is considered by Gardner¹²⁹ to be the young of *Venus*.

The holotype, a left valve, came from "silex beds" at Ballast Point, Tampa Bay, Hillsborough County, Fla. (U. S. National Museum no. 109229.

Horizon: Tampa limestone, lower Miocene.

Other occurrence: Station 7358, Tarpon Springs, Pinellas County, Florida (common).

CHIONE aff. C. BAINBRIDGENSIS Dall

1916. *Chione bainbridgensis* Dall, U. S. Nat. Mus. Proc., vol. 51, p. 499, pl. 84, figs. 5, 6.

Dall described *Chione bainbridgensis* as follows:

"Shell small, slightly inequilateral, moderately inflated, thin; beaks small, rather prominent, prosococlous, with a short lanceolate impressed lunule below them; the escutcheon narrow and more elongated; sculpture of numerous sharp recurved lamellae, somewhat sparser on the beaks but elsewhere uniformly distributed, and more elevated near the anterior end; radial sculpture of numerous fine threads evenly distributed, with narrower interspaces, strong on the front surface of the lamellae and in the interspaces, but wanting on the back or concave side of the lamellae; inner margin of the valves finely crenulated; anterior end of the valves rounded, the base prominently arcuate, the posterior end more pointed; hinge as usual in the genus. Height of somewhat defective valve, about 25; length, 35; diameter (double) 18 mm."

The holotype (fig. 5, U. S. Nat. Mus. no. 166717) came from station 7095, on the east bank of Flint River at the bend near the "Old Factory," about three-fourths of a mile northeast of the railway station at Bainbridge, Georgia; and the paratype (fig. 6) came from station 7131, Cherry Shute, 2¾ miles below Bainbridge, in hard residual blocks of limestone.

Horizon: Georgia; Flint River formation, Oligocene.

The following specimens, preserved either as molds or pseudomorphs from localities in Florida, appear to be closely related to *Chione bainbridgensis* Dall; Station 11116, Blackwater Creek at S. A.

¹²⁸ Dall, W. H., U. S. Nat. Mus. Bull. 90, p. 149, 1915.

¹²⁹ Gardner, Julia, U. S. Geol. Survey Prof. Paper 142-D, p. 173. 1926.

L. Ry. crossing, Hillsborough County; station 12762, $2\frac{3}{4}$ miles south of Zephyrhills, Pasco County; station 11113, Brooksville, Hernando County; station 12321, 3 miles east of Brooksville, Hernando County; station 12758, 5.9 miles northeast of Brooksville, Hernando County; station 12757, 10.2 miles northwest of Brooksville, Hernando County, upper part of quarry; station 12756, 10.2 miles northwest of Brooksville, lower part of quarry; station 11109, $1\frac{1}{2}$ miles north of Live Oak, Suwannee County; station 6825, 3 miles west of Live Oak, Suwannee County; station 6828, Falmouth, Suwannee County; station 6178, Rock Island, three-fourths mile above White Springs, Columbia County; station 12749, one-fourth mile southeast of Fort White, Columbia County; station 12303, Suwannee Sulphur Springs, Suwannee County; station 12301, 10 miles east of Wacissa, Jefferson County; station 2372, "Wacissa" swamp, Jefferson County.

Horizon of Florida localities: Suwannee limestone, Oligocene.

Subgenus CHIONE Megerle von Mühlfield, 1811

CHIONE (CHIONE) cf. C. SPENCERI Cooke

Plate 21, Figure 5

1919. *Chione spenceri* Cooke, Carnegie Inst. Washington Pub. 291, p. 150, pl. 15, figs. 1a, 1b.

Cooke described this species as follows:

"Shell ovate, moderately convex, with low, prosogyrate beaks and a sharply defined, lozenge-shaped lunule with imbricating growth-lamellae; escutcheon lanceolate, flat or slightly concave, and with fine growth-lines; radial sculpture of minute, close, low, rounded ridges becoming obsolete at the anterior and posterior ends; concentric sculpture of erect, evenly spaced lamellae, 24 on the type specimen, smooth on the dorsal surface and on the upper part of the ventral surface, but with a row of beads, contiguous to the radial ribbing, at the base of the ventral surface.

"Length, 26 mm.; height, 23 mm.; diameter of joined valves, 15.5 mm.

"Localities: Antigua, Spencer (type); Willoughby Bay, Antigua, station 6881; Vaughan.

"Geologic horizon: Oligocene.

"Type: U. S. Nat. Mus. No. 163352."

Occurrence in Florida: Tampa limestone, lower Miocene, station 12292, Cherokee Sink, Wakulla County.

Two external molds, smaller than the holotype of *Chione spenceri* Cooke, were collected. In all characters discernible, the impressions taken of these molds agree with the Antigua specimen, but specific identity is questioned until more specimens may be obtained.

Genus ANOMALOCARDIA Schumacher, 1817

ANOMALOCARDIA PENITA (Conrad)

1846. *Venus penita* Conrad, Am. Jour. Sci., 2d ser., vol. 2, p. 399, text figure.
1846. *Venus floridana* Conrad, idem, p. 400, text figure.
1887. *Venus penita* Conrad. Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 116.
1903. *Anomalocardia floridana* (Conrad). Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1303, pl. 55, figs. 14, 15.
1915. *Anomalocardia floridana* Conrad. Dall, U. S. Nat. Mus. Bull. 90, p. 150, pl. 23, figs. 4, 5.
1926. *Anomalocardia penita* (Conrad). Gardner, U. S. Geol. Survey Prof. Paper 142-D, p. 173. (Part, the specimens reported by Dall to be this species from Sopchoppy limestone probably should be excluded.)

Conrad described this species in 1846 as follows:

"Cuneiform, concentrically striated, the lines strong anteriorly, posteriorly less distinct, posterior side produced, compressed, extremity angulated; ligament margin very oblique and straight from umbo to extremity; summits very prominent; cardinal teeth very robust; basal margin slightly arched posteriorly; inner margin crenulated.

"Ballast Point, Tampa Bay."

I believe *A. floridana* (Conrad) is a young specimen of *A. penita* (Conrad).

Horizon: Tampa limestone, lower Miocene.

Occurrence: Common in the "silex beds" at Ballast Point, Tampa Bay, and the overlying limestone, Hillsborough County, Florida; station 13847, Gadsden Point, 4 miles below Ballast Point; Sixmile Creek, near Orient, Hillsborough County; station 12300, 1¼ miles northeast of Lloyd, Jefferson County; station 12728, 1½ miles below Willis bridge, Calhoun County; station 12287, Aspalaga Bluff, Apalachicola River; highest fossiliferous bed, estimated 45-50 feet above the river level; station 12735, 11 miles nearly southwest of Tallahassee, Leon County (imperfect cast and determination not confirmed); station 12285, quarry half mile south of River Junction, Gadsden County, at an elevation about 150 feet above sea level; station 12283, Old Chattahoochee Landing at elevation 155-165 feet above sea level; station 13841, Aspalaga Bluff, 10 feet above a 4-foot clay bed.

Dall¹⁴⁰ also reports *A. "floridana"* from the Sopchoppy limestone and Baileys Mill Creek sink, three-fourths mile northeast of Lloyd, Jefferson County. I have not seen specimens from the Sopchoppy limestone. Specimens from Baileys Mill Creek sink are from the Tampa limestone.

¹⁴⁰ Dall, W. H., Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1303, 1903.

Genus VENUS (Linnaeus) Lamarck, 1799

VENUS HALIDONA Dall

1900. *Venus halidona* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 5, p. 1194, pl. 38, figs. 1, 1a.
1903. *Venus halidona* Dall, idem, pt. 6, p. 1307.
1915. *Venus halidona* Dall, U. S. Nat. Mus. Bull. 90, p. 150, pl. 26, figs. 3, 5.

Dall described this species in 1903 as follows:

"Shell small for the genus, subovate, slightly truncate behind; beaks low, anteriorly directed over a rather large lanceolate lunule; posterior dorsal area narrow, nearly smooth, elongate, laterally keeled; sculpture of sharp, thin, elevated, concentric lamellae, slightly produced at their intersections with the posterior dorsal keels, the interspaces slightly striated by lines of growth without radial sculpture; hinge with 3 cardinals in each valve, the posterior right and middle left grooved or bifid; the rugose area narrow and inconspicuous but definitely present; pallial line with a short angular sinus; the inner border of the valves finely crenate. Height of short and an elongate specimen respectively 32.5 and 34.0, length 34.0 and 40.0, diameter 22.0 and 20.0; concentric lamellae 6 to 14 on a radial centimetre.

"Oligocene silex beds of Hillsboro Bay and Ballast Point near Tampa, Florida, Dall, Burns, and Wilcox."

Holotype: U. S. Nat. Mus. no. 109244.

Horizon: Tampa limestone, lower Miocene.

Other occurrence: Sixmile Creek near Orient Station, Hillsborough County (Tucker); station 11115, upper bed at Kendrick, Marion County; ?station 11186, midway between Lowell and Sparr, Marion County; ?station 12300, 1¼ miles northeast of Lloyd, Jefferson County.

VENUS MARIONANA Mansfield, n. sp.

Plate 20, figure 8

Shell rather small, ovate, and moderately inflated. Sculpture of nearly erect concentric lamellae and radial lines which overrun the lamellae and interspaces. These radials give the margins of the lamellae a denticulate ornamentation. The beak and hinge are obscured by matrix.

Holotype (right valve) (U. S. Nat. Mus. no. 495994) measures: Length, 53.6 mm.; height, 45.0 mm.; convexity, 21.0 mm.

Type locality: Station 11186, pit on old Raysor property, near hilltop, midway between Lowell and Sparr, Marion County, Florida.

Venus marionana, differs from *V. halidona* Dall in possessing radial sculpture. In size and outline, the new species resembles *V. plena* (Conrad) from the Miocene Chesapeake group of Maryland and Virginia, but it possesses a stronger radiate sculpture than *V. plena*.

Horizon: Tampa limestone, lower Miocene.

VENUS? sp.

Internal molds which may or may not belong to the genus *Venus* have been collected in Hernando County from the following localities: Station 12319, 2 miles south of Brooksville; station 12317, 10.2 miles northwest of Brooksville; station 12318, 5 miles west of Brooksville; station 12321, 3 miles east of Brooksville. The molds represent larger shells than those of *V. halidona* Dall but in general outline are similar to that species.

Horizon: Suwannee limestone; Oligocene.

Superfamily TELLINACEA

Family TELLINIDAE

Genus TELLINA Linnaeus, 1758

Subgenus TELLINELLA Mörch, 1853

TELLINA (TELLINELLA) SEGREGATA Dall

1900. *Tellina segregata* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 5, p. 1019, pl. 37, figs. 7, 8.
1915. *Tellina* (*Tellina*) *segregata* Dall, U. S. Nat. Mus. Bull. 90, p. 151, pl. 17, figs. 3, 11.

Dall described this species in 1900 as follows:

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

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

This species and the following new species, *T. silicata*, appear to be closely related to *T. interrupta* Wood, a living East Coast species.

The figured holotype (U. S. Nat. Mus. no. 15747) came from the "silex beds" at Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene.

Occurrence elsewhere: This species has not been found for certainty outside of its type locality.

TELLINA (TELLINELLA) SILICATA Mansfield, n. sp.

1915. *Tellina (Tellina) chipolana* Dall, U. S. Nat. Mus. Bull. 90, p. 151, pl. 22, figs. 1, 2. (Not *T. chipolana* Dall, 1900, a *Chipola* species.)
?1916. *Tellina segregata* Dall, U. S. Nat. Mus. Proc., vol. 51, p. 501.

Shell ovate, rather thin, inequilateral, equivalve. Anterior side of both valves longer than posterior, moderately inflated and marginally rounded in outline; posterior side pointed, the left valve more so than the right, rostrate, flexed, the right more so than the left. Both valves provided with two radial ribs, with an intervening sulcus, the lower one being near the dorsal line and the upper one forming the round-angled shoulder. Beaks low and pointed. Sculpture on the beaks and distally for about 5 mm. consists of low, rather widely spaced primary concentric lamellae intercalated with very fine concentric threads. Distally the secondary concentric sculpture disappears and only the primary sculpture, consisting of rather closely spaced, beakward-inclined thin lamellae, persists. Very fine radials ornament the area lying between the middle of the disk and the posterior shoulder. Within the shell the posterior ventral area is weakly depressed on the right valve and on the left valve is nearly flat.

Cotypes (U. S. Nat. Mus. no. 165219) measure: Right valve, length, 29.5 mm.; height, 18.5 mm.; convexity, 4.7 mm. Left valve, length, 29.5 mm.; height, 18.5 mm.; convexity, 4.5 mm.

Type locality: "silex beds" at Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene; ?Suwannee limestone, Oligocene.

Tellina chipolana Dall is closely related to *T. silicata* but differs from the latter in having a larger and thicker shell and in having more closely spaced primary concentric lamellae and fewer and stronger secondary concentric threads. The sculpture on the early part of the shell of the new species is very similar to that on *T. segregata* Dall, but the latter species has a smaller and relatively more elongate shell.

Specimens preserved as external molds from the following localities in Florida appear to be very closely related to *T. silicata*; Tampa limestone, station 12753, upper bed at Kendrick, Marion County (mold of part of a shell and its relationship to the new species is very doubtful); station 12292, Cherokee Sink, Wakulla County; and station 7080, quarry about half mile south of River Junction, an elevation about 150 feet above sea level, Gadsden County. Suwannee limestone, station 6826, 1½ miles north of Live Oak, Suwannee County; station 12303, Suwannee Sulphur Springs, Hamilton County; station 12298, 1½ miles east-southeast of Flint Rock, Jefferson County; station 12301, 10 miles east of Wacissa, Jefferson County.

Dall¹⁴¹ identified a fragment of a shell revealing the posterior end, collected at station 7075, about 10½ miles below Bainbridge, Ga., as *Tellina segregata* Dall. If the specimen belongs to the genus *Tellina*, it probably is more closely related to *T. silicata* than to *T. segregata* Dall.

TELLINA (TELLINELLA?) DIRA Dall

Plate 20, Figure 7

1915. *Tellina (Tellina) dira* Dall, U. S. Nat. Mus. Bull. 90, p. 151.

Dall described this species as follows:

"Shell small, thin, posterior end slightly bent to the right, elongate, with beaks slightly behind the middle of the shell; beaks not prominent, minutely projecting, smooth; remainder of the shell sculptured with low, sharp, elevated lamellae, which are obsolete on the posterior dorsal slope; the shell shows no radial sculpture; dorsal slopes about equally descending; anterior end longer, evenly rounded into the base, which is arcuate and rather prominent mesially; posterior end bluntly rounded and attenuate; interior with the pallial markings obscured; hinge with two strong laterals and two adjacent cardinal teeth, of which the posterior is larger and grooved. Length 11, height 9, double diameter 2.75 mm.

"Tampa silex beds at Ballast Point, Tampa Bay, Florida. E. J. Post, U. S. Nat. Mus. No. 165220.

"A single right valve was received too late for figuring but the species is well marked."

Horizon: Tampa limestone, lower Miocene.

Tellina dira Dall is founded upon a single right valve. It has not been found outside its type locality.

Subgenus ARCOPAGIA (Leach Ms.) Thomas Brown, 1827

Section MERISCA Dall, 1900

TELLINA (MERISCA?) MERULA Dall

1900. *Tellina (Macaliopsis?) merula* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 5, p. 1019, pl. 46, fig. 4.

1915. *Tellina (Macaliopsis) merula* Dall, U. S. Nat. Mus. Bull. 90, p. 152, pl. 24, fig. 7.

Dall described this species in 1900 as follows:

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

¹⁴¹ Dall, W. H., U. S. Nat. Mus. Proc., vol. 51, p. 501, 1916.

"Shell recalling *T. mera* Say but of different form.
"Oligocene of Tampa silex beds at Ballast Point."

Holotype, right valve, U. S. Nat. Mus. no. 157848.

Horizon: Tampa limestone, lower Miocene.

Dall placed this species in the section *Macaliopsis* Cossmann of which *T. barrandei* Deshayes, an Eocene species from the Paris Basin, is the type; but it appears more closely related to *T. crystallina* Wood, type of the section *Merisca*.

Occurrence: Type locality (common): Sixmile Creek, near Orient Station, Hillsborough County (Tucker); station 3420, 15 miles south of Tallahassee, Wakulla County (molds).

TELLINA (MERISCA) HALIDONA Dall

1900. *Tellina (Merisca?) halidona* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 5, p. 1021, pl. 38, figs. 3, 3a.

1915. *Tellina (Merisca) halidona* Dall, U. S. Nat. Mus. Bull. 90, p. 152, pl. 23, figs. 1, 3.

Dall described this species in 1900 as follows:

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

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

Holotype, left valve, U. S. National Museum, no. 157856.

Horizon: Tampa limestone, lower Miocene.

Occurrence: Type locality, rare; Sixmile Creek, near Orient Station, Hillsborough County (Tucker).

Subgenus MOERELLA Fischer, 1887

TELLINA (MOERELLA) ATOSSA Dall

1915. *Tellina (Angulus) atossa* Dall, U. S. Nat. Mus. Bull. 90, p. 153, pl. 4, fig. 11.

Dall described this species as follows:

"Shell egg-ovate, thin, rather compressed, nearly equilateral, with low sub-central beaks; anterior end full, rounded; posterior end compressed, attenuated, almost rostrate; anterior dorsal slope moderately convex, posterior slope straight; surface nearly smooth except toward the margins where the incremental lines rise into low sharp lamellae with flattish interspaces; there is no radial sculpture, and neither lunule nor escutcheon; hinge of the right valve with two cardinal teeth, the posterior large and bifid, an anterior larger lateral, and more distant smaller posterior lateral tooth; pallial sinus large, coincident with the pallial line

below, and not reaching the anterior adductor scar. Length of shell 21, height 14, diameter (estimated) 7 mm.

"Tampa silex beds at Ballast Point, Tampa Bay, Florida, one right valve, U. S. Nat. Mus. No. 166118 [holotype].

"This shell belongs to the type of *A. decumbens* Carpenter, a recent Panama form, and is very distinct from any other."

Horizon: Tampa limestone, lower Miocene.

Occurrence: This species has not been recognized outside of its type locality.

Genus *MACOMA* Leach, 1819

***MACOMA IRMA* Dall**

1900. *Macoma irma* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 5, p. 1047, pl. 46, fig. 15.

1915. *Macoma irma* Dall, U. S. Nat. Mus. Bull. 90, p. 153, pl. 24, fig. 9.

Dall described this species in 1890 as follows:

"Shell ovate, moderately convex, short, with a marked posterior flexure, nearly equilateral; beaks not conspicuous, anterior end broad, rounded, posterior attenuated, bluntly pointed, flexed to the right; surface marked only by rather rude incremental lines; hinge-plate strong, teeth normal; pallial sinus obscure but apparently connecting the adductor scars, and wholly confluent with the pallial line below. Lon. 28, alt. 20, diam. 10 mm.

"The specimens are rather poor pseudomorphs in silica, but evidently belong to the genus *Macoma* and to a species distinct from any others listed from this horizon.

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

Holotype: U. S. Nat. Mus. no. 157906.

The holotype is not well preserved.

Horizon: Tampa limestone, lower Miocene.

Occurrence: This species has not been recognized outside of its type locality.

Family SEMELIDAE

Genus *SEMELE* Schumacher, 1817

***SEMELE SARDONICA* Dall**

1915. *Semele sardonica* Dall, U. S. Nat. Mus. Bull. 90, p. 154, pl. 20, figs. 4, 7.

Dall described this species as follows:

"Shell small, ovate, the beaks behind the middle of the shell and inconspicuous; lunule deep and narrow; escutcheon confined to the left valve, very narrow, longer than the lunule; ends evenly rounded, subequal, passing smoothly into the arcuate base; sculpture of narrow, sharp, low vertical concentric lamellae with much wider interspaces, which are more or less concentrically striated, especially toward the ends of the shell; the lamellae are more crowded toward the anterior

end; pallial sinus rounded, high; not approaching the pallial line below; hinge normal, the chondrophore small. Length 16.5, height 11.5, diameter 5.7 mm.

"Tampa silex beds at Ballast Point, Tampa Bay, Florida, U. S. Nat. Mus. No. 165222 [Holotype].

Horizon: Tampa limestone, lower Miocene.

Occurrence: Type locality (rare); ?station 12292, Cherokee Sink, Wakulla County (molds).

SEMELE SILICATA Dall

1900. *Semele silicata* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 5, p. 987, pl. 38, fig. 6.

1915. *Semele silicata* Dall, U. S. Nat. Mus. Bull. 90, p. 154, pl. 23, fig. 7.

Dall described this species in 1900 as follows:

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

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

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

Horizon: Tampa limestone, lower Miocene; ?Suwannee limestone, Oligocene.

Occurrence: Tampa limestone, type locality, common; station 13847, 4 miles south of Ballast Point. Suwannee limestone, ?station 12761, highway 2 miles north of Hudson, Pasco County, Florida (a poorly preserved external mold).

Superfamily MYACEA

Family CORBULIDAE

Genus CORBULA (Bruguière) Lamarck, 1801

Subgenus CARYOCORBULA Gardner, 1926

CORBULA (CARYOCORBULA) KAGHRIANA Dall

1915. *Corbula (Cuncocorbula) kaghriana* Dall, U. S. Nat. Mus. Bull. 90, p. 155, pl. 21, figs. 4, 5.

1915. *Corbula (Cuncocorbula) sarda* Dall, idem, (in part, not *C. sarda* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 4, pl. 36, fig. 14, 1908).

Dall described this species as follows:

"Shell small, inequivalve, plump, behind pointed and almost rostrate; left valve smaller; beaks small, pointed, prosocoelous, not prominent; there is no lunule; a wide, strongly concentrically striate posterior dorsal area is bounded

by a strong keel on each side; both valves are sculptured by strong concentric rounded ridges with wider interspaces; the ridges anteriorly sharp and appear even slightly recurved toward the beaks; behind they cease at the keels; the margin of the right valve below is tortuous and folded over the margin of the left valve behind; the dorsal margins between the keels pout prominently. Length 10, height 6.2, maximum diameter 5 mm."

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

"U. S. Nat. Mus. No. 165224 [Holotype]. Also recent."

Horizon: Tampa limestone, lower Miocene.

The specimens from the "silex beds" referred by Dall to *C. sarda* Dall, a Chipola species, appear to be a larger form of *C. kaghriana* Dall.

Dall identified a Recent species from Jamaica as *C. kaghriana*. The Recent form differs slightly from the fossil and perhaps should be regarded as a subspecies of the fossil. The fossil form has a weak, medial, radial constriction not observed on the Recent form and lacks fine radial threads on the posterior dorsal slope and elsewhere. The left valves of both forms are very similar, but the right valve on the fossil form has a more pointed posterior extremity than the Recent form.

Occurrence: Common at the type locality; station 7172, outskirts of River Junction, Gadsden County, Florida (mold, identification not definitely determined).

CORBULA (CARYOCORBULA) BURNSII Dall

1898. *Corbula engonata burnsii* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 4, p. 847 (in part, Chipola form excluded).

1915. *Corbula (Cuneocorbula) burnsii* Dall, U. S. Nat. Mus. Bull. 90, p. 155 (in part, Chipola form excluded), pl. 18, figs. 4, 5.

Shell rather small, solid, plump, coarsely concentrically sculptured, inequilateral, inequivalve and rostrate. Beaks pointed, terminally inclined anteriorly, nearly proximate. Middle part of disk nearly flat, anterior end evenly rounded, posterior dorsal area precipitous, medially concave and projecting at the margins. Right valve larger than left and overlaps it at the margins. Sculpture of both valves similar consisting of rather coarse concentric lamellae which extend from the posterior carina to the anterior margin. Posterior dorsal area sculptured with a few fine concentric threads which are more crowded at the lower posterior end.

Cotypes measure: Large cotype (fig. 5, pl. 18, Bull. 90), length, 10 mm.; height, 6.8 mm.; diameter, 5.3 mm. Smaller cotype (fig. 4, pl. 18, Bull. 90), length, 8 mm.; height, 5.2 mm.; diameter, 3.8 mm.

Type locality: Tampa "silex beds" at Ballast Point, Tampa Bay, Florida.

Horizon: Tampa limestone, lower Miocene.

Corbula burnsii is closely related to *C. kaghriana* Dall, differing from the latter in having a plumper and relatively shorter shell with coarser concentric sculpture.

Occurrence: Common at the type locality; not recognized outside the type area.

Family SAXICAVIDAE

Genus *PANOPE* Ménéard de la Groye, 1807

PANOPE aff. *P. GOLDFUSSII* (Wagner)

Internal molds from a few localities in Florida, though not well enough preserved for specific determination appear to be related to *Panope goldfussii* (Wagner). The largest imperfect molds were collected at station 12292, Cherokee Sink, Wakulla County, Florida. These represent a large elongate shell and appear to differ from *P. goldfussii* in having a higher beak and a relatively wider posterior extremity. A fragment of a shell from the "silex beds" at Ballast Point which Dall¹⁴² referred to *P. whitfieldi* Dall may belong to this group, but the specimen is too fragmental for determination.

A. parawhitfieldi Gardner, a species from the Oak Grove sands, has a more nearly equivalve shell than the specimens from Cherokee Sink. The following specimens from localities not mentioned above may belong with this group: station 13847, Gadsden Point, 4 miles below Ballast Point; Sixmile Creek, near Orient Station, Hillsborough County (Tucker); station 12753, upper bed at Kendrick, Marion County; station 7168, echinoderm bed, Old Chattahoochee Landing, Gadsden County.

Horizon: Tampa limestone, lower Miocene.

An undetermined species of *Panope* from the Trent marl on Trent River, 4 miles downstream from Pollocksville, Jones County, N. C. (station 10656), figured by Kellum,¹⁴³ is similar to the specimens from Cherokee Sink.

PANOPE BROOKSVILLENSIS Mansfield, n. sp.

Plate 21, Figures 1, 2

Shell narrow, elongate, very inequilateral and moderately inflated. Ventral margin weakly arcuate; posterior margin rounded, narrower than anterior. Posterior end gradually tapering and about two-thirds

¹⁴² Dall, W. H., U. S. Nat. Mus. Bull. 90, p. 156, 1915.

¹⁴³ Kellum, L. B., U. S. Geol. Survey Prof. Paper 143, pl. 10, figs. 5, 6, 1926.

length of shell. Sculpture consists of moderately strong concentric undulations. Pallial sinus prominent and extending anteriorly as far as the beaks.

Holotype (U. S. Nat. Mus. no. 495995), measures: Length, 104 mm. (estimated, anterior end broken); height, 40 mm.; diameter, 29.8 mm. Paratype (U. S. Nat. Mus. no. 495933) measures: Length, 85 mm. (estimated, not entire); height, 40 mm.; diameter, 26.8 mm.

Type locality of holotype: Station 12322, quarry three-fourths mile southwest of Brooksville, Hernando County, Florida; paratype, station 12321, quarry 3 miles east of Brooksville.

The types and other specimens referred to the new species consist of internal molds.

Horizon: Suwannee limestone, Oligocene.

P. brooksvillensis is very closely related to *P. oblongata* Conrad, an Oligocene species, differing from the latter in having a narrower and relatively more elongate shell.

Occurrence: Type localities (common); station 12758, 5.9 miles northeast of Brooksville; station 12761, 2 miles north of Hudson (mold which is less slender than other specimens and determination queried).

Outside occurrence: Internal molds of specimens collected by L. B. Kellum from 2 miles south of Rock Landing on the Neuse River, North Carolina (Field No. 12) are similar in outline to *P. brooksvillensis*.

Family GASTROCHAENIDAE

Genus GASTROCHAENA Spengler, 1783

GASTROCHAENA aff. G. CUNEIFORMIS Spengler

An external impression of a left valve of a species of *Gastrochaena*, collected at station 12292, Cherokee Sink, Wakulla County, Florida, appears to be very closely related to *G. cuneiformis* Spengler, a living species ranging from North Carolina to Brazil. The form is rather large, ovate, arched and rather wide at the posterior extremity. The external impression measures: Length, 12 mm.; greatest height, 11 mm.

Horizon: Tampa limestone, lower Miocene.

Inderterminable burrows are the only specimens from the "silex beds" at Ballast Point, Tampa Bay, Florida. Dall¹⁴ referred these burrows to *G. rotunda* Dall.

¹⁴ Dall, W. H., U. S. Nat. Mus. Bull. 90, p. 157, 1915.

Family TEREDINIDAE

Genus TEREDO Linné, 1758

TEREDO? INCRASSATA (Gabb)

Plate 21, Figure 4

1873. *Kuphus incrassatus* Gabb, Amer. Philos. Soc., Trans., vol. 15, p. 246.
1881. *Kuphus incrassatus* Gabb, Acad. Nat. Sci. Philadelphia, Jour., vol. 8, new ser., p. 342, pl. 44, figs. 12a-c.
1917. *Teredo incrassata* Gabb. Maury, Bull. Amer. Paleontology, vol. 5, p. 399, pl. 39, fig. 24.

Living species of *Teredo* are woodborers. Species of *Kuphus* Guettard are said to bore in sand or silt. It is not known whether the fossil tubes were made by wood or sand borers.

Bartsch¹⁴⁵ proposed a collective group name *Teredolithus* for the reception of those generically indeterminable species of fossil ship worms (*Kuphus incrassatus* [Gabb] being included). This name has no generic standing. I have queried the generic name *Teredo* to include the fossil tubes now under consideration.

Large broken tubes, occurring at a number of localities in Florida, are similar in appearance and size to those from Santo Domingo that have been referred to *Teredo incrassata* (Gabb) by Maury.

Large tubes occur at the following localities in Florida: Station 11116, Blackwater Creek at S. A. L. Ry. crossing, Hillsborough County; station 12761, 2 miles north of Hudson, Pasco County; station 12762, $2\frac{3}{4}$ miles south of Zephyrhills, Pasco County; station 12332, Brooksville, Hernando County; station 12318, 5 miles west of Brooksville; station 12317, 10.2 miles northwest of Brooksville; station 12758, 5.9 miles northeast of Brooksville; station 11109, $1\frac{1}{2}$ miles north of Live Oak, Suwannee County; station 11110, Suwannee Sulphur Springs, Suwannee County; station 2308, 4 miles west of Live Oak, Suwannee County; station 12737, 9.7 miles west of Perry, Taylor County; station 2372, "Wacissa" swamp, Jefferson County; station 12299, Walker Spring, Jefferson County; station 12298, $1\frac{1}{2}$ miles southeast of Flint Rock, Jefferson County.

Occurrence elsewhere: Near Santiago and elsewhere in Cuba. Specimens associated with a fauna, as reported by Cooke,¹⁴⁶ that bears a close resemblance to that in the Tampa and Anguilla formations. Cercado formation and other horizons in Santo Domingo not definitely placed stratigraphically.

Horizon in Florida: Suwannee limestone, Oligocene.

¹⁴⁵ Bartsch, Paul, Science, vol. 71, pp. 460-461, 1930.

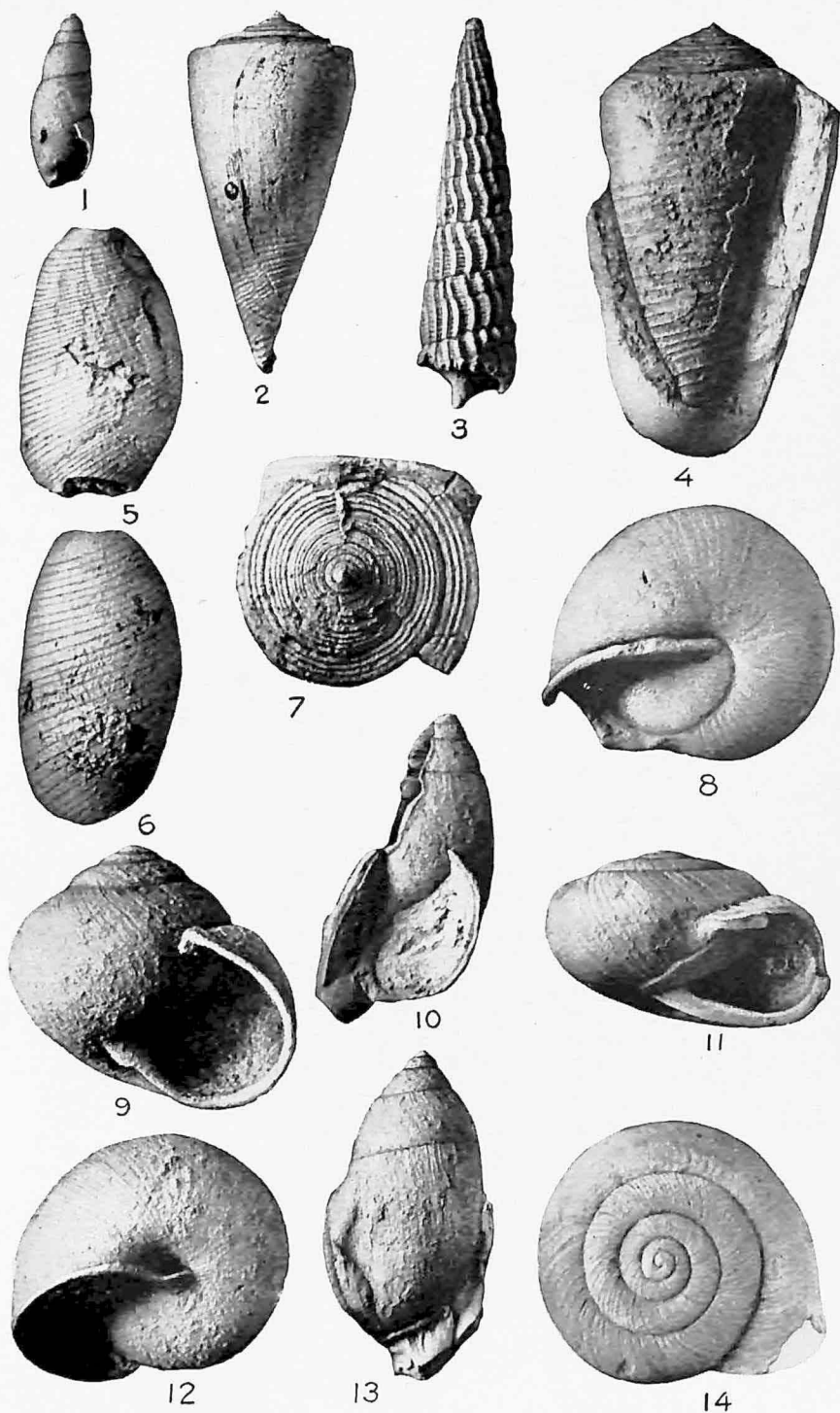
¹⁴⁶ Cooke, C. W., Carnegie Inst. Washington Pub. No. 291, p. 109, 1919.

PLATES 1-21

Mollusks of the Tampa and Suwannee limestones

PLATE 1

- FIGURE 1. *Spiraxis? tampae* Dall. Holotype, x4. Page 72.
- FIGURES 2, 4, 7. *Conus planiceps weakullensis* Mansfield, n. subsp. 4, 7, Squeeze of the holotype x1½; 2, paratype, U. S. Nat. Mus. no. 496225, 1¼ miles northeast of Lloyd, Jefferson County. Page 81.
- FIGURE 3. *Terebra (Strioterebra) ballista* Mansfield, n. sp. Holotype, x3. Page 77.
- FIGURES 5, 6. *Scaphander ballistus* Mansfield, n. sp. 5, Paratype x2; 6, holotype, x4. Page 75.
- FIGURES 8, 11, 14. *Pleurodonte kendrickensis* Mansfield, n. sp. Holotype, x2. Page 66.
- FIGURES 9, 12. *Humboldtiana? tuckeræ* Mansfield, n. sp. Holotype, x2. Page 66.
- FIGURES 10, 13. *Bulimulus americanus weakullæ* Mansfield, n. subsp. Squeeze of the holotype, x1½. Page 70.



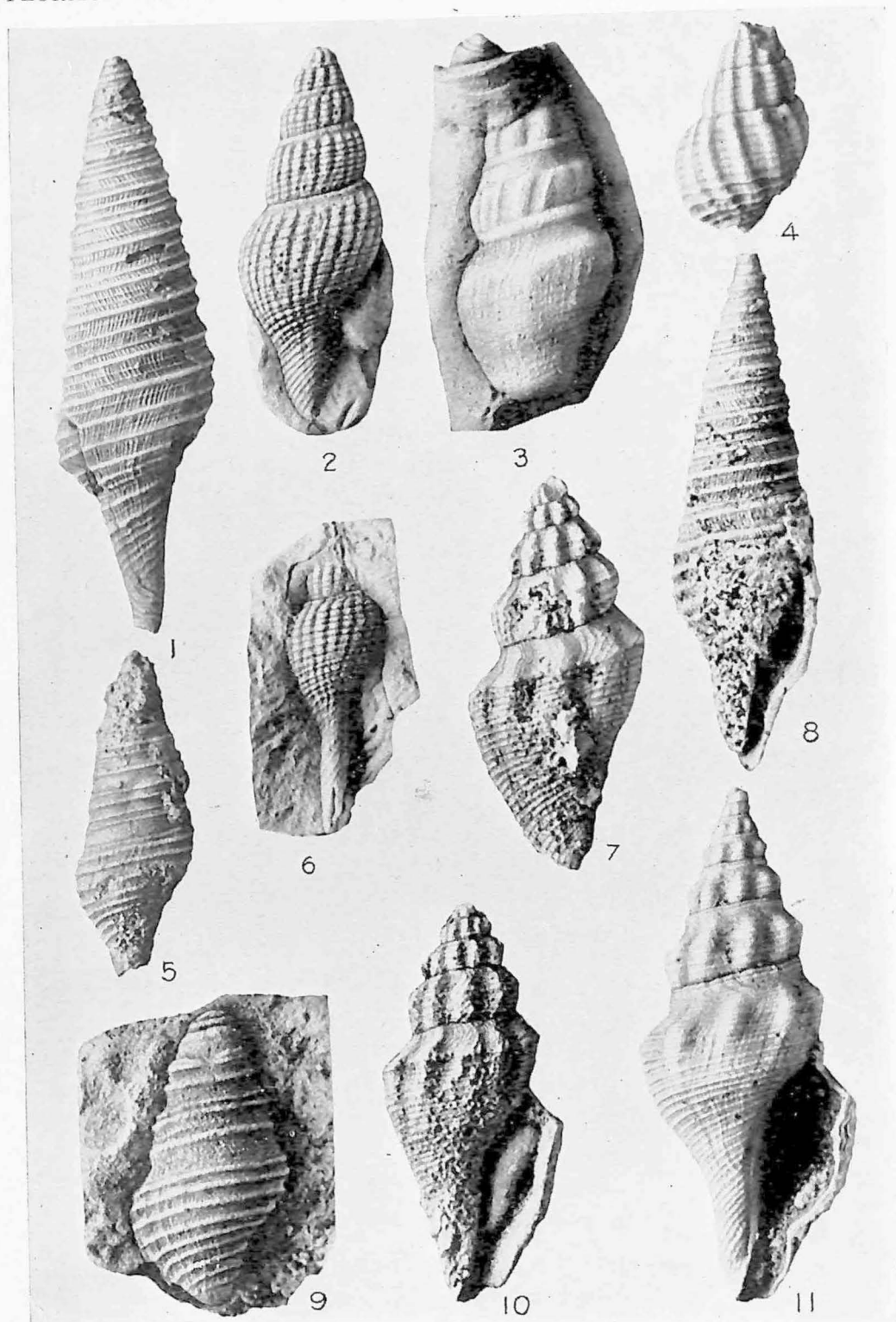
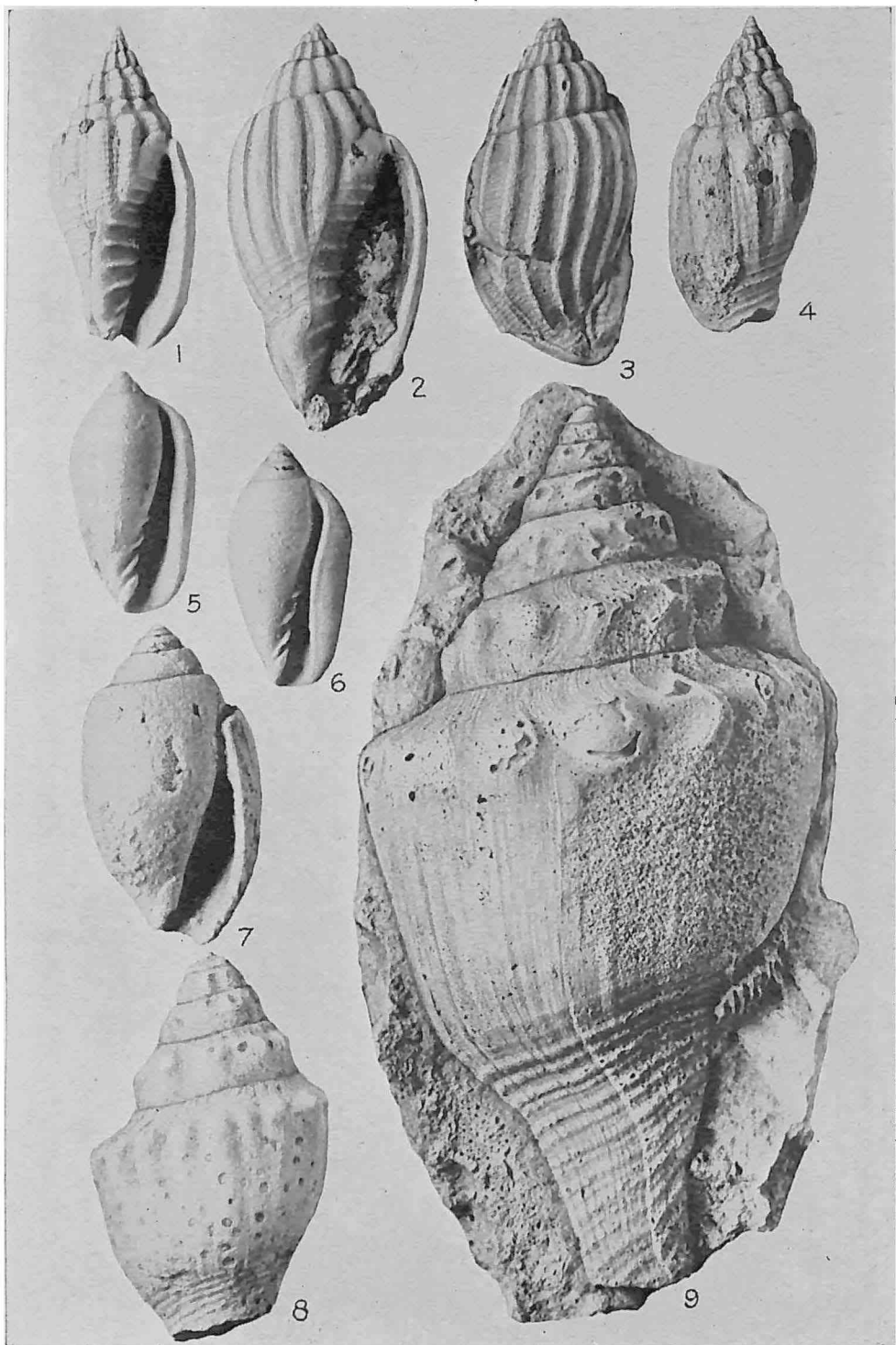


PLATE 2

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|---------|---|
| FIGURES | 1, 8. <i>Polystira tampensis</i> Mansfield, n. sp. Cotypes, 1, x4; 8, x3. Page 82. |
| FIGURES | 2, 6. <i>Euclathurella?</i> <i>liccoakensis</i> Mansfield, n. sp. Cotypes, x3. Page 92. |
| FIGURE | 3. " <i>Drillia</i> " aff. " <i>D.</i> " <i>plutonica</i> Casey. Squeeze, x4. Page 91. |
| FIGURE | 4. <i>Alectrion</i> sp. <i>b</i> , aff. <i>A. harrisi</i> Maury, x5. Page 125. |
| FIGURES | 5, 9. <i>Knefastia?</i> <i>brooksvillensis</i> Mansfield, n. sp. Cotypes, 5, x2; 9, squeeze, x4. Page 83. |
| FIGURES | 7 10. <i>Cryoturris?</i> <i>hillsboroughensis</i> Mansfield, n. sp. Holotype x4. Page 92. |
| FIGURE | 11. <i>Fusiturricula condominia silicata</i> Mansfield, n. subsp. Holotype, x3. Page 85. |

PLATE 3

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|---------|-------|---|
| FIGURES | 1, 4. | <i>Lyria musicina</i> (Heilprin). Figured specimen, natural size, from Ballast Point, Tampa Bay, Florida, U. S. Nat. Mus. no. 112106. Page 105. |
| FIGURE | 2. | <i>Lyria musicina dalli</i> Mansfield, n. subsp. Holotype, $\times 1\frac{1}{2}$. Page 106. |
| FIGURE | 3. | <i>Lyria mississippiensis</i> Conrad?, Squeeze, $\times 2$. Page 108. |
| FIGURE | 5. | <i>Marginella (Porcellanella) gregaria</i> Dall. Lectotype, $\times 2$. U. S. Nat. Mus. no. 165051. Page 100. |
| FIGURE | 6. | <i>Marginella (Porcellanella) gregaria silicata</i> Mansfield, n. subsp. Lectotype, $\times 3$. Page 101. |
| FIGURE | 7. | <i>Olivella liveoakensis</i> Mansfield, n. sp. Holotype, $\times 4$. Page 96. |
| FIGURE | 8. | <i>Nancus polygonatus</i> (Heilprin). Figured specimen, natural size, from station 12763, Anclote River at Tarpon Springs, Pinellas County. Page 111. |
| FIGURE | 9. | <i>Nancus polygonatus suwanensis</i> Mansfield, n. subsp. Squeeze of holotype, natural size. Page 112. |



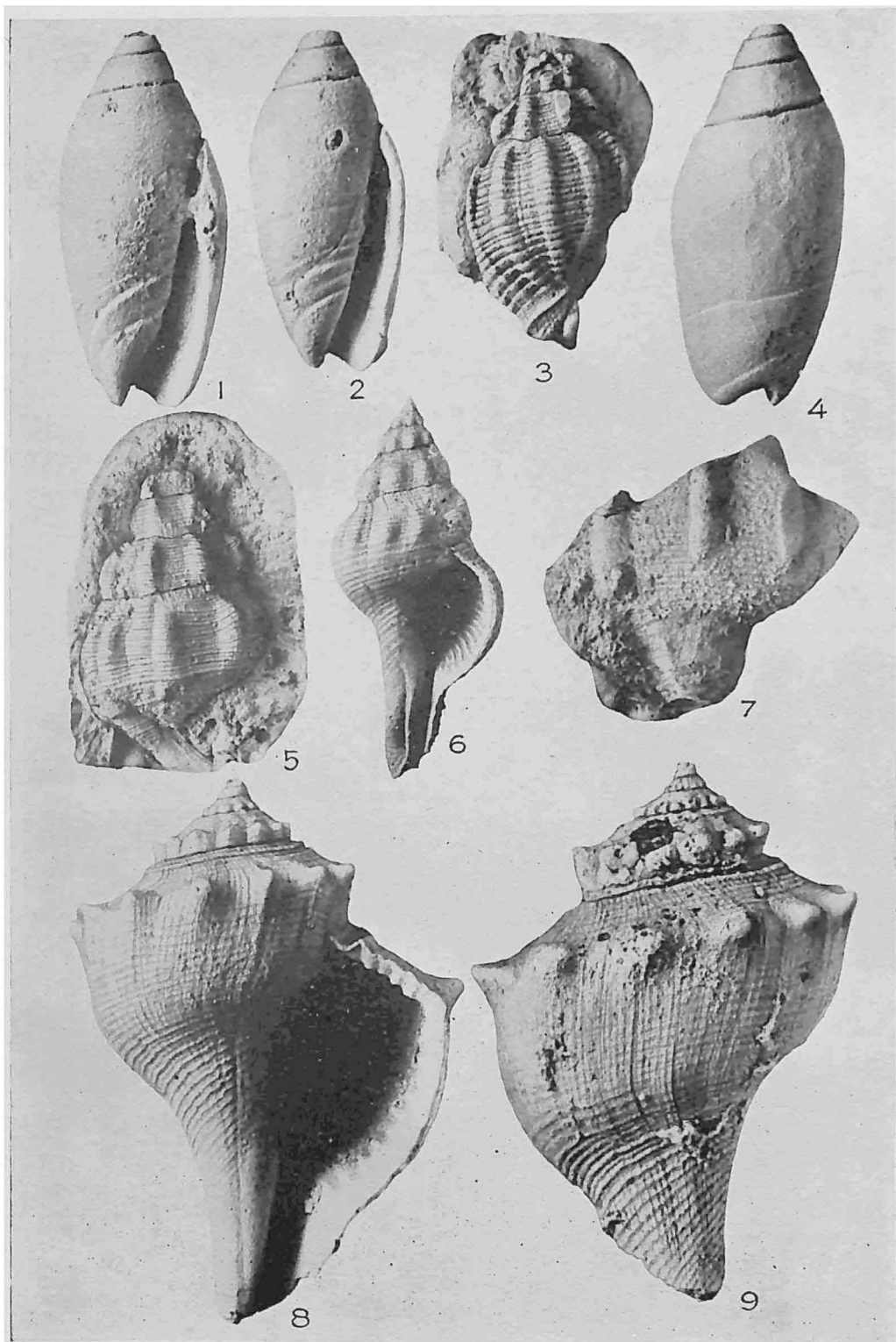
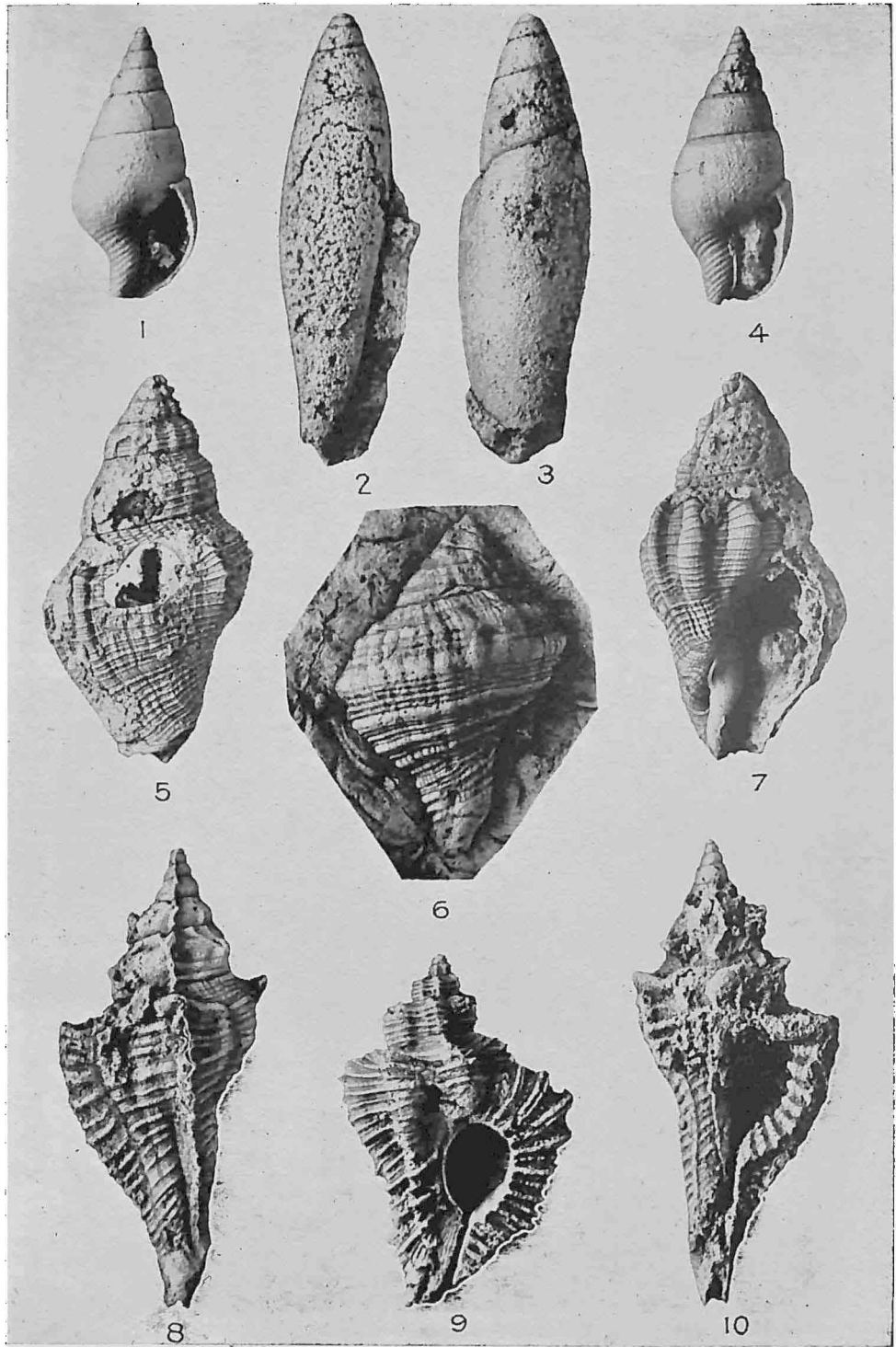


PLATE 4

- FIGURES 1, 2, 4. *Olivella brooks-villensis* Mansfield, n. sp. Cotypes, x3. Page 96.
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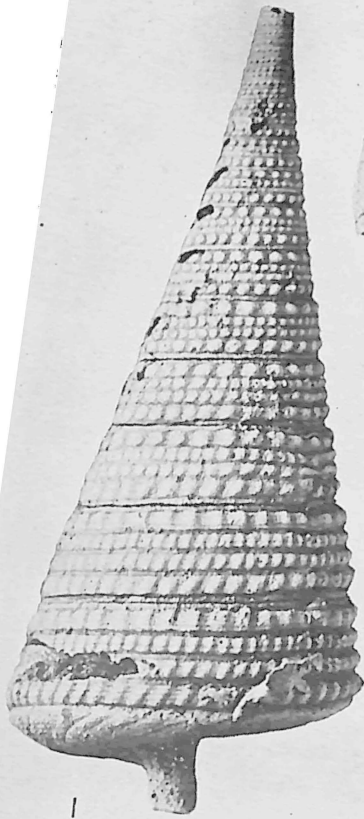
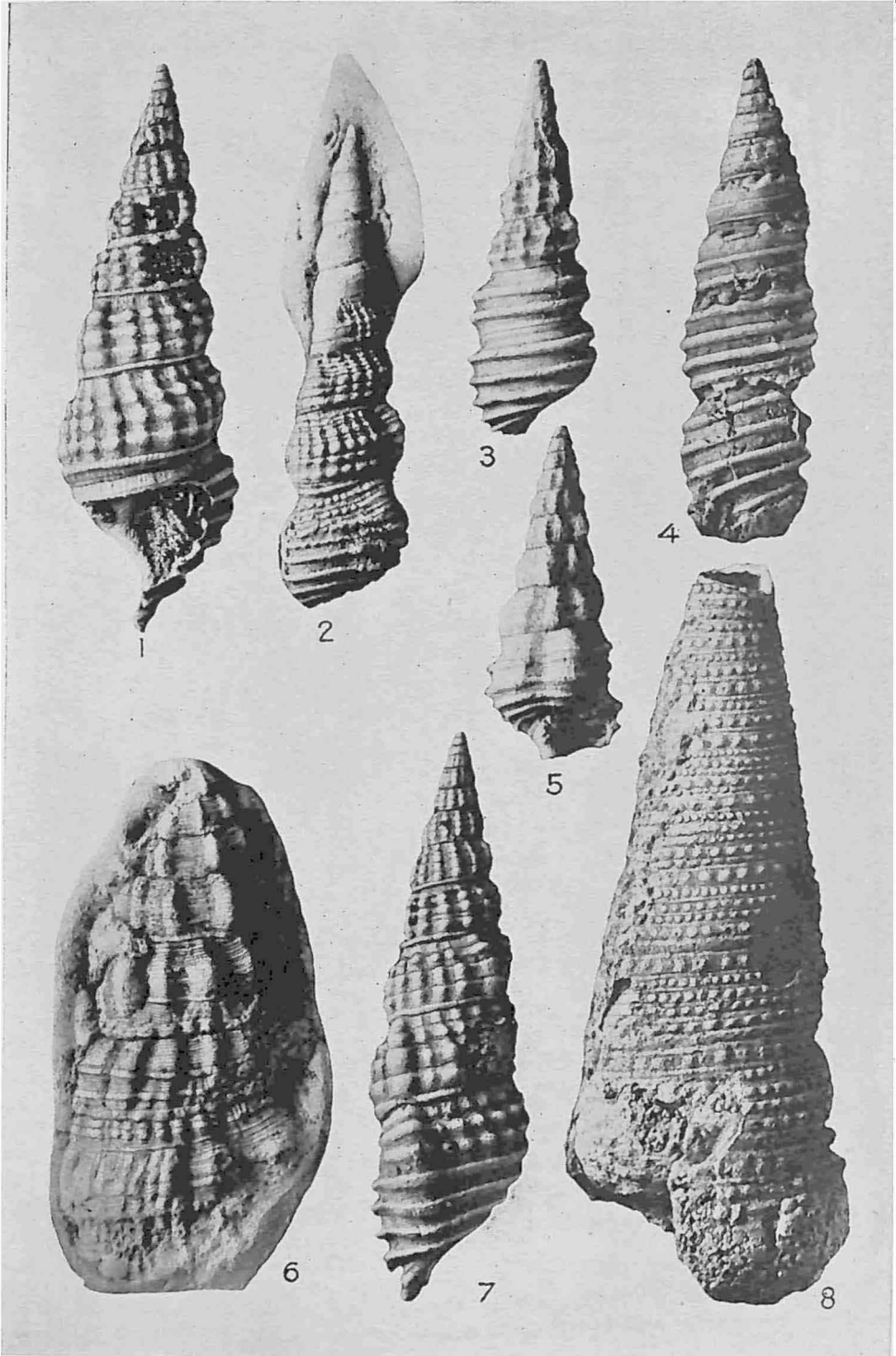


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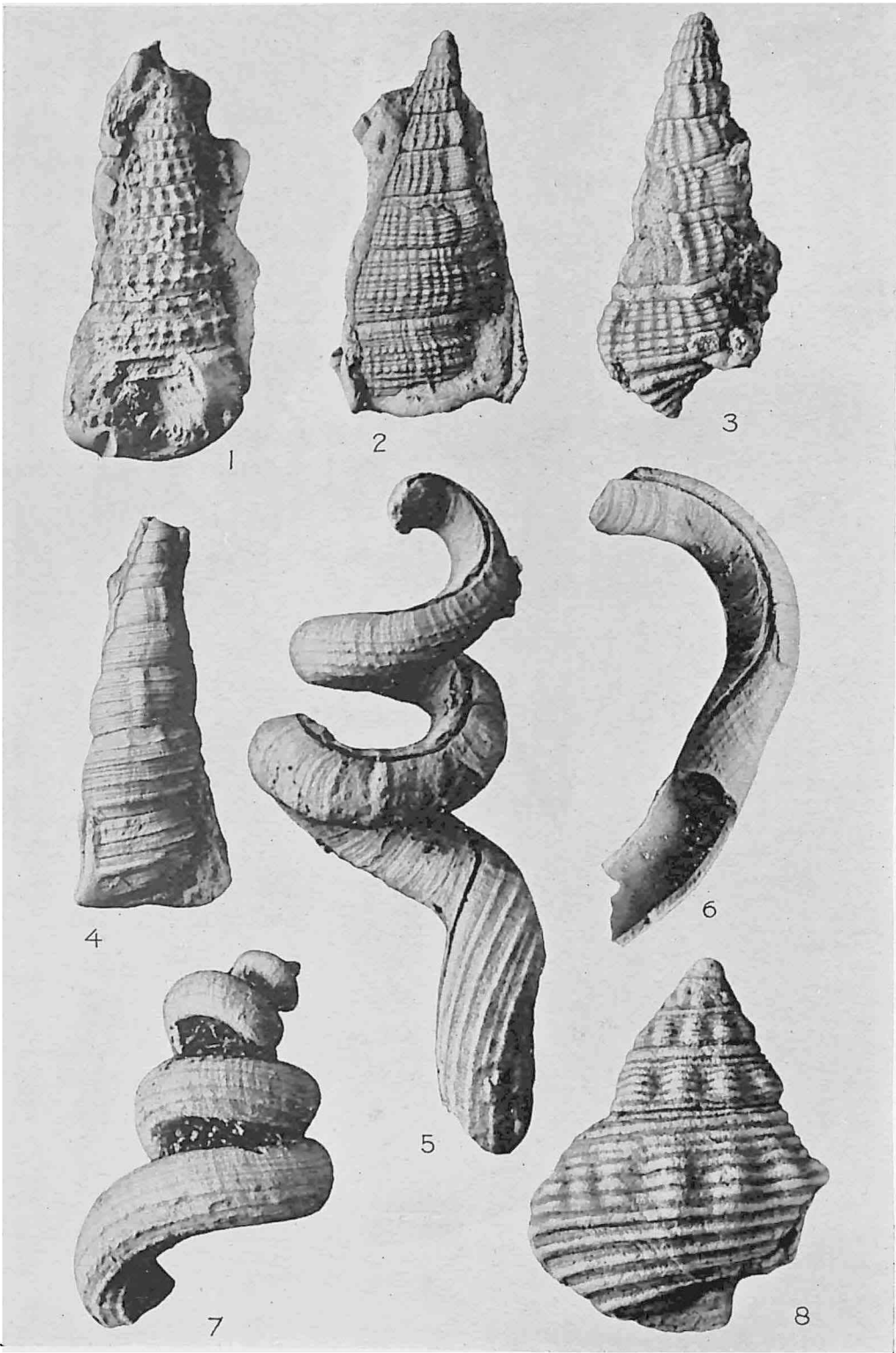
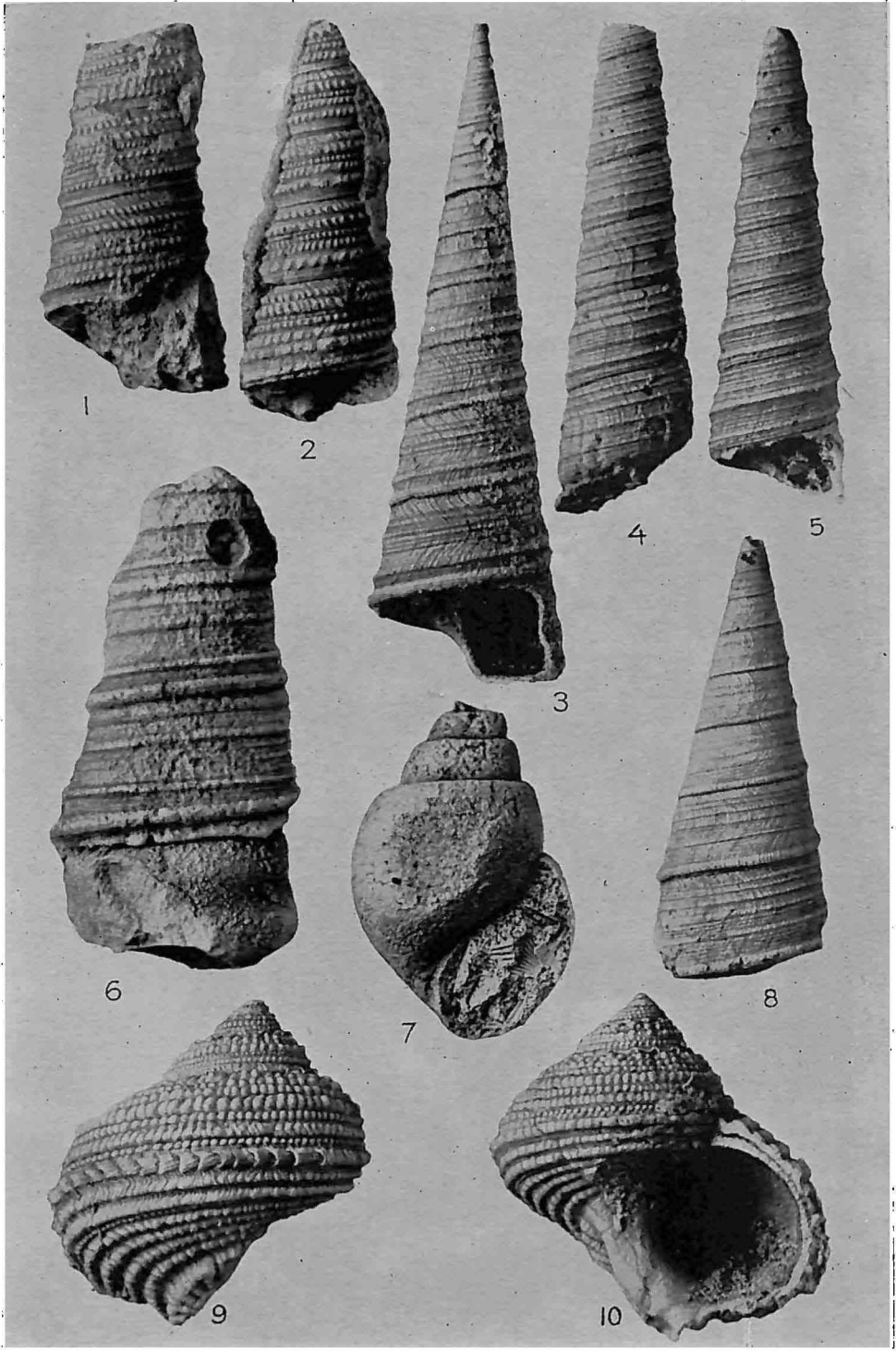


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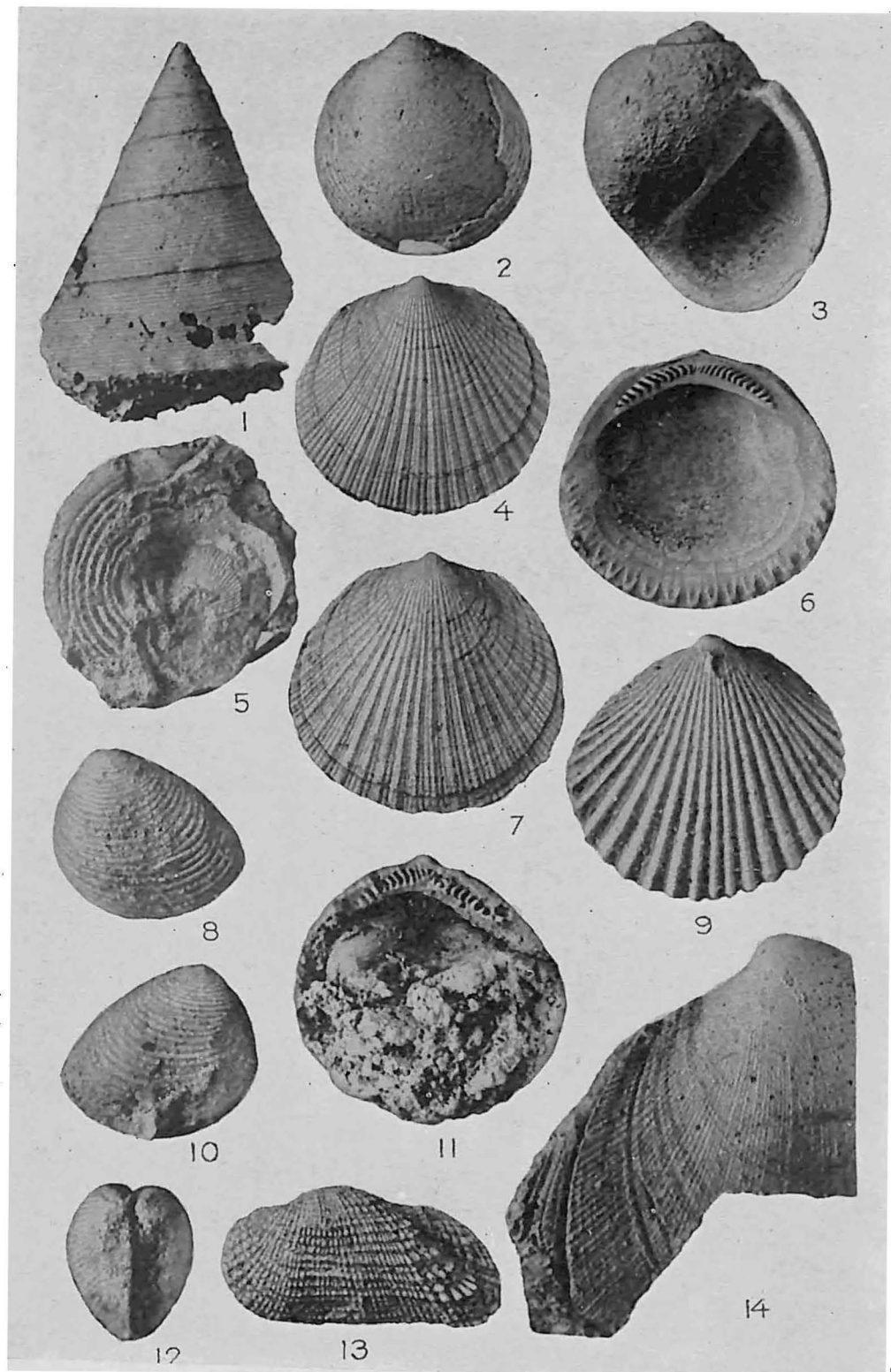
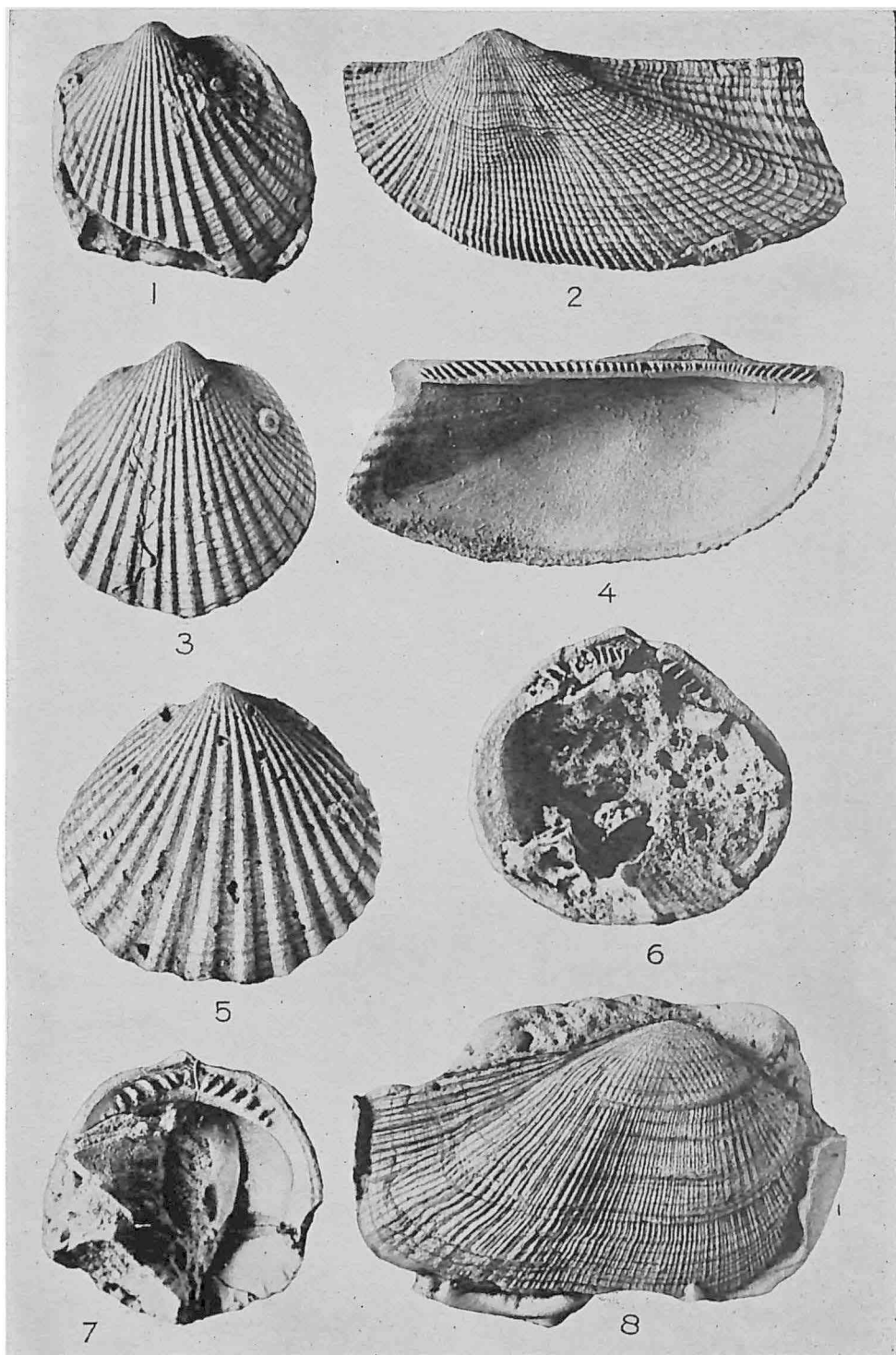


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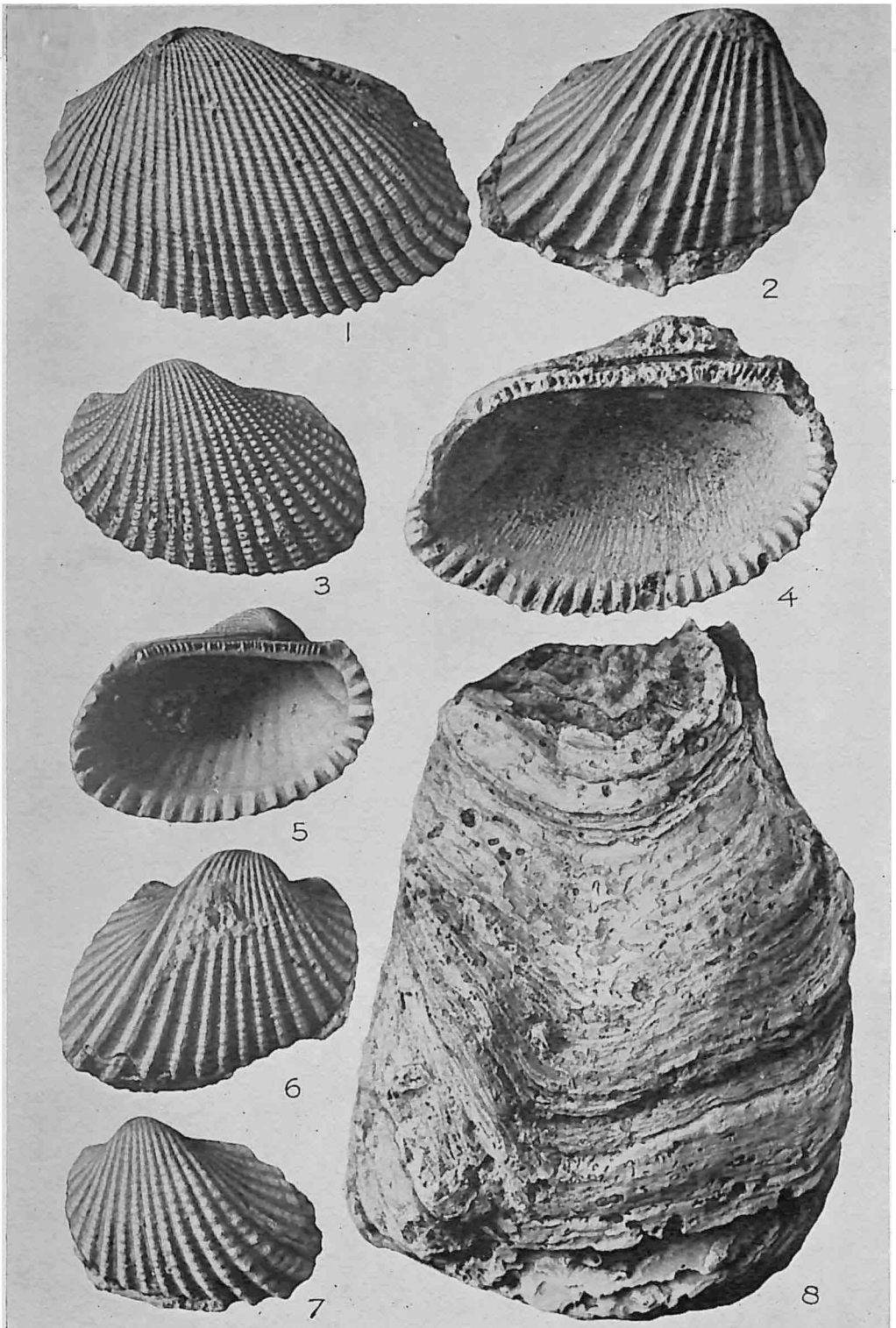


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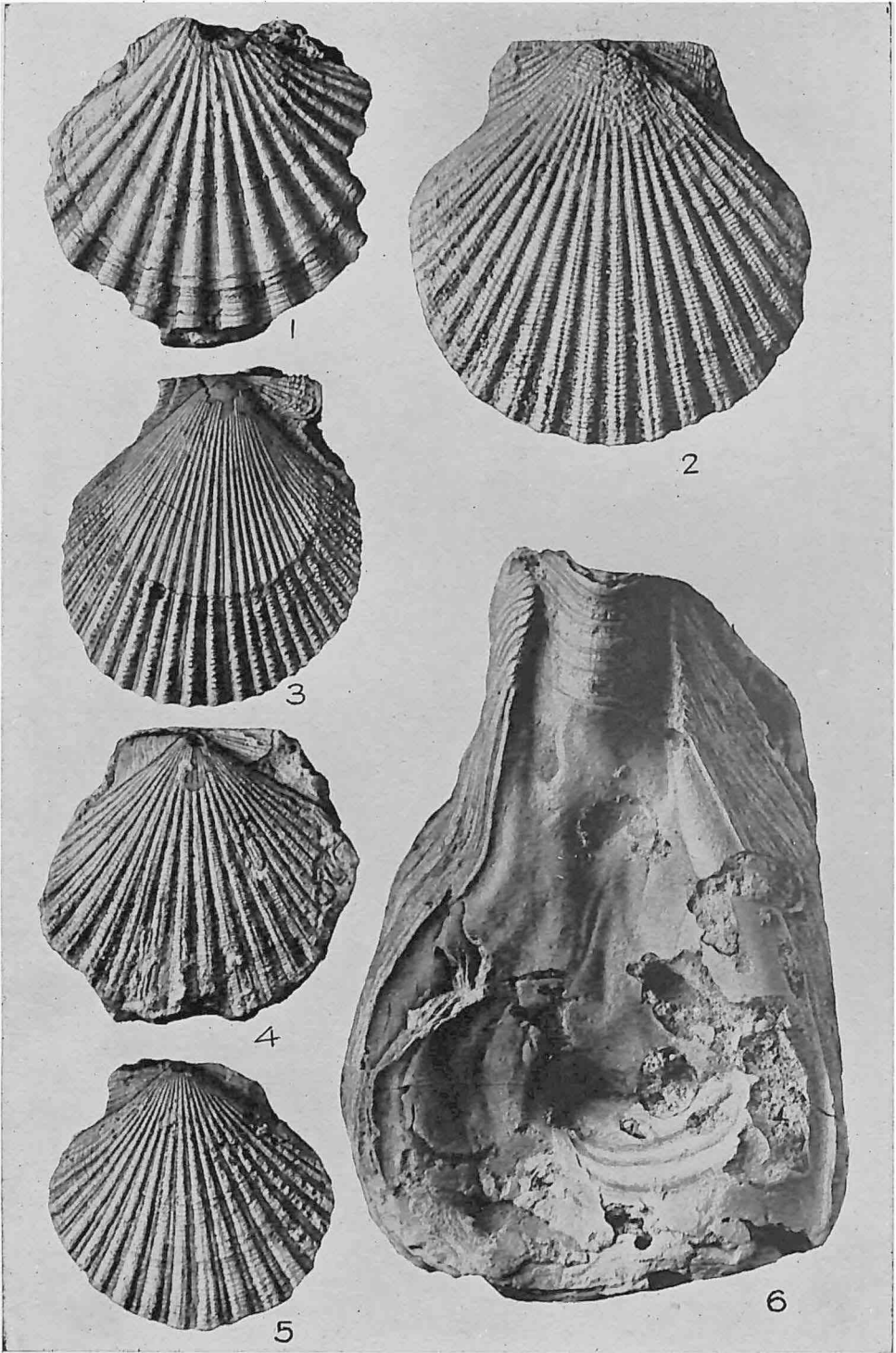
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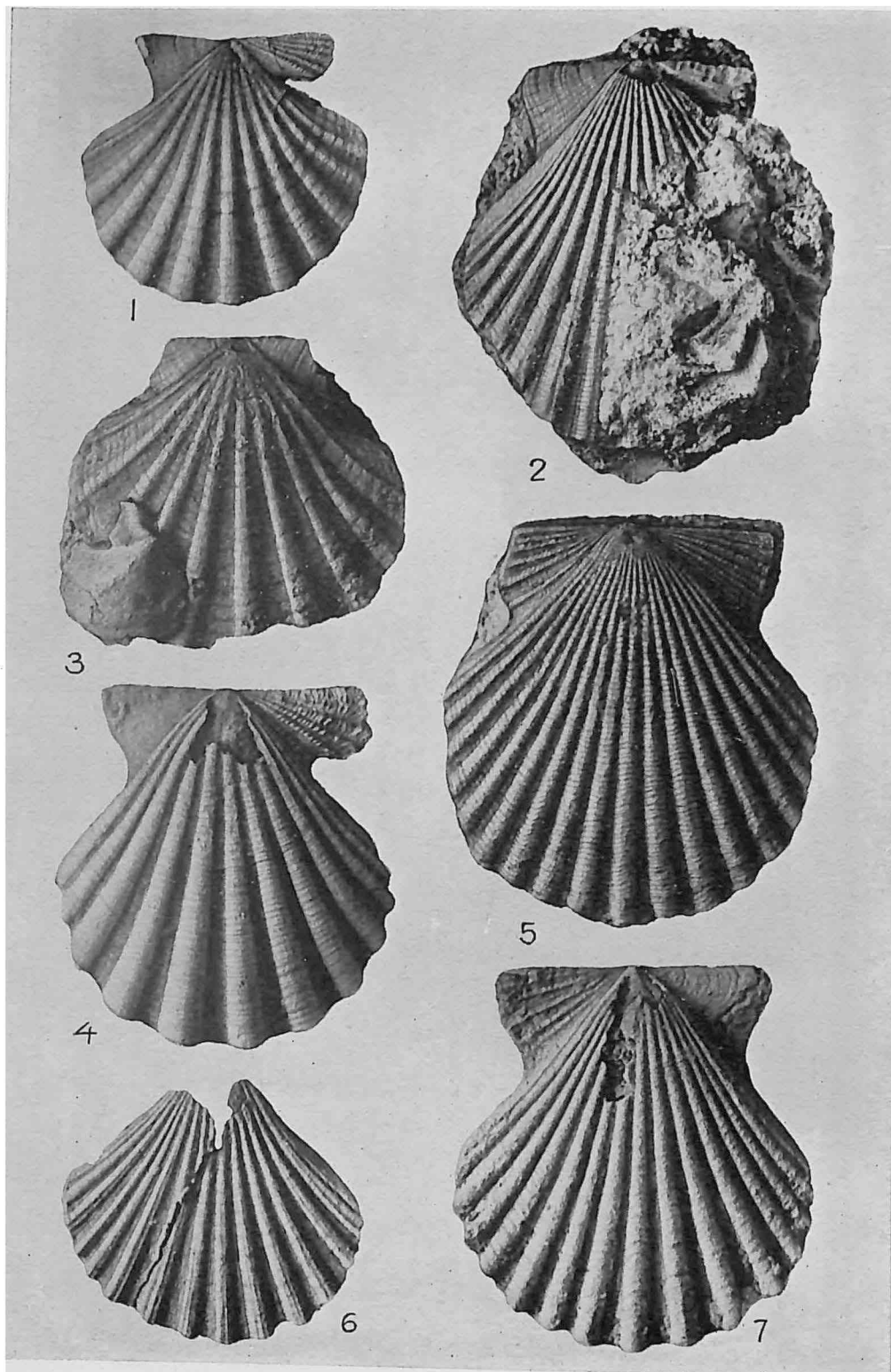
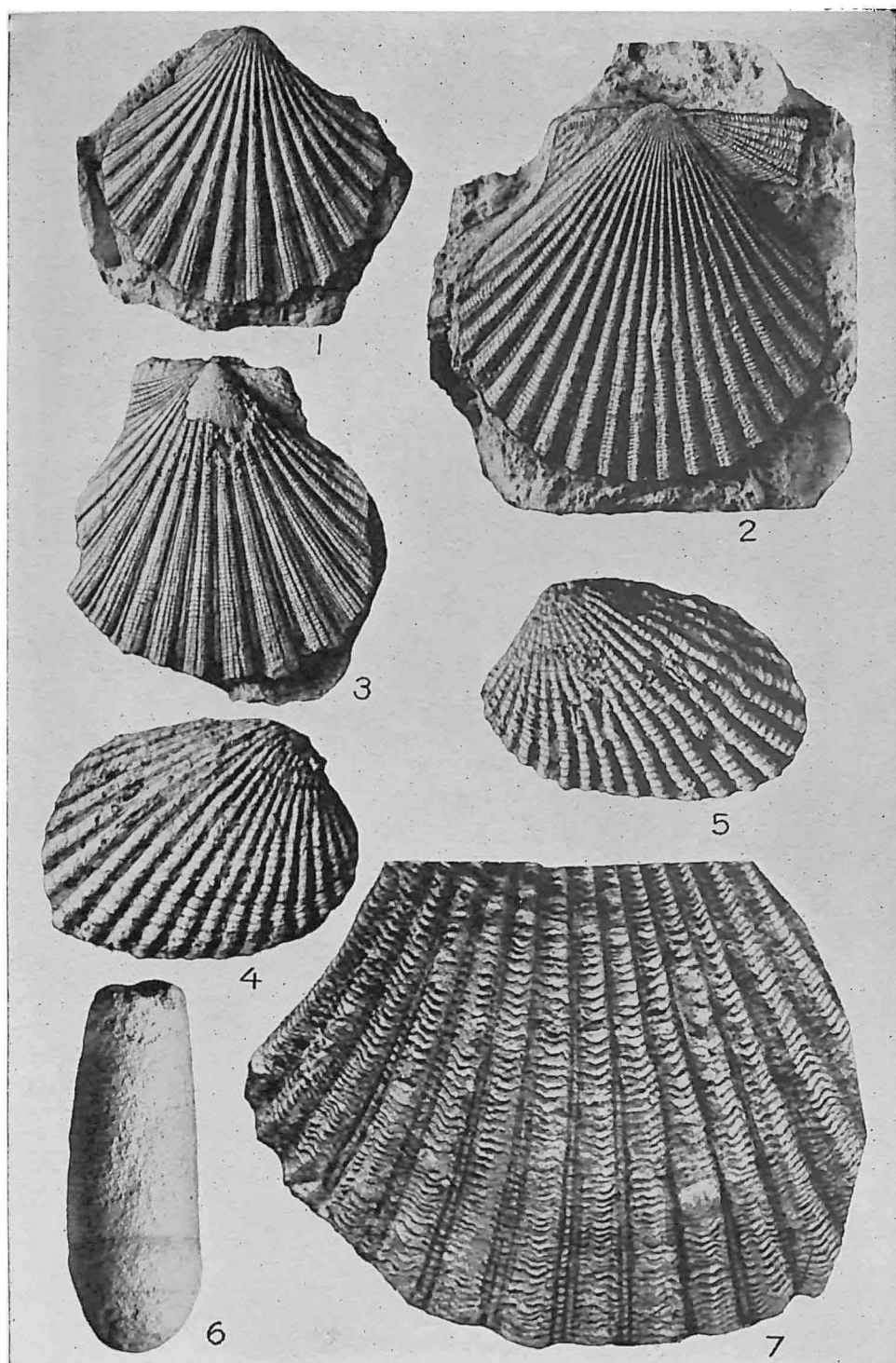


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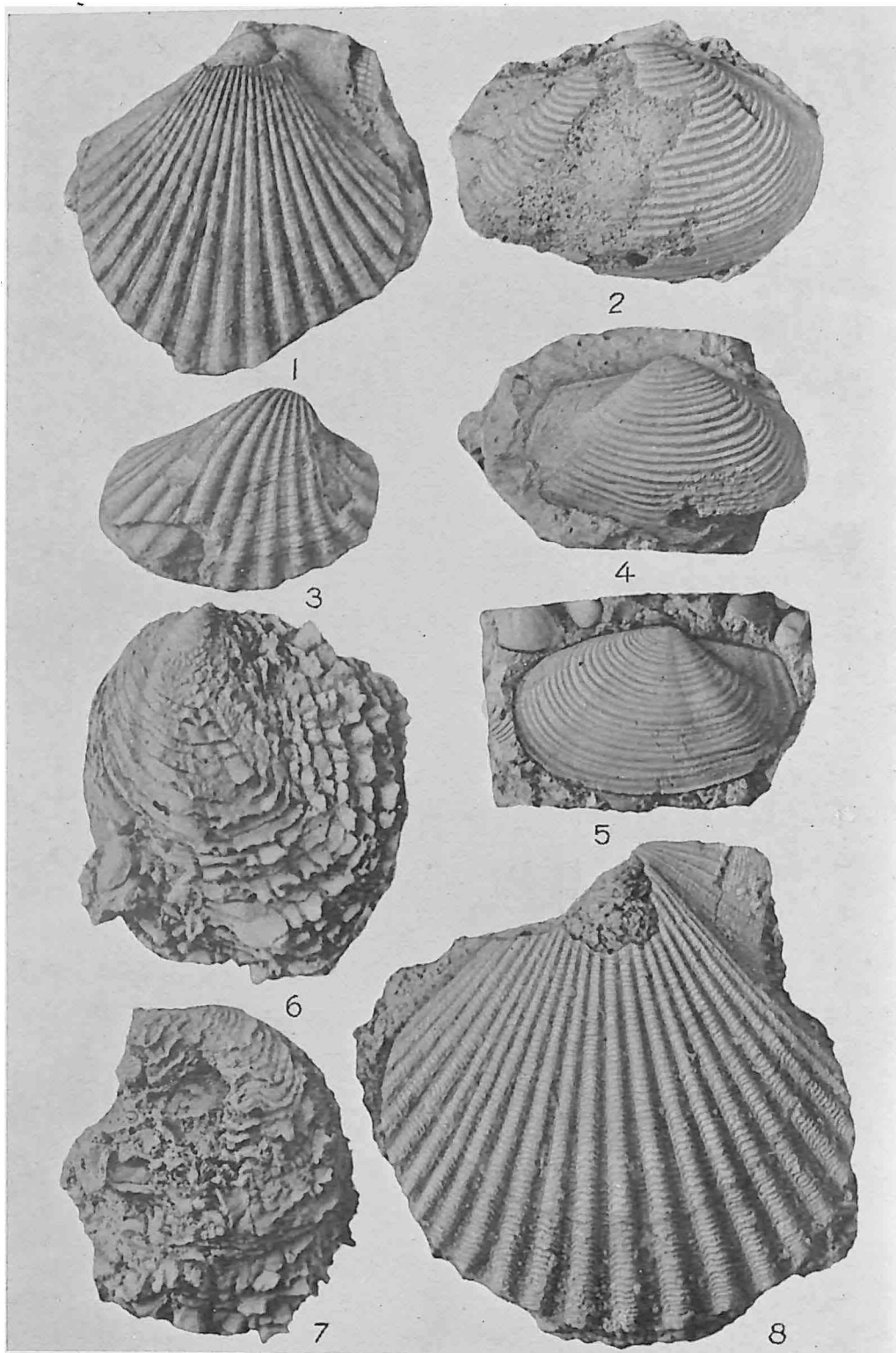
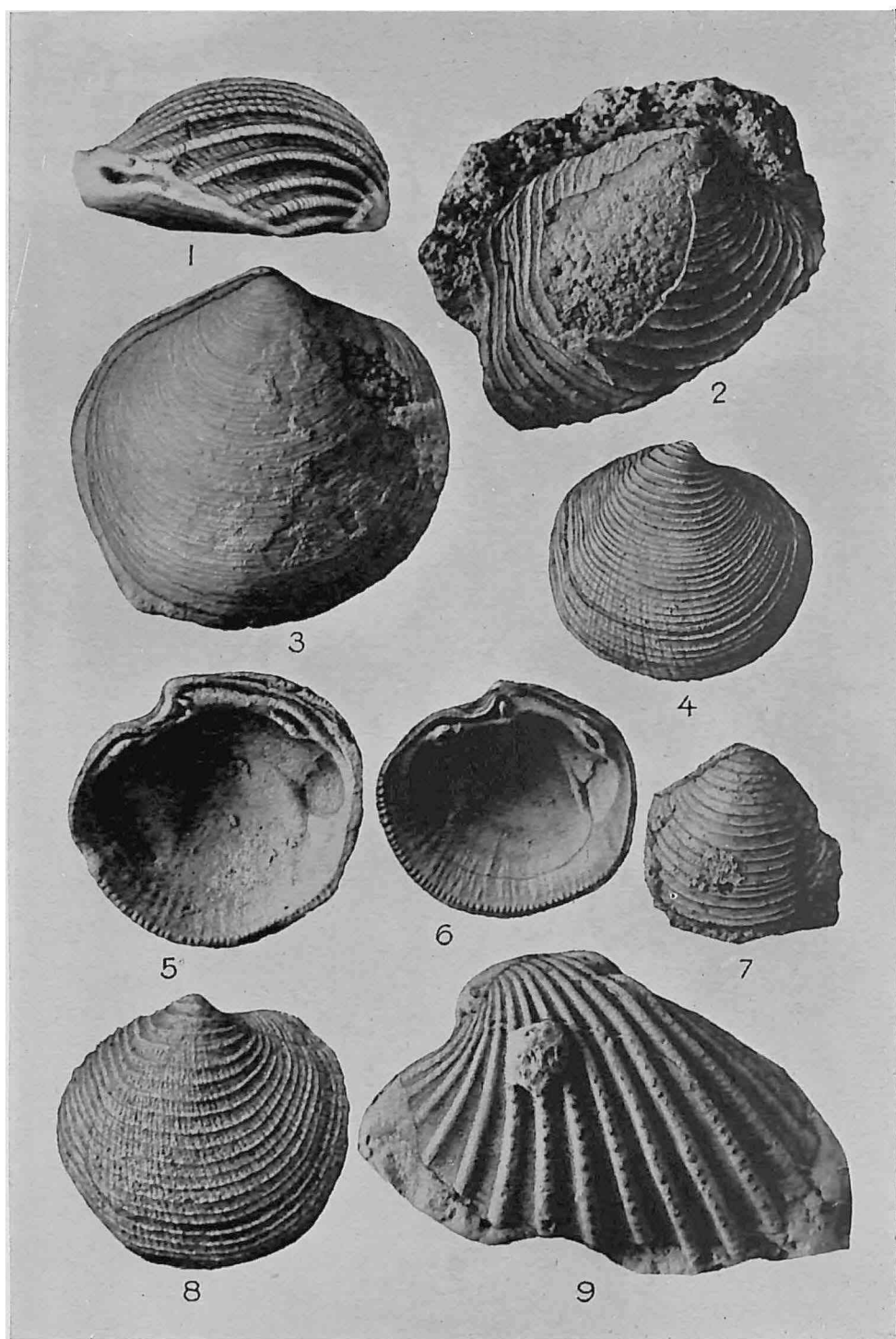


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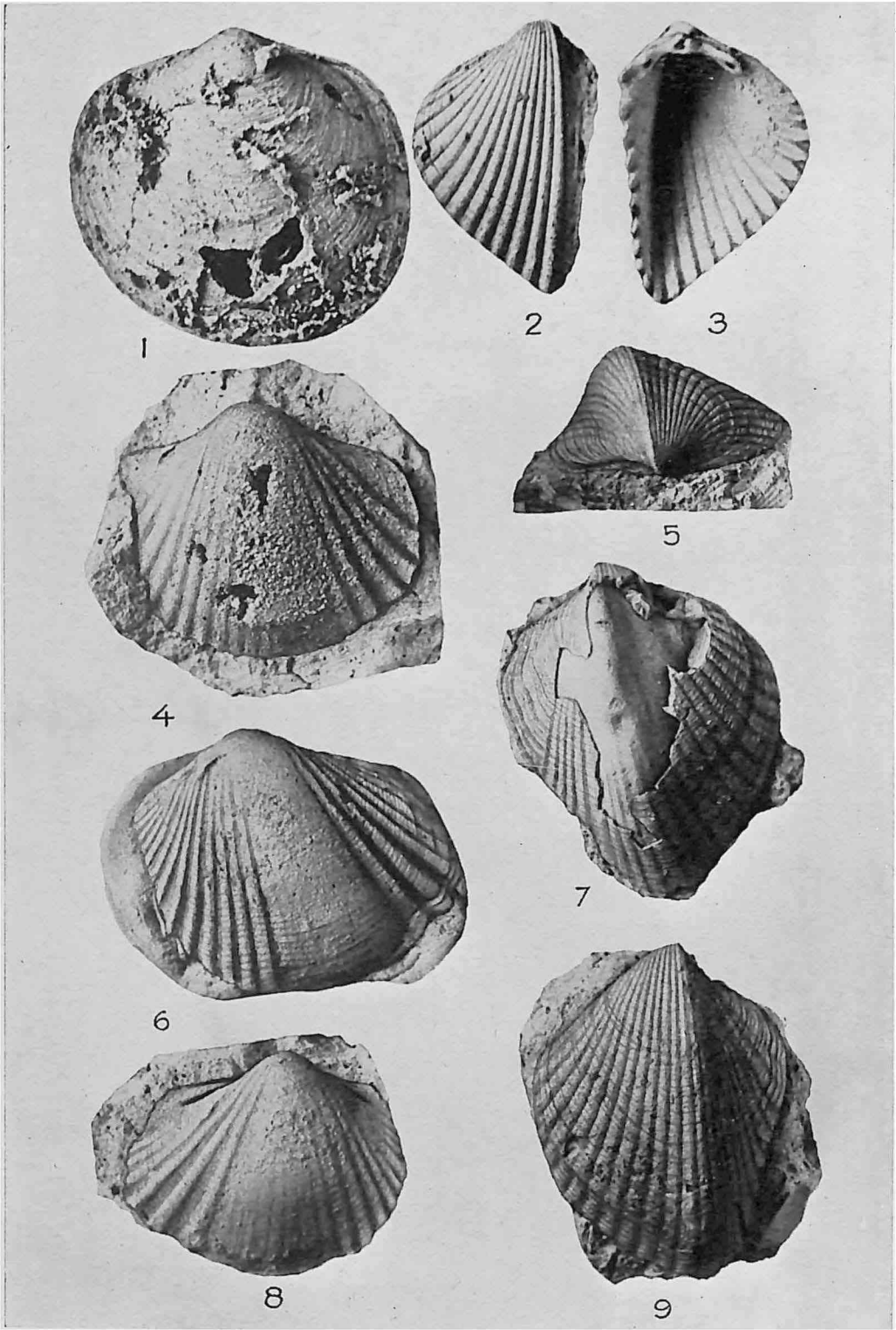
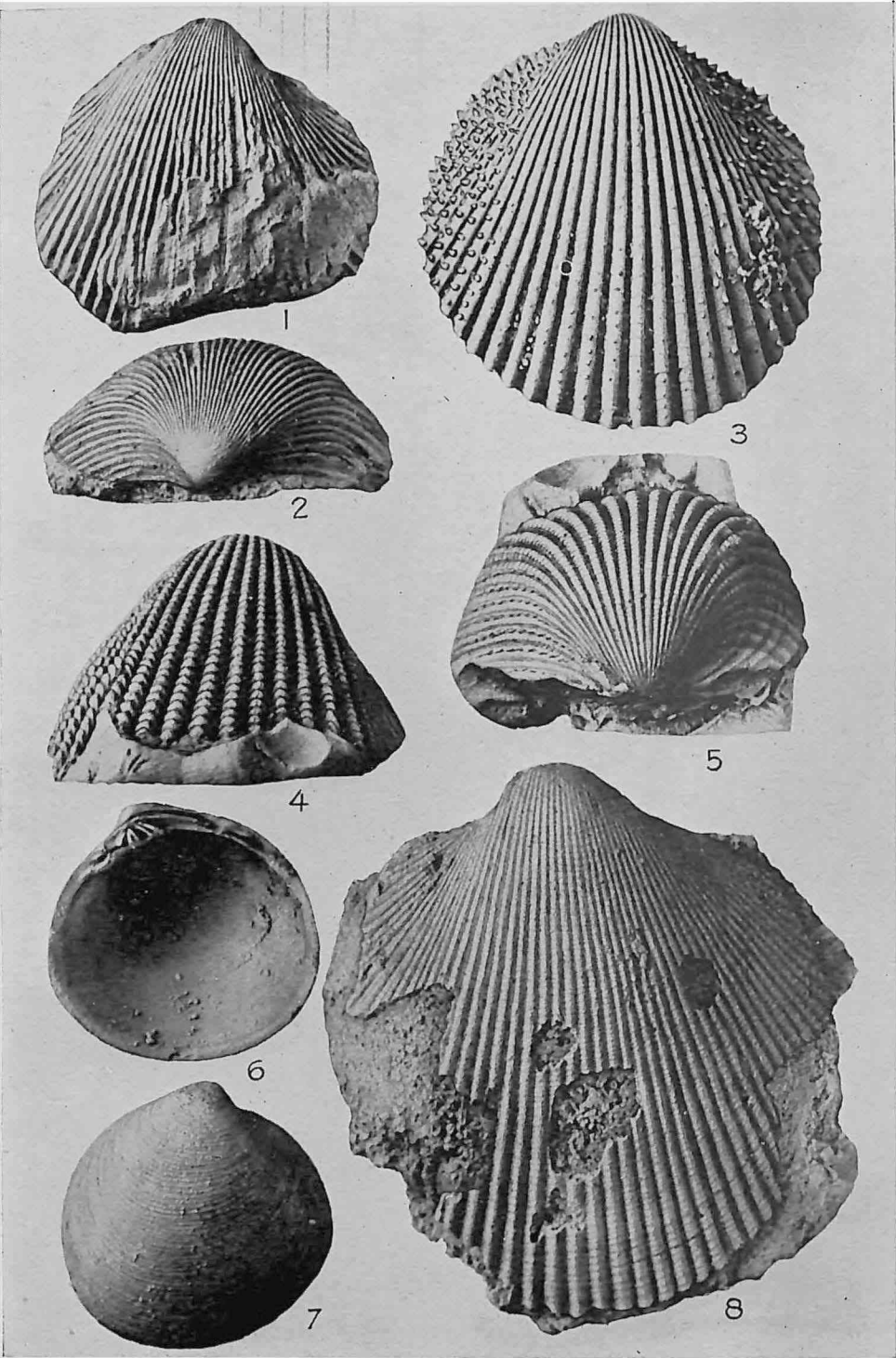


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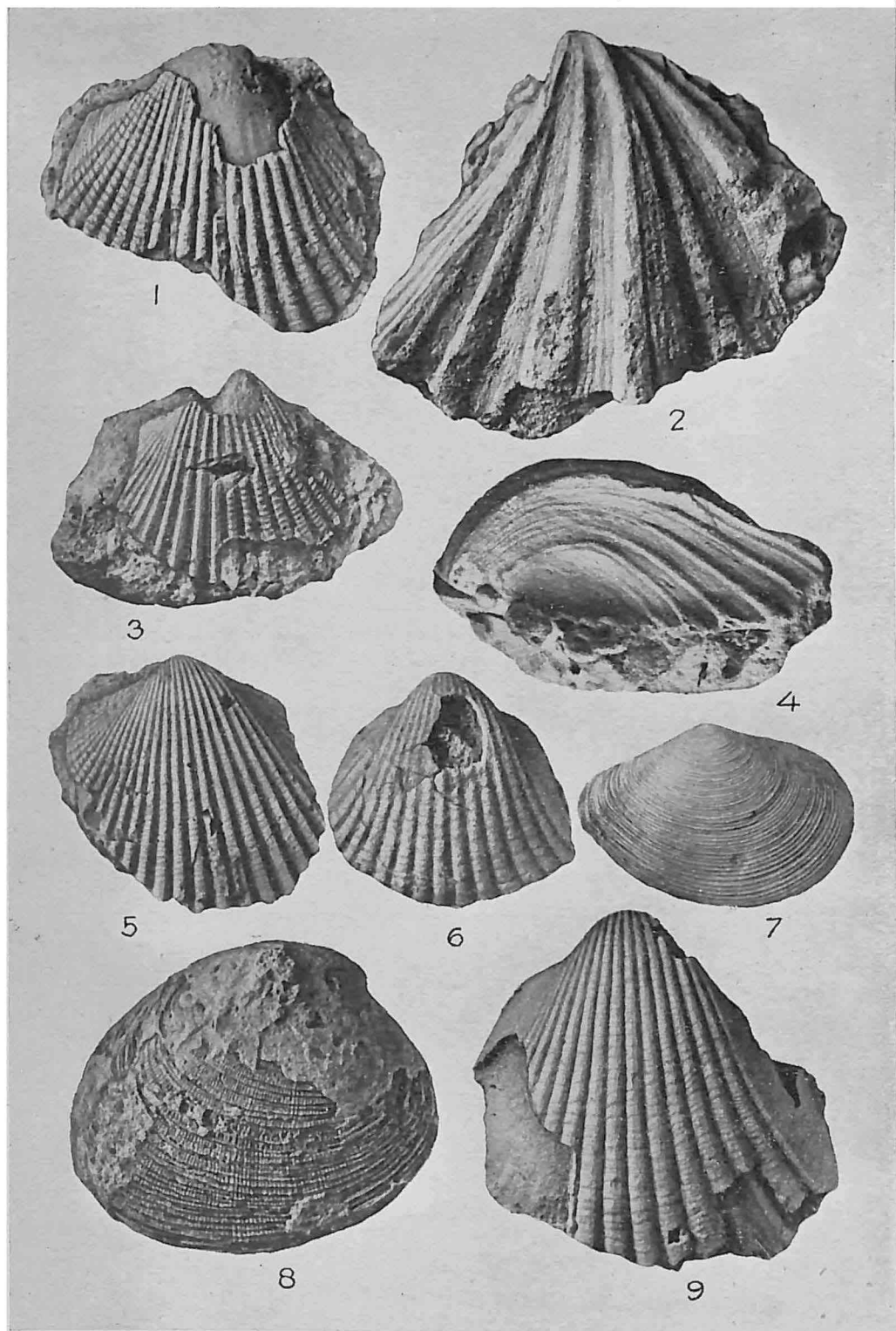
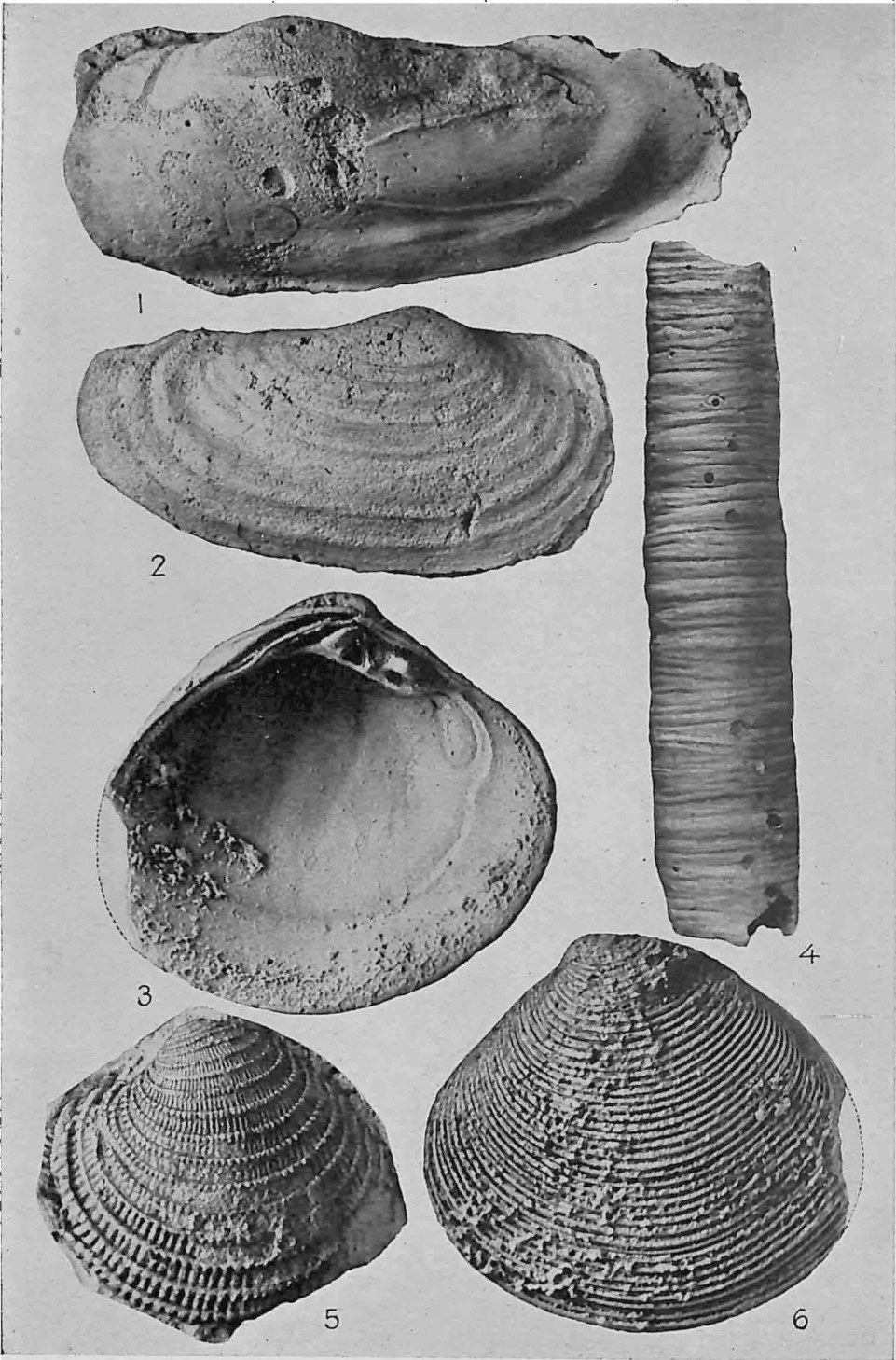


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Turritella megalobasis tripartita	164	willcoxii, Hipponix	171
Turritella pagodaeformis	25, 163	wilsoni, Xancus	112
Turritella subgrundifera	19, 20		
Turritella tamnae		X	
..... 21, 22, 23, 25, 26, 35, 48, 161		Xancus polygonatus 15, 22, 23, 25, 111	
Turritella tampae medioconstricta		Xancus polygonatus suwannensis	
..... 18, 162		 57, 112	
Turritella tarponensis	15, 22, 166	Xancus rex	15
Typhis siphonifera	135	Xancus wilsoni	112
		Xenophora conchyliophora	172
U			
umbonata, Acra 16, 21, 22, 26, 33, 193		Y	
undulata, Astarte	18		
Urocoptis floridana	71	Voldia cf. frater	189

TABLE NUMBER TWO

DISTRIBUTION OF SPECIES OF THE SUWANNEE LIMESTONE

	Pasco County	Hernando County	Columbia County	Suwannee County	Hamilton County	County Taylor	Jefferson County	REMARKS
	7356, 1 mi. N. of Hudson		4960, 6827, 12307, Bass					
	12761, 2 mi. N. of Hudson		6774, 6178, 12745, Island ¾ mi. above White Springs					
	12762, 2¼ mi. S. of Zephyrhills		6818, 12749, ¼ mi. S. E. of Ft. White					
		Brooksville Area	12305, 1½ mi. W. Santa Fe River					
			6821, 12309, Ellaville, highest bed					
			6828, 12746, Falmouth					
			12741-2, 2½ mi. above Ellaville					
			6826, 12308, 11:09, 1½ mi. N. Live Oak					
			6825, 3 mi. W. Live Oak					
			7339, 11110, 12:03, Suwannee Sulphur Springs					
			12739, Suwannee River at Noble Ferry Bridge					
			12738, Suwannee River, 4 mi. above Ellaville					
			12737, 9.7 mi. N. W. of Perry					
			12298, 1½ mi. E. S. E. Flint Rock					
			4990, 12299, Walker Spring					
			2372, "Wacissa Swamp"					
			12301, 10 mi. E. Wacissa					
			12302, 8 mi. E. Wacissa					
GASTROPODA:								
Scaphander sp. -----		X ₃	X					^a Lower part of quarry at Brooksville.
Conus cookei Dall -----		X ₃	X					
Knefastia? brooksvillensis Mansfield -----								
Euclathurella? liveoakensis Mansfield -----								
"Drillia" aff. "Drillia" pleutonica Casey -----						X ₃		Drillia pleutonica is a Vicksburg species.
Olivella liveoakensis Mansfield -----						X		
Olivella brooksvillensis Mansfield -----						X		
Lyria musicina dalli Mansfield -----	X	X				X		
Lyria mississippiensis Conrad? -----						X		
Xancus polygonatus suwannensis Mansfield -----						X		
Vasum engonatum Dall -----						X		
Latirus? sp. -----		X ₃			X	X		The species occurs in the Tampa limestone.
Alectrion sp. a. -----					X	X		^a Lower part of quarry at Brooksville.
Purpura propeposti Mansfield -----					X	X		
Cassia sp. -----		X						
Orthaulax pugna hernandoensis Mansfield -----	X	X	X					At Station 1/103 (Goodman, Fla.); also at Station 8867 (Geneva, Ala.).
Terebellum hernandoensis Mansfield -----		X						
Cerithium pascoensis Mansfield -----		X						
Cerithium liveoakensis Mansfield -----						X ₃		
Cerithium brooksvillensis Mansfield -----		X				X	X	
Cerithium suwannensis Mansfield -----						X		
Potamides cornutus Heilprin -----						X		
Cerithium hernandoensis Mansfield -----		X ₃						The species occurs in the Tampa limestone.
Cerithium vaginatum Dall -----		X ₃						Closely aff. C. halense Dall (Flint River formation).
Modulus liveoakensis Mansfield -----						X		Closely aff. C. vaughani Dall (Flint River Formation).
Turritella bowenae Mansfield -----	X	X	X			X		
Turritella cf. T. halensis Dall -----						X		
Xenophora conchylipora Born? -----		X				X	X	
Ampullina flintensis Mansfield -----		X				X		
"Amauropis" aff. A. burnsi meridionalis Pilsbry -----		X	X			X		Occurs in Flint River formation.
Sinum aff. S. imperforatum Dall -----		X				X		
Calliostoma silicatum Mansfield -----		X	X					
SCAPHOPODA:								
Dentalium ladinum Dall -----			X					
PELECYPODA:								
Glycymeris suwannensis Mansfield -----		X	X			X		
Glycymeris hillsboroughensis Mansfield -----						X		
Glycymeris tuckerae Mansfield -----						X ₃		
Barbatia marylandica Conrad -----						X ₃		
Ostrea aff. O. antiquensis Brown -----			X			X		
Chlamys flintensis Mansfield -----						X	X	
Chlamys aff. C. vaun wythei Hertlein -----						X		
Chlamys brooksvillensis Mansfield -----			X			X		Closely aff. unnamed form from Cedar Grove and 2½ miles S. of Chipley.
Chlamys liveoakensis wannensis Mansfield -----						X	X	
Chlamys liveoakensis Mansfield -----						X		
Lima halensis Dall -----		X						Type from Hale Landing, Ga., Flint River fm.
Modiolus silicatus Dall -----		X	X	X				Also Tampa limestone.
Modiolus blandus Dall -----			X ₃					^a One specimen.
Modiolus grammatus Dall -----			X			X		Also Tampa limestone.
Thracia vicksburgiana hernandoensis Mansfield -----	X		X	X	X	X		
Cardita liveoakensis Mansfield -----			X	X	X	X		
Venericardia serricosta brooksvillensis Mansfield -----			X	X	X	X		
Phacoides wacissanus Dall -----			X	X	X	X		
Phacoides hillsboroensis Heilprin -----		X	X	X	X	X	X	Also Tampa, but larger than Tampa.
Phacoides hernandoensis Mansfield -----		X	X	X	X	X		The species occurs in the Tampa limestone.
Divaricella sp. -----		X				X		
Cardium suwannense Mansfield -----						X		
Cardium aff. C. gadsdenense Mansfield -----	X	X	X			X		
Cardium phlyctaena Dall -----	X					X		
Cardium brooksvillense Mansfield -----		X	X			X		Also occurs in the Tampa limestone.
Cardium precursor Dall -----						X		
Cardium hernandoense Mansfield -----		X				X		A Vicksburg group species.
Pitaria aff. P. imitabilis Conrad -----		X	X	X	X	X		? Tampa limestone.
Chione aff. C. bainbridgensis Dall -----		X	X	X	X	X	X	
Venus? sp. -----		X						
Semele silicata Dall -----	X							The species occurs in the Tampa limestone.
Tellina silicata Mansfield -----								
Panope brooksvillensis Mansfield -----	X	X	X					Closely aff. P. oblongata Conrad (Oligocene).
Teredo? incrassata (Gabb) -----	X	X	X			X	X	
ECHINOIDEA:								
Rhyncholampas gouldii (Bouvé) -----	X	X	X	X	X	X	X	

DISTRIBUTION OF SPECIES IN THE TAMPA LIMESTONE

	Hillsborough County	Polk County	Pinellas County	Pasco County	Marion County	Jefferson County	Walulla County	Leon County	Liberty County	Gadsden County	Calhoun County	Washington Co.	REMARKS
GASTROPODA (land and fresh-water):													
Cepolis (Plagiopitycha) latissima (Dall)	XXXXXX												
Cepolis (Plagiopitycha) instrumosa (Dall)													
Cepolis (Plagiopitycha) dropta (Dall)													
Pleurodonte haruspica Dall			X										
Pleurodonte crassa (Dall)													
Pleurodonte cunctator (Dall)			X										
Pleurodonte kendrickensis Mansfield					X								
Pleurodonte dreyeri (Dall)													
Polygyra adamsi (Dall)	XXXXXX												
Bulimulus (Hyperaulax) floridanus Conrad													
Bulimulus (Hyperaulax) heilprinianus Dall													
Bulimulus (Hyperaulax) americanus (Heilprin)													
Bulimulus (Hyperaulax) americanus wakullaensis Mansfield			X										
Bulimulus (Hyperaulax) tampae Dall													
Bulimulus (Hyperaulax) stevensi Dall													
Bulimulus (Hyperaulax) ballistae Dall													
Bulimulus (Hyperaulax) ballistae Dall													
Bulimulus (Hyperaulax) remolius Dall													
Bulimulus (Hyperaulax) americanus patulinus Dall													
Bulimulus (Hyperaulax) americanus laxus Dall													
Cerion (Eostrophia) anodonta (Dall)			X										
Cerion (Eostrophia) anodonta floridanum Dall													
Microcerion floridanum Dall													
Pupoides pilosus (Dall)	XXXXXXXXXXXXXXXXXXXX												
Urocoptis floridana (Dall)	XXXXXXXXXXXXXXXXXXXX												
Planorbis (Torquus) willcoxii Dall	XXXXXXXXXXXXXXXXXXXX												
Planorbis (Torquus) eliusi Dall	XXXXXXXXXXXXXXXXXXXX												
Stropharia? tampae Dall	XXXXXXXXXXXXXXXXXXXX												
Humboldtiana? tuckerae Mansfield	XXXX		X										
Helicina ballista Dall	XXXX		X										
Helicina ballista tampae Dall	XXXX		X										
Helicina posti Dall	XXXX												
GASTROPODA (Marine):													
Acteon tampae Dall	XXXXXX												
Acteocina westermilleri Lea?	XXXXXX												
Acteocina squarrosa Dall	XXXXXX												
Tectusa? vaginata Dall	XXXXXX												
Scaphander ballistae Mansfield	XXXXXX												
Haminea? sulcosulcata Dall	XXXXXX												
Terebra (Strophotrebra) ballista Mansfield	XXXXXX												
Conus holus Dall	XXXXXX		X										
Conus planiceps Heilprin	XXXXXX												
Conus planiceps wakullaensis Mansfield	XXXXXX												
Conus designatus Dall	XXXXXX												
Polyspira sp. f. alba (Perry)	XXXXXX												
Polyspira tampensis Mansfield	XXXXXX												
Fusiturricula condonina (Dall)	XXXXXX												
Fusiturricula condonina severina (Dall)	XXXXXX												
Fusiturricula condonina silicata Mansfield	XXXXXX												
Fusiturricula? aff. F. servata (Conrad)	XXXXXX												
Fusiturricula lapenoterei (Dall)	XXXXXX												
Crassispira sella (Dall)	XXXXXX												
Crassispira eupora (Dall)	XXXXXX												
Crassispira amila (Dall)	XXXXXX												
Crassispira euectora (Dall)	XXXXXX												
Syntomodrillia spica (Dall)	XXXXXX												
Syntomodrillia tecta (Dall)	XXXXXX												
Syntomodrillia newmani (Dall)	XXXXXX												
Syntomodrillia glyptostoma (Dall)	XXXXXX												
"Drillia" silfa Dall	XXXXXX												
"Drillia" illota Dall	XXXXXX												
Cancellaria (Trigonostoma) subthomasi Dall	XXXXXX												
Cancellaria (Trigonostoma) depressa Dall	XXXXXX												
Oliva posti Dall	XXXXXX												
Olivella lata Dall	XXXXXX												
Olivella colleta Dall	XXXXXX												
Olivella eutorta Dall	XXXXXX												
Ancilla shepardii Dall	XXXXXX												
Marginella (Prunum) ballista Dall	XXXXXX												
Marginella (Prunum) ballista tampae Dall	XXXXXX												
Marginella (Prunum) intensa Dall	XXXXXX												
Marginella (Prunum?) myrina Dall	XXXXXX												
Marginella (Porcellanella) gregaria Dall	XXXXXX		X										
Marginella (Porcellanella) gregaria silicata Mansfield	XXXXXX												
Marginella (Porcellanella) posti Dall	XXXXXX												
Marginella (Porcellanella) bellia Dall	XXXXXX												
Marginella (Porcellanella) inepta Dall	XXXXXX												
Marginella (Porcellanella) infecta Dall	XXXXXX												
Marginella (Porcellanella) faunula Dall	XXXXXX												
Marginella (Serrata) mollitor Dall	XXXXXX												
Marginella (Serrata) newmani Dall	XXXXXX												
Marginella (Serrata) elegantula	XXXXXX												
Marginella (Serrata) immanis Dall	XXXXXX												
Lyria muscinea Heilprin	XXXXXX												
Lyria heilprini Dall	XXXXXX		X										
Lyria heilprini tampensis Mansfield	XXXXXX												
Mitra (Tara) silicata Dall	XXXXXX												
Mitra cf. M. prodoma Gardner (Ms.)	XXXXXX												
Vexillum (Tromita) syrum (Dall)	XXXXXX												
Vexillum (Tromita) myrrum (Dall)	XXXXXX												
Conomitra angulata (Heilprin)	XXXXXX												
Ganaca polygonus (Heilprin)	XXXXXX												
Vasum subcapitellum Heilprin	XXXXXX												
Vasum enegatum Dall	XXXXXX												
Pasciolaria petrosa Dall	XXXXXX												
Latirus floridanus Heilprin	XXXXXX												
Latirus multilinctus Dall	XXXXXX												
Latirus callimorphus Dall	XXXXXX												
Latirus rugatus Dall	XXXXXX												
Fusinus ballista Dall	XXXXXX												
Fusinus nexilis Dall	XXXXXX												
Busycyon tampensis Dall	XXXXXX												
Busycyon tampensis ballastense Mansfield	XXXXXX												
Busycyon tampensis perizonatum Dall	XXXXXX												
Busycyon stellatum Dall	XXXXXX												
Melongenella turricula Dall	XXXXXX												
Melongenella turricula Dall?	XXXXXX												
Solenostoma quinquespina (Dall)	XXXXXX												
"Phos" urens (Dall)	XXXXXX												
Cantharus palper Dall	XXXXXX												
Alectron ethelinda Dall	XXXXXX												
Alectron sp. b. aff. A. harrisi Maury	XXXXXX												
Mitrella turgida (Dall)	XXXXXX												
Mitrella acanthodes (Dall)	XXXXXX												
Mitrella cluthera (Dall)	XXXXXX												
Mitrella? dicaria (Dall)	XXXXXX												
Anachis? eutheria Dall	XXXXXX												
Murex tritropis Heilprin	XXXXXX												
Murex trophoniformis Heilprin	XXXXXX												
Chicoreus larvaecosta (Heilprin)	XXXXXX												
Chicoreus crispangula (Heilprin)	XXXXXX												
Chicoreus burnsi Whitfield?	XXXXXX												
Purpura (Parapurpura) posti Dall	XXXXXX												
Typhis siphonifera Dall	XXXXXX												
"Murexides" heilprini Cossmann	XXXXXX												
Eupleura sexangula (Dall)	XXXXXX												
"Trilonella" scabra Dall	XXXXXX												
Corallophila magna Dall	XXXXXX												
Urosalpinx? inornata (Dall)	XXXXXX												
Urosalpinx? hillsboroensis Mansfield	XXXXXX												
Rapana tampensis Dall	XXXXXX												
Rapana bicoloris Dall	XXXXXX												
Rapana vaughani Mansfield	XXXXXX												
Cyprea tumulus Heilprin	XXXXXX												
Cyprea tumulus ballista Dall	XXXXXX												
Morum chipolanum tampanum Mansfield	XXXXXX												
Morum cf. chipolanum Dall M. S.	XXXXXX												
Orthaulax inornatus Gabb	XXXXXX												
Orthaulax pugnax (Heilprin) Dall	XXXXXX												
Strombus loeculus Dall	XXXXXX												
Cerithiopsis silicata Dall	XXXXXX												
Bitium praeum Dall	XXXXXX												
Bitium (praeum var.?) sora Dall	XXXXXX												
Bitium adela Dall	XXXXXX												
Cerithium praecursor Heilprin	XXXXXX												
Cerithium plectrum Dall	XXXXXX												
Cerithium species	XXXXXX												
Cerithium aff. georgianum Lyell and Sowerby	XXXXXX												
Potamides (Lampadella) transecta Dall	XXXXXX												
Potamides hillsboroensis (Heilprin)	XXXXXX												
Potamides aspinosus Mansfield	XXXXXX												
Potamides (Pyrazisinus) campanulatus Heilprin	XXXXXX												
Potamides (Pyrazisinus) cernuus Heilprin	XXXXXX												
Potamides (Pyrazisinus) acutus Dall	XXXXXX												
Modulus turbinatus (Heilprin)	XXXXXX												
Serpulorbis ballistae Dall	XXXXXX												
Serpulorbis granifera (Say)?	XXXXXX												
Petalocochus varians D'Orbigny?	XXXXXX												
Siliquaria tampensis Mansfield	XXXXXX												
Turritella tampae Heilprin	XXXXXX												
Turritella tampae medicostriata Dall	XXXXXX												
Turritella pagodiformis Heilprin													

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