

**FOSSILS OF THE PLIOCENE ("FLORIDIAN") FORMATION
OF THE CALOOSAHATCHIE.**

Murex imperialis, Swainson.

Zoological Illustrations, 2d ser., ii, p. 67.

Tryon, Manual of Conchology, ii, p. 101, pl. 23, fig. 206.

A limited number of individuals from the banks of the Caloosahatchie below Fort Thompson, showing no essential variation from the living form. The occurrence of this species in the Pliocene deposits of the State practically determines its true home to be the Atlantic border of America and not the Pacific coast, as is frequently asserted (Reeve, *Conchologia Iconica*, *Murex*, sp. 42).

Murex brevifrons, Lam., *var. calcitrapa*, Lam.

Animaux sans Vertèbres, ix, p. 573.

Tryon, Manual of Conchology, ii, p. 95, pl. 19, fig. 175.

Banks of the Caloosahatchie below Fort Thompson.

All the specimens obtained by us appear to be immature forms, and none would measure, if perfect, more than an inch and a half in length. I can detect no character by which to distinguish them from the recent form, unless it be in a greater regularity and prominence of the revolving lines, and a further projection of the variceal spines. The species also grades into *M. crocatus*, which appears to be nothing more than a nodulose variety of *M. brevifrons*.

Fusus Caloosaensis, nov. sp. Fig. 1.

Shell typically fusiform, of about ten volutions; spire acuminate, about one-third the length of shell, with a slightly papillate apex; whorls sub-angular, longitudinally ribbed, and crossed by somewhat distantly-placed, elevated, revolving lines, the median two of which on the whorls above the body-whorl appear more developed than the others.

Body-whorl with about nine revolving lines, the two on the shoulder, with occasional intermediate finer lines, least prominent; aperture semi-oval, with a long, nearly straight canal, of about twice its own length, the two combined considerably more than one-half the length of the entire shell; outer lip thin, striated internally.

Length, 2.2 inches; width, .6 inch.

Caloosahatchie, in the banks below Fort Thompson.

This shell most nearly resembles among living forms *Fusus Dupetit-Thouarsi*, but differs from it in its subangular whorls (evenly convex in

the latter), and the absence of the numerous lines on the shoulders. In the first of these characters, as well as in the smaller number of revolving lines, it also differs from the closely resembling *Fusus Henekeni* of Sowerby, a common Miocene fossil of the West Indies.

Fasciolaria scalarina, nov. sp. Fig. 2.

Shell sub-fusiform, of about ten volutions, longitudinally ribbed or plicated; spire elevated, nearly one-third the length of shell; whorls convex, those of the spire angulated at about the middle, crossed by numerous elevated, and more or less rounded, revolving lines, from ten to fourteen on each of the more prominent whorls; central line most prominent, forming the median angulation or carination; interstitial finer lines present at irregular intervals.

Body-whorl with about 15-20 ribs or plicæ, which, as a rule are less prominently angulated than those of the spire, making the shell appear more regularly convex; revolving lines somewhat over thirty, a limited number of which are interstitial; aperture about one-half the length of shell, or somewhat over, produced anteriorly into a broad canal of moderate length; outer lip prominently lined on the inside; columella with two very oblique folds, the lower of which is practically obsolete.

Length, 6.5; width, 2.5 inches.

In the banks of the Caloosahatchie, below Fort Thompson.

The only American *Fasciolaria* to which this species bears any great resemblance is *F. Sparrowi* of Emmons (North Carolina Geol. Surv., 1858, p. 253, fig. 115), from the Miocene of North Carolina, or at any rate, a fossil from that State which has been identified as such by Conrad. I find in the collections of the Academy of Natural Sciences of Philadelphia two specimens of a large *Fasciolaria* marked by Conrad "*F. Sparrowi*, Emmons, N. C.," and have every reason to believe that the forms so identified are Emmons' species, although differing widely from the description given by that geologist. This description is, however, very vague, and manifestly erroneous in several of its details, so that little satisfaction can be derived from it; Emmons' figure more nearly resembles the fossil in question, and this fact, combined with the knowledge that Conrad had access to the collections of the Carolina survey, lead me to assume the correctness of the latter paleontologist's identification.

From the *Fasciolaria Sparrowi*, recognized as such, the Florida fossil differs in the lesser convexity, and more pronounced median angulation of the whorls of the spire, the greater number and prominence of the longitudinal ribs, which are largely obsolete on the body-whorl of *F. Sparrowi*, the greater relative elevation of the spire, and the absence of the regular alternation of coarse and fine revolving lines seen in the Carolina species.

Among recent forms the species apparently most nearly related to *Fasciolaria scalarina* is *F. filamentosa* of Chemnitz, from the Indo-Chinese seas. This species has much the habit of the American form, but is largely deficient in the number of longitudinal ribs, which are also much more distinctly nodose, and bring about a very prominent angulation to the whorls of the spire not less than to the body-whorl; the columellar plaits are three in number, instead of two. The same characters approximately serve to distinguish *F. scalarina* from the European Miocene *F. Tarbelliana* of Grateloup (Atlas Conch. Foss. Bassin de l'Adour, pl. 23, fig. 14; Hörnes, Die fossil. Mollusken d. Tertiär-Beckens von Wien, 1, p. 298, pl. 33, figs. 1-4), which, if not identical with the recent form above referred to, is certainly very closely related to it.

***Fasciolaria gigantea*, Kiener.**

Icon. Coq. Viv. p. 5, pl. 10, 11.

Tryon, Manual of Conchology, iii, p. 75, pl. 60, fig. 14-16.

Two specimens of this large conch were found in the upper part of the banks below Fort Thompson, on the verge of the Post-Pliocene layer. They do not seem to differ essentially from the living form. The nodes appear somewhat less prominent, and are in a measure indented through a passing shallow sulcus.

***Fasciolaria tulipa*, L.**

Syst. Nat., 12th ed., p. 1213.

Tryon, Manual of Conchology, iii, p. 74, pl. 59, figs. 1-5.

In the banks of the Caloosahatchie, below Fort Thompson.

The largest specimen measures just six inches in length. A probable variety of this species, with a more elevated spire and a correspondingly depressed aperture, appears to be identical with the variety figured by Tuomey and Holmes in their work on the Pliocene fossils of South Carolina, pl. 30, fig. 8.

***Melongena subcoronata*, nov. sp. Fig. 3.**

Shell broadly-turbinata, of about five volutions; spire moderately elevated, scalariform, its rounded whorls profoundly ribbed, subangulated or carinated medially, and crossed by numerous well-defined revolving lines, which alternate as coarser and finer striæ; the ribs of the whorl next to the body-whorl, and sometimes also the one above, distinctly tuberculated or spinose, or even coronated.

Body-whorl very ventricose, obtusely angulated above, with a row (in presumably adult individuals) of from eight to ten prominent scaly tubercles, which stand outward from the shoulder angulation; a single row of supra-basal tubercles, six or seven in number, some of which are developed into short pyramidal spines; entire surface covered with coarse, closely arranged striæ, which may become partially obsolete on the shoulder.

Columellar surface broad, slightly flattened, completely covered by the thin labium; aperture about two-thirds the length of shell, or less, quadrangular, broadly-open.

Length of largest specimen, somewhat more than four inches; greatest width, over the shoulder angulation, 2.7 inches.

Caloosahatchie, in the banks below Fort Thompson.

This species closely resembles the recent *Melongena corona* of the southern coast, and, at first sight, can be readily mistaken for it. But it differs in the greater elevation of the spire, the obtuseness of the shoulder angulation (shoulder concave in *M. corona*), the much smaller number of spines, both on the superior and inferior carinations, the nature of the spines or tubercles, which are much more nearly closed (less scaly) in *M. subcoronata*, and in the circumstance that the shoulder spines are directed outward, and not upward and inward, as we find them in *M. corona*.

Fulgur rapum, nov. sp. Fig. 4.

Shell pyruliform, closely inwound, with a short depressed spire; whorls of the spire about five, gently crenated basally (or above the sutural line); apex papillate.

Body-whorl ventricose, high, convex, sub-angulated above, and to an extent also inferiorly, somewhat nodulose on the rounded shoulders; neither true tubercles nor spines; tendency to nodulation in some cases entirely wanting; aperture of nearly the entire length of the shell, elliptical above, and produced into a long, narrow, straight canal, which is slightly deflected to one side; outer lip strongly lined internally.

Columella arcuate, rapidly contracting the aperture at the beginning of the canal; columellar fold not very prominent. The entire surface of the shell covered with closely-placed, moderately elevated, revolving striæ, which have a gently sinuous outline, and exhibit a distinct alternation of coarser and finer lines.

Length, 6.5 inches; width, 3.5 inches.

In the banks of the Caloosahatchie, below Fort Thompson.

None of the recent species of *Fulgur* at all approach this shell, and even among the fossil species there is none from which it cannot almost immediately be distinguished. The species that most nearly resembles it is undoubtedly the form figured by Conrad on pl. 47 of his *Medial Tertiary Fossils* (1839) as *F. maximus*, which has apparently never been described. The ornamentation of this shell is practically identical with that of *F. rapum*, but it can be readily distinguished by its broad and arcuate canal, and the more elevated and scalariform spire. The swelling along the base of the body-whorl in *F. maximus* also helps to identify the species.

Fulgur maximus.

Conrad, Fossils of the Medial Tertiary Formations, pl. 47, not described.

Gill, "On the Genus Fulgur and its Allies," Am. Journ. Conch., iii, p. 46 (enumeration of species only).

Shell sub-pyruliform, with a short scalariform spire; spiral whorls about five, convex, slightly hollowed above the middle, the upper two or three gently carinated and crenulated.

Body-whorl ventricose, somewhat concave on the shoulder, which supports a number of irregularly placed, and not clearly defined nodules; longitudinal lines of growth well-marked, disfiguring the surface of the shell; an irregular swelling near the base of the whorl; aperture nearly four-fifths the length of the shell, oval above, produced into a broad and open arcuate canal; outer lip striated internally.

Columella sigmoidal, its surface covered with a thin callus; columellar fold nearly obsolete. The entire surface of the shell covered with numerous slightly wavy revolving lines, which in a measure alternate in size.

This species, in its typical form, cannot readily be confounded with any of its immediate congeners; the absence of well-defined tubercles serves to distinguish it almost at a glance. But the incipient nodulation seen in some, or most of the specimens, becomes much more sharply defined in others, and, indeed, advances with such gradational steps that a continuous passage is led up to the prominently tuberculated *F. Tritonis* (Conrad, Proc. Acad. Nat. Sciences, 1862, p. 583), from the Miocene of Virginia, and from this again, by insignificant changes, to *F. filiosus* (Proc. Acad. Nat. Sciences, p. 286), from the same series of deposits. The gradation is absolute, and permits of no natural separation of the different forms here indicated. Whether or not, therefore, these forms are to be regarded as distinct species, or as varieties representing but a single species, with well-marked characters defining the extreme forms, is of little moment. That they are modifications of, or derivatives from, one and the same form, there is, it appears to me, very little doubt.

This species I identified among the fossils of the Caloosahatchie by a limited number of specimens. The largest of these, which measures upwards of five and a half inches in length, is absolutely undistinguishable in character from the Miocene fossil.

Fulgur contrarius, Conrad.

Am. Journ. Science, xxxix, p. 387; Fossils Medial Tert. Form. U. S., pl. 45, fig. 11.

Busycon perversum, Emmons, North Carolina Geol. Rept. p. 249, fig. 107.

Common in the banks of the Caloosahatchie, below Fort Thompson.

This shell has the general character of *Fulgur rapum*, from which it differs in being sinistral. Dr. Gill, in his review of the genus Fulgur (Am. Journ. Conch., iii, p. 144), remarks that in the greater number of sinistral shells the form is not more obliquely wound than in the dextral,

as may be proved by the use of a mirror. This may or may not be true as a general thing, but the rule certainly does not hold in the case of the mutually representative species here referred to. The obliquity in *F. contrarius* is decidedly more pronounced than in *F. rapum*.

I am not exactly satisfied as to the relation which this species holds to the recent forms. It certainly most nearly approaches *F. perversus* of Linnæus, and I must admit that it is undistinguishable from some of the non-spinose varieties that are usually referred to this species. Whether these last, however, are specifically distinct from the typical spined *F. perversus* I am not prepared to say; they certainly have much the same general facies, and they would appear to grade into one another. Still, the distinguishing characters—rounded body-whorl, absence of spines, and a more closely-enveloping spire in the non-typical form—are well-marked, especially in the case of the fossils, where they appear to be constant, and may serve to characterize a good species. But whether distinct or not, it is positive that the fossil is represented in the living fauna. Our collection contains one very ponderous form, which retains all the distinctive characters of the smaller individuals, and may be immediately separated from *F. perversus* by its great convexity, the rounded outline of the body-whorl, and its pear-form.

Dr. Gill (*op. cit.*) erroneously refers to this species the form described by Tuomey and Holmes, in their work on the Pliocene Fossils of South Carolina, as *Busycon perversum* (pl. 29, fig. 3). The species in question is Conrad's *F. adversarius*, referred to (*Am. Journ. Conch.*, iii, p. 185) as the "only reversed form with tubercles instead of spines," but which, as far as I am aware, has thus far never been described.

Fulgur excavatus, Conr.

Am. Journ. Science, xxxix, p. 387; *Foss. Med. Tert. Form.*, pl. 45, fig. 12.

Cassidulus Carolinensis, Tuomey and Holmes, *Pliocene Foss. S. Carolina*, p. 147, pl. 30, fig. 1.

Common on the banks of the Caloosahatchie, below Fort Thompson.

The typical forms of this species can be readily distinguished from the recent *F. pyrum*, Dillw., by its scalariform spine, more depressed, and slender body, and the much deeper sub-sutural canaliculation, which is also carried further towards the apex. The shell, in addition, appears to be considerably thicker. But these characters do not appear to be invariable, and I am far from satisfied that the species ought not to be classed rather with the recent form than as a distinct type. Numerous intermediate stages unmistakably unite it with *F. pyrum*. As is the case with the last, this species also exhibits a marked variation in the amount of angulation of the body-whorl, sometimes appearing merely rounded, with only a faint trace of carination, at other times very sharply angulated, and with a decidedly concave shoulder.

Fulgur pyrum, Dillwyn.

Catalogue, 485.

Tryon, Manual of Conchology, iii, p. 143, figs. 402, 403.

One of the specimens that might be said to constitute the *Fulgur excavatus* series is unquestionably the recent form. It proves the impracticability of drawing closely delimited division lines, where specific characters so closely approach one another, and demonstrates the necessarily arbitrary classification which the evidences of transformism must carry with them.

Fulgur pyriformis, Conr.

I have been unable to find a description of this species, and only know it from a specimen in the Academy's collection marked such in Conrad's handwriting. It is identical with the scalariform varieties (so considered) of *F. pyrum* (*F. plagosus* of Conrad?), which in several characters depart widely from the typical forms of that species, and might, perhaps, with propriety be considered distinct. It stands intermediately between *F. excavatus* and *pyrum*.

Banks of the Caloosahatchie below Fort Thompson.

Turbinella regina, nov. sp. Fig. 5.

Shell ovate-oblong, sub-fusiform; spire elevated, gradually tapering, and consisting of from eight to ten volutions; whorls nearly flat, or slightly convex, somewhat angulated above, and only nodulose in the region of the apex; surface covered with revolving raised lines, about five on each whorl below the upper angulation, above which they are less pronounced and more closely placed.

Body-whorl convex, considerably longer than one-half the length of the shell, and ornamented by numerous raised lines, similar to those found on the other whorls. Toward the base these lines become more crowded, somewhat flexuous and coarse, appearing in the form of paired rugations; suture impressed; aperture elliptical, produced into a straight, but deflected, canal of considerable length.

Columellar surface covered with a thick deposit of callus, which leaves partially uncovered a long and narrow umbilicus; columellar plaits three, the median one of which is the strongest.

Length of longest specimen—imperfect below and above, and lacking probably an inch and a half—eleven inches; width across the centre, four inches.

Caloosahatchie, in the banks below Fort Thompson.

We found but two specimens of this stately *Turbinella*, which in linear measure surpasses all other species of the genus, with the exception of *T. scolymus*. In its general characters it most approximates among recent forms *Turbinella ovoidea* of Kiener (Icon. Coq. Viv., 7), which is

said to inhabit the coast of Bahia, Brazil, and is not an uncommon species in the Miocene deposits of Santo Domingo (Gabb, "Santo Domingo," Trans. Am. Phil. Soc., xv, p. 218), but differs in its much more ponderous proportions, the greater relative elevation of the spire, the absence of well-marked nodulations on the whorls of the spire, and the smaller number of prominent revolving lines on the whorls of the spire. The body-whorl also lacks the basal quadrangulation seen in *T. ovoidea*. I know of no fossil form that in any way approaches the Florida species, nor any species of the existing Gulf fauna that is as near to it as *T. ovoidea*.

Vasum horridum, nov. sp. Fig. 6.

Shell ovate, thick, ventricose, with the greatest width at about the middle; spire elevated, about one-fourth the length of the shell, and consisting of ? nodulose volutions.

Body-whorl strongly angulated on the shoulder—the angulation being at an angle of about 45 degrees to the outer wall—and probably prominently coronated with foliaceous or lamellar tubercles; surface, as well as that of the rest of the shell, profoundly grooved, with about eight sharply elevated revolving ridges below the shoulder angulation, the sixth and seventh from the top most prominent, and separated from each other by a space equal to two of the other interspaces; sutural line somewhat impressed, and bordered inferiorly by a lamellar ridge; aperture produced posteriorly into a short canal, somewhat more than one-half the length of the shell.

Columellar surface covered with a thick deposit of callus, which leaves partially exposed a broad umbilicus; columellar plaits three, of which only the upper two are prominent, the basal one being rudimentary.

Length of imperfect specimen, lacking probably a full half-inch, about five and a half inches; width, three and a half inches.

Caloosahatchie, in the banks below Fort Thompson.

We obtained but a single adult specimen of this large *Vasum*, which apparently exceeds all other species of the genus in size. Unfortunately, its imperfect condition prevents the absolute determination of all its characters, but sufficient remains to indicate that it is a clearly-defined species. There are but few traces of the coronating tubercles left, but I think there can be no doubt, seeing the acute angulation of the shoulder, and the character of the spines in the young shell, that the tubercles were squamose, as in the East Asiatic *V. imperialis* and not of the typical blunt type seen in our southern *V. muricatum*. From the latter, apart from the character just indicated, the Florida fossil differs in its less turbinated form, the greater length of its spire, the smaller number and much

greater prominence of its revolving ridges, and in the deficiency of its columellar plaits. The shoulders of the whorls are also much less depressed than in the recent species, rising at a considerable angle instead of being nearly flat.

In the sum of its characters the Florida fossil appears to be most closely related to *Vasum imperialis*, but unfortunately this assumption is based solely upon an examination of the figures and description of that form, the collections of the Academy of Natural Sciences, otherwise so rich in the department of conchology, being deficient in the species.

Genus **MAZZALINA**, Conrad.

This genus was constituted by Conrad for the reception of an Eocene fossil from Claiborne, Ala., which in general characters approximates the recent forms now generally referred to *Lagena* of Schumacher. The genus is thus briefly characterized (Journ. Acad. Nat. Sciences of Philadelphia, 2d ser., iv, p. 295): "Turbinate, smooth; columella projecting interiorly and furnished with closely arranged, oblique, obtuse plaits." Mr. Tryon, in monographing the species of recent shells, appears to have overlooked this description, for in the appendix to his review of the family Fusidæ (Manual of Conchology, iii, p. 225, 1881) he makes the following statement: "Genus *Mazzalina*, Conrad, not characterized;"—and further: "The type [*M. pyrula*] appears to be very similar to *Lagena*, Schum., if not identical with that genus. I figure it from the original specimen."

The reference of the genus to *Lagena* is, I believe, erroneous, and is probably founded upon an imperfect examination of the unique specimen, which is decidedly *Lageniform*, and the assumption that other specimens, if found, would depart somewhat from the type, and more nearly approximate the recent form. In the light of additional specimens obtained during our recent explorations, I can affirm that the characters, such as they are, separating *Mazzalina* from *Lagena* are distinct and permanent, and leave no doubt as to the propriety of separating the two genera (or sub-genera). These characters are most clearly exhibited in the peculiarly flexuous disposition of the columella, the deflected and produced canal, obliquity of the columellar plaits, and the absence of an umbilicus. The general form of the shell, too, is rather pyriform than bucciniform.

Mazzalina bulbosa, nov. sp. Fig. 7.

Shell bulbiform, or imperfectly pear-shaped, ventricose, thin in substance; spire conical, made up of about six convex whorls; aperture about two-thirds the length of the shell, oval, and produced anteriorly into a (deflected) canal of moderate length; outer lip thin, notched below

the sutural line, forming a prominent sinus, and crossed on its inner face by numerous parallel, raised (revolving) lines; columella conspicuously arched or flexed, with some five to seven oblique plaits, the lower two of which are much more prominent than the others; no umbilicus; general surface of shell smooth.

Length, two and half inches; width across the centre, somewhat more than an inch and a third.

Caloosahatchie, in the banks below Fort Thompson.

This species appears at first sight very much like the Eocene *M. pyrula*, but may be readily distinguished by its greater ventricosity, the convexity of the whorls, and the absence of the sutural carination (or more properly, sub-angulation). The columellar plaits are also considerably more prominent in the Florida form.

As far as I am aware these are the only two species that can be properly included in the genus, which appears, consequently, to be extinct. Whether or not the modern *Lagena*, which so closely resembles it, is immediately related, remains to be determined.

Voluta Floridana, nov. sp. Fig. 8.

Shell fusiform-ovate, smooth, except two or three of the terminal whorls of the spire, which are longitudinally ribbed, and cancellated by a number of delicate revolving lines; spire elevated, of about six volutions, terminating in a slightly papillated apex; whorls convex, hollowed above the middle, the depression in the upper whorls forming a sub-sutural band or carination.

Body-whorl smooth, about four-fifths the length of the shell, covered with delicate revolving lines, which become obsolete with age; aperture of nearly equal length, truncated at base; columellar surface with four prominent oblique folds, the upper of which is generally the longest.

Length of longest specimen somewhat less than six inches; greatest width, 2.3 inches.

Abundant in the banks of the Caloosahatchie below Fort Thompson.

I have little hesitation in affirming that this shell is the probable ancestor of the recent *Voluta Junonia* of Chemnitz which is occasionally obtained along the western keys (Egmont Key, etc.) and in the deeper waters of some of the inner bays. So close is the resemblance between the two species that at first sight there would appear to be not even the most insignificant characters by which to separate them. Although the fossils are in nearly all cases badly worn, yet in some the indications of color are still fairly preserved, which lead me to conclude that the general coloration of the shell was much as in the recent form. About the only character of any significance that I can indicate which might serve to distinguish the two species lies in the formation of the

apical portion of the spire, which is much more distinctly papillated in *Voluta Junonia*, and on which the longitudinal sulcation is but barely visible. Although these characters are seemingly of not much importance, they are, nevertheless, constant, and serve invariably to distinguish the one form from the other; were it not for them, I must admit that it would be very difficult, if not impossible, to separate the two. The Florida fossil appears, however, to attain a much larger size; at least, I have seen no specimens of the recent species that in any way begin to compare with it, nor have I seen any figures or descriptions of the shell that would lead me to infer that equally large specimens have ever been found. Still, the same is not impossible, and I am informed by Mr. John Ford, of this city, that, to the best of his recollection, specimens of *Voluta Junonia* of the size above indicated had been seen by him.

It is certainly an interesting circumstance to find a large volute so nearly resembling the recent species, yet slightly differing from it, in a geological formation antedating the present era by but a single period, and in a region corresponding to the habitat of the living form, especially where no traces of the latter are to be found associated with it. That the one is a modified descendant of the other we have, of course, no direct means of proving, but the inference in that direction is certainly very strong—indeed, almost irresistible. To assume that the Pliocene species should have become totally extinct before the modern era, and been then followed by a specifically new form almost absolutely its identical, as far as we are able to judge, and in a region which appears to have undergone during the common period but little alteration either in its physical or physiographical features, is barely consonant with our present evolutionary conceptions, and certainly far less plausible than the view which holds the interderivation of the two forms. The latter supposition, apart from its own abstract position, is further strengthened by the similar resemblances which bind together other members of the recent and extinct Floridian faunas.

If, however, this species is interesting as indicating a probable line of modification and descent progressionally, it is equally interesting as indicating a similar line retrospectively, or one leading up to it from a still earlier period. Thus, the species stands in about as intimate relation with the *Voluta Trenholmi* of Tuomey and Holmes, from the late Miocene or Mio-Pliocene deposits of South Carolina, as it does with the recent *Voluta Junonia*, and, indeed, might be properly considered to effect a passage between the two. About the only distinctive character separating it from the older form, likewise, as far as we are permitted to judge in the absence of color ornamentation and the animal itself, the one character separating the last from the recent species, is the less prominence of the spire in *V. Trenholmi*, and a corresponding rise in the shoulders

of the body-whorl, giving the shell a less fusiform outline than in either *V. Floridana* or *V. Junonia*.* But just in this character the last two species are absolutely in accord, yet, strikingly enough, the immature shells of *V. Trenholmi* and *V. Floridana* are, in this respect, undistinguishable. The fact that we have in the Miocene, Pliocene, and recent periods but a single species of the type here referred to inhabiting the (approximate) region under consideration, combined with the circumstance that over a considerable portion of this region no species of *Voluta* are any longer to be found, lends, I believe, conclusive evidence proving a case of true evolution and migration.

Mitra lineolata, nov. sp. Fig. 9.

Shell fusiform, gradually tapering; spire elevated, of six or seven volutions, terminating in a papillated apex, which, however, is wanting in all but the youngest specimens; whorls of spire deeply furrowed, three pseudo-sulcations on each whorl, formed or bounded by four sharply raised revolving lines or ridges, the lower of which is less prominent than the others, and constitutes a supra-sutural carination; suture slightly impressed.

Body-whorl gently convex, excavated below the suture, which is bounded inferiorly by a double carination; surface crossed by numerous (nearly equally placed) elevated revolving lines, which are not raised into ridges as on the other whorls; towards the base these lines become crowded, here and there appearing in pairs, which are separated by shallow sulcations; aperture semi-lunate, considerably more than half the length of the shell; outer lip thin.

Columellar surface nearly straight, crossed by seven oblique plaits, which rapidly diminish in prominence from above downwards.

Length, four inches; width, 1.3 inches.

Caloosahatchie, in the banks below Fort Thompson.

This species most nearly resembles *Mitra Carolinensis* of Conrad, originally described from the Miocene of Duplin Co., North Carolina (Am. Journ. Science, xxxix, p. 387; xli, p. 345, pl. ii, fig. 5), and subsequently identified by Tuomey and Holmes from the nearly equivalent deposits of South Carolina. The general characters of the two species are very nearly the same, and on a cursory inspection the Florida and Carolina fossils could readily be mistaken for one another. Closer examination, however, reveals the following points of difference, which I find to be constant for all the specimens of both species that I have had an opportunity to study: In *Mitra Carolinensis* the revolving lines on the body-whorl are much less

* The type specimen of this species, which has been kindly submitted to me for examination by Prof. Whitfield, of the American Museum of Natural History of New York, has a more markedly papillate apex than either the Florida fossil or *Voluta Junonia*.

prominent than in *M. lineolata*—this portion of the shell appearing nearly smooth—and towards the base, best seen on the back, they are no longer *elevated* but *impressed*, or impressed with a marginal carination, a feature not seen in *M. lineolata*, in which all the lines are elevated; in *M. Carolinensis* the infra-sutural excavation, besides being narrower, is clearly defined on several of the whorls, whereas in *M. lineolata* it is apparent as such only on the body-whorl; the whorls of the spire in *M. Carolinensis* are much more distinctly convex, whereas the elevated ridges are not nearly as sharply defined as they are in *M. lineolata*. The young of *M. lineolata* is equally ridged over the entire surface, which does not appear to be the case with *M. Carolinensis*.

Despite the differences here indicated, there can hardly be a doubt, it appears to me, that the two forms are merely derivatives one from the other—an expression of the ceaseless law of evolution.*

Marginella limatula, Conrad.

Jour. Acad. Nat. Sciences, Phila., vii, p. 140.

I identify a shell from the Caloosahatchie with this species, which may, perhaps, be properly considered to be only a variety of the recent *M. apicina* of Mencke. The typical forms of the latter, however, differ in the produced spire and in lacking the prominent denticulations on the labrum. In the series of Marginellas obtained by Gabb from the Miocene deposits of Santo Domingo, and identified by that paleontologist with *M. apicina*, we have the gradual passage leading from the high-spired form to the form in which the apex is almost completely buried in the callus developed by the rising outer lip; the character of the crenulations on the labrum is also shown to vary considerably. Gabb's form appears to be identical with the species from the Caloosahatchie, and, as far as I can determine, is undistinguishable from the Miocene fossil of the Carolinas and Virginia. The species referred to by Tuomey

* Since writing the above I have obtained for comparison, through the kindness of Prof. Whitfield, of the American Museum of Natural History of New York, the specimen which Tuomey and Holmes identified with Conrad's species. This shows a character of ornamentation more nearly that of the Florida fossil, but the convexity of the spiral whorls, and the lesser prominence of the revolving ribs or sulcations, serve readily to distinguish it from that species. It really stands intermediate between the typical *Mitra Carolinensis* and *Mitra lineolata*, although nearer the former, and whether all three should now be united into a single species, or the extremes, which are very well marked, be retained apart, is a matter of little import. It is manifest that with the continued discovery of intermediate forms the classification of species (and no less that of genera, etc.) will become more and more artificial and arbitrary, necessitating ultimately, if convenience is still to be considered, the placing of the same "specific" form, with its attendant varieties, into a series which might include distinct species, genera, families, or even orders. For it cannot be denied that the relationship established through phylogeny is at least as important from a classificatory point of view as that furnished by the taxonomic characters derived from living forms alone.

and Holmes as being abundant in the Post-Pliocene deposits of South Carolina, and but barely differing from *M. limatula*, is undoubtedly the recent *M. apicina*.

***Oliva literata*, Lamarck.**

Annales du Muséum, xvi, p. 315.

Tryon, Manual of Conchology, v, p. 83, pl. 31, figs. 5-7.

***Oliva reticularis*, Lamarck.**

Annales du Muséum, xvi, p. 314.

Tryon, Manual of Conchology, v, p. 83, pl. 30, figs. 90-95; pl. 31, figs. 96, 4; pl. 34, fig. 57.

Both of these forms, as far as I am able to judge, are represented among the fossils of the Caloosahatchie. The two species, however, so very closely resemble one another in the general characters of the shell, that I am far from certain that they can in all cases be distinguished in the absence of color-markings. The produced and more attenuated spire of *O. literata*, which may serve in the majority of instances to separate this species from *O. reticularis*, is not a constant distinguishing character, inasmuch as we sometimes find the relative condition of this portion of the shell reversed; *i. e.*, depressed in *O. literata* and elevated in *O. reticularis*. A more constant character can, perhaps, be obtained from the direction taken by the basal columellar folds, which, as a rule, are slightly more transverse and arched in *O. reticularis*—more nearly direct in *O. literata*. I must admit, however, that the correspondences and divergences seen in these minor characters give but insecure grounds for either the determination or separation of the species; indeed, it appears to me, it might be fairly questioned whether the two living forms here indicated are not in reality only varieties of one and the same species.

***Columbella rusticoides*, nov. sp. Fig. 9*.**

Shell turreted, with an acute spire of some six volutions; whorls convex, impressed below the suture, the uppermost obscurely plicated, the lower ones indistinctly (longitudinally) lined; body-whorl high, flattened on the shoulder, and ornamented with numerous revolving lines (or bands), the upper of which are nearly obsolete; aperture ascending, narrow, somewhat more than one-half the length of the shell; outer lip thick, coarsely crenulated; columellar surface with five or six basal beads.

Length, .5 inch.

From the banks below Fort Thompson.

This species is very close to the recent (European) *C. rustica*, differing from it mainly in the upper angulation of the body-whorl and the sub-sutural sulcation of the whorls generally. It is a little remarkable that it should approach a trans-Atlantic form more nearly than any of the American species.

Cancellaria reticulata, L.

Syst. Nat., 12th ed., p. 1190.

Tryon, Manual of Conchology, vii, p. 69, pl. 2, figs. 25, 26.

Banks of the Caloosahatchie, below Fort Thompson.

Pleurotoma limatula? Conrad.

Journ. Acad. Nat. Sciences, Phila., vi, p. 224, pl. ix, fig. 12.

Several individuals of a small *Pleurotoma* were found in the banks below Fort Thompson, which agree very closely with the Miocene fossil from Maryland, differing from it mainly, or solely, in a somewhat pronounced acuteness of the obliquely directed ribs. The limited number of specimens at my command prevent me from absolutely determining a specific identity, which, however, I firmly believe exists. The species represents *P. Suessi* from the Vienna Basin.

Conus Tryoni, nov. sp. Fig. 10.

Shell sub-conical, sinistral, rather thin in substance; spire more elevated than in the typical cones, of about eight or nine volutions, terminating in a prominent pointed apex; whorls of the spire subangulated, or carinated above the suture, the carination sharply but minutely crenulated on the first five or six whorls; suture bordered inferiorly by a prominent raised convex line, which is followed by from four to five less prominent (and occasionally quite obscure) revolving lines on the shoulders of the whorls.

Body-whorl about four-fifths the length of the shell, gently convex, crossed for the greater part of its extent by numerous obscure lines or composite bands, which become conspicuous toward the base, and exhibit there a distinct, although irregular, alternation of coarser and finer lines.

Aperture somewhat arcuate, broadest near the base; columellar surface slightly folded basally; outer lip thin; sinuall inflection a half-inch in depth.

Length, five inches; greatest width, 2.3 inches.

Caloosahatchie, in the banks below Fort Thompson.

This beautiful cone, by far the largest reversed species of the genus with which I am acquainted, can readily be distinguished from the only other sinistral form that has thus far been described from the Tertiary deposits of the Eastern United States, *Conus adversarius*, by its more ponderous proportions, the greater relative elevation of the spire, and the revolving lines on the shoulders of the whorls. These last are obscured through erosion in some specimens, which then more nearly approach the Miocene fossil. There appears to be a narrower form of this type, which possibly represents a distinct species. It differs in the more pronounced angulation of the body-whorl, the lesser relative width

of the crown, and a more pronounced straight-sidedness in the bounding lines of the shell. The number of such specimens in our collection is not very great, and scarcely sufficient to warrant a specific separation of the form from the species just described.

Named after Geo. W. Tryon, Jr., the distinguished conchologist of the Academy of Natural Sciences of Philadelphia, from whom the author has received much valuable assistance in the preparation of this and other paleontological papers.

Conus Mercati? Brocchi.

Conchiologia Fossile Subapennina, ii, p. 287, pl. 2, fig. 6.

Hörnes, Die foss. Mollusken d. Tertiärbeckens von Wien, ii, p. 23.

Shell obconical, broad, straight-sided; spire moderately elevated, gradually sloping for about six volutions, then abruptly elevated in the apex; total number of volutions about twelve; surface smooth; aperture nearly straight and parallel-sided; columellar folds obscure.

Length, 2.3 inches; width, 1.3 inches.

Caloosahatchie, banks below Fort Thompson.

The species of cone here described so closely resembles in its general features *Conus Mercati* of Brocchi that I fail to find any distinguishing characters by which to separate it from that form, with which I have accordingly doubtfully united it. It must be admitted, however, that the determination of the species of *Conus* is a very difficult one, rendered doubly so in the absence of all color-markings. In our specimens, unfortunately, no markings remain; hence, despite the general agreement, some little uncertainty must still attach to an identification which neglects one of the primary distinguishing characters.

The species is apparently also closely related to a Santo Domingo fossil which Gabb identifies (doubtfully) with Michelotti's *C. Berghausii*, but differs from it in the more pronounced angulation of the shoulder, and the greater elevation of the apex. From the Miocene *Conus Marylandicus*, of Conrad, it can readily be distinguished by its much greater width, the comparatively depressed spire, and the absence of carinations on the whorls of the spire.

Conus catenatus? Sowerby.

Quart. Jour. Geol. Soc. London, vi, p. 45, pl. 11, fig. 2.

I refer to this species a number of small cones which agree so closely with the Santo Domingo fossil as to be barely separable from it. The only differences that I can detect, and these are but very faintly indicated, are a slight concavity in the outline of *S. catenatus*, and a somewhat more pronounced elevation above one another of the whorls of the spire.

Strombus Leidyi, nov. sp. Fig. II.

Shell of the general habit of *Strombus accipitrinus*, thick, ponderous, and, barring the wing, oblong-fusiform, with an abruptly reflected base; spire elevated, somewhat less than one-half the length of the shell, and consisting of from eight to ten volutions; the whorls flattened, the upper slightly nodose along their basal margins; surface of the whorls ornamented with numerous elevated revolving lines, which alternate irregularly in size—from twelve to fifteen on the larger whorls—and are crossed at right angles by longitudinal faintly-waved creases or ridges, representing lines of growth; body-whorl slightly concave on the shoulder, and projected anteriorly into a symmetrically curved wing, which ascends to about the middle of the penultimate whorl of the spire, and whose furthest expansion corresponds approximately with the centre line of the shell; body-whorl faintly tuberculated on the shoulder, the seven or more tubercles continued as so many distinct ridges extending about half-way to the base, and showing a tendency in some specimens to develop into true nodes; surface of the shoulder covered with numerous slightly-waved or crenulated concentric lines, which below the shoulder are replaced by broad regularly-placed bands (about fifteen or sixteen in number, and measuring about five to the inch), which, more especially on the expanded portion of the wing, can be clearly seen to be of a composite nature; wing very thick, thickest near the margin, and but faintly reflected; columellar surface covered with a thick deposit of callus, which extends nearly to the posterior apex of the recurved base.

Length of largest specimen, eight inches; greatest width, five inches.

Very abundant in the banks of the Caloosahatchie below Fort Thompson, where it is found from the water-line to the base of the *Venus cancellata* (Post-Pliocene) bed; I am not sure that we obtained any specimens from the latter deposit, but, doubtless, the species is also found there. Specimens despoiled of the wings have the form of *Conorbis*, and could readily be mistaken for giant species of that genus, especially as there is a slight sinual flexion in the lines of growth over the shoulder.

This beautiful stromb, which I take pleasure in naming after the distinguished President of the Philadelphia Academy, has unquestionably its nearest ally in the recent *Strombus accipitrinus*, Lam. (*S. costatus*, Gmelin), of the West Indian seas. Indeed, its resemblance to certain varietal forms of this species is so great, that in the absence of specimens for immediate comparison the one might almost be mistaken for the other, and I feel confident that in the recent form we have merely a derivative from the fossil; in other words, that the fossil species is the direct or immediate ancestor of the living one. This conclusion is supported, apart from the general characters uniting the two species, and the circumstance that *S. accipitrinus* is the only form now living in the region, or elsewhere,

which at all approximates in structure the fossil species, by the ready adaptability to variation which the recent form exhibits. So marked, indeed, is this tendency to vary that some of the extreme varieties of the species might almost be said to approach more nearly *S. Leidyi* than their own type forms. This variation is seen in the flattening of the whorls of the spire, the less prominence of the wings, and in a reduction in the size of the tubercles of the body-whorl, characters, in the accentuation of which, primarily, *S. Leidyi* differs from *S. accipitrinus*. In the more common, or what might be called typical, forms of the latter species the wing is quadrangular, exhibiting its greatest expansion above the shoulder-line of the shell; in the greater number of individuals of *S. Leidyi*, on the contrary, the wing has a regular crescentic outline, although a tendency toward quadrangulation is very apparent in many of the specimens. It might be said that the two species vary toward each other in respect of this character, the one showing a tendency toward losing the quadrangulation of the wing, the other toward assuming it. A like variable feature separating the two species is exhibited in the nodulation (*S. accipitrinus*) or non-nodulation (*S. Leidyi*) of the whorls of the spire. Of much more permanent value as distinguishing characters are the greater elevation and flattening of the spire in *S. Leidyi*, the absence of true tubercles on the body-whorl, and the much greater ponderosity of the shell generally.

Lister figures a stromb (pl. 856), *Strombus integer* of Swainson, which in many respects, especially in the form and structure of the wing, recalls the Florida fossil. The species is described by Gray in his "Descriptive Catalogue of Shells" (June, 1832, p. 2) as follows: "Shell ventricose, solid, white; spire elongate, conical; last whorl nodulose behind; lip thick, rounded, white." Most authors, it appears, have failed to identify this species, described from a figure alone, as a member of the living fauna, and have accordingly discarded it from their catalogues. Mörch, however, claims it as a good species, and adds (*Malakozoologische Blätter*, xxiv, p. 17): "In 1869 I obtained by [from] Mr. Landauer, at Frankfurt, a specimen from a French collection marked '*S. inermis*, Florides,' exactly corresponding to Lister's figure. It is the only [one] I recollect to have seen." His description of the species is as follows: *Testa planiuscula, solidula, albescens; spira elongata, acuta, conica; ultimo anfractu postice leviter noduloso; labro tenui expanso*. Whether or not Mörch and Gray refer in their descriptions to the same species, it is a little difficult to determine, despite the assurance given us by the former that his specimen corresponds absolutely with Lister's figures. There can be little question from Lister's drawing that the specimen intended to be represented by him has a thick lip, as correctly interpreted by Gray, whereas Mörch maintains that the lip is thin. The general form of

Lister's species, especially the outline of the wing, is so unlike that of any stromb, except the Florida fossil, that one might be readily tempted, making due allowance for imperfect drawing, to unite the two into a single species, the more especially as the shell is described (by Gray) as being white, a feature foreign to the recent representatives of the family, and indicative to a certain extent of a fossil condition. Indeed, the only marked difference between the two forms appears to lie in the more pronounced nodulation of the spire in *S. integer*, a feature not unlikely exaggerated in the drawing, which is manifestly erroneous in the delineation of the spire. Were it not for Mörch's positive statement that he has secured a specimen, with a thin lip, absolutely conforming to Lister's drawing, I should have felt little hesitancy in relegating Swainson's species to the category of fossils, and of uniting with it the species from the Caloosahatchie; and even now I am far from convinced that this identity does not exist, but as it appears practically hopeless to positively identify any form with the *S. integer*, I have deemed it the safer plan to describe the Florida fossil as a distinct species.

***Strombus pugilis*, L.**

Linnaeus, Syst. Naturæ, 12th ed., p. 1209.

Tryon, Manual of Conchology, Part xxvi, p. 109, pl. 2, figs. 13-15.

This species, in the variety known as *S. alatus*, Gmel., is fairly abundant in the *Venus cancellata* bed at Fort Thompson, but less so in the underlying Pliocene deposits. The specimens obtained do not differ essentially from the recent form.

Genus **CYPRÆA.**

Subgenus **Siphocypræa**, Heilprin.

I propose this subgenus for a group of remarkable Cypræas, which differ from all other members of the family in the possession of a deep, comma-shaped sulcus or depression, occupying the apical portion of the shell, and which, as the posterior continuation of the aperture, is curved dextrally around the axis of involution. It would appear that the presence of this sulcus is due to a siphonal prolongation of the mantle, which, contrary to what is seen in other Siphonata, must have been projected in advance of the animal; otherwise, the position of the sulcus would have been posterior, instead of anterior, to the apical axis. The other characters of the shell are those of Cypræa generally. In the absence of positive knowledge respecting the organization of the animal, I have retained it provisionally under Cypræa, although not improbably the distinguishing characters above indicated are of generic value.

Cypræa (*Siphocypræa*) *problematica*, nov. sp. Fig. 12.

Shell ovately cylindrical, completely involute, exhibiting in the apical region a deep comma-shaped depression—prolongation of the aperture—which is wound dextrally around the axis of involution.

Base plano-convex, slightly tumid superiorly; aperture somewhat eccentric, narrow, arcuate, continued into the comma-shaped depression above referred to; canal short, broadly reflected; labrum with from twenty to twenty-five prominent plaits, which are considerably stronger, and much less crowded, than the equally numerous plaits on the columellar surface.

Length, 2.7 inches; width, 1.4 inches.

Common in the banks of the Caloosahatchie below Fort Thompson.

This species is a much narrower shell than the Miocene *Cypræa Carolinensis*, and differs in like respect from all the larger Tertiary species of the West India Islands with which I am acquainted. It most nearly approaches in outline the recent *Cypræa exanthema*, of the Florida coast. The remarkable comma-shaped depression on the apical portion serves to distinguish it readily from all other species of the genus, either recent or fossil, that have come under my notice.

Pyruia reticulata? Lam.

Animaux s. Vertèbres (Ficula), ix, p. 510.

Tryon, Manual of Conchology, vii, p. 265, pl. 5, fig. 28; pl. 6, fig. 33.

Caloosahatchie, in the banks below Fort Thompson.

Mr. Tryon separates the common species of the southern United States (*P. papyratia* of Say) from the eastern *P. reticulata*, observing that the shell of the former is slimmer and more delicately sculptured. Whether these seemingly trivial characters are constant or not in the living forms I am not prepared to say, but, obviously, the ornamentation of the Florida fossil more nearly resembles that of Lamarck's species than of the presumably distinct form described by Say.

Natica canrena, L.

Mus. Ulr., p. 674.

Tryon, Manual of Conchology, viii, p. 20, pl. 4, fig. 58.

Caloosahatchie, banks below Fort Thompson.

Natica duplicata, Say.

Journ. Acad. Nat. Sciences, Phila., ii, p. 247.

Tryon, Manual of Conchology, viii, p. 33, pl. 12, fig. 3.

Below Fort Thompson.

Crucibulum verrucosum, Reeve.

Conch. Icon., ii, Crucibulum, Species 19.

Tryon, Manual of Conchology, viii, p. 119.

Turritella perattenuata, nov. sp. Fig. 13.

Shell very slender, gradually tapering; whorls very numerous, doubly carinated, the carinæ crenulated or beaded, the upper and lower about equally removed from the upper and basal margins of the whorls respectively, the upper carina frequently appearing double through the presence of a contiguous additional line; shoulder of the whorls prominent, with one or two elevated lines; the concave space between the carinæ with two obsoletely crenulated lines, the upper of which is somewhat the more prominent. Aperture quadrangular.

Length of a restored specimen nearly five inches; greatest width, .6 inch.

Common in the banks of the Caloosahatchie below Fort Thompson.

This shell can be at once distinguished by its extremely elongated or attenuated outline, surpassing in this character all other forms of the genus with which I am acquainted, either recent or fossil. It bears a (superficially) close resemblance to *Turritella tornata* of Guppy (Q. Journ. Geol. Soc., London, xxii, p. 580), a Miocene fossil of the island of Santo Domingo, but differs in its more slender outline, the greater relative elevation of the shoulder, and in the less prominence of the two intermediate lines between the carinæ. These are also much more distinctly beaded in *T. tornata*. Gabb maintains ("Santo Domingo," Trans. Am. Philos. Soc., xv, p. 240) that Guppy's description applies only to a single variety of the species, and enumerates other characters which are by him held to cover other varieties of the species as well. I fail, however, to see upon what ground this emendation to the original description is made. The specimens in Mr. Gabb's collection marked *T. tornata* certainly do embrace two or more distinct forms of *Turritella* one of which is indisputably Guppy's species, but why these should be all linked together as a single species I do not exactly comprehend. It is true that they bear a general resemblance toward one another, both in outline and ornamentation, but I fail to detect any gradual passage of the one form into the other—a condition which might naturally be expected on the hypothesis of specific identity—at any rate, not into the form which accords precisely with Guppy's description.

Turritella apicalis, nov. sp. Fig. 14.

Shell gracefully tapering, with an acute apex; whorls numerous, straight-sided, carinated above and below, the carinæ about equally removed from the upper and lower sutures respectively, distinctly beaded; a prominent subsutural line, placed about medially on the shoulders of the whorls; the flattened space between the carinæ with an obscurely beaded sub-median line, and numerous finer lines, which are almost invisible to the naked eye; the beads of the carinæ oblique, and inclined in opposite

directions, the upper ones downward to the right, the lower ones downward to the left; aperture quadrangular.

Length, 1.7 inches; width of base, .3 inch.

Caloosahatchie, abundant in the banks below Fort Thompson.

Turritella cingulata, nov. sp. Fig. 15.

Shell elevated, straight-sided; whorls flat, faintly carinated inferiorly by an obscurely beaded (or "roped") line or band, which is followed successively in the direction of the apex by two distinctly crenulated or beaded lines, an obliquely and obscurely lined (barely elevated) band, and a delicate terminal line; the band above the two lines is more distinctly beaded along its base, appearing somewhat like a third crenulated line; aperture quadrangular.

Length, 2.4 inches; width of base, .5 inch.

From the banks below Fort Thompson.

Turritella mediosulcata, nov. sp. Fig. 16.

Shell rapidly tapering, straight-sided; whorls flattened, appearing somewhat concave through the presence of a depressed median area or band, which is bounded inferiorly by a fairly prominent beaded line; surface covered with numerous fine revolving lines, which above the medial depression are cut obliquely (downward to the right) by obscure rugations; aperture quadrangular; base flat.

Length of fragment, 1.5 inches; width of base, .4 inch.

A solitary specimen, from below Fort Thompson.

Turritella subannulata, nov. sp. Fig. 17.

Shell turreted, acuminate; whorls angular, marked by a broad basal impressed band or channel, which is ornamented with numerous delicate revolving lines; surface of the whorls above the channel longitudinally plicated, with two well-defined submedial lines, and numerous finer lines, as in the channel; aperture rounded; base convex.

Length, 1.2 inches; width of base, .25 inch.

Abundant in the banks below Fort Thompson.

Cerithium atratum? Born.

Mus. Cæs., p. 324, pl. ii, figs. 17, 18.

I doubtfully refer to this species a solitary specimen found in the banks below Fort Thompson. It is a somewhat more elevated shell than the recent form, and its ornamentation also differs slightly; but on the whole its facies is very similar, and I am inclined to believe that among a selection of specimens individuals would be found to grade into the typical *C. atratum*, which is itself a markedly variable species. The specimen measures an inch and a half in length.

Cerithium ornatissimum, nov. sp. Fig. 18.

Shell acuminate, gracefully tapering; whorls numerous, fifteen or more, furrowed below the suture, and rugated with a very elaborate ornamentation; the upper seven or eight whorls of the spire distinctly plicated (longitudinally), the plications on the lower whorls becoming obsolete, and replaced by broken nodes, which are disposed in a double series—one row above the sub-sutural furrow, the other immediately below it—the nodes of the two series at first opposite, then alternate; the lower portions of the whorls granulated; body-whorl with four distinct lines of granulations, the basal one, which is separated by an interval from the others and followed by three elevated, non-granulated lines, the strongest; entire surface of the shell covered with fine revolving lines, which alternate in size; aperture about one-fifth the length of shell, gently arcuate.

Length, somewhat above two inches; width, a half-inch.

A solitary specimen from the banks below Fort Thompson.

This species can be readily distinguished by its form and ornamentation from the recent *C. atratum* and *C. eburneum*, to both of which it bears a general resemblance.

LAMELLIBRANCHIATA.

Panopæa Menardi, Deshayes. Fig. 19.

Dict. Class. d'Hist. Nat., xiii, p. 22.

Panopæa Faujasi (auct.).

Several large specimens from the banks below Fort Thompson, with the valves still attached.

I can find no characters by which to separate the Florida fossil from the well-known species of the European Miocene and Pliocene formations. It is almost without doubt the species figured and described by Say as *Panopæa reflexa* (Journ. Acad. Nat. Sciences Phila., vol. 4, p. 153, pl. xiii, fig. 4), which is stated to have the "shell transversely oblong-subovate; anterior margin somewhat narrower and longer than the posterior margin, the edge reflected; surface wrinkled, and profoundly so towards the base. Length, three inches and two-fifths; breadth, five inches and seven-tenths." In the above description *posterior* [margin] should stand for *anterior* and *vice versa*; *height* for *length* and *length* for *breadth*. I have not seen any specimens from the American Miocene deposits which correspond with Say's figures. The form that has been identified with it by Conrad—of which the collections of the Academy possess numerous specimens—and which has been generally accepted as Say's species, is a very different shell, easily recognized by its declining posterior slope, the position of the umbones, which are almost invariably placed nearer the posterior border than the anterior, and the acute angulation and narrowness of

the sinual inflection. In Say's *P. reflexa*, as well as in the Florida fossil and *P. Menardi*, the hinge-line is about equally elevated both anteriorly and posteriorly, the beaks are somewhat anterior, and the sinual inflexion relatively shorter and broader. The shell is also more massive. In view of the differences here indicated, I would propose for the common form of the Atlantic Middle Tertiaries, hitherto referred to *Panopæa reflexa*, the name of *P. cymbula*, the species to be defined as follows:

Panopæa cymbula, nov. sp. Fig. 20.

Panopæa reflexa, of most authors.

Shell expanding anteriorly, where it is highest, gracefully rounded; rapidly sloping posteriorly, with the border reflected, permitting of a broad gape; beaks somewhat posterior, or beyond the middle, considerably sloping, the apex directed slightly to the rear; a prominent transverse cardinal tooth beneath the apex, followed by a strongly-bordered cartilage plate; muscular and pallial impressions rugged, deep; sinual inflection generally narrow and acutely pointed; external surface of shell strongly and roughly furrowed.

Length, 5.3 inches; height, three inches.

Miocene of the Atlantic slope.

Panopæa Florida, nov. sp. Fig. 21.

Shell oblique, expanding and ascending anteriorly, abruptly truncated behind; hinge-line in front of the umbones rising considerably, declivous beyond the cartilage-plate, and ascending again toward the posterior extremity; posterior margin reflected, the shell gaping broadly; umbones well in front of the middle; cartilage-plate very strong; ligamental sulcus deep; muscular and pallial impressions well impressed, rough, the sinual inflection often v-shaped.

Length, 5.1 inches; height, three inches.

Both valves of a single individual.

This species can be readily distinguished from *P. Menardi* (*P. reflexa*, Say) by its truncated form, and the rise in the hinge-line in front of the umbones; the height of the gape is also relatively greater.

Panopæa navicula, nov. sp. Fig. 22.

Shell (known only by the right valve) short, broadly-oval, obliquely rounded anteriorly, abruptly truncate behind, the gape (posterior) very broad; umbo in advance of the middle of the shell, the apex directed forward; hinge-line sigmoidal, or flexuously curved, ascending in front, reflected posteriorly; cardinal tooth prominent, arched upward; cartilage plate strong; muscular and pallial impressions very deep, the sinual inflection short and openly quadrangular; surface of shell prominently sulcated.

Length, five inches; height, 3.5 inches.

This shell most nearly approaches the preceding in outline, but can be distinguished by its broadly swelling anterior border, its greater height, and the form of the sinual inflection.

Semele perlamellosa, nov. sp. Fig. 23.

Shell thin, transversely elongated, oval, about equilateral; beaks central, acute, not prominent; right valve with a vertically incised, lamellar, cardinal-tooth, which is followed by the very oblique, and broadly opening cartilage sulcus; dental fissure in left valve narrow, apparently duplicated; lateral teeth subcentral; surface covered with numerous, regularly placed, elevated lamellæ of growth, which are gently angulated on the posterior slope.

Length, 2.8 inches; height, two inches.

A single specimen from the banks below Fort Thompson.

Venus rugatina, nov. sp. Fig. 24.

Shell ventricose, subcircular, appearing on its inner aspect much like *Isocardia*, with a prominent anterior projection, corresponding to the lower boundary of the deeply-impressed lunule; hinge-line in each valve with two prominent, transversely projecting, cardinal teeth, and a third (posterior) oblique one, which, in the left valve, is separated from the median tooth by a deep, obliquely directed, dental sulcus; the anterior tooth in the left valve deeply grooved above, and preceded by a dental papilla; posterior lateral teeth not prominent; surface covered with very numerous, sharply-defined, imbricated lines of growth, which at nearly regular intervals are marked off by lines of special prominence, immediately below which the normal lines are least closely crowded; number of prominent lines twenty-five and upward; number of normal lines between these from six to eight; border crenulated, the crenulation extending under the lunule.

Length, 2.5 inches; height, 2.1 inches.

Abundant in the banks below Fort Thompson.

Closely resembles the recent *Venus rugosa*, but may be readily distinguished by the greater interval separating the more prominent lines.

Cardium Floridanum, nov. sp. Fig. 25.

Shell obliquely cordate, upright, posterior slope somewhat depressed, flattened; beaks elevated, with the apex turned gently toward the anterior margin; left valve with a deep pit immediately under the apex, in front of which is a prominently projecting pointed tooth; two pyramidal lamellar teeth, underneath which are corresponding dental pits; right valve with the lateral teeth underlying the dental pits; hinge-line raised anteriorly into a flattened vertical plate, which ascends beyond the apex of the beak.

Surface radiately ribbed; ribs narrow, about thirty in number, profoundly squamous, the scales erectly vaulted, compressed and carinate, or overlapping, on the posterior side, broadly flattened anteriorly, so as to produce shallow cups, through which the ribs appear to pass.

Height, 1.4 inches.

This species most resembles among recent forms *Cardium consors* from the west coast of South America, which differs in the greater number and closer imbrication of the scales on the posterior slope, and in lacking the open cup-like forms of the anterior border; the elevated dental plate is also less prominent.

Hemicardium columba, nov. sp. Fig. 26.

Shell (known only by the left valve) elevated, gibbous, carinated on the umbonal slope; posterior cordiform space profoundly hollowed; anterior border evenly rounded; base slightly sinuous posteriorly, somewhat produced; posterior border deeply emarginate; beaks elevated, transverse, the apex appearing as though directed to the rear; cardinal teeth two, enclosing a deep pit, the anterior one much the more prominent; lateral teeth lamellar, pyramidal; entire surface of shell closely ribbed, ribs echinated, about thirty-six in number, some thirteen of which are on the posterior slope; basal margin crenulated.

Height, to summit of beak, four-fifths of an inch; length, .7 inch.

I have but two valves of this species, a near ally of the recent *Hemicardium media* of the southern coast, from which it can be distinguished by its more upright form, the deeper hollowing of the posterior face, and the more pronounced carination of the umbonal slope.

Chama arcinella, L.

Syst. Nat., p. 1139.

Numerous in the banks below Fort Thompson.

The individuals of this species vary in the fossil much as they do in the recent form, the variation depending upon the convexity of the valves, the disposition and thickness of the spines, the presence or absence of interstitial secondary radiating lines, etc. In the collections of the Academy of Natural Sciences there are a number of *Chama* valves, from Cape Fear River, North Carolina, which are marked in Conrad's handwriting *Arcinella spinosa*. I am not aware that the species has ever been described as such, but it is nothing other than an unusually spiny variety of *C. arcinella*, and, doubtless, the form which is correctly referred in Emmons's North Carolina report to the living species.

Chama crassa, nov. sp. Fig. 27.

Shell thick, ponderous, cordiform, with a prominent sulcus descending the posterior slope; both valves very convex, the left one somewhat the larger; beaks spirally twisted, much as in *Isocardia*; the hinge-line (in

the left valve) with a profound arciform ligamental furrow, and two nearly horizontally placed cardinal teeth, separated by a broad, slightly curved, dental sulcus; muscular impressions sharply defined, deep; external surface rugose, covered with the somewhat sinuous lines of growth; basal margin entire, not crenulated.

Length of largest specimen, measured along the antero-posterior axis, and through the umbones, 3.7 inches; height, nearly three inches; depth of a single valve somewhat over two inches.

Common in the banks below Fort Thompson.

This form may be readily distinguished from all the other species of North American *Chama*, either recent or fossil, by its ponderous form, and the near equality of the two valves, differing in the latter character conspicuously from the European *Chama gryphoides*, which much resembles it. It differs in this respect also from the American *Chama corticosa* of Conrad (Miocene), which, however, is a sinistral shell.

Lucina disciformis, nov. sp. Fig. 28.

Shell compressed, suborbicular, higher than broad, flattened on the umbonal slope; beak subcentral, acute, overlooking a deeply impressed lunule; ligamental sulcus profound; cartilage-pit oblique; cardinal teeth two in each valve, the posterior in the right valve, and the anterior in the left valve, bifid; anterior margin of shell impressed somewhat above the middle; muscular impressions elevated, the anterior ribbon-form, long and narrow, departing somewhat from the rather distantly' separated pallial line; external surface ornamented with numerous distantly placed lines of growth, which at nearly equal intervals rise into rugose elevated lamellæ; interior of shell longitudinally rugated.

Height, 2.5 inches; width, 2.4 inches.

This shell bears a similarity of outline to the Miocene *Lucina Americana* (*L. anodonta*), and is barely distinguishable from that species by external characters alone; the latter is, however, edentulous. Among recent forms it approximates *L. Childreni*, but that species is inequivalve.

Arca scalarina, nov. sp. Fig. 29.

Shell obliquely rhomboidal, elevated, ventricose, angulated posteriorly, flattened; anterior end short, evenly rounded; beaks prominent, transverse, about eight, distant; ligament-area diamond-shaped, nearly smooth in the young shell, with delicate transverse lines—in the adult, with a limited number of coarse, sinuous longitudinal lines; hinge-line straight, somewhat more than one-half the greatest length of shell; teeth numerous, somewhat oblique toward either end.

Ribs prominent, about twenty-four, broad, square, robustly crenate, those of the left valve broader than the interspaces, flattened posteriorly, about eight on the anal angulation; those of the right valve of about the

same width as the interspaces (the anterior ones the broadest), with an interstitial secondary rounded rib in the centre of the interspace; the two valves unequal, the basal margin of the left valve greatly protruding beyond that of the right; base profoundly crenulated.

Length, 3.3 inches; height, 2.5 inches.

Abundant in the banks of the Caloosahatchie below Fort Thompson.

I am not absolutely satisfied as to the value of this species, although the form, so far as all the specimens collected by us are concerned, is a very clearly defined one. It closely resembles the shell identified by Tuomey and Holmes with *Arca scalaris* of Conrad (Foss. Med. Tert. Form. U. S., p. 59, pl. 31, fig. 1; Tuomey and Holmes, Pliocene Fossils of South Carolina, p. 43, pl. xvi, figs. 1, 2), and might, indeed, be readily mistaken for it. Through the kindness of Prof. Whitfield I have been permitted to make a comparison with the type-forms described and figured by Tuomey and Holmes, and find that their shell differs very materially from the Florida fossil. In the first place it is decidedly more oblique, and secondly, the ribs adjoining the posterior slope (on the left valve) are not nearly as broad relatively, nor as flattened, as they are in *A. scalarina*; the ribs of the left valve are more remotely placed from one another, and lack the pronounced interstitial secondary rib, which is so prominently defined in the Florida fossil. Its place is taken by a hair line, which is present in some of the intercostal spaces. The characters of the Florida shell are remarkably constant, showing practically no variation, and were I as positive of the stability of characters in the Carolina fossil, I should have no hesitation in regarding the two as specifically distinct; unfortunately, only a single pair of valves of Tuomey and Holmes's shell has been positively identified, which, therefore, gives no information on this point. As it is, the characters of the two are sufficiently distinct, indeed, fully as well-marked as those which separate the Florida fossil from the recent *Arca incongrua* of the Southern coast, which may, with much plausibility, be looked upon as its immediate descendant. The recent species agrees more nearly in the general outline of the shell, being upright rather than oblique, but differs in the less width (in the left valve) of the ribs, and in lacking the true interstitial rib of the right valve (although an indication of it appears in a faint elevated line), agreeing in this respect with the South Carolina fossil. That the three forms are most intimately related there can be no question, and I believe there is likewise little or no question that they all lie on the same line of descent. Tuomey and Holmes assert that their shell is closely allied to *Arca transversa*. This is certainly a mistake; the two shells, beyond the general characters uniting the majority of Arcas, have very little in common—neither in shape, size, nor ornamentation.

Another point that remains to be determined in this connection is

whether the fossil described by Tuomey and Holmes is really the *Arca scalaris* of Conrad, or not. That paleontologist was acquainted with the left valve only of his species, nor do the collections of the Academy of Natural Sciences, which embrace the greater number of the specimens either obtained or described by Conrad, show any other portion of that species but the left valve. Inasmuch as one of the more important distinguishing characters lies in the opposite valve, it is impossible to say whether the form in question would approximate more nearly the South Carolina fossil or *Arca scalarina*, or, indeed, whether it is the equivalent of either the one or the other. All the valves, which include the figured form, are of comparatively small size, and, as far as mere outline is concerned, more nearly resemble *A. scalarina*. The posterior ribs, however, as in the South Carolina shell, are narrower than in the Florida fossil, lacking the peculiar flattening of that species, and, reasoning from the fact that the shell was obtained from the same series of deposits which also yielded the South Carolina fossil, it may perhaps be assumed that the two are identical. This is, however, a matter of conjecture. The umbones in Conrad's shell are considerably less prominent than in either the South Carolina or the Florida fossil, and possibly the form never attained a size comparable with that of either of the two other forms.

Arca crassicosta, nov. sp. Fig. 30.

Shell subquadrangular, ventricose, ponderous, ornamented with about twenty coarse, elevated, transversely barred, terete ribs, which are somewhat irregular and crowded on the anterior half of the shell, becoming widely separated and profoundly elevated on the posterior half; beaks nearly anterior, looking forward, separated from each other by a fairly broad interval; hinge-line almost as long as the greatest length of the shell, pectinated with numerous narrow, nearly vertical teeth; ligamental area narrow, elongated, with about six longitudinal lines, which rise toward the apex of the beak; interior of the shell coarsely rugated; base ascending anteriorly, profoundly crenated.

Length, 2.7 inches; height, two inches.

Below Fort Thompson.

This shell can be readily distinguished by its profoundly elevated and widely separated ribs, being the most coarsely costated *Arca* with which I am acquainted. It closely resembles *Arca rustica*, of Tuomey and Holmes (Pliocene Fossils of South Carolina, p. 39, pl. xv, fig. 1), and may, indeed, be that shell. Unfortunately, these authors have given but a very meagre and unsatisfactory description of their species, which barely permits of an absolute determination being made. Their figure, drawn from a mere fragment, does not represent the profound ribs seen in the Florida fossil; the posterior interspaces are apparently also much

narrower, nor does there appear to be any marked variation either in the disposition or the size of the costæ. Still, the differences here indicated, which are based upon figure and description only, may be more apparent than real, and the two forms, as above intimated, may in reality represent a single species. Unfortunately for the determination of this point, the only perfect valve possessed by Tuomey and Holmes was lost before the publication of their monograph, and the fragment which served as the type of the species, for both figure and description, and which, as far as I am aware, was the only other specimen extant illustrating the species, has since been lost from the collection of the South Carolina geologists. I am informed to this effect by Prof. Whitfield, of the American Museum of Natural History, of New York city, where the type collections of the South Carolina Survey are deposited.

Arca lienosa, Say.

American Conchology, pl. 36, fig. 1.

Arca Floridana (recent), Conrad.

This shell is identical with the recent *Arca Floridana*, from the Florida coast, the specific name of which will have to be replaced by that of Say's species, which has priority. The only difference that it presents, and this is probably not constant, and at most a trifling character, is a somewhat greater anterior projection of the hinge-line, making the shell appear more distinctly eared. It does not appear, however, that the recent form attains the size of that seen in the fossil; one of the specimens from the upper Caloosahatchie measures six inches in length, and three inches in height to the top of the umbones. The ribs where worn, especially towards the base, show a double or quadruple structure, best seen in the larger specimens.

Arca aquila, nov. sp. Fig. 31.

Shell (known only by its left valve) elongated, rectangular, winged, profoundly sulcated on the posterior slope; anterior border vertical, straight; basal line slightly sinuous beyond the middle; posterior border deeply emarginated; hinge-line straight, of nearly equal length with the base; teeth very numerous, gradually increasing in size towards either end, where they are markedly oblique; hinge-area broad, obscurely furrowed in longitudinal lines; beak moderately elevated, incurved, the apex directed backward; surface of the shell radiately ribbed, the ribs sinuous, beaded—especially on the anterior portion of the shell, where they are separated by an intermediate fine line—becoming obsolete in the posterior sulcus and on the wing, where they are represented by two pairs of lines; lines of growth prominent towards the base and on the wing; basal margin crenulated.

Length, 1.25 inches; height, from base to hinge-line, .5 inch.

This winged ark is at once distinguished from *A. aviculæformis* (*v. post.*) by the absence of the anterior rostrum and its rectangular form. The last character, in addition to differences in the ornamentation, also serves to distinguish it from the Miocene *Arca incile*, which resembles it somewhat in the pterination of the posterior slope.

ARCA.

Subgenus *Arcoptera*, Heilprin.

Shell elongated, aviculæform, rostrated anteriorly, winged posteriorly; hinge-line practically the entire length of the shell, exceedingly narrow, and pectinated with a crowded series of transversely directed or partially v-shaped teeth; umbones widely separated; ligamental area very broad, open; base sinuous, with a median opening.

I propose this subgenus for a series of very remarkable arks, which can be readily distinguished from all other members of the genus by their peculiar pterination and rostration, giving an external outline precisely that of *Avicula*. This character is accompanied by a most extraordinary attenuation anteriorly of the chamber of the shell.

Arca (*Arcoptera*) *aviculæformis*, nov. sp. Fig. 32.

Shell elongated, aviculæform, rostrated anteriorly, winged posteriorly, with a prominent obtuse carination on the umbonal slope bounding the wing; rostrum declivous, marked off from the body of the shell by a broad hollow; basal margin of shell sinuous, showing a median opening, and rapidly sloping upward in the direction of the rostrum; posterior border deeply emarginate.

Umbones acute, very excentric, moderately elevated, and but slightly incurved, with a gradual continuous slope to either extremity of shell; hinge-line nearly the whole length of shell, very narrow, pectinated with a crowded series of lamellar, transversely directed, teeth, which exhibit a tendency to become oblique and v-shaped on the posterior half of the line; ligamental area broad, open, arching upward in a gentle curve, longitudinally lined, and irregularly grooved by numerous diagonal or v-shaped furrows resembling insect borings.

Surface of shell ornamented with numerous radiating wavy lines, alternating in coarseness, which become more or less obsolete on the umbonal slope, and are wholly wanting on both the beak and wing, which only show concentric lines of growth; of the radiating lines on the anterior part of the shell the series runs about as follows: coarse line, followed by two finer lines, then a slightly more prominent single line, again two finer lines, and then a coarse line, same as first, marking the coarse

lines at intervals of about six or seven; interior of shell deep, cuneiform; margin entire.

Length, 5.4 inches; width across the beaks, 2.5 inches.

Caloosahatchie, in the banks below Fort Thompson.

Spondylus rotundatus, nov. sp. Fig. 33.

Shell (known only by the larger valve) capacious, orbicular below the hinge-line, distinctly auriculated; hinge-line triangular, pyramidal, the beak acute, laterally twisted at the apex, traversed by a median slit; cartilage-pit profound, reaching about half-way to the apex; cardinal teeth powerful, slightly spreading; external surface coarsely ornamented with irregular squamous ribs and intermediate scaly fine lines, the (imbricated) scales on the latter drawn out into flattened spines or echinations.

Height to apex, 3.5 inches; greatest width, 2.5 inches.

A solitary, perfectly preserved valve from the banks below Fort Thompson.

This species is quite distinct from any form, either recent or fossil, with which I am acquainted.

Pecten solarioides, nov. sp. Fig. 34.

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

Height, 5.7 inches.

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

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

Pecten comparilis, Tuomey and Holmes.

Pliocene Fossils of South Carolina, p. 29, pl. xi, figs. 6-10.

Pecten eboreus of Conrad (in part).

I refer to this species a number of large Pectens, found in the banks below Fort Thompson, and also at Thorpe's, some of whose forms are

absolutely undistinguishable from the Carolina fossil.* The largest perfect specimen measures 4.2 inches in height, and nearly five inches in greatest width. The form appears to be a rather variable one, the variation depending upon the relative convexity of the valves and ribs, the latter, in the larger individuals, more generally assuming the flattened form, with a submarginal carination; the interspaces between the ribs may also exhibit two or more faint carinations (imbricated longitudinal lines), a character which was used by Conrad to distinguish *P. Edgecomensis* (Proc. Acad. Nat. Sciences, 1862, p. 291) from *P. eboreus*. I have not seen any specimens of *P. Edgecomensis*, and am therefore unable to say whether it corresponds to the variety of *P. comparilis* here indicated, or not.

Pecten (Pleuroneotes) Mortoni, Ravenel.

Proc. Acad. Nat. Sci. Phila., ii, p. 96.

Identified by one nearly perfect specimen and several fragments from among the fossils of the upper Caloosahatchie. This species is most intimately related to *Pleuroneotes Japonicus*, of the East Asiatic seas, and can only be distinguished from it by the characters drawn from the radiating raised lines of the interior of the shell, which in *P. Mortoni* are disposed in narrow pairs, passing as such to the border. In *P. Japonicus* the lines, while starting in pairs, lose their dual character long before reaching the margin.

Pecten nodosus, L.

Syst. Nat., 12th ed., p. 1145.

A solitary fragment, absolutely undistinguishable from the recent species.

Caloosahatchie, below Fort Thompson.

Ostrea meridionalis, nov. sp. Fig. 35.

Shell (at first) strongly plicated, suborbicular or elongated, becoming massive and ponderous when full-grown, with an almost complete obliteration of the plications; the plications in the adult not visible on the

* I have examined what is supposed to be the type-specimen of Tuomey and Holmes's *Pecten comparilis*, and find that it differs somewhat from what has generally been assumed to be species in question. The characters in which it varies, as the greater convexity of the apical portion of the shell, and a slight reduction in the number of ribs, are, however, insignificant, and inasmuch as the specimen is a solitary one, and consequently throws no light upon individual variation, I think that the identity of the species with the form that Conrad has recognized as *P. comparilis*, a shell attaining a very much larger size than that figured and described by Tuomey and Holmes, may be fairly assumed. This form, moreover, is that which was also subsequently identified with their own species by the South Carolina geologists. Whether the species is distinct from Conrad's *Pecten eboreus* is a question which, in the absence of a sufficiently large number of specimens for comparison, I am not prepared to answer.

interior faces of the valves; hinge-area, in the adult, greatly elongated, either straight or laterally twisted, sometimes nearly one-half the length of shell; the median groove of variable width and depth, projecting below the lateral ridges, so as to make the hollow of the shell appear two-horned; cavity of shell shallow, impressed medially just below the hinge-line; muscular scar semilunar, deep.

Length (height), 6.3 inches; width, variable; thickness of shell, two to two and a half inches and upward.

Very abundant in the "marl" banks below Thorpe's, where the shell can be seen several feet below the surface of the water; less abundant in the banks below Fort Thompson, and at one or two points between this locality and Thorpe's.

This form may be readily distinguished from all the other Eastern species of *Ostrea* by its ponderous proportions, greatly surpassing in this respect *O. percrassa* from the Miocene of New Jersey. In its early stage it resembles in both outline and ornamentation the recent *O. borealis*, but the adult form, from its manner of growth, is wholly different.

The following additional species of Mollusca were obtained from the deposits below Fort Thompson:—

- Nassa vibex**, Say.
Journ. Acad. Nat. Sciences Phila., ii, p. 231.
- Crepidula cymbæformis**, Conr.
Proc. Acad. Nat. Sciences Phila., ii, p. 173.
- Crepidula fornicata**, L.
Syst. Nat., p. 1257.
- Bulla striata**, Brug.
Dict., No. 3.
- Siliqua bidentata**, Spengler.
Skript. Nat. Selsk., iii, p. 104.
- Semele variegatum**, Lam.
Anim. s. Vertèbr., vi, p. 126.
- Rangia cyrenoides**, Des M.
Actes Soc. Linn. Bordeaux, v, p. 57.
- Venus cancellata**, L.
Syst. Nat., p. 1130.
- Venus Rileyi**, Conr.
Foss. Med. Tert. U. S., p. 9, vi, fig. 1.
- Venus Mortonii**, Conr.
Journ. Acad. Nat. Sciences Phila., vii, p. 251.
- Artemis discus**, Reeve.
Conch. Icon., *Artemis*, 9.
- Artemis elegans**, Conr.
Foss. Med. Tert. U. S., p. 30.
- Dione (Calliste) gigantea**, Chem.
Conch. Cab., x, p. 354.

- Dione maculata**, L.
Syst. Nat., p. 432.
- Cardium magnum**, Born.
Mus. Cæs., pl. 3, fig. 5.
- Cardium isocardia**, L.
Syst. Nat. (Gmelin ed.), p. 3249.
- Lucina edentula**, L.
Mus. Ulr., 74.
- Lucina Pennsylvanica**, L.
Syst. Nat., p. 1134.
- Lucina Floridana**, Conr.
Amer. Journ. Science, xxiii, p. 344 (1833).
- Lucina tigerina**, L.
Syst. Nat., p. 1133.
- Carditamera arata**, Conr.
Foss. Shells Tert. Form. U. S., p. 20.
- Arca plicatura**, Conr. (et *Arca improcera*).
Foss. Med. Tert. U. S., p. 61.
Heilprin, Proc. Acad. Nat. Sciences Phila., 1881, p. 451.
- Pectunculus lineatus**, Reeve.
Proc. Zool. Soc. London, 1843.
- Pectunculus aratus**, Conr.
Am. J. Science, xli, p. 346.
- Plicatula ramosa**, Lam.
Anim. s. Vertèbr., vi, p. 176.
- Pecten nucleus**, Born.
Mus., p. 107.
- Anomia Ruffini**, Conr.
Foss. Med. Tert. U. S., p. 74.
- Ostrea Virginia**, Gmel.
Syst. Nat., 3336.

List of species found in the deposits of the Caloosahatchie :

- | | |
|------------------------|----------------------|
| *Murex imperialis, | Panopæa Menardi, |
| * " brevifrons, | " Floridana, |
| Fusus Caloosaensis, | " navicula, |
| Fasciolaria scalarina, | Semele perlamellosa, |
| * " gigantea, | * " variegatum, |
| * " tulipa, | *Rangia cyrenoides, |
| Melongena subcoronata, | Venus rugatina, |
| Fulgur rapum, | * " cancellata, |
| * " contrarius, | " Rileyi, |
| " excavatus, | * " Mortoni, |
| * " pyrum, | *Artemis discus, |
| * " pyriformis, | * " elegans, |

* <i>Nassa vibex</i> ,	* <i>Dione (Calliste) gigantea</i> ,
<i>Turbinella regina</i> ,	* " <i>maculata</i> ,
<i>Vasum horridum</i> ,	<i>Cardium Floridanum</i> ,
<i>Mazzalina bulbosa</i> ,	* <i>Cardium magnum</i> ,
<i>Voluta Floridana</i> ,	* " <i>isocardia</i> ,
<i>Mitra lineolata</i> ,	<i>Hemicardium columba</i> ,
<i>Marginella limatula</i> ,	* <i>Chama arcinella</i> ,
* <i>Oliva literata</i> ,	" <i>crassa</i> ,
* " <i>reticularis</i> ,	<i>Lucina disciformis</i> ,
<i>Columbella rusticoides</i> ,	* " <i>edentula</i> ,
* <i>Cancellaria reticulata</i> ,	* " <i>Pennsylvanica</i> ,
<i>Pleurotoma limatula</i> ?	* " <i>Floridana</i> ,
<i>Conus Tryoni</i> ,	* " <i>tigerina</i> ,
" <i>Mercati</i> ?	<i>Carditamera arata</i> ,
" <i>catenatus</i> ?	<i>Arca scalarina</i> ,
<i>Strombus Leidyi</i> ,	" <i>crassicosta</i> ,
* " <i>pugilis</i> ,	* " <i>lienosa</i> ,
<i>Cypræa (Siphocypræa) problematica</i> ,	" <i>aquila</i> ,
* <i>Pyrula reticulata</i> ,	" <i>plicatura</i> ,
* <i>Natica canrena</i> ,	" (<i>Arcoptera</i>) <i>aviculæformis</i> ,
* " <i>duplicata</i> ,	* <i>Pectunculus lineatus</i> ,
* <i>Crucibulum verrucosum</i> ,	" <i>aratus</i> ,
<i>Crepidula cymbæformis</i> ,	<i>Spondylus rotundatus</i> ,
* " <i>fornicata</i> ,	* <i>Plicatula ramosa</i> ,
<i>Turritella perattenuata</i> ,	<i>Pecten solarioides</i> ,
" <i>apicalis</i> ,	" <i>comparilis</i> ,
" <i>cingulata</i> ,	" <i>Mortoni</i> ,
" <i>mediosulcata</i> ,	* " <i>nodosus</i> ,
" <i>subannulata</i> ,	* " <i>nucleus</i> ,
* <i>Cerithium atratum</i> ?	<i>Anomia Ruffini</i> ,
" <i>ornatissimum</i> ,	<i>Ostrea meridionalis</i> ,
* <i>Bulla striata</i> ,	* " <i>Virginica</i> .
* <i>Siliqua bidentata</i> ,	

The species preceded by an asterisk are living forms.

It will be seen from the above enumeration that of a total of some eighty-nine species forty-one are still members of the recent fauna, constituting forty-six per cent. of the entire number. In addition to these immediate representatives of the recent fauna there are a number of forms which are secondarily representative in the circumstance of being ancestral, *i. e.*, they are manifestly types from which, through an evolutionary process, a portion of the recent fauna has been derived. The close relation which thus binds together the fauna of the present period with that

of the Caloosahatchie leaves no doubt as to the Pliocene age of the latter.

The exact position in the Pliocene series which the Caloosahatchie deposits occupy, gauged by the standard of classification adopted by European geologists, cannot be readily determined, owing to the very limited number of forms which appear to be common to both sides of the Atlantic. In the percentage of living forms the formation stands nearest to the Antwerp (Black) Crag, the Diestian of the Belgian geologists and to horizon III of the Bolognese Apennines, in which the proportion of living to extinct forms, as determined by Foresti, is somewhat above 43 per cent. (*vide* Fuchs, *Die Gliederung der Tertiärbildungen am Nordabhange der Apenninen von Ancona bis Bologna*, Sitzungsber. d. k. Akad. Wissensch., lxxi, p. 177, Vienna, 1875; Heilprin, Contributions to the Tertiary Geology and Paleontology of the United States, p. 64, 1884). This horizon constitutes the base of the Italian Pliocene series (Astian) according to those geologists who, like Capellini, recognize in the lower sub-Apennine deposits a transition formation (Mio-Pliocene; Messinian, in part, of Meyer) uniting the Miocene with the Pliocene. The relation held by the "Floridian" formation to the deposits of next oldest date occurring in the eastern United States is almost precisely similar to that which obtains in the case of the Bolognese Apennines. Thus, the "Carolinian" formation, which until the discovery of the South Floridian bed just referred to was considered to represent the newest stage of the Atlantic Tertiary series, occupies a position analogous to the Mio-Pliocene of Capellini. In its upper member, which comprises the beds occurring in South Carolina, the proportion of living to extinct molluscan forms is, as I have elsewhere shown,* from 35-38 per cent., and I have indicated that while both stratigraphically and faunally this series is more nearly Miocene than Pliocene, it yet might be considered to occupy a position intermediate between the two. In the upper member of Capellini's Mio-Pliocene, Foresti's horizon II, the percentage of living forms is 38.8. The "Floridian" formation may thus be safely considered to represent the base of the true Pliocene. The percentage of recent forms in the oldest of the British Crag series, is, according to Lyell, upwards of sixty.

* Contributions to the Tertiary Geology and Paleontology of the United States, p. 62.

FOSSILS OF THE SILEX-BEARING MARL (MIOCENE) OF
BALLAST POINT, HILLSBORO BAY.

GASTEROPODA.

Genus **WAGNERIA**, Heilprin.

I propose this genus for a very remarkable shell, distinguished by peculiarities of structure which broadly separate it from all other Gasteropoda. These peculiarities are: firstly, that the inner or columellar lip is so largely developed as to cause it to envelop a very large, if not the greater, part of the shell, duplicating the outer wall and labrum; and secondly, that through an apparent conjunction of both folds of the mantle, a dome of shell is built over the spire, from which its own walls are separated by a free air-space. This part of the shell appears, therefore, as a second section, completely separated from the basal or apertural division. In what precise manner this dome was formed it is impossible to say, but manifestly the lobes of the mantle must have extended upward from the aperture, arched over, and deposited the shell-layer. The free space which separates the dome from the spire would seem to indicate that the mantle possessed a special rigidity, by which it retained itself. The genus may be briefly characterized as follows:

Shell irregularly oval or rounded-fusiform, intumescently knobbed; spire elevated, broadly scalariform, concealed in a pointed dome which is formed over it by a free upward extension of both lobes of the mantle; aperture narrow, deflected forward in its upper course, where it is reduced to a mere slit, appressed to the body of the shell by a pseudalar expansion of the outer lip; inner lip developed to a most extraordinary extent, covering by its expansion almost the entire, or the whole, shell, duplicating the outer lip.

This extraordinary genus of shells, which I take pleasure in naming after the late Prof. William Wagner, the generous founder of the Wagner Free Institute of Science, of this city, is apparently a near ally of *Orthaulax* of Gabb (Proc. Acad. Nat. Sciences Phila., 1872, p. 272, pl. ix, figs. 3, 4; Trans. Am. Phil. Soc., xv, p. 234), a form evidently closely related to some of the *Rostellariæ*, as *Calyptrophorus* and *Hippochrenes* (*Macroptera*), in which the inner lip is frequently abnormally developed. The remarkable duplication seen in *Wagneria*, produced by the complete backward prolongation of the labium, which actually overlaps a large, if not the greater,

part of the labrum, serves, apart from all other characters, to readily distinguish it from the more nearly related forms of the group. Mr. Gabb remarks that in *Orthaulax* the "adult shell [is] enveloped over the whole spire by an extension of the inner lip," but adds that the "outer lip [is] apparently sharp and simple." An examination of the specimens deposited by Gabb in the Academy of Natural Sciences shows that the latter part of his statement is incorrect, the outer lip being to a considerable extent duplicated. The Florida species which I refer to *Wagneria*, exhibits this character in a very striking degree, the backward extension of the labium, as seen on a cross-section some distance from the actual base, being fully as ponderous in structure as the labrum proper, which it overlaps as a very distinct outer layer. The duplication exists over at least two-thirds of the shell. The unique dome which conceals the spire is a character not seen in *Orthaulax*, and is one of the most anomalous structures found among the Gasteropoda.

Wagneria pugnax, nov. sp. Fig. 36.

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 crescentical 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 very 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 inch.

What the precise relationship of the genus represented by this species may be I am not prepared to say.

Zittel (*Handbuch der Palæontologie*, 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.

Murex larvæcosta, nov. sp. Fig. 37.

Shell angulated, obscurely scalariform; varices seven to eight in number, obtusely rounded, direct; whorls moderately angulated on the shoulder, crossed by numerous elevated revolving lines, about ten 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 shell, the (slightly-deflected) canal about one-half the length of aperture.

Length, 1.6 inch; width, .9 inch.

Murex crispangula, nov. sp. Fig. 38.

Shell strongly angulated, markedly rugose; spire elevated, of about five volutions; varices six (on the body-whorl), sharp, deflected obliquely toward the base of the shell; surface of shell very strongly lined, the lines of three series, primary, secondary, and tertiary; those of the first series about ten 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 shell, the very narrowly-contracted canal gently deflected.

Length, 1.6 inch; width, .7 inch.

This species may be readily distinguished from *M. larvæcosta*, 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.

Murex tritonopsis, nov. sp. Fig. 39.

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 costæ 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*, Conr., from the Vicksburg beds, but may be distinguished by the presence of two sharply-defined costæ between each pair of varices, and in the character of the revolving striæ, which are very much finer and more crowded in the Mississippi fossil.

The young of *M. pomum* somewhat resembles the Florida fossil, but may be readily distinguished by the superior angulation of the whorls and the irregularity of the costation.

Murex trophoniformis, nov. sp. Fig. 40.

Shell having the form of Trophon; whorls about six, sub-angulated superiorly, very convex; varices placed at irregular intervals, four on the body-whorl, the intervariceal spaces with one, or two, or even three secondary costæ; aperture about two-thirds the length of 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.

Murex spinulosa, nov. sp. Fig. 41.

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.

Latirus Floridanus, nov. sp. Fig. 42.

Shell fusiform, about equally tapering; whorls convex, sub-angulated superiorly, costated; about ten obtuse costæ on the body-whorl; aperture somewhat exceeding one-half the length of 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.

An apparent variety of this form, possibly a distinct species, has a somewhat more depressed outline, a more pointed apex, and is generally more rugose in its ornamentation. The columellar folds are more nearly transverse, and three to four in number.

This species appears to be on the whole most nearly related to the recent *Latirus infundibulum*, from which it differs in the greatly reduced spire, and a proportional elongation of the siphonal tract.

Fulgur coronatum, Conr.

Bull. Nat. Inst., p. 187.

A fossil from the Miocene deposits of Maryland.

Fulgur spiniger? Conr.

Journ. Acad. Nat. Sciences Phila., new ser., i, p. 117, pl. 11, fig. 32, as *Fusus*.

A solitary specimen, somewhat imperfect, which differs from the Vicksburg fossil only in the slightly more depressed character of the shoulders of the whorls.

Turbinella polygonata, nov. sp. Fig. 43.

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 costæ obsolete, resolved into a number (about eight) of shoulder-nodes, which break the circumferential outline into a polygon; aperture greatly exceeding the spire in length; columellar folds three, 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.

Vasum subcapitellum, nov. sp. Fig. 44.

Shell elevated, pagodæform; whorls of the spire about seven in number, coronated and strongly costated, the concentric lines (two or three) 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 six in number, below which are two not very prominent lines, and above, some seven 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; columellar plaits three, transverse, the upper the largest; surface of shell covered with rugose lines of growth.

Length, 1.4 inch; width, .7 inch.

This shell very closely resembles the recent *Vasum capitellum*, especially the young of that form, and might at first sight be readily mistaken for that species. It differs in its less foliaceous aspect, smaller size, the elevation of the shoulder (nearly flat in *V. capitellum*), and in the presence of only a single row of basal spines (instead of two). I believe there can be no doubt as to its being the ancestor of the living form.

Voluta musicina, nov. sp. Fig. 45.

Shell cylindrical; spire elevated, of about seven volutions; whorls convex, strongly costated, impressed below the suture, so as to divide the costæ into a double series; costæ very prominent, obtuse, about ten on the body-whorl, crossed at right angles by rather distantly-placed, elevated revolving lines; outer lip with a reflected border; inner lip distinct in its lower half, plicated over its entire extent, the plicæ increasing in size from above downward, nearly transverse in direction; aperture considerably over half the length of shell, narrow.

Length, nearly two inches; greatest width, at about the middle of the shell, slightly exceeding one inch.

The shell bears a very general resemblance to the recent *Voluta musica*, of which it may be considered an immediate ancestor, differing from that form principally in its narrower outline, the depressed shoulder

of the body-whorl, and the subsutural impression. There is no trace of coronation. The form is intermediate between *Voluta* proper and *Lyria*, perhaps nearer to the latter.

Voluta (Lyria) zebra, nov. sp. Fig. 46.

Shell cylindriform, with an elevated, slightly scalariform spire of about six volutions; whorls costated, the costæ (about twenty on the body-whorl) closely-placed, sharply-defined, oblique, forming a pseudo-coronation on top of the whorls; outer lip greatly thickened on the border, slightly ascending; inner lip irregularly plicated over its entire extent, the three or four basal plicæ 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 costæ, 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.

This shell most nearly resembles *Voluta pulchella* of Sowerby, a Miocene fossil of Santo Domingo (Q. J. Geol. Soc. London, vi, p. 46, pl. ix, fig. 4), but may be distinguished by its narrower spire, the greater number (best seen on the spire) and more direct obliquity of the costæ, and the costal coronation on top of the whorls. Exceptionally the costæ are equally crowded in *V. pulchella*, but the regular convexity of the whorls, and the absence of the subsutural coronation, seem invariably to distinguish that form. Much the same characters separate it from *Otocheilus (Fulgoraria) Mississippensis* of Conrad, from the Vicksburg (Oligocene) group, which is also a narrower shell. In its ornamentation the Florida fossil more nearly approaches the recent *V. Delessertiana*.

Mitra (Conomitra) angulata, nov. sp. Fig. 47.

Shell ovately cylindriform, longitudinally plicated; whorls of the 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 shell; columellar folds four, the upper nearly oblique.

Length, .4 inch; width, .17 inch.

Conus planiceps, nov. sp. Fig. 48.

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.

Very closely resembles *Conus Haitensis* of Sowerby, a Santo Domingo fossil, from which it may be distinguished by its more regularly depressed crown, and the character of its ornamentation. The latter species is so variable, however, that not impossibly the Florida form may ultimately prove to be only a variety, although in the extensive series of specimens contained in the Gabb collection, illustrating Sowerby's species, I fail to find anything which fully agrees with it.

? *Pleurotoma ostrearum*, Stearns.

I identify with this species a small *Pleurotoma* which appears to differ (?) from the living form only in having the costæ more distantly removed from one another, and possibly also a little more prominent. It very closely resembles *P. abundans*, of Conrad, from the Vicksburg deposits of Mississippi.

Cypræa tumulus, nov. sp. Fig. 49.

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 twenty-five evenly placed dental plications; columellar surface flattened, the teeth less prominent; surface of 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.

This species may be readily recognized by the marked elevation of its dome, which is more pronounced than in the case of any other American species of the genus, except *C. sphaeroides*, Conr., from the Vicksburg (Oligocene) beds, in which this character is still more emphasized. The latter species may be distinguished by its globose form, contracted aperture, and the absence of revolving striæ.

Oniscia Domingensis, Sowerby (1850).

Q. Journ. Geol. Soc. London, vi, p. 47, pl. 10, fig. 3.

Gabb, "Santo Domingo," Trans. Am. Philos. Soc., xv, p. 223 (as *Morum*).

A single individual, measuring .7 inch in length, in which the granules are largely wanting on the columellar surface, a condition which, according to Sowerby, also characterizes the young of the Dominican form. Mr. Gabb affirms that this species is "very different from *Oniscia harpula*, Conr., from the Vicksburg Eocene [Oligocene], although Mr. Conrad has asserted their identity." I must admit, however, that an examination of the type of Conrad's species, described in the Journal of the Academy of Natural Sciences for 1848 (p. 119), inclines me to the

belief that Conrad's determination is the correct one. The two forms are certainly most intimately related, despite Gabb's assertion to the contrary; the Mississippi fossil has a somewhat higher spire, and a more thickened outer lip, but these distinguishing characters may belong exceptionally to the single individual which in the Philadelphia collection represents Conrad's species.

Natica amphora, nov. sp. Fig. 50.

Shell semi-globular, depressed on the basal surface; spire elevated, of about four volutions, all the whorls deeply channeled along the sutural 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 sub-carinated; surface smooth.

Length, about four inches; greatest width, across the centre of aperture, 3.7 inches.

This species, the largest of the American fossil *Naticas*, cannot be readily confounded with any of the hitherto described members of the genus. Although in a general way recalling the recent *N. duplicata*, it is immediately distinguished from that form by the deeply impressed sutural-line and the exposed umbilicus. Its nearest ally appears to be *N. maxima*, Grateloup, from the deposits of Bordeaux and Dax, France, but it lacks the peculiar expansion of the body-whorl of that species, and further differs in the exposed umbilicus.

Amaura Guppyi, Gabb.

Trans. Am. Philos. Soc., xv ("Topography and Geology of Santo Domingo"), p. 224.

Identified by a single specimen.

Natica streptostoma, nov. sp. Fig. 51.

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.

Turritella pagodæformis, nov. sp. Fig. 52.

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.

Turritella Tampæ, nov. sp. Fig. 53.

Shell moderately elevated, the whorls 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 sub-quadrangular; base convex.

Length ?

Turbo crenorugatus, nov. sp. Fig. 54.

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 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*.

Turbo heliciformis, nov. sp. Fig. 55.

Shell dome-shaped, the whorls convex, closely enveloping above—toward the apex—less so below, ornamented with numerous equally-placed revolving lines, upon one or more of which immediately adjoining the suture there is a faint crenulation; aperture obliquely-oval; base convex; umbilicus deep, round.

Length (height), .4 inch; diameter of base, .6 inch.

Most nearly resembles *Turbo (Omphalius) viridis*.

Delphinula (?) solariella, nov. sp. Fig. 56.

Shell turbinate, moderately umbilicated; whorls subangular, channeled on the basal margin, ornamented with about five concentric beaded lines, the beads largest on the upper lines; base of shell flattened, indis-

tinctly 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.

Closely resembles *Solariorbis bella*, of Conrad, from the Claiborne (Eocene) sands of Alabama, but the whorls in that shell are much more angular, and have two equally prominent circumferential channels instead of the single basal one seen in the Florida fossil. The generic position of the species cannot be definitely determined.

Genus **PSEUDOTROCHUS**, Heilprin.

Shell turbate, umbilicated, with the general aspect of the members of the family *Turbinidae* or their allies, but differing in the siphonate character of the aperture; aperture round, the lip continuous except at the base, which is truncated through the formation of a sharply and obliquely deflected short canal.

I propose this genus for a rather anomalous shell, whose relationship I cannot even guess at. As stated in the generic diagnosis it recalls in habit the turbos, troques, or delphinulas, from which, however, it is immediately separated by the apertural canal. It also in a measure recalls *Trichotropis*, but is of a much firmer and heavier build. Whether or not the shell was nacreous in structure I am unable to say, as the original material has been completely replaced by silica. I know of no form, either recent or fossil, with which it can be said to be closely related.

Pseudotrochus turbinatus, nov. sp. Fig. 57.

Shell doubly turbate, 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 pseudo-costulations, which are crossed by several transverse lines; base of shell pyramidally convex, concentrically ridged and lined; aperture sub-rotund, canaliculate; inner lip raised, and forming a border to the umbilical sulcus.

Length, .8 inch; greatest width, .8 inch.

Cerithium præcursor, nov. sp. Fig. 58.

Shell small, slender, of the general habit of the recent *C. muscarum*; whorls about ten, longitudinally plicated and concentrically ridged, the ridges or lines about three on each of the whorls of the spire, five 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.

Differs from *C. muscarum* in lacking the basal carination of that species; from *C. ferrugineum*, apart from differences in the character of the ornamentation, in the form of the outer lip, which is not sub-orbicular.

Genus **POTAMIDES.**

Sub-genus **Pyrazisinus**, Heilprin.

I propose to designate under this name certain shells which combine the general characters of Potamides and Pyrazus, differing from the former in the non-canaliculate character of the aperture, and from the latter in the possession of a deep sinus in the labrum; the outer lip is effuse, thickened—much as Cerithidea—and carried completely over to the labium, so as to enclose a round siphonal aperture, as seen in the recent *Pyrazus sulcatus*.

Pyrazisinus campanulatus, nov. sp. Fig. 59.

Shell elevated, rapidly tapering; whorls of spire about ten, convex, obliquely costated, concentrically striated, appearing generally rugose; costæ 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.

Partula Americana, nov. sp. Fig. 60.

Shell ovately-cylindrical, of about seven volutions; the whorls very convex, longitudinally finely lined, the lines, which are barely visible to the naked eye, somewhat more regular than simple lines of growth, and directed downwards obliquely to the right; body-whorl nearly two-thirds the length of shell; aperture narrowly oval, vertical, somewhat less than half the length of shell; lip reflected.

Length, .65 inch; width, .3 inch.

This shell, as far as I am aware, is the first fossil species of *Partula* known, and is remarkable as extending the range of the genus to a region removed by one-half the circumference of the globe from its true habitat. In what manner its ultimate distribution was effected can only be a matter of conjecture. The species is closely related to *P. grisea*.

Helicina, sp.?

Several specimens closely resembling in outline *H. substriata* of Gray.

Strophia, sp.?

One specimen, very like *S. incana* of Binney, only a trifle broader; compared with recent specimens from Florida.

LAMELLIBRANCHIATA.

Venus penita, Conrad.

Am. Journ. Science, second ser., ii, p. 399.

? *Venus Floridana*, Conr., id., ii, p. 400.

Shell cuneiform, evenly rounded anteriorly, produced posteriorly; base sinuous; umbones prominent, overlooking a broadly cordiform lunule; the posterior slope sharply angulated, the angulation preceded by a gentle undulating fold; ligamental margin very oblique, and straight from umbo to extremity; cardinal teeth robust; external surface covered with fine concentric lines, the series interrupted at irregular intervals; base crenulated.

Length of largest specimens, 1.3 inch; height, nearly one inch.

The shell is not produced posteriorly to the extent that is represented in Conrad's figure, which is taken from a cast; nor is the anterior portion prolonged much beyond the beaks, so that despite its peculiar cuneiform outline the shell appears high. I have little doubt that Conrad's *V. Floridana* is the young of this species, which is closely related to the recent *V. macrodon* of Deshayes, from the coast of Central America. The latter form is distinguished by its much coarser ribs, and the interstitial semi-line that appears on the posterior angulation.

Venus magnifica, Sowerby.

Thesaurus Conchyliorum, ii, p. 704, pl. 153, fig. 5; Gabb, "Santo Domingo," Trans. Am. Philos. Soc., xv, p. 249.

A single valve, which is undistinguishable from the Dominican fossil (Miocene) and the recent species of the Philippine seas; it differs from *V. puerpera* in having a straight hinge-line. In the collection of the Academy of Natural Sciences of this city there is an undetermined species of *Venus* from Egmont Key, Florida, which is very closely related to our fossil. It differs in the want of regularity of the concentric raised lines, and in its broadly cordiform lunule.

? *Cytherea staminea*, Conrad.

Foss. Med. Tert. U. S., pl. 21, fig. 1.

Two valves, which differ in but insignificant details from the Miocene fossil of the Atlantic slope.

? *Cytherea Sayana*, Conrad.

Foss. Med. Tert. U. S., p. 13.

A single valve, which has much the aspect of this species, but is a somewhat longer shell and less convex proportionately. It may possibly represent a distinct form.

Cytherea nuciformis, nov. sp. Fig. 61.

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.

? *Chama macrophylla*, Chemnitz.

Conch. Cab., vii, p. 149.

Gabb, "Santo Domingo," Trans. Am. Philos. Soc., xv, p. 251.

Numerous small shells, the largest not measuring over one inch in greatest extent, which have a general resemblance to the recent form. In the absence of larger specimens I prefer to consider the identification as somewhat doubtful, seeing how very closely the young of different species of *Chama* resemble one another. The species appears to be both dextral and sinistral, unless, indeed, two distinct forms are represented by the valves in my possession. One or more of the individuals are undistinguishable from Conrad's *Chama congregata* (Miocene of the Atlantic border).

Lucina Hillsboroensis, nov. sp. Fig. 62.

Shell (known only by the left valve) disciform, suborbicular, evenly rounded anteriorly and basally, truncated posteriorly; beak pointed, sub-central; the pre-umbonal border rapidly declivous, direct; two oblique, fairly prominent, cardinal teeth; surface covered with numerous regularly-placed, concentric and slightly flexuous, lamellæ, about eighteen to the inch, between which are seen finer lines.

Length, 2.2 inches; height, the same.

Differs from *Lucina disciformis*, Heilpr., in its suborbicular outline; from the recent *L. filosa*, apart from other characters, in lacking the convexity of that species.

Crassatella deformis, nov. sp. Fig. 63.

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.

Cardita (Carditamera) serricosta, nov. sp. Fig. 64.

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 the top of umbo, one inch.

This species bears a close resemblance to the recent *C. laticostata*, but may be distinguished by the narrowness of its ribs—as broad as or broader than the interspaces in the recent form—and the prominence of its umbones.

***Arca imbricata*, Bruguiere.**

Encycl. Méth., 1789, p. 98.

Gabb, "Santo Domingo," Trans. Am. Philos. Soc., xv, p. 254.

A number of individuals, which are practically identical with the recent forms from Key West, Fla. (from the collections of Hemphill), and the Miocene fossil of Santo Domingo (*Arca Noë?* of Guppy, Q. Journ. Geol. Soc. London, xxii, p. 293). The species is also very closely related to, if not identical with, the Mediterranean *A. tetragona* of Poli. *Arca ocellata*, Reeve, from the coasts of the Malay Peninsula, so nearly resembles the Florida fossil as to be barely distinguishable from it. The only points of difference appear to be a more pronounced angulation (in the eastern shell) of the posterior slope, and the lack of radiating lines on the basal portion of this slope. *Arca protracta*, Conrad, from the Oligocene deposits of Vicksburg, is a close ally, but is a much more elongated shell, and has the posterior border emarginated or sinuous, instead of direct.

***Arca Listeri?* Philippi.**

Abbild. und Beschreib. Conchyl., iii (1851), p. 87.

I have identified with this form a number of arks undistinguishable from a recent species of the South Florida coast, which Mr. Tryon has determined to be Lister's species. I am not absolutely satisfied as to the correctness of this determination, since the recent Florida shell lacks the peculiar light color stripe which, according to Philippi's description, would appear to be characteristic of his species, and has the umbonal region in addition less inflated. The general habits and other characters are, however, the same in both forms. Gabb's *Barbatia Bonaczyi*, from the Miocene of Santo Domingo, appears to be identical with the Florida form.

***Arca arcula*, nov. sp. Fig. 65.**

Shell moderately elongated, sharply angulated on the posterior slope, the dorsal and ventral 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.

Leda flexuosa, nov. sp. Fig. 66.

Shell subequal, 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.

This shell most nearly resembles the recent *Leda costellata* of Sowerby, but differs from that species in the non-flexed basal outline, and in lacking the very pronounced angulation of the concentric lines on the posterior slope. From *L. acuta* it differs in the comparative coarseness of its ornamentation, its larger size, and the posterior flexion in its lines.

Lithodomus, sp.?

Two casts, very much like *L. inflatus* or *L. corrugatus*.

? *Lima scabra*, Born.

Mus. Cæs., p. 110.

Two valves which are undistinguishable from the less spinose variety of the recent species inhabiting the West Indian seas. The echination is very fine, appearing somewhat like a raised tessellation. Possibly this form may represent a variety of the East Indian *L. tenera*, of Chemnitz.

*List of Species occurring in the Miocene deposits of Ballast Point,
Hillsboro Bay.*

Wagneria pugnax,	Turbo heliciformis,
Murex larvæcosta,	Delphinula (?) solariella,
“ crispangula,	Pseudotrochus turbinatus,
“ tritonopsis,	Cerithium precursor,
“ trophoniformis,	Potamides (Pyrazisinus) campanu-
“ spinulosa,	latus,
Latirus Floridanus,	Partula Americana,

Fulgur coronatum,	Helicina sp.?
“ spiniger?	*Strophia incana?
Turbinella polygonata,	Venus penita,
Vasum subcapitellum,	* “ magna,
Voluta musicina,	Cytherea staminea?
“ (Lyria) zebra.	“ Sayana?
Mitra (Conomitra) angulata,	“ nuciformis,
Conus planiceps,	*Chama macrophylla?
*Pleurotoma ostrearum,	Lucina Hillsboroensis,
Cypræa tumulus,	Crassatella deformis,
Oniscia Domingensis,	Carditamera serricosta,
Natica amphora,	*Arca imbricata,
“ streptostoma,	* “ Listeri,
Amaura Guppyi,	“ arcula,
Turritella pagodæformis,	Leda flexuosa,
“ Tampæ,	*Lithodomus inflatus?
Turbo crenorugatus,	*Lima scabra.

The species preceded by an asterisk are living forms.

Of the forty-seven species here enumerated from four to eight are living forms, so that the representation of the recent fauna might perhaps in a general way be assumed to be about 13-15 per cent. The Miocene age of the deposit is thus placed beyond question; and if the proportion of living forms determined for this limited collection be assumed to be approximately correct for a more extended series, then manifestly the exact position of the horizon will be not far from the base of the Miocene. This accords well with the location of the formation, and its own special faunal relationship. None of the fossils—possibly, with one exception—appear to be identical with forms found in the Oligocene deposits of the southern United States; on the other hand, some six or more—*Oniscia Domingensis*, *Amaura Guppyi*, *Venus magna*, *?Chama macrophylla*, *Arca imbricata*, *?Arca Listeri*, *Lithodomus*, sp.?—are common to the deposits of Santo Domingo. In these deposits the proportion of recent to extinct forms is claimed by Gabb to be as high as 30 to 33 per cent. (“Topography and Geology of Santo Domingo,” Trans. Am. Philos. Soc., xv, p. 101), which would make the formation of considerably newer date than is indicated by the Florida fossils. I have not had an opportunity to verify Mr. Gabb's determination, but from a casual examination of his collection it appears to me that strong exceptions might be taken to many of the specific determinations. Comparisons with a number of forms satisfy me that in at least several cases the selected distinctive characters cannot be relied upon, being more imaginary than real, and this criticism applies as well to cases of specific identification as to those of specific separation. But with all necessary

allowances for imperfections and deficiencies, it would still be impossible to determine whether the percentage of recent forms ought rather to be increased or diminished, unless a critical re-examination of all the species were entered into. It is, however, a significant fact, that the percentage, as determined by geologists who preceded Mr. Gabb, is placed very much lower than by Gabb himself. Thus, by Guppy the proportion is reduced to 20 per cent., and by Carrick Moore to from 17 to 8 or 9 per cent. (Q. Journ. Geol. Soc. London, xxii, p. 577). Mr. Guppy further recognizes the proportion of living forms among the Jamaican fossils, nearly all of which are stated by Gabb to occur also in Santo Domingo, to be likewise 20 per cent., but in all these cases the material upon which the determination was made was much less complete than that which served as a basis for Gabb's computation, so that not unlikely the latter's figures are more nearly correct than those furnished by his predecessors. Granting the accuracy of Mr. Gabb's conclusions, the Santo Domingo formation would then seem to represent a horizon somewhat higher in the Miocene scale than is represented by the Florida deposits, in which, as has already been shown, the proportion of recent forms is reduced to 13-15 per cent. This conclusion is in a measure borne out by the comparatively limited number of forms that are held in common by the two series of deposits, a fact significantly emphasized when the proximity to each other of the two areas under discussion is taken into consideration. Still, it is not safe to premise on too scanty material, and while it may be admitted without reservation that the silex-bearing deposit of Ballast Point is of Miocene age, its exact horizon in the Miocene scale may be considered to be as yet undetermined, although the strong probability points to its representing a part of the "Virginian" series. It is surprising that so few of the distinctly Miocene fossils of the Atlantic border should be found here, the more especially as on the Big Manatee River, not more than some thirty miles distant (almost due south), such fossils—*Pecten Madisonius*, *Pecten Jeffersonius*, *Venus alveata*, etc.—are prominent by their abundance.

The fact that the silex-bearing deposit of Ballast Point can be shown to be unequivocally of Miocene age is important as bearing directly upon the age of the foraminiferal rock occurring at the same locality, and at Magbey's Spring, about a quarter of a mile above Tampa, on the Hillsboro River. It will be remembered that this rock was correlated by Conrad with the white limestone of the Vicksburg (Oligocene) group, and merely from the circumstance of its containing in abundance the remains of a foraminifer, supposed to be a nummulite (*Nummulites* [*Assilina*] *Floridanus*). This supposed nummulite is, however, no nummulite at all, but an orbitolite, so that whatever inference may have been drawn from the occurrence of a form considered to be nearly related

to the foraminiferal exponent of the Vicksburg beds counts for naught, although in itself the presence in great quantity of an orbitolite would, if not exactly indicate, at least suggest, the Oligocene period. But the genus is also fairly abundant in the periods preceding and succeeding—*i. e.*, Eocene and Miocene—so that corroborative evidence of one kind or another is needed before we can definitely assign its true position as a constituent of rock masses. Now, it is a significant circumstance that the Oligocene rock proper of the Floridian peninsula—that which I have indicated as the “Orbitoitic”—which is characterized by an abundance of remains of the genera *Orbitoides* and *Nummulites* (either of the one or the other, or of both), is wholly wanting in the genus *Orbitolites*, at least no indications of that genus have as yet come to light there. On the other hand, the genus is represented in the Miocene deposits of the island of Santo Domingo, and by a form which differs but little, if at all, from that which is so abundantly developed in the cream-colored or yellowish limestone of Ballast Point and Magbey’s Spring. This form appears to be closely related to, if not identical with, *Orbitolites complanata*, a well-known fossil of the European Tertiaries, whose range extends from the base of the Eocene possibly to the present time. Again, in the orbitolite rock of the localities just referred to, I failed to detect even as much as a trace of either *Nummulites* or *Orbitoides*, a circumstance of no little significance when the proximity of this formation to the recognized Orbitoitic of the North is taken into account. The conjunction of these circumstances leads naturally to the supposition that the rock in question is *not* a member of the Oligocene series, as has been very generally supposed. Its geographical position, and the fact that the genus *Orbitolites* is a member of the Dominican fauna, lends strong support toward considering the true age as Miocene, a conclusion which receives further confirmation from the evidence carried by the fossils associated with *Orbitolites*. These are in most cases in the form of casts and impressions, mainly undeterminable, but a few of them are sufficiently distinct and characteristic to permit of definite location. One of these, and possibly the form that is most abundantly represented, is *Venus penita*, from the casts and impressions of which in this rock the species was originally described by Conrad. This shell figures very prominently among the silicified fossils of Ballast Point, but is, as far as I am aware, entirely wanting in the Cerithium rock of the Hillsboro River, which, as has already been shown, underlies the rock containing *Orbitolites*. Other species apparently identical with forms occurring in the silex-bearing “marl” of this locality are *Cytherea staminea* and *C. nuciformis*. A large cone, possibly identical with *Conus planiceps*, is represented by several casts.

It is to be further remarked, that the Cerithium—*C. Hillsboroensis*—

which constitutes the distinctive faunal feature of the underlying cherty-rock of the Hillsboro, and of the tough blue rock which crops out at Ballast Point, is wholly absent from the rock with orbitolites; similarly, the orbitolite appears to be wanting in the Cerithium rock. What the precise age of the latter deposit may be cannot be determined from its faunal features alone, since the Cerithium, which, as far as my own experience goes, constitutes the only clearly definable species among the numerous molluscan impressions, has thus far not been met with in any other formation, and consequently gives no clue as to the horizon represented by it; but from the position occupied by the rock—stratigraphically underlying the Miocene (probably the lowest member of the Miocene) and geographically wedged in between the Oligocene and Miocene—from both of which it differs widely in faunal characters—I think it may be fairly assumed that it lies on the border horizon of the two series, forming the transition ground.

FOSSILS FROM LOCALITIES NORTH OF BALLAST POINT.

Cerithium Hillsboroensis, nov. sp. Fig. 67.

Shell elevated, of ten or more volutions; sutures 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.

Of the type of the European *Cerithium elegans*, but the moniliations on the lower lines of the whorls are direct, and not oblique, and the number of such lines is also different; the upper granulations are, in addition, comparatively more prominent.

Very abundant in the rock forming the bed of the Hillsboro River, which is the first example in this country of a true *Cerithium* bed. The horizon represented is probably the junction of the Oligocene with the Miocene.

Cerithium cornutum, nov. sp. Fig. 68.

Shell elevated, rapidly tapering, of about 10-12 volutions; whorls convex, strongly costated, the costæ (about seven on the penultimate whorl) oblique and somewhat sigmoidal; body-whorl 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. Willcox. This form may be readily recognized by its peculiar cornual protuberances.

Orbitolites Floridanus, Conrad (sp.)

Am. Journ. Science, new ser., ii, p. 293, as *Nummulites (Assilina)*.

Nemophora Floridana, Conr., Proc. Acad. Nat. Sciences Phila., 17, p. 74, 1865.

Cristellaria? Floridana, D'Orbigny, Prodrome de Paléontologie, ii, p. 406.

In my paper "On the Occurrence of Nummulitic Deposits in Florida, and the Association of Nummulites with a Fresh-water Fauna" (Proc.

Acad. Nat. Sciences Phila., July, 1882; Contributions to the Tertiary Geology and Paleontology of the United States, 1884, p. 80) I call attention to the vague description and apparently imperfectly represented figure of the fossil which Conrad refers to Nummulites, remarking that its reference appeared to me very doubtful. Up to that time I had not seen any specimens of the fossil in question, my search among rock fragments that had been sent to me by different parties from Florida proving in all cases ineffectual. At Ballast Point, on Hillsboro Bay, and again in the rock at Magbey's Spring, about a quarter of a mile above the town of Tampa, on Hillsboro River, I was fortunate in finding great quantities of the form that I had been so long in search of, and which had been overlooked for a period of nearly forty years. A cursory examination of the species immediately confirmed my suspicions as to the inaccuracy of its generic determination. The species does not even belong to the great group which includes Nummulites, much less to the genus; it is a true orbitolite, and very close specifically to—if not, indeed, identical with—the common European *Orbitolites complanata*. Its internal structure can be determined even with an ordinary hand-magnifier with considerable precision. The greater number of the individuals are regularly involute, but others assume the cycloidal form represented by Conrad, an appearance in some cases brought about by an irregular exposure of the different planes of the test. More frequently, perhaps, the same form is due to an actual exocyclic involution of the test, as has also been observed by Carpenter and others in the European fossil and the recent species.

The probable Miocene age of the Orbitolitic rock has been commented on in the last section.

Other Foraminifera observed in the peninsula were:—

Nummulites Willcoxi, Heilpr.

Proc. Acad. Nat. Sciences Phila., 1882, p. 191; Contributions to the Tertiary Geology and Paleontology of the United States, 1884, p. 80.

Very abundant in the rock at Loenecker's, on the right bank of the Cheeshowiska River, about four miles above its mouth.

Nummulites Floridensis, Heilpr.

Proc. Acad. Nat. Sciences Phila., 1884, p. 321.

Associated with the preceding in the same locality.

Orbitoides ephippium (sella), Schloth.

Die Petrefact., 1820, p. 89.

Very abundant at the nummulite locality on the Cheeshowiska; less abundant near the mouth of the river (John's Island, etc.), at the spring-head, and in the rock of the Homosassa.

? *Orbitoides dispansa*, Sowerby.

Trans. Geol. Soc. London, 2d ser., v, pl. xxiv, fig. 10, 1840, as *Lycophris*.

With the preceding.

Heterostegina, sp.?

In the Miliolite limestone of the Homosassa River.

Sphæroidina, sp.?

“ “ “ “ “

? *Biloculina*, sp.?

“ “ “ “ “

Triloculina, sp.?

“ “ “ “ “

Quinqueloculina, sp.?

“ “ “ “ “

Spiroloculina, sp.?

“ “ “ “ “

Several of the last named genera are also represented in the rock near the head-springs of the Cheeshowiska River, and in the mass that crops up on the immediate ocean-front above the landing at Clearwater.

The following table exhibits the relations of the Tertiary formations of the eastern and southern United States :—

Atlantic and Gulf Tertiaries of the United States.

POST-PLIOCENE.			<i>Foreign Equivalents.</i>
PLIOCENE.	FLORIDIAN.	Deposits of the Caloosahatchie.	Astian, in part; Foresti's horizon III of the Bolognese sub-Apennines?
MIOCENE.	CAROLINIAN. (Upper Atlantic Miocene.)	Deposits of North and South Carolina ("Sumter" epoch of Dana). Fossiliferous beds of Rocky Bluff, Manatee River, and of Philippi's Creek and Little Sarasota Inlet, Florida?	Probably the equivalent of a portion of the Messinian of Mayer (Sarmatian, in part, of Austrian geologists), and of the Miocene of the Bolognese sub-Apennines.
	VIRGINIAN. (Middle Atlantic Miocene.)	Deposits of Virginia and the newer group in Maryland ("Yorktown" epoch, in part, of Dana). Siliceous-bearing "marl" of Ballast Point; Orbitolite rock of Hillsboro Bay and River (Florida)?	Probably of the age of the "Second Mediterranean" of the Austrian geologists, and of the faluns of Touraine; Caroni beds of Trinidad; and Miocene of Santo Domingo, Jamaica and Cumaná?
	MARYLANDIAN. (Lower Atlantic Miocene.)	Older Miocene deposits of Maryland, and possibly the lower beds in Virginia ("Yorktown" epoch, in part, of Dana).	Probably (or at least partially) the equivalent of the "First Mediterranean" of the Austrian geologists, and of the faluns of Léognan and Saucats.
OLIGOCENE.	ORBITOITIC.	Strata characterized by species of <i>Orbitoides</i> . Vicksburg beds, Florida Nummulitic beds, etc.	Aquitanian. Deposits of Crosara and Castel Gomberto (Vicentin), Oligocene of the Mayence basin, sands of Fontainebleau, lower limestone of Malta, Fernando beds on Trinidad, Antigua chert, St. Bartholomew Oligocene.
EOCENE.	JACKSONIAN.	Jackson beds of Mississippi, "White Limestone" of Alabama.	Barton Clay (Bartonian). Sands of Beauchamp?
	CLAIBORNIAN.	Fossiliferous arenaceous deposit of Claiborne, Ala., etc.	Age of the "Calcaire Grosier" of France (Parisian).
	BUHRSTONE.	Beds below the true Claibornian on the Alabama River, "Chalk Hills" of the southern part of the State, etc. "Siliceous Claiborne" (Hilgard) of Mississippi. Maryland Eocene, in part?	Londonian?
	EO-LIGNITIC.	Lignite, sands, and clays situated at the base of the Tertiary series in Alabama, etc. Marlborough and Piscataway beds of Maryland? Shark River deposits of New Jersey.	Thanetian? Bognor rock?

ADDITIONS TO THE FLORIDIAN FAUNA.

Tropidonotus taxispilotus (?) var **Brocki**. Pl. 17.

I venture to describe, under the above name, the ophidian figured on plate 17, which agrees in general characters with one of the common forms of southern water-snake (*Tropidonotus taxispilotus*), but yet differs in certain elements of structure, which, taken by themselves and under absolutely normal conditions, would be considered to be of at least generic value. This peculiarity of structure rests principally in the disposition of the parietal head-shields, which, instead of consisting of the normal triangular pair, meeting in the median line, diverge from one another, leaving in the opened posterior angle or space a pair of accessory minor plates, that might be termed inter-parietals. The presence of this accessory pair may be due to a want of coalescence in calcification, since even the primary parietals show a disposition to split off into minor plates; or, at any rate, the presence of the outlines of the ordinary rhomb scales in these plates proves them to be composites in structure. In how far the peculiarly modified parietals, and the presence of the accessory pair, may represent permanent structures, I am unable to say, inasmuch as we obtained but a single individual of the species; but it is interesting to note, as will be observed by a reference to plate 17, that the distinctive feature is accompanied by a slight variation also in the arrangement and disposition of the ventral head-shields as well. Recognizing the multiple character of the head-shields, it becomes a question in how far these may be used as a basis for classification. In the present instance, although I have not been able to discover a parallel case, I feel confident that the characters are not of generic, nor probably of even specific value, and I have, therefore, referred the form in question to *Tropidonotus taxispilotus*, although separating it as a sub-species or variety.

Eagle Bay, Lake Okeechobee.

Ictalurus Okeechobeensis, nov. sp. Pl. 18.
(Okeechobee Cat.)

Of the general form and outline of *Ictalurus lacustris*, from which it differs principally in color, the relative position of the dorsal fin, and the greater length of the humeral spine. Head broad, depressed, of nearly equal width and length, with the eye nearly central antero-posteriorly; body moderately stout; dorsal fin nearer to the adipose fin than to the snout (the reverse in *I. lacustris*); humeral process moderately acute, covered by skin, about one-half the length (or more) of the pectoral

spine (barely more than one-third in *I. lacustris*); caudal fin deeply forked, the two lobes nearly equal, with a slight advantage in favor of the upper one. Color above, and largely over the sides, black or bluish-black, yellowish or cream-white on the under surface; one pair of inferior barbels white.

Total length, 21 inches.

Found in Lake Okeechobee.

Aplysia Wilcoxi, nov. sp. Pl. 19.

I would propose this name for a species of *Aplysia* which is probably fairly abundant in some of the western shallows, although we only met with it in Little Gasparilla Bay. The animal, in its general characters, appears to be most closely related to the European *A. depilans* (*leporina*), with which it may have been heretofore confounded, but differs in several well-marked points of structure, notably in color, the position of the buccal aperture, and in the characters of the pore connecting with the shell cavity. While in *A. depilans*, as described by Rang in his monograph of the *Aplysia* group (*Histoire Naturelle des Aplysiens*, Paris, 1828), the mouth is placed beneath the tentacular lobes—*i. e.*, the latter are superior, in the Florida species it is central with regard to those organs, the lobes being circumferentially connate, and completely encircling the aperture. The pore leading to the shell-sac is minute, and raised on a small papilla; the stellate markings radiating from the base of the papilla are very feeble, and can barely be discerned without close examination. The shell, which is about two inches in length, is horny-calcareous, deeply emarginate, and striated longitudinally and transversely. General color of the animal sea-green, tinged with purple, and irregularly blotched and speckled with spots of lighter color. Length, 7 to 8 inches. The animal emits a brilliant crimson fluid.

Found on a grass-bank, at a depth of about 2 to 3 feet, and also floating on the free surface of the water.

SUPPLEMENT.

ADDITIONAL SPECIES FROM THE PLIOCENE DEPOSITS OF THE
CALOOSAHATCHIE.

For the following new species of fossils I am indebted to Mr. Joseph Willcox and Dr. W. H. Dall, by whom they were collected during a recent visit to the region.

Pecten pernodosus, nov. sp. Fig. 69.

Shell nearly equivalve, strongly plicated and ribbed, the basal margin of both valves incurved; ribs about nine, broadly elevated, and profoundly knobbed on both valves, those of the right valve almost throughout broader than the interspaces, those of the left valve of equal width, or narrower than the interspaces, and alternating in size; knobs closely placed, more or less hollow, about ten on each rib in the largest specimen; ribs and interspaces radiately ribbed or lined, the lines crossed by numerous rugose creases of growth; ears unequal, longitudinally lined or grooved, the lines declivous; cardinal pit moderately deep.

Length, four inches; height, from apex to basal margin, four inches.

This beautiful scallop, which is, with little doubt, the immediate ancestor of the recent *Pecten nodosus*, can be readily distinguished from that species (and likewise from *Pecten subnodosus*, which is hardly more than a variety of *P. nodosus*) by the much greater prominence and regularity of its closely packed knobs, and in the circumstance that both valves are nearly equally knobbed. In *Pecten nodosus* the ribs of one valve, usually the right, are largely destitute of true knobs, although exhibiting here and there ephippial undulations; the knobs are also less regularly rounded, and the radiating lines are less numerous. Much the same differences separate the species from *P. Peedeensis*, from the Miocene of South Carolina.

Cardium Dalli, nov. sp. Fig. 70.

Shell ovately elevated, moderately ventricose, with the beaks apical, touching (or nearly so), and directed slightly backwards; ribs about 30 to 33, smooth, moderately elevated, teretely rounded, with narrow, impressed interspaces; the ribs on the posterior slope narrower and more crowded than over the general surface, minutely echinated in part.

Hinge-line narrow, acutely curved, with prominent lateral teeth; a prominent triangular cardinal tooth in each valve.

Height, from apex to basal margin, 5.3 inches; length (width), 3.7 inches.

This very interesting cockle, which I have the pleasure of naming after Mr. W. H. Dall, the distinguished malacologist of the U. S. National Museum, is closely related to the recent *Cardium subelongatum* from the West Indian seas, of which it is not unlikely the progenitor. In the latter the ribs are much narrower, scarcely exceeding in width the interspaces, and proportionately much more elevated. The echination on the posterior slope in the recent form appears also to be more strongly developed. As far as the color traces remain in the fossil species it would seem that the general scheme of coloring was the same in both species.

An interesting relationship is also maintained between *Cardium Dalli* and the Eastern *C. elongatum*, from the Philippines, which in size and general habit perhaps even more nearly corresponds to the Florida fossil than does *C. subelongatum*; it is, however, a much more ventricose shell.

Cerithidea scalata, nov. sp. Fig. 71.

Shell broadly turreted, scalariform; whorls ten or more, strongly ribbed, those beyond the sixth or seventh whorl from the apex with a more or less hollowed or excavated shoulder; ribs oblique, defined only on the lower half of the later whorls, twenty or more on the body-whorl, with one or two variceal interruptions; revolving lines distinct on the apical portion of the spire, cancellating that part of the shell; aperture? (broken); canal short, moderately deflexed.

Length (of imperfect specimen), 2.4 inches.

Vasum horridum, nov. sp. Fig. 72.

Having received a number of perfect specimens of this beautiful species, I am now able to supplement and complete the description given on page 75 of this report (Fig. 6).

Shell turbinata, thick, with the greatest width at about one-third the distance from the apex to the base; spire moderately elevated, of about 6 to 7 whorls, most of which are doubly coronated or calcitrapated by prominent lamellar or flattened spurs; the spurs regularly increasing in size, with the apices turned slightly backward.

Body-whorl strongly angulated on the shoulder, beautifully coronated, and crossed by about eight prominent revolving ridges, the four immediately following the shoulder coronation nearly equal, scaly, the sixth and seventh, more particularly, carrying long lamellar spines or tubercles, those of the sixth row inflexed upward.

Columellar plaits three, the uppermost by far the most prominent; aperture about two-thirds the length of shell, flexuous inferiorly; umbilicus long and broad.

Cypraea (Siphocypraea) problematica, nov. sp. Fig. 73.

Specimens of this species (*v. ant.*, p. 87, Fig. 12), with a complete coating of enamel, show that the general color of the shell was buff or cream-yellow above, irregularly and minutely spotted with darker shades of the same color (inclining to orange), and impure white below.

Mitra lineolata, nov. sp. Fig. 74.

Specimens of this shell, in certain respects more perfect than the type described on p. 79, indicate that the surface was covered by revolving lines of purple, corresponding in position to the raised lines, and that these were regularly blotched with spots of the same color, resembling the similar markings of *Voluta Junonia*. I have already indicated the characters which doubtfully serve to distinguish this species from Conrad's *Mitra Carolinensis*, and am now more than before inclined to believe that it may prove only a variety of that form.

Conus Tryoni, nov. sp. Fig. 75.

Length, six inches.

The following additional species have been identified as occurring in the "Floridian" (Pliocene) deposits of the Caloosahatchie :

Fusus exilis.	Niso, nov. sp.
Fasciolaria acuta.	Turbonilla, sp.
*Marginella roscida.	Corbula, sp?
*Terebra dislocata.	*Tellina tenera.
*Columbella lunata.	*Amphidesma equalis.
Cancellaria depressa?	*Semele rosea.
*Conus papilionaceus	*Cardium serratum.
(with color markings).	*Lucina cribraria.
*Conus Floridanus?	* " radians (Antillarum).
*Trivia pediculus.	*Leda acuta.
*Xenophora conchyliorum?	Astarte undulata?
Turbo, nov. sp.	Glandina.
Crucibulum ramosum.	Planorbis.
* " scutellatum.	Amplexa.
*Trochita centralis?	Paludina.
*Obeliscus arenosus.	

The species preceded by an asterisk are living forms.

With the above were found associated the remains of a proboscidean, horse, alligator and turtle.

Note on the geology of Little Sarasota Bay.—Mr. Willcox furnishes me with the following observations, made during a more recent visit, bearing upon the geology of this region: "Two small fresh-water streams empty into Little Sarasota Bay, not far south of Mr. Webb's house. At

the mouth of these streams a bed of ferruginous sandstone has been formed, the largest being about 100 yards in extent along the bay. The iron oxide, cementing the sandstone, undoubtedly was supplied by the fresh-water streams. In this bed are found abundantly many species of shells, such as are now found living in the Gulf of Mexico, one mile distant from this locality. These shells are in good condition, indicating only a small amount of erosion. More than twenty fragments of Indian pottery were found in this bed during a late visit to it, some pieces being nearly as large as a man's hand, and rudely ornamented. Vertebrae and teeth of sharks also abound in this sandstone, also many fragments of manatee bones; the latter were, however, all eroded into smooth, oval forms before they were enveloped in the sandstone."

Mr. Willcox also furnishes the following approximate section of the North Creek exposure, to which reference is made in the report:

Sand (3 feet).

Hard limestone rock (2 feet).

Sand and calcareous marl (6 to 7 feet) containing shells, which are most abundant near the water-level.

Water-level.

The shell deposit, in all probability, belongs to the Pliocene period.

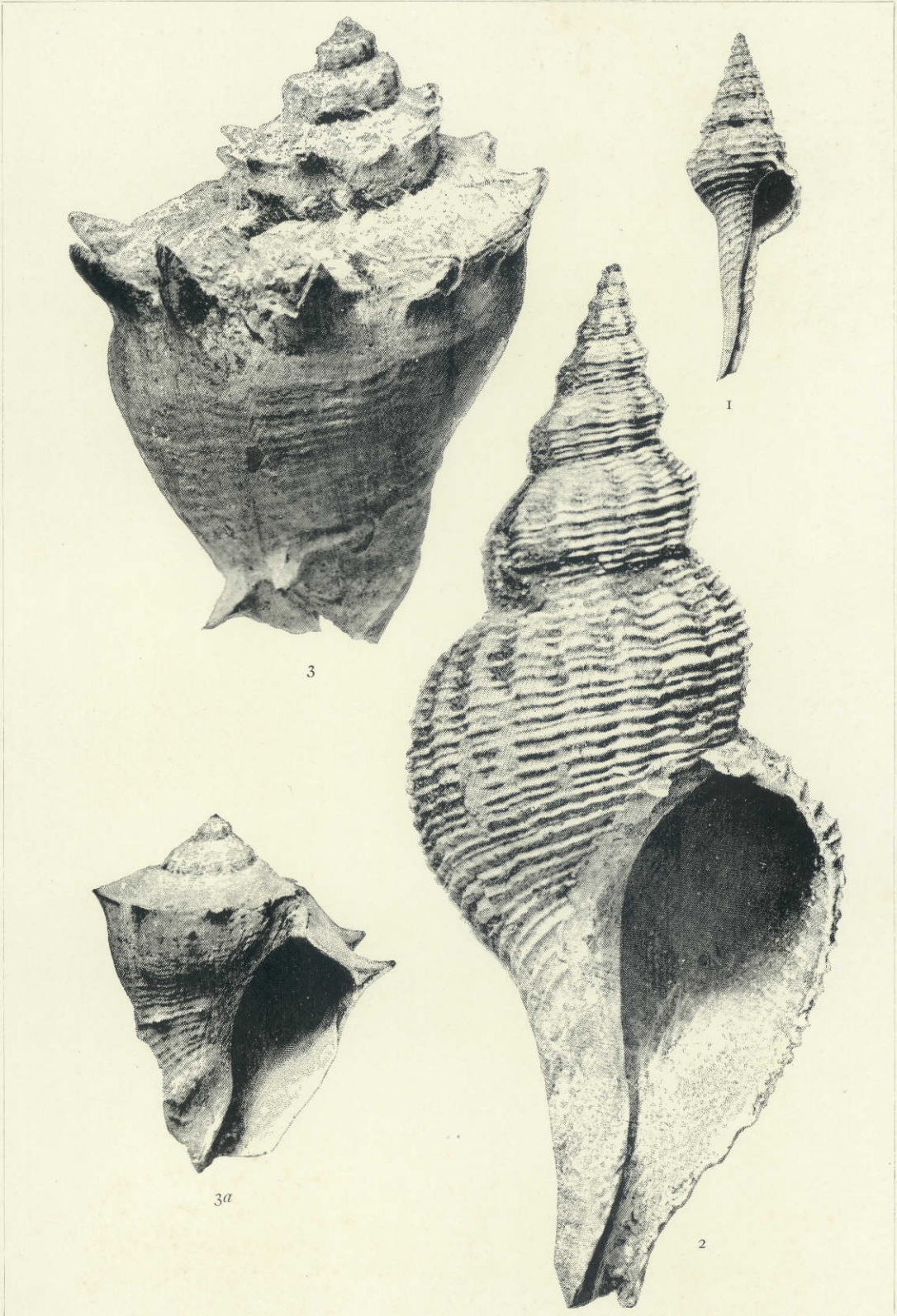


Fig. 1, *Fusus Caloosaensis*. 2, *Fasciolaria scalarina*. 3, 3a, *Melongena subcoronata*.

PLIOCENE FOSSILS OF FLORIDA.



22



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Fig. 21, *Panopsea floridana*. 22, *Panopsea navicula*.

PLIOCENE FOSSILS OF FLORIDA.

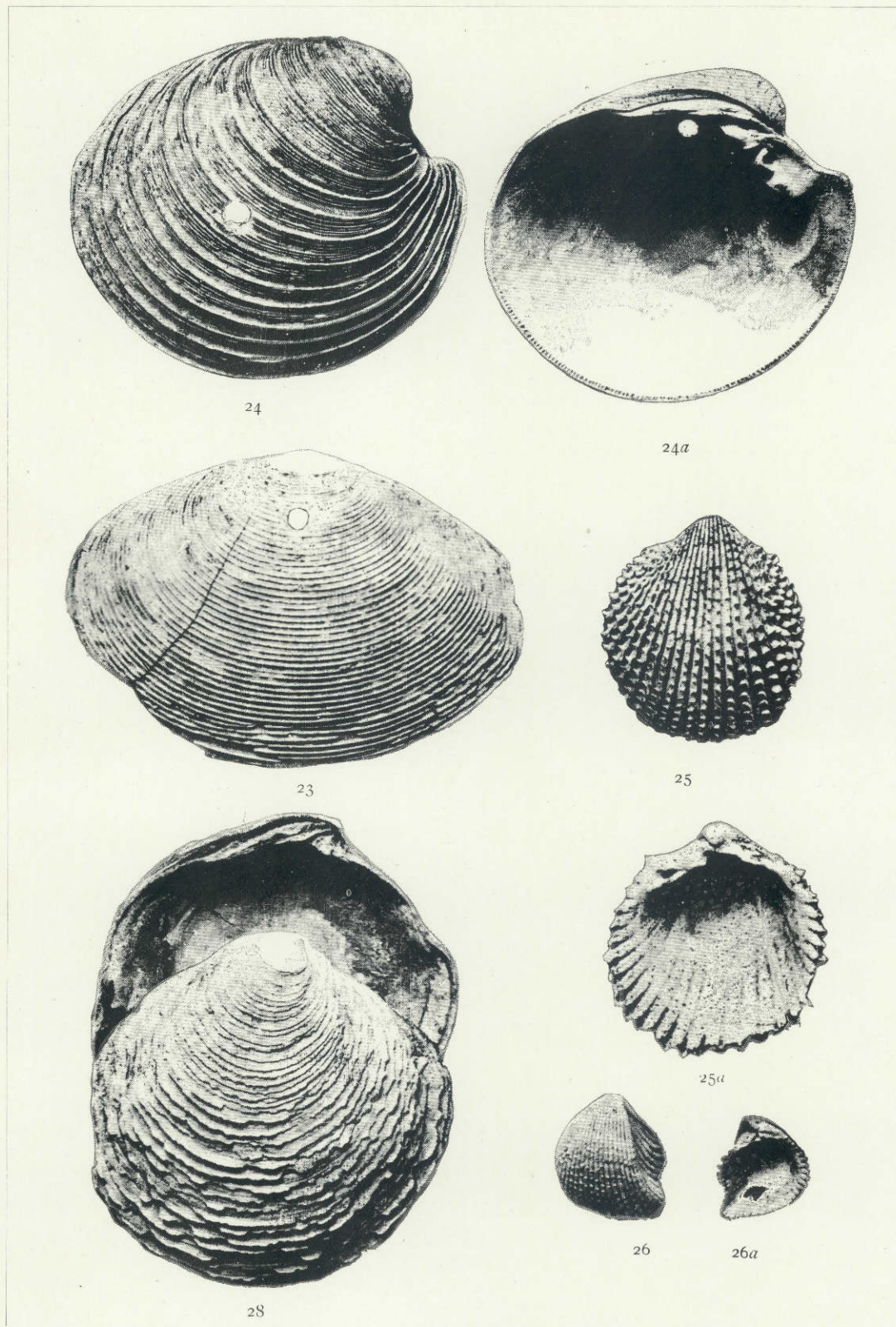
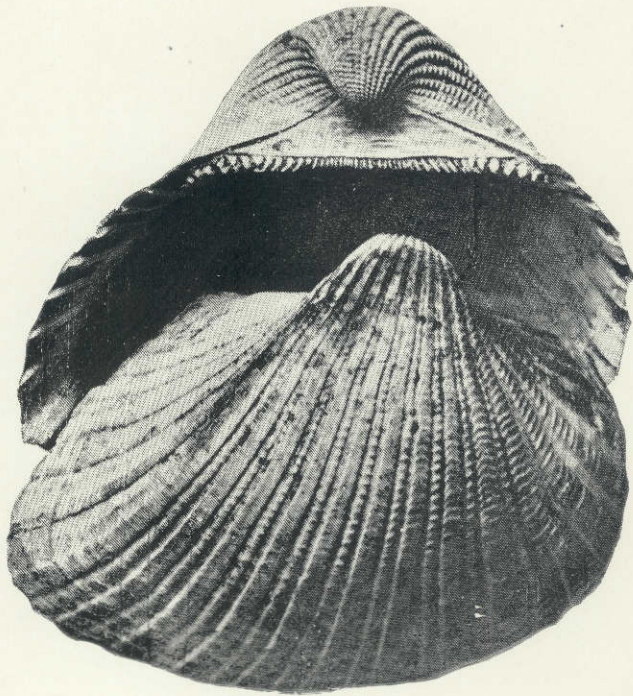


Fig. 23, *Semele perlamellosa* 24, 24a, *Venus rugatina*. 25, 25a, *Cardium Floridanum*. 26, 26a, *Hemiochardium columba* 28, *Lucina disciformis*.

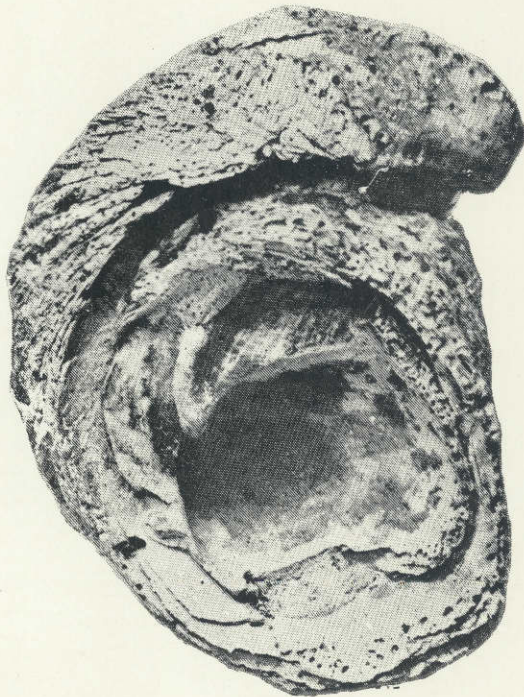
PLIOCENE FOSSILS OF FLORIDA.



29



31



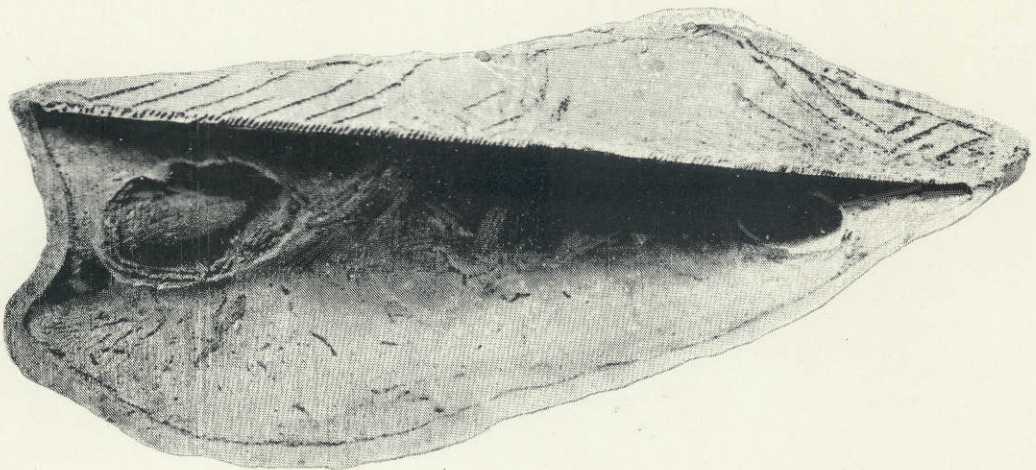
27

Fig. 27, *Chama crassa*. 29, *Arca scalarina*. 31, *Arca aquila*.

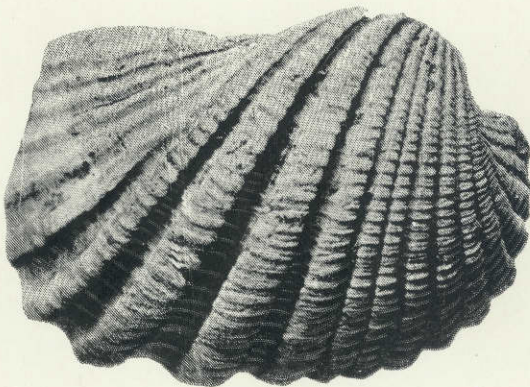
PLIOCENE FOSSILS OF FLORIDA.



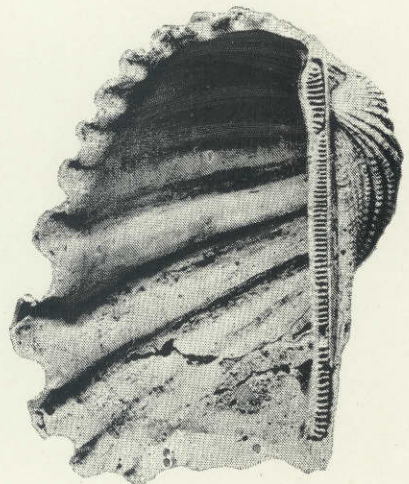
32



32a



30



30a

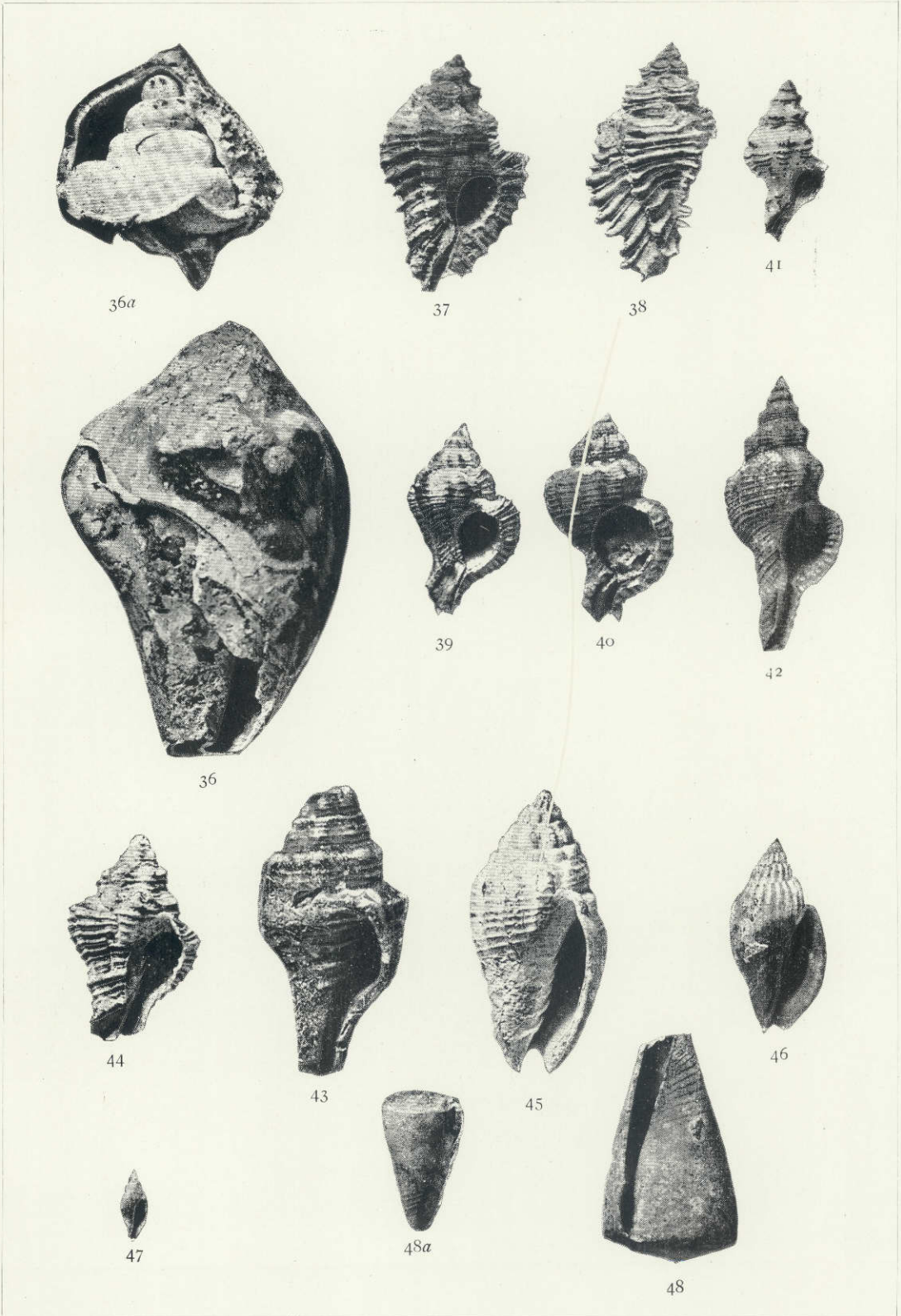
Figs. 30 and 30a, *Arca crassicosta*. 32, 32a, *Arca (Arcoptera) aviculaeformis*.

PLIOCENE FOSSILS OF FLORIDA.



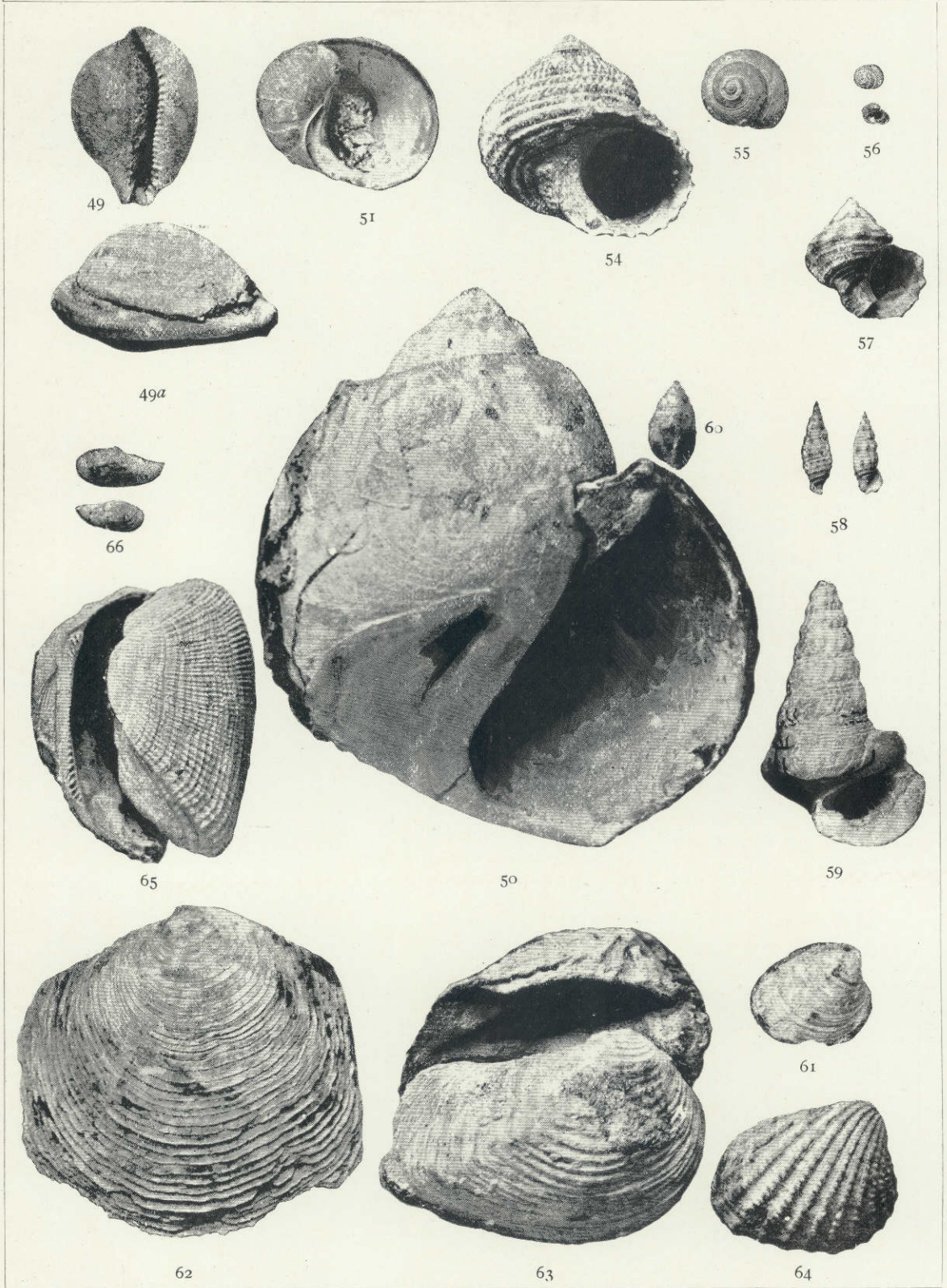
Fig 27, *Chama crassa*. 33, *Spondylus rotundatus*. 35, 35a, *Ostrea meridionalis*.

PLIOCENE FOSSILS OF FLORIDA.



Figs. 36, 36a. *Wagneria pugnax*. 37, *Murex larvescosta*. 38, *Murex crispipapula*. 39, *Murex tritonopsis*. 40, *Murex trophoniformis*. 41, *Murex spinulosa*. 42, *Latirus Floridanus*. 43, *Turbinella polygonata*. 44, *Vasum subcapitellum*. 45, *Voluta musicina*. 46, *Voluta (Lyria) zebra*. 47, *Mitra (Conomitra) angulata*. 48, 48a, *Conus planiceps*.

MIOCENE FOSSILS OF FLORIDA.



Figs. 49, 49a, *Cypræa tumulus*. 50, *Natica amphora*. 51, *Natica streptostoma*. 54, *Turbo crenorugatus*. 55, *Turbo heliceformis*. 56, *Delphinula* (?) *solariella*. 57, *Pseudotrochus turbinatus*. 58, *Cerithium precursor*. 59, *Pyrazisinus campaniatus*. 60, *Partula Americana*. 61, *Cytherea nuciformis*. 62, *Lucina Hillsboroensis*. 63, *Crassatella deformis*. 64, *Cardita* (*Carditamera*) *serricosta*. 65, *Arca arcula*. 66, *Leda flexuosa*.

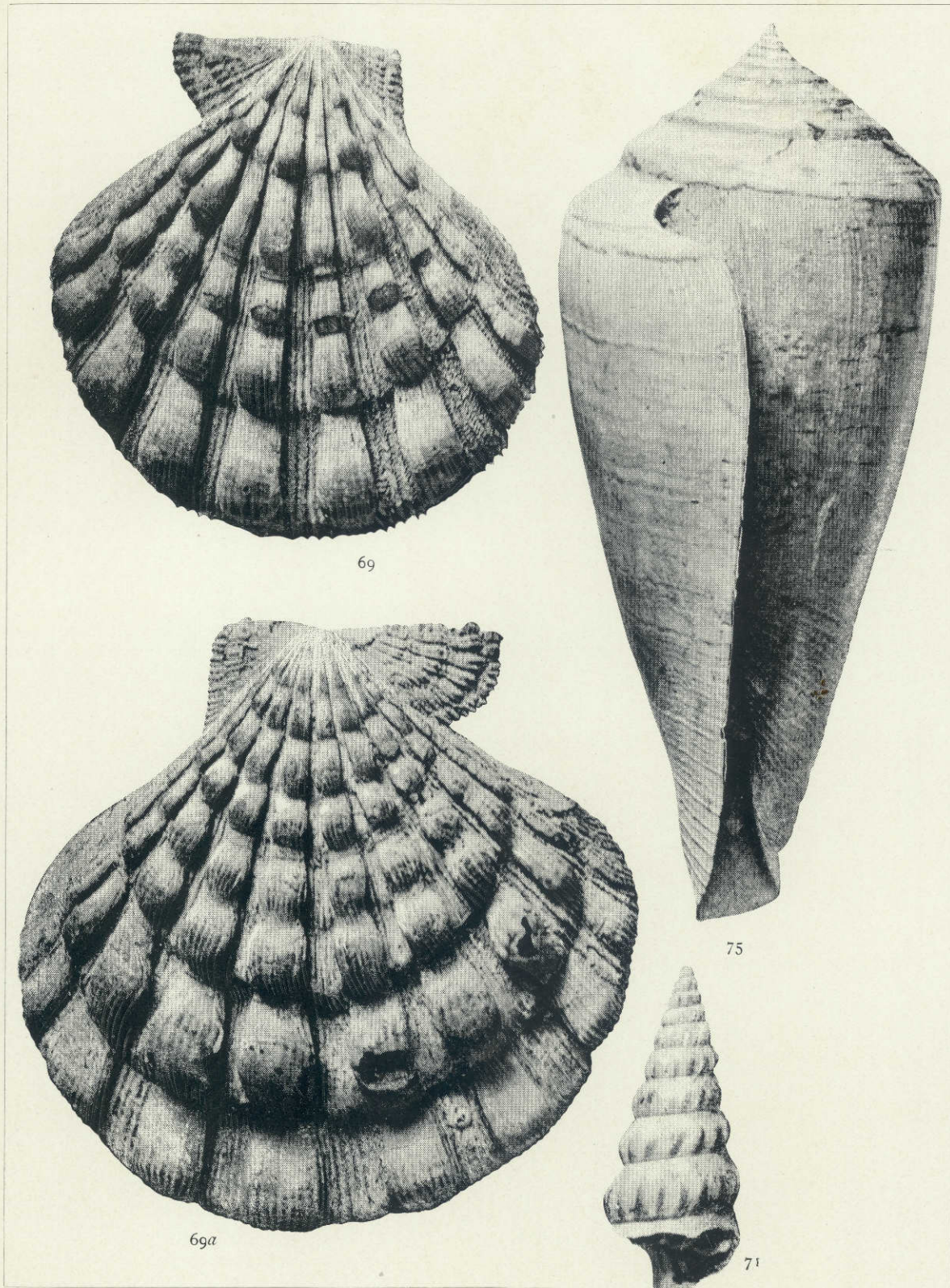
MIOCENE FOSSILS OF FLORIDA.



Fig. 70 *Cardium Dalli*. 71, *Vasum horridum*.

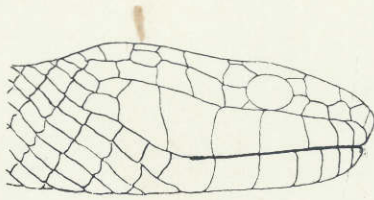
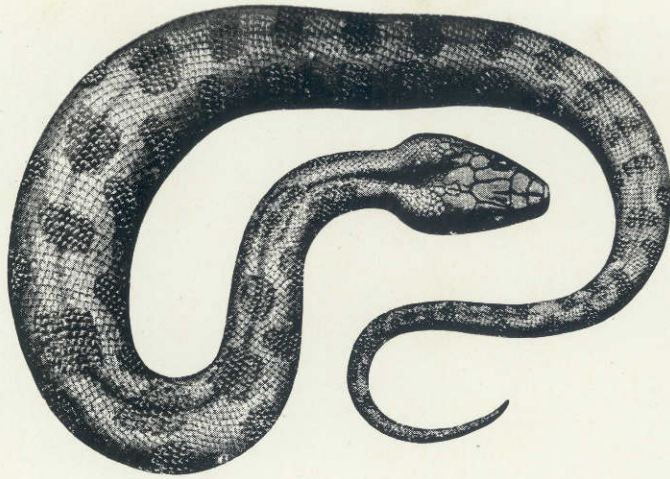
72, *Cyprea* (*Siphocyprea*) *problematica*. 73, *Mitra lineolata*

PLIOCENE FOSSILS OF FLORIDA.

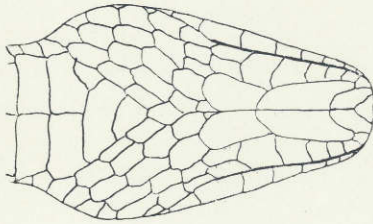


Figs. 69, 69a, *Pecten pernodosus*. 71, *Cerithidea scalata*. 75, *Conus Tryoni*.

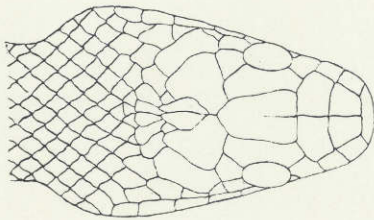
PLIOCENE FOSSILS OF FLORIDA.



a



b



c

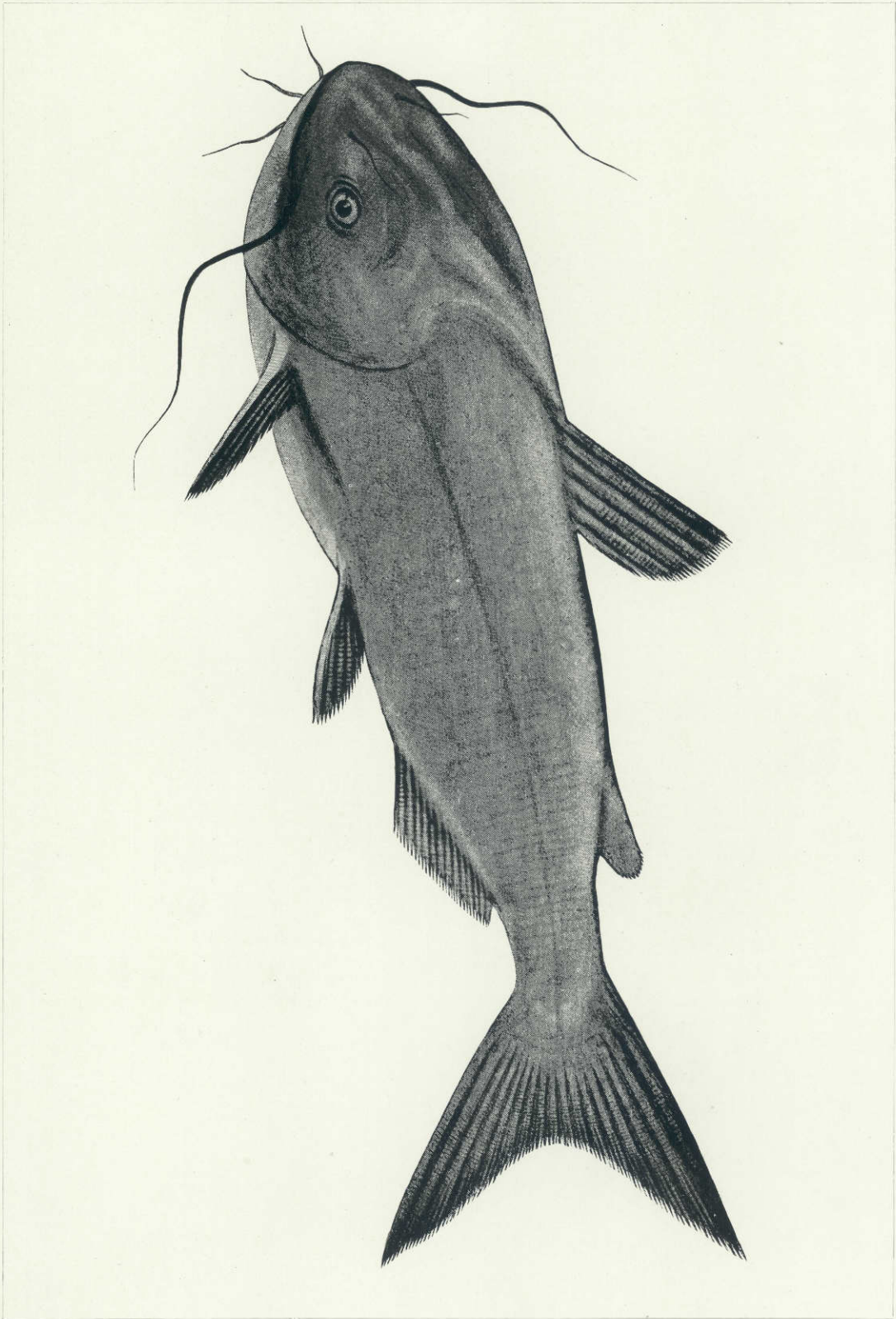
Fig. a, Lateral aspect of head. b, Ventral. c, Dorsal.

TROPIDONOTUS TAXISPILOTUS (?), VAR. BROCKI.



Fig. 4, *Fulgur rapum*. 7, *Mazzalina bulbosa*. 9, 9a, *Mitra lineolata*.

PLIOCENE FOSSILS OF FLORIDA.



ICTALURUS OKEECHOBEEENSIS (OKEECHOBEE CAT)



Fig. a, Showing position of mouth. b, Shell, c, Position of mouth in *A. depilans*.

APLYSIA WILLCOXI.

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Fig. 5. *Turbinella regina*.



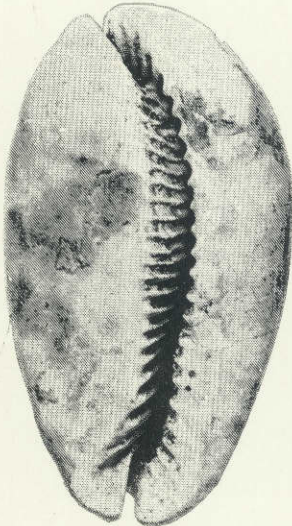
6



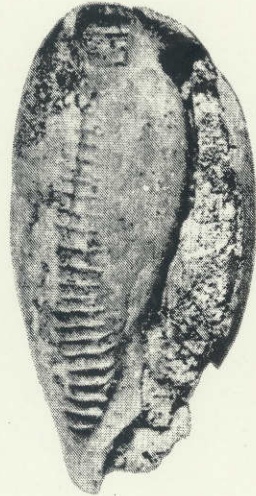
12



6a



12a



12b

Figs. 6, 6a, *Vasum horridum*. 12, 12a, 12b, *Cypræa* (*Siphocypræa*) *problematica*.



Fig. 8, *Voluta Floridaana*. 8*, *Voluta Junonia*, 10, *Cerus Tryoni*.

PLIOCENE FOSSILS OF FLORIDA.



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Fig. 11. *Strombus* Leidy.

PLIOCENE FOSSILS OF FLORIDA.



11a

Fig. 11a. *Strombus Leidyi*

PLIOCENE FOSSILS OF FLORIDA.

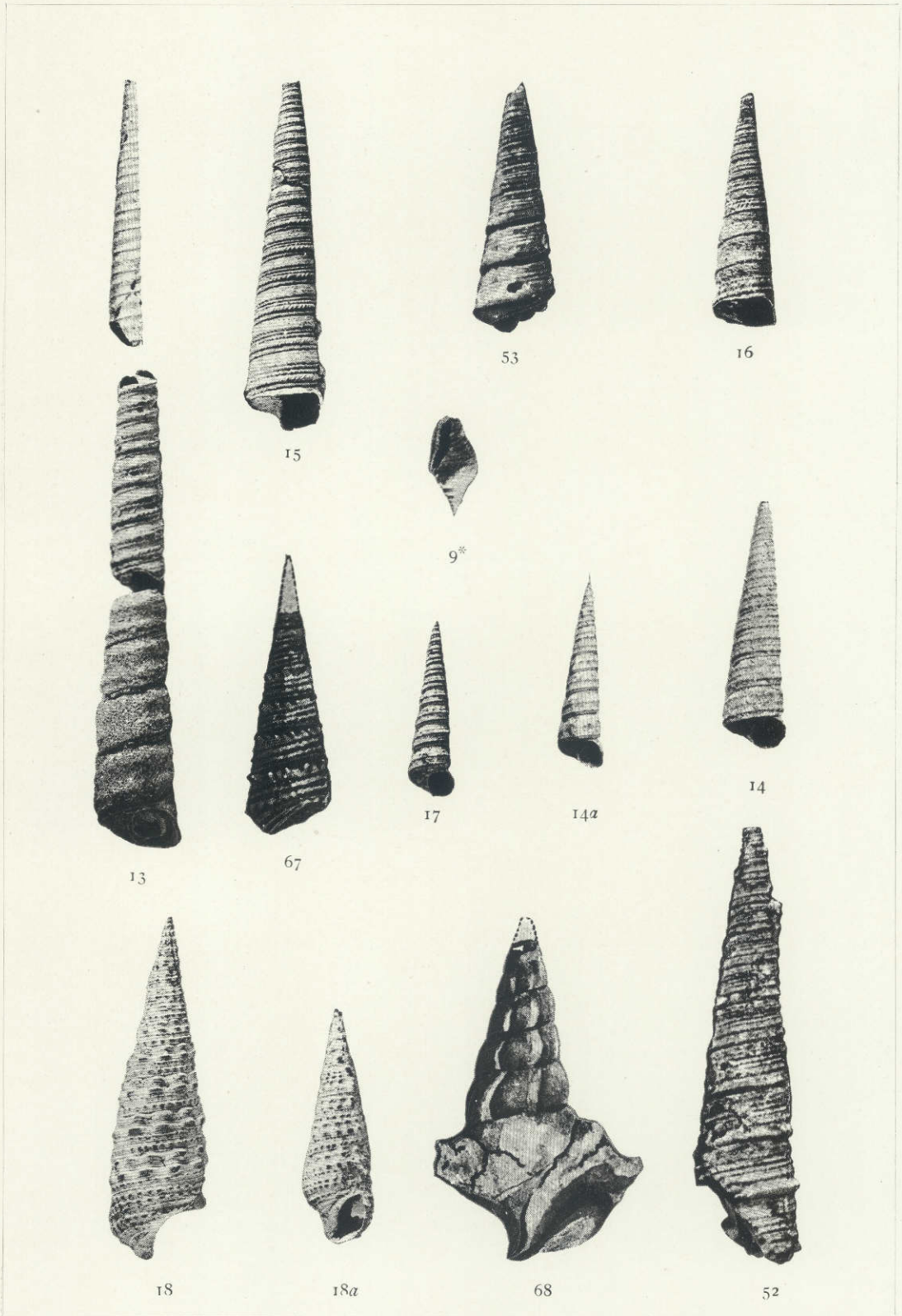
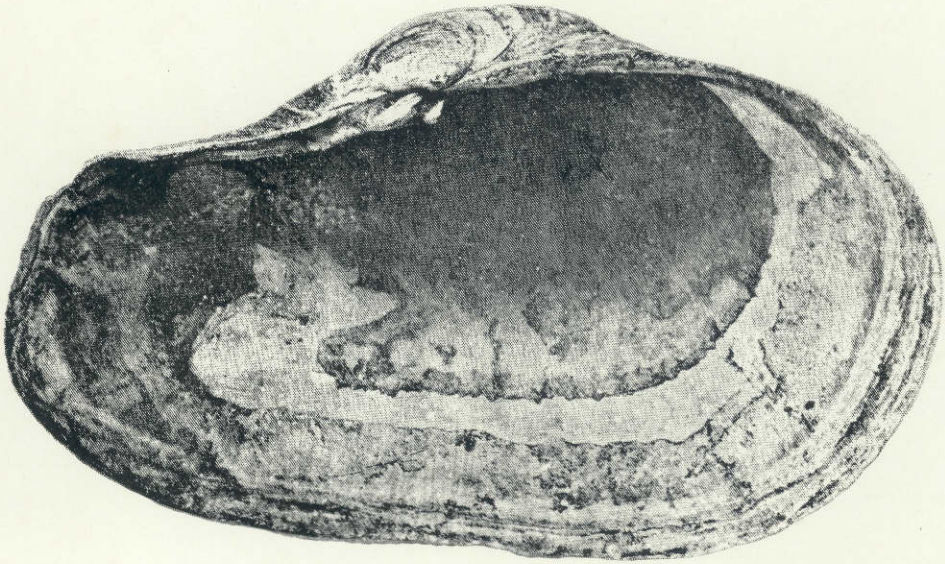
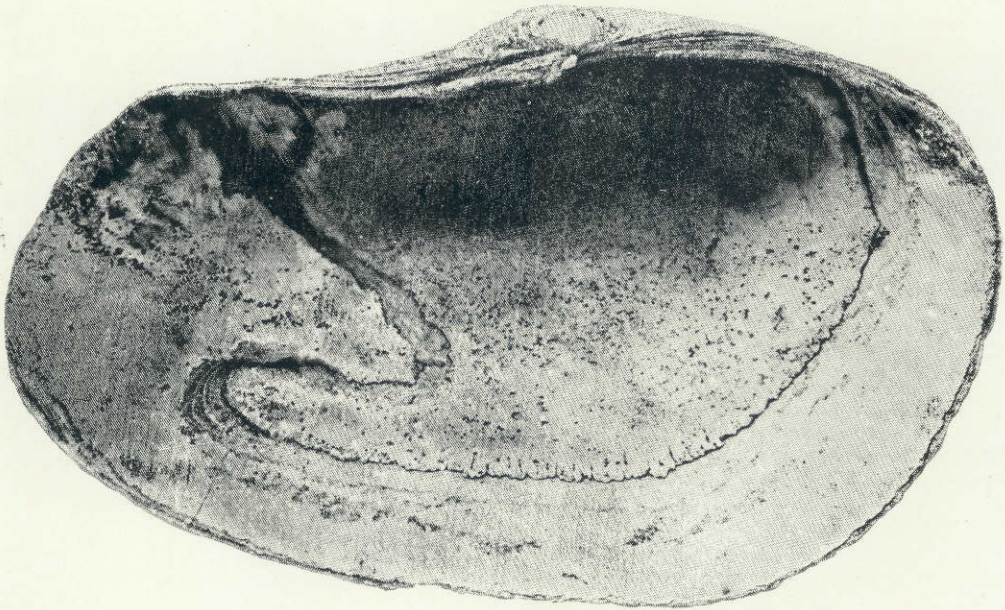


Fig. 9*. *Columbella rusticoides*. 13, *Turritella perastenuata*. 14, 14a, *Turritella apicalis*. 15, *Turritella cingulata*. 16, *Turritella mediosulcata*. 17, *Turritella subannulata*. 18, 18a, *Cerithium ornatisimum*. 52, *Turritella pagodesformis*. 53, *Turritella Tampae*. 67, *Cerithium Hillsboroensis*. 68, *Cerithium cornutum*.

TERTIARY FOSSILS OF FLORIDA



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Fig. 19, *Panopæa Menardi*. 20, *Panopæa cymbula*.

PLIOCENE FOSSILS OF FLORIDA.