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UNITED STATES DEPARTMENT OF THE INTERIOR

**THE MOLLUSCAN FAUNA OF THE
ALUM BLUFF GROUP OF FLORIDA**

PART VII. STENOGLOSSA (IN PART)

GEOLOGICAL SURVEY PROFESSIONAL PAPER 142-G

UNITED STATES DEPARTMENT OF THE INTERIOR
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THE MOLLUSCAN FAUNA OF
THE ALUM BLUFF GROUP OF FLORIDA

BY
JULIA GARDNER

PART VII. STENOGLOSSA (IN PART)

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By JULIA GARDNER

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INTRODUCTION

The systematic description of the Mollusca of the Alum Bluff group is continued in this paper. The examination of the gastropod order Stenoglossa is begun and is carried from the Xancidae through the Nassariidae. Of these the genus *Uzita*, of the Nassariidae, is represented by the greatest number of species—28 species and subspecies. *Busycon*, of the Busyconidae, is next with 10 species.

LIST OF LOCALITIES

The following list shows the localities cited by number in the text and tables (see also map, Part I, p. 2):

- 2211. Lower bed, Alum Bluff, Liberty County, Fla.
- 2212. Tenmile Creek, 1 mile west of Baileys Ferry, Calhoun County, Fla.
- 2213. 1 mile below Baileys Ferry, Chipola River, Calhoun County, Fla.
- 2238. Flournoy's millrace, 2 miles east of Argyle, Walton County, Fla.
- 2564. McClelland farm, 1 mile below Baileys Ferry, Calhoun County, Fla.
- 2645. McClellan farm, Shoal River, 5 miles east of Mossyhead, Walton County, Fla.
- 2646. Oak Grove, Yellow River, Okaloosa County, Fla.
- 3385. Gastropod Gulch, 4 miles southeast of Bainbridge, Decatur County, Ga.
- 3386. Roseland plantation, 3½ miles southeast of Bainbridge, Decatur County, Ga.
- 3419. McClelland farm, 1 mile below Baileys Ferry, Calhoun County, Fla.
- 3704. Quincy, Gadsden County, Fla.
- 3731. Near Mossyhead, sec. 6, T. 3 N., R. 21 W., Walton County, Fla.
- 3732. Dave Adams Mill Creek, sec. 2, T. 3 N., R. 21 W., Walton County, Fla.
- 3733. Three-quarters of a mile west of Shell Bluff, Shoal River, Walton County, Fla.
- 3742. Shell Bluff, Shoal River, Walton County, Fla.
- 3748. Summerville millrace, 1 mile east of Argyle, Walton County, Fla.
- 3856. 6 miles west-northwest of Mossyhead, Walton County, Fla.
- 5079. Half a mile below Shell Bluff, Shoal River, Walton County, Fla.
- 5080. First ravine below Shell Bluff, Shoal River, Walton County, Fla.
- 5184. First ravine below Shell Bluff, Shoal River, Walton County, Fla.
- 5193. Crowder's crossing, 1½ miles below Shell Bluff, Shoal River, Walton County, Fla.
- 5194. 1½ miles below Shell Bluff, Shoal River, Walton County, Fla.
- 5195. First ravine below Shell Bluff, Shoal River, Walton County, Fla.
- 5618. 3½ miles southwest of De Funiak Springs, Walton County, Fla.
- 5630. 100 yards below Oak Grove Bridge, Yellow River, Okaloosa County, Fla.
- 5631. Oak Grove Bridge, Yellow River, Okaloosa County, Fla.
- 5632. Oak Grove, Yellow River, Okaloosa County, Fla.
- 5633. Oak Grove, Yellow River, Okaloosa County, Fla.
- 6175. Left bank of Suwannee River three-quarters of a mile above White Springs, Columbia County, Fla.
- 7054. 400 feet below bridge, Oak Grove, Okaloosa County, Fla.
- 7055. Old Senterfeit mill, 4½ miles southwest of Laurel Hill, Walton County, Fla.
- 7148. Gastropod Gulch, 5½ miles southeast of Bainbridge, Decatur County, Ga.
- 7151. Tenmile Creek, Calhoun County, Fla.
- 7183. Alum Bluff (lower bed), Liberty County, Fla.
- 7257. Sexton's marl bed, Tenmile Creek, sec. 11, T. 1 N., R. 10 W., Calhoun County, Fla.
- 7261. Upper Alaqua Lethu (?) Bluff, near De Funiak Springs, Walton County, Fla.
- 7264. De Funiak *Cardium* beds, Alaqua Creek, Walton County, Fla.
- 7893. Boynton Landing, Choctawhatchee River, Washington County, Fla.

SYSTEMATIC DESCRIPTIONS

Phylum MOLLUSCA
 Class GASTROPODA
 Order CTENOBRANCHIA
 Suborder STENOGLOSSA
 Family XANCIDAE
 Genus XANCUS Roeding

1798. *Xancus* Roeding, Museum Boltenianum, pt. 2, p. 134.
 =*Turbinella* Lamarek, 1799.

Type (by subsequent designation; Dall, Jour. Conchology, London, vol. 11, p. 296, 1906): *Voluta pyrum* Gmelin. Recent in the Indian Ocean.

Shell large, moderately heavy, pear-shaped or fusiform, protoconch large, papillate. Spire varying in relative altitude from more than one-half to less than one-third that of the entire shell. Whorls rather numerous, flattened or angulated at the periphery, closely appressed at the sutures. External sculpture dominantly axial, frequently nodose. Anterior canal straight or very loosely sigmoidal. Outer lip strongly arcuate, not reinforced nor lirate within. Inner lip much thickened and reflected. Three robust horizontal plaits borne near the base of the body and, in some species, notably the genotype, a fourth much less prominent fold in front of them. Umbilical chink occasionally visible between the canal wall and the reflected labium.

Xancus is separated from the Volutidae and Mitridae on the one hand and from the *Fasciolaridae* on the other by the development of the three uniformly strong, approximately horizontal folds on the medial or slightly posterior portion of the columellar wall.

The genus occurs throughout the Tertiary, though never abundantly. The Recent forms are confined to the Indian Ocean and the Brazilian coast. The Indian *Xanci*, especially *X. pyrum*, are used in many of the Brahminic religious ceremonies. Vishnu bears a "shankh," the colloquial name for the type species and a corruption of the Chinese word "xangi," but always the rare sinistral form.

Xancus has a meager representation in the Alum Bluff faunas. Only a single species occurs in the Chipola formation, and another, a close analog, in the Oak Grove sand. The presence of the genus in the Shoal River formation has not been established. The Recent east coast *Xanci* are few in number, but they are all shallow-water forms. The two species described here may be distinguished as follows:

Adult whorls broadly rounded.....*Xancus chipolanus* Dall
 Adult whorls shouldered.....*Xancus dodonaius* Gardner, n. sp.

Xancus chipolanus (Dall)

Plate XLIX, figure 1

1890. *Turbinella chipolana* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 97, pl. 10, fig. 7.

This form would at first sight be taken for a variety of *T. Wilsoni* with a little shorter spire and more rounded whorls than that species, but a study of a good series shows the following distinctive characters:

The last whorl is rounded and not with flattened sides and the keel at the shoulder is obsolete; there is no presutural constriction or band; the whorls, except in the earliest on two, are not appressed, but distinct or even partially channelled; the space of 20.0 mm. from the base of the larval shell forward includes three and a half instead of seven whorls; instead of seven or more ribbed whorls there are but two or three; instead of uniform strong spiral threads as in *T. Wilsoni*, the spirals on the early whorls alternate coarse and fine; the whorls are gracefully rounded and not flattened; the diameter of the spire at the anterior end of the larval shell is 4.0 mm., instead of 1.3 mm.; the spirals are finer and continue more distinctly over the whorls in the adult; the adult shell has six whorls beside the nucleus, *T. Wilsoni* has eleven or more in the same length.

T. chipolana varies, as all the species do to some extent, in its elongation and in the presence or absence of an umbilical chink; the aperture is more than half the length of the shell and has a prominent sinus behind; the apertural callus is prominent, the lip simple, the canal narrow and moderately differentiated. A rather short, thick specimen [a cotype] measures 120.0 x 55.0 mm., without the nucleus; a more elongated specimen 138.0 x 55.0 mm., the aperture being 85.0 mm. long. The nucleus is remarkable, consisting of more than four (none are complete) spirally striate, or smooth, regularly coiled whorls, probably preceded by a tip like that of *T. regina* (Pl. XLIX, fig. 1). The fourth of these whorls has exactly the same diameter as the first, so that the coil is nearly subcylindrical, having a length of 9 and a diameter of 3.5 millimeters.—Dall, 1890.

Cotypes: U. S. Nat. Mus. Nos. 498892 and 111914.

Type locality: No. 2212, Tenmile Creek, 1 mile west of Baileys Ferry, Calhoun County, Fla.

The shell is large and heavy, the maximum diameter approximating the median horizontal. The spire tapers rather rapidly, as a rule, to the subcylindrical nucleus. The body is rather strongly constricted at the base and somewhat fulguroid in contour. The whorls of the adult conch are probably 7 in number, while those of the protoconch number 2 to 5. The tip of the protoconch of *X. chipolanus* is quite distinct from that of *X. reginus* but very similar to that of *X. scolymoides* Dall. The coils are moderately inflated, subequal in diameter, and piled evenly one on top of the other to the apex, where the rounded tip is plunged into the axis of the shell. That portion of the posterior surface of the apex not included in the tip is slightly concave, and the outer margin is rather sharply angulated. In *X. reginus*, however, it is as if the apex were laterally compressed so that the posterior surface exposed in *X. chipolanus* is entirely concealed. A faint spiral threading is occasionally perceptible on the nucleus of the Chipola species. The dividing line between conch and protoconch in *X. chipolanus* is rather obscure, but it is indicated by a slight change in the texture of the shell and by the gradual initiation of both the axial and the spiral sculpture. There is often a slight backward creep of the first post-nuclear whorl upon the final nuclear volution. The

axial sculpture, except for a fine incremental striation, is usually restricted to the 3 or 4 earliest whorls of the conch. On the initial whorl there are usually 6 or 7 broadly rounded axials, somewhat nodose in character and inclined to evanesce posteriorly, separated by lacunalike depressions of approximately the same width. These costals become increasingly broader and more rounded, evanesce entirely posteriorly, and upon the third whorl of the conch are, as a rule, little more than periodic bulges which soon die out altogether. There are usually developed on the first post-nuclear whorl from 4 to 6 sharp and sharply elevated spiral lirae approximately equal and equally spaced. The posterior margin is closely appressed in the axially sculptured whorls, and there are 1 or 2 rather lower and more obtuse spirals developed upon this appressed portion; secondaries are frequently intercalated on the third or even the second volution. The spiral sculpture is more persistent than the axial but weakens and more or less completely evanesces on about the fifth and sixth volution of the conch. The medial and posterior portions of the body are very obscurely lirate, the posterior less so than the medial except in the fully adult specimens, in which the striations are entirely obsolete. The base of the body and the pillar are sculptured with about 16 low, wavy, more or less irregular threads, frequently with intercalated threadlets, and the anterior fasciole with 6 to 9 equal and evenly spaced lirae. The sutures are distinct, undulated in the axially sculptured portion, channeled toward the aperture in the senile forms. The aperture is obliquely pyriform, the portion behind the canal subelliptical. The outer lip is thin and sharp, slightly expanded both axially and incrementally, and smooth within. In senile forms, such as the unfigured cotype, the posterior sinus is rather pronounced. The inner wall of the aperture is reflected in a broad arc spreading from the commissure to the canal, the outer edge discrete in the fully adult. The columella is triplicate, the posterior fold placed directly at the base of the body and at only about one-fourth the distance from the commissure to the anterior extremity. The other two are equally elevated and likewise horizontal. The pillar is broad like that of *Fulgur*, the canal is rather long and straight with parallel, proximate margins. The anterior fasciole is well differentiated, arched in the adults, and obliquely truncate at its extremity. In the gerontic types there is rather a wide umbilical chink between the arching fasciole and the edge of the pillar. The unfigured cotype, which is the stouter individual measured by Dall, exhibits other gerontic characters in the obscure shouldering of the final whorl and in the development of irregular and ill-defined protuberances upon the shoulder. The growth lines are also very strongly defined and stand out as thin-edged laminae bordering the posterior sinus.

There is no evidence of more than this one *Xancus* in the deposits along the Chipola River. The species, however, offers an unusual range of variation in age characters, and in the length of time during which these age characters may persist. The protoconch may be only twice coiled, or it may contain 5 complete volutions. The axial sculpture may, in extreme individuals, begin to evanesce on the second post-nuclear whorl, or it may in other extreme individuals persist until the sixth. The period between late adolescence and the assumption of gerontic characters is apparently very short.

There is another species at Alum Bluff, too imperfect to name but represented, possibly, by very young shells and by decorticated fragments of adults that must have attained a height of at least 200 millimeters. The fragments referred by Dall¹ to the Tampa species, *Turbinella polygonata* Heilprin, are doubtless referable to this undescribed form. The young forms in question are very much broader relatively than the young of *X. chipolanus* and may possibly represent the same species as the large individuals. There are also young individuals at Alum Bluff that have been referred to the Vicksburg species *Turbinella wilsoni* Conrad² but that much more closely resemble a *chipolanus* in which the axial sculpture is abnormally persistent.

Xancus chipolanus Dall is widely distributed in the Chipola but is not very common at any single locality.

In the Oak Grove analog, *X. dodonaius*, the spiral sculpture is more persistent and the later whorls develop an angular shoulder that in the larger individuals is regularly nodulated.

Occurrence: Chipola formation, localities, 2212^p, 2213^p, 2564^r, 3419^p, 2211.^r

Xancus dodonaius Gardner, n. sp.

Plate XLIX, figure 2

Shell probably very large and heavy, the height of perfect individuals exceeding a foot. Outline rudely fusiform, the maximum diameter approximating the median horizontal. Whorls of conch probably 8 or 9 in number. Outline of the early volutions obscured by the axial costae, the medial whorls narrowly tabulated, flattened laterally or feebly rounded, rudely trapezoidal in outline; the later volutions developing an acute keel a little behind the median line, this shouldered portion becoming increasingly less oblique and in the older individuals, becoming tuberculate. Body flattened medially, smoothly constricted at the base. Protoconch broken away in all available material but probably large at the base. Axial sculpture, with the exception of the

¹ Dall, W. H., Contributions to the Tertiary fauna of Florida, with especial reference to the Miocene Siliceous-beds of Tampa and the Pliocene beds of the Caloosahatchie River: Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 97, 1890.

² Idem, p. 96.

incrementals, restricted to the early whorls. Axials on the earliest whorls of the conch narrow, rounded, persistent to the posterior suture, probably as many as 10 in number, rapidly becoming broader and evanescent on the closely appressed posterior third, reduced to 7 in number on the third and later volutions, becoming increasingly broader and lower on each succeeding volution and altogether obsolete near the fifth. Spiral lirae initiated with the axials, sharp and sharply elevated, and from 4 to 6 in number upon the earliest whorls, with 2 or 3 additional lirae developed upon the appressed posterior portion; secondaries intercalated on the third or fourth volution, as in *chipolanus*; spiral sculpture diminishing with the axial but persisting as well defined lirae through another revolution; an obscure spiral shagreening but no well defined liration usually visible on the adult whorls. Base of body, pillar, and fasciole in many individuals finely and rather obscurely threaded. Sutures impressed upon the earlier volutions, feebly channeled upon the later. Aperture obliquely pyriform in outline. Labrum broadly arcuated, not lirate within. Parietal wall heavily glazed, the callus spread in a broad arc from the posterior commissure to the anterior canal. Columella triplicate, the posterior fold placed directly at the base of the body, the outer two approximately equal and parallel to it and almost horizontal near their termination. Anterior canal rather broad, very feebly recurved. Anterior fasciole strongly arched in the adults, corrugated by the incrementals, obliquely truncate or broadly emarginate at its extremity. Umbilicus normally imperforate.

Dimensions of holotype: Height, 90 millimeters; length of aperture, 55 millimeters; maximum diameter, 34.0 millimeters.

Holotype: U. S. Nat. Mus. No. 371439.

Type locality: No. 2646, Oak Grove, Yellow River, Okaloosa County, Fla.

An individual known only from a section through the body whorl but probably referable to this species attains a diameter which, if the shell were of the same relative proportions as a younger and nearly perfect specimen, would give it an altitude of 307.0 millimeters.

Xancus dodonaius is the Oak Grove analog of *X. chipolanus* Dall. The early post-nuclear whorls of the two species are very similar, but the medial whorls of *dodonaius* are more flattened laterally and the spiral sculpture is less persistent upon them. Gerontic individuals of *chipolanus* exhibit an obscure shoulder with irregular protuberances upon it but nothing like the well-defined shoulder of the late adolescent and adult stages of *dodonaius*. Probably the crenulated and tuberculated shoulder is assumed in the adult stage, though possibly not until the gerontic stage.

The large species from Alum Bluff, too imperfect to be described, has a decidedly broader spire than that of *X. dodonaius* and a very much heavier pillar. *X.*

dodonaius is apparently less common and less widely distributed than its *Chipola* analog.

Occurrence: Oak Grove sand, localities, 2646^b, 7054^r.

Genus VASUM Roeding

1798. *Vasum* Roeding, Museum Boltinianum, pt. 2, p. 56.

Type (by subsequent designation; Cossmann, *Essais de paléoconchologie comparée*, livr. 4, p. 65, 1901): *Turbinella cornigera* Lamarck = *Voluta turbinella* Linnaeus, fide auctores. Recent in the Indo-Pacific.

Shell thick, heavy; ovate in outline. Spire usually low. Body whorl, at least, strongly shouldered. Protoconch paucispiral, obtuse; external surface heavily nodulated or spinose, a series of spines usually developed at the periphery and another at the base, often with intermediate series on the body. Sutures deeply impressed. Aperture rather narrow, oblique. Outer lip somewhat thickened, angulated at the shoulder, commonly lirate within. Columella heavy, plicated near the base of the whorl with 3 to 6 usually more or less unequal and approximately horizontal folds, the posterior fold commonly stronger than those in front of it. Anterior canal short, recurved, the umbilical entrance between the arched anterior fasciole and the edge of the pillar not entirely concealed by the reverted labium.

Vasum differs from *Turbinella* in its heavier shell, lower spire, stronger and more bizarre sculpture, often more numerous and more unequal labial folds, and in the shorter and more strongly recurved anterior canal. *Vasum* or the closely related *Eovasum* has been recognized in every series since the opening of the Cenozoic, but the representation in all is very meager. There are two species of *Eovasum* reported from the Eocene of Egypt, and a few species of *Vasum* from the Oligocene of Europe and Haiti and from the later Tertiary horizons of southwestern France and Florida. Only about a dozen species are known in the Recent seas, all of them restricted to the Indian and west Pacific Oceans and to the Caribbean and South American seas. The Caribbean species are denizens of the intertidal zone.

Only a few fragments establish the presence of this genus in the Alum Bluff, all of them collected from the *Chipola*. The species is probably distinct but is a member of the group that includes the Tampa form *V. engonatum* Dall, the Santo Domingan *V. haitense* Sowerby, and the Recent West Indian *V. muricatum* Born.

Vasum aff. *V. engonatum* Dall

1890. *Vasum haitense* Sowerby var. *engonatum* Dall (part), Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 100.

1915. *Vasum engonatum* Dall (part), U. S. Nat. Mus. Bull. 90, p. 63 (figs. excluded).

This form is perhaps the ancestor of *V. cestus* Brod. and *V. muricatum* Born. *V. haitensis* Sowerby is closely related; it resembles *V. engonatum* in the flatness of the spire for the last three or four whorls, but was referred by Gabb to a variety

of *muricatum*, which other details indicate not to be the case. *V. haitensis* has fewer spines and a more elevated and acute apex than the form now under consideration.

V. engonatum differs from *V. muricatum* when adult in having the suture appressed closely to the angle of the preceding whorl; in its less prominent apex; in its finer and much more numerous spirals; in its larger, more prominent, and conical spines, which are less by one or two in number, on the angle of the last whorl; in its single series of very large and conical spines anteriorly (*cestus*, *muricatum*, and *haitense* have two or even three series); in its more prominent siphonal fasciole enclosing a larger umbilical depression; and in its broader pillar and more triangular form. In *V. cestus* the spines are blunter and the spirals still coarser than in *V. muricatum*. Alt. of shell 96.0; diameter about 94.0; alt. of aperture 80.0 mm. There are three or four plaits on the pillar, the posterior plait much larger than the others.

—Dall, 1890.

The Chipola species has been considered identical with the species from the silex beds at Tampa, and though this identification is probably in error the former has not been named because there is no specimen in the collection sufficiently well preserved to serve as the type.

The Chipola species, like that from Ballast Point, is solid, rudely ovate in outline, and of large dimensions. The spire is not nearly so low in *V. engonatum*, the peripheral spines in that species rising a little above the succeeding volution, while in the Chipola individuals they are half buried in it. In this character the Chipola species more closely approaches *V. haitense* Sowerby than does the form from Ballast Point. The protoconch of *engonatum* is not known, but small Vasi from Chipola, a part of them probably referable to the species in question, exhibit a smooth twice-coiled protoconch, the initial whorl of which is broadly rounded and immersed at the tip, the succeeding volution gradually flattening toward its close. Both the axial and the spiral sculpture are introduced at the beginning of the conch. The axial sculpture on the first five or more whorls is manifested in the form of nodose axial costae evanescent on the appressed posterior portion, probably averaging 9 to the whorl, gradually compressing into peripheral nodes that evenly crenulate the peripheral margin and are later produced into triangular spines. There are also an adolescent individual and a few young ones from this same locality that may represent at least a distinct subspecies and that differ in having a less obtuse protoconch, a broader spire, 7 instead of 9 axial costae, and a more finely and closely sculptured shoulder.

The fully developed spines of *engonatum* are apparently more rounded at the base and less acute at the tip than those of the Chipola species. This is true not only of the peripheral series of spines but also of the series at the base of the body. It is probable, too, that, in *engonatum*, there is an average of one more spine to each row.

The spiral sculpture is about the same on the Ballast Point and the Chipola adults—8 or 9 subequal but not very regular spiral lirae that conform to a certain extent to the sinuosities of both the posterior and the anterior margins. The bodies of both are obscurely and irregularly lirate, and the suture lines are rather deeply impressed. In the Chipola individuals, however, these lines are conspicuously stellate, while in the form from Ballast Point the sutures do not curve around the spines as they do in the Chipola species. The aperture is quite narrow, broadening posteriorly. The outer lip is nonlirate within, angulated at the shoulder, and emarginate at the entrance to the anterior canal, possibly, as in *Strombus*, for the protrusion of the eyestalks. The parietal wall and pillar are heavily reinforced, and 4 unequal folds are borne upon the columellar wall. The posterior fold is much the broadest and also the most elevated of the four, while the fold next to the anterior one is the narrowest and most acute. The anterior canal is very short and slightly recurved in both the species in question, and the anterior fasciole in both is greatly compressed and heavily corrugated. In the Chipola form the umbilical opening is entirely concealed by the reverted lip of the pillar, but in *engonatum* not more than one-fourth of the opening is closed in this manner. There is a large degree of age variation in this character, but some of it may be specific as well.

The Chipola species apparently differs from *V. haitense* Sowerby in the more strongly flattened shoulder and in the somewhat more numerous spines on the body. It probably approaches the Haitian form more closely, however, than does *V. engonatum* Dall.

Occurrence: Chipola formation, localities 2212^r, 2213^p, 3419^r, 2211^r.

Family FASCIOLARIIDAE

Genus FASCIOLARIA Lamarck

1799. *Fasciolaria* Lamarck, Prodrôme d'une nouvelle classification des coquilles, Mém. soc. hist. nat. Paris, p. 73.

Type by monotypy: *Murex tulipa* Linnaeus. Recent off the east coast of North America from Hatteras to Florida and west to Texas.

Shell large, often gigantic, fusiform. Spire elevated. Nucleus paucispiral, smooth, obtuse. Sculpture dominantly spiral, the axials inclined to be nodular and peripheral. Aperture oval-elongate, terminating in an open, more or less twisted canal. Columella concave, furnished with one to three oblique, diminishing folds, the anterior folds, as in the volutes, being the more prominent. Parietal wall glazed. Anal fasciole narrow, inconspicuous. Umbilicus closed. The species here described may be distinguished as follows:

Axial costae rarely exceeding 9 in number; axials prominently nodose at the periphery but persisting to the anterior suture. *Fasciolaria kinlei* Maury

Axial costae usually exceeding 9 in number; axials evenly crenulating the periphery, not persisting to the anterior suture on the later turns.-----*Fasciolaria ramondi* Maury

***Fasciolaria kindlei* Maury**

Plate XLIX, figures 5, 6.

1890. *Fasciolaria sparrowi* Emmons (part). Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 104.

Not *Fasciolaria sparrowi* Emmons 1858.

1910. *Fasciolaria kindlei* Maury, Bull. Am. Paleontology, vol. 4, No. 21, p. 19, pl. 5, fig. 4.

Shell small, slender, fusiform; earlier whorls eroded, remaining whorls, five; suture fairly distinct; transverse sculpture of nine prominent, subequal ribs on each whorl; spiral sculpture of prominent threads, with one or two alternating, much finer threads; outer lip thin, lirate within; canal long, nearly straight. Length of decollate shell 54; of aperture and canal 29; greatest width 16 mm.

Chipola marls, Baileys Ferry, Florida.

Cornell University collection.

Dedicated to Dr. Kindle of the U. S. Geological Survey.—Maury, 1910.

Topotype: U. S. Nat. Mus. No. 124970.

The whorls of the spire are closely appressed posteriorly, the body rather sharply constricted at the base. The nucleus is large and obtuse and performs approximately two revolutions. The initial turn is smooth, rather strongly inflated, and partially immersed. The first half of the second revolution is moderately inflated medially and smooth. Axial sculpture is introduced within the final half turn in the form of 4 to 8 axial costae, which are uniform in elevation between the sutures and become increasingly broader toward the close of the protoconch. The beginning of the conch is indicated by the introduction of the postnuclear axial sculpture and by the gradual initiation of the spirals; the spiral that later crowns the periphery, the primary in front of it, and a single shoulder spiral appear at the beginning of the conch. The adult axials are inflated and somewhat nodular in character, most prominent on the periphery but persisting with diminished vigor to the anterior suture, completely evanescent, however, before reaching the posterior suture and upon the medial portion of the body. There are about 10 subequal primary spirals on the later whorls of the spire and a little more than twice as many on the body and pillar, those in front of the periphery a little more prominent than those behind them. The threads on the pillar are also narrower and sharper than those on the body. There are, in addition, about half a dozen ill-defined threadlets on the arched anterior fasciole. The aperture, exclusive of the canal, is broadly elliptical and rather acutely angulated posteriorly. The outer lip flares widely and is obtusely angulated at the shoulder. The inner wall of the aperture is smoothly excavated at the base of the body. A rather prominent fold is born at the entrance to the canal, and behind it and parallel to it two other less elevated folds, the posterior

the most feeble of them all. The parietal wall and pillar are reinforced. The anterior fasciole is slightly sinuous and obliquely truncate at its extremity.

A fragment of a probable member of this species in the National Museum collection is of dimensions so large that, if the relative proportions are constant, the height of the perfect adult must have been about 110 millimeters.

It is rather remarkable that in the Museum collections *F. kindlei* is represented by four more or less imperfect conchs and by an equal number of protoconchs in an almost perfect state of preservation. The forms referred in some of the earlier checklists to *F. sparrowi* Emmons from the Duplin of North Carolina are quite certainly referable to this species. Emmons' species is much less sharply sculptured spirally and the axials are obsolete upon all of the later whorls. *F. kindlei* is rather similar in general contour to *F. scalarina* Heilprin from the Caloosahatchee, but the spirals that ornament *F. scalarina* are less numerous and more elevated than those of *kindlei*.

The congenetic *F. ramondi* Maury is similar in the character of the sculpture, but the whorls of *ramondi* are more strongly angulated at the periphery, the spirals are more obtuse, the axials more sharply nodular, and the pillar broader.

Occurrence: Chipola formation, localities, 2213°, 3419°, Cornell University collection.

***Fasciolaria ramondi* Maury**

1902. *Fasciolaria ramondi* Maury, Bull. Am. Paleontology, vol. 3, No. 15, p. 66, pl. 28, fig. 1.

1910. *Siphonalia Kempi* Maury, Bull. Am. Paleontology, vol. 4, No. 21, p. 20, pl. 5, fig. 5.

Shell of medium size, rather thin, eight-whorled. Nucleus small, smooth. Succeeding whorls with transverse peripheral ribs varying in number from eight to eleven. Ribs slightly less marked on the terminal than on the three preceding whorls. Entire surface covered with fine, transverse lines. Incremental lines irregular. Suture distinct on the later whorls, which are flattened beneath it. Spiral sculpture of threads, usually alternating in strength, and covering the entire surface. Canal one-fourth the entire length of the shell. Aperture elliptical. Callus thin. Plaits on columella well marked within. Outer lip thin, crenulated where perfect, compressed near the suture. Internal lirae of unequal lengths, usually not extending to the margin of the lip. Length of shell, 70 mm., width, 30 mm. Length of canal and aperture, 40 mm.

This species resembles closely *Fasciolaria intermedia* Sow., from Santo Domingo, but the latter species is larger, much more solid, and lacks the fine transverse markings of the Chipolan shell.

Named in honor of M. G. Ramond of the Jardin des Plantes, Paris.

Locality. Upper Oligocene of the Chipola River at Baileys Ferry.—Maury, 1902.

Shell rather large, fusiform, with about eight shouldered whorls. Longitudinal sculpture of ribs; strongly nodular at the periphery of the whorls, but all fade out immediately above and below the shoulders except the final rib which extends prominently almost to the base of the shell. Spiral sculpture of

threads which tend to alternate with finer raised lines. Outer lip very strongly lirate within, the lirae usually resembling strings of very small beads. The spirals and internal lirae resemble those of *S. dilatata* Quoy. Length of incomplete shell 65; greatest width 33 mm.

Apparently no species of *Siphonalia* or *Chrysodomus* have yet been described from the Florida Tertiaries. This species is now placed in *Siphonalia* because of the strong internal lirae not present in *Chrysodomus*. Yet this has been done with hesitation because of the present distribution of *Siphonalia* in Pacific and Australian waters only. If the Florida shell is correctly placed in *Siphonalia*, it is an added indication of the affinities of the Gulf Tertiary fauna with that of the Pacific.

Chipola marls, Baileys Ferry, Florida.

Dedicated to Professor Kemp.

Cornell University collection.—Maury, 1910.

A specimen in the National Museum collection shows 10 axial ribs. The peripheral primary and the one a little in front of it are the most prominent of the spirals, four of which lie in front of the anterior primary; midway between the anterior and peripheral primary spirals there is a strong liration which on the later volutions approximates them in prominence; and there are even finer threads in front of and behind this secondary. The shoulder, which equals or exceeds half of the entire width of the whorl and slopes away from the suture at an angle of about 45°, is threaded by 4 sharply elevated lirae, with finer threads regularly intercalated. There is also an ill-defined lira directly in front of the impressed suture. The incremental sculpture is rather vigorous upon the shoulder.

F. ramondi Maury is more angular than the congenetic *F. kindlei*, the spirals are less acute, the axials more nodose, and the pillar is broader.

Occurrence: Chipola formation, locality 2213* and Cornell University collection.

Genus MAZZALINA Conrad

1860. *Mazzalina* Conrad, Acad. Nat. Sci. Philadelphia Jour., 2d ser., vol. 4, p. 295.

Type (by monotypy): *Mazzalina pyrula* Conrad. Eocene of Alabama.

Turbinate, smooth; columella projecting interiorly and furnished with closely arranged, oblique, obtuse plaits.—Conrad, 1860.

Dall³ has given *Mazzalina* subgeneric rank under *Fasciolaria* on the ground that "*Mazzalina* is a *Fasciolaria* of short, stout form with supplementary, *Latirus*-like plaits imposed on its columella." Cossmann has considered it as a subgenus of *Latirus*. In the early conchal whorls of the genotype of *Mazzalina* the shoulder ramp is very wide and the periphery is crenulated by numerous short, regular, axial riblets which die out directly behind the periphery but which are continued

forward to the anterior suture. The later whorls, however, retain no trace of axial sculpture, and the peripheral keel is rounded off. The columellar folds are not persistent but record the resting stages in the growth of the shell. For that reason they are irregular in number, intermittent, and in many individuals are not visible at the aperture. These characters, shared neither by *Fasciolaria* nor by *Latirus*, together with the apparent concentration of *Mazzalina* in the Eocene, justify the separation of the group from both the genera under which it has been placed.

The group is small and almost entirely restricted in its known distribution to the early Tertiary of the Gulf.

"Mazzalina" costata Dall

Plate XLIX, figures 3, 4

1890. *Mazzalina costata* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 106.

As Conrad's type specimen of *M. pyrula* has so far remained unique, its limits of variation are uncertain, but in the Miocene of the Chipola River near Baileys Ferry, west Florida, and in that of White Beach, Little Sarasota Bay, south Florida, is a species which differs from it in the following particulars:

It is wholly covered with not very prominent, coarse spirals crossed by distinct incremental lines instead of being smooth behind the canal. It has eight or nine wide, rounded, prominent costae, which begin in front of the shoulder and extend forward to the suture, which is undulated by them. It has three strong, continuous plaits on the pillar, the anterior of which is undulated instead of simple on its edge, and two or three supplementary, fainter ridges appear behind the others at maturity. The adult shell has six or seven whorls and the canal is narrower and proportionately a little longer than in *M. pyrula*. The young are more slender than *M. pyrula*, but the adult is quite globose, and the costae are obsolete on the last whorl. The adult measures about 48 x 30 mm.

My specimens of this form are too fragmentary and imperfect to be suitable for figuring, but they appear to me to be quite distinct from the Eocene species.—Dall, 1890.

The species is almost certainly not *Mazzalina* and probably represents a new superspecific group. The "three strong, continuous plaits on the pillar, the anterior of which is undulated instead of simple on its edge," are characters not indicated in any group recorded from the Tertiary or Recent faunas of the Middle Atlantic seaboard. The crenulations upon the anterior fold are distinct and regular upon each of the three individuals in the U. S. National Museum collections and continue for some distance within the aperture, although they die out upon the whorls of the spire.

The state of preservation of the material does not justify the erection of a new genus upon it.

No representatives of the species appear in the later collections.

Holotype: U. S. Nat. Mus. No. 114547.

Type locality: No. 2213, 1 mile below Baileys Ferry, Chipola River, Calhoun County, Fla.

Occurrence: Chipola formation, localities 2213*, 26175.

*Dall, W. H., Contributions to the Tertiary fauna of Florida, with especial reference to the Miocene Siliceous-beds of Tampa and the Pliocene beds of the Caloosahatchie River: Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 105, 1890.

Genus *HESPERISTERNIA* Gardner, n. gen.

Type herewith designated: *Hesperisternia waltonia* Gardner. Shoal River formation of Florida.

Shell rather small, not very heavy, rudely biconic, the base of the body constricted into a short, broad neck. Protoconch small, naticoid, including about three smooth convex whorls. The conch including about twice as many volutions, which may be obscurely shouldered but not constricted posteriorly. Axial sculpture of blunt ribs traversing the whorls of the spire and extending well down upon the body but not arranged in continuous series. Incrementals strong, grating the spaces between the spirals. Spiral sculpture developed over the entire conch, the spirals tending to alternate in strength and most elevated, as a rule, in the peripheral area. Suture line impressed, undulated by the costals of the preceding volution. Anterior fasciole arched and lirate, margined posteriorly by neither a depression nor a keel. Aperture fairly wide, obliquely pyriform. Outer lip expanded, the growth lines retractive posteriorly, the thin margin finely crenate in harmony with the spiral sculpture; inner lirae corresponding in position to the interprimary spaces. Labium strongly excavated at the base of the body; parietal wash heavy but not concealing the primary spirals; transverse denticles commonly developed upon it. Margin of pillar twisted and compressed into an obtuse fold, thrown into relief by the shallow groove behind it, both the fold and the groove continued up the columella to the apex of the conch but no other axial plications developed. Anterior canal short, obliquely directed, rather wide, with parallel margins, obliquely truncate or obscurely emarginate at the extremity. Umbilical chink almost or entirely closed by the reverted pillar lip.

Hesperisternia includes a small group of species characterized by a naticoid protoconch, a conch of medium size with an undulating axial sculpture and closely set spirals, an expanded nonvaricose outer lip, lirate within, a more or less denticulate inner lip angulated and monoplicate at the entrance to the short canal, and an anterior fasciole not keeled posteriorly. *Peristernia*,⁴ an Indo-Pacific group, is similar in general aspect, but the protoconch is smaller, the whorls of the conch are compressed into a narrow collar in front of the suture, and the aperture is guttered posteriorly. In the Eocene species referred by Mrs. Palmer⁵ to *Verconella*, the final whorl of the protoconch is keeled, the parietal wall smooth, and the anterior canal

longer. In *Cantharus*, the *Tritonidea* of Swainson, the inner margin of the aperture is less strongly angulated and the edge of the pillar is not pinched into a fold, as it is in *Hesperisternia*. *Cantharus* is the larger and heavier shell as a rule, and the axial sculpture is relatively less strong and uniform. The two genera resemble one another in the general characters of the protoconch and in the fine incremental grating.

The genus is established in the Alum Bluff by three species of rather meager representation—the one from the Chipola formation, the genotype from the Shoal River formation, and a third from the Oak Grove sand of Georgia. There are also numerous fragments from the Oak Grove indicating a fourth species larger than *H. chipolana* but related to it. These species may be distinguished as follows:

Primary spirals most elevated on the periphery:

Height of adult shell not exceeding 20.0 millimeters.

Hesperisternia chipolana Gardner, n. sp.

Height of adult shell exceeding 20.0 millimeters.

Hesperisternia waltonia Gardner, n. sp.

Primary spirals subequal:

Hesperisternia bainbridgensis, Gardner, n. sp.

Hesperisternia chipolana Gardner, n. sp.

Plate XLIX, figure 14

Shell rather small for the group and rather slender, the maximum diameter falling in front of the median horizontal. Spire elevated and acutely tapering. Whorls of conch, probably 6 in the fully adult, inflated medially. Body abruptly constricted into the broad pillar. Sutures inconspicuous, crenulated by the costals. Protoconch small, smooth, highly polished, probably including $3\frac{1}{2}$ volutions, the initial turn minute, inflated, and largely immersed in the succeeding whorls, the $2\frac{1}{2}$ remaining volutions broadly convex and increasing rather rapidly in altitude and diameter. A very faint axial shagreening appears at the close of the protoconch, which is marked by a slight thickening of the shell and the first appearance of a faint spiral sculpture; both axial and spiral sculpture well established by the close of the first turn of the conch. Axials prominent, well rounded upon their summits, most elevated at the periphery of the whorl but persistent from suture to suture and well down to the base of the body, usually 8 on each of the earlier whorls, 7 on the later, separated by concave interspaces of approximately the same width. Spiral threading vigorous over the entire conch, the lirae narrow, sharply elevated, rather angular. Typical sculpture developed early, the 2 peripheral primaries on the spire and the 3 on the body the most prominent of any on the whorl, with 2 or rarely 3 scarcely less prominent lirations behind them and a couple of rather feeble lirae in front of them; filamentary secondaries rather regularly intercalated between each pair of primaries. Base of body sculp-

⁴ *Peristernia* Mörch. Catalogus Conchyliorum quae reliquit D. Alphonso D'Aguirra & Gadea Comes de Yoldi, fasc. 1, p. 99, 1852.

Type (by subsequent designation; Cossmann, Maurice, Essais paléontologie comparée, livr. 4, p. 47, 1901); *Turbinella nassatula* Lamarck. Recent in the Indian Ocean.

⁵ Palmer, Katherine Van Winkle, The Claibornian Scaphopoda, Gastropoda, and dibranchiate Cephalopoda of the southern United States: Bull. Am. Paleontology, vol. 7, no. 32, pp. 318–322, 1937.

tured with 5 or 6 additional primaries more angular than those behind them. Anterior fasciole rather wide and closely threaded with about half a dozen subequal lirae. Aperture obliquely pyriform in outline, obtusely angulated at the posterior commissure. Outer lip thickened behind the margin, thin and sharp at the margin and finely crenulated in harmony with the spiral sculpture; lirae within, the lirae corresponding in position to the interprimary areas and persisting far within the aperture; entrance to anterior canal marked by a shorter and more prominent fold. Inner wall of aperture strongly and symmetrically concave between the posterior commissure and the entrance to the anterior canal; parietal wash not sufficiently heavy to conceal entirely the spiral sculpture at the base of the body. Marginal fold upon the pillar prominent, oblique, tending to bifurcate at its outer extremity; two or three irregular ridges of callus also developed upon the anterior portion of the pillar. Anterior canal short, moderately broad, feebly recurved, truncate at its extremity.

Dimensions of incomplete holotype: Height, 15 millimeters; length of aperture, 6.5 millimeters; maximum diameter, 8.5 millimeters.

Holotype: U. S. Nat. Mus. No. 371797.

Type locality: No. 7893, Boynton Landing, Choctawhatchee River, Washington County, Fla.

Hesperisternia chipolana is only about two-thirds as large as the closely related *H. waltoniana* from the Shoal River and is much more slender. The character of the sculpture, however, is almost identical in the two species. There is a curious parallelism between *Hesperisternia chipolana* and *Phos* (*Strongylocera*) *chipolanus* Dall in those specimens in which the extremities are broken away. The protoconchs are, of course, distinct, and there is no sulcus nor keel developed at the base of the body of *Hesperisternia* as there is in *Phos*.

A species known only from juveniles and fragments occurs quite commonly at Oak Grove. The form in question is larger than *Hesperisternia chipolana*, probably more than twice as large, and the spiral sculpture seems to be sharper and more elevated. It is to be hoped that this hiatus in the *Hesperisternia* fauna of the Alum Bluff may be filled shortly by the finding of entire individuals of the Oak Grove analog.

Occurrence: Chipola formation, localities 7893^r, 3419^r, 2211^r.

Hesperisternia waltonia Gardner, n. sp.

Plate XLIX, figures 15, 16

Shell of moderate dimensions for the group, fairly heavy, stout fusiform in outline, the maximum diameter falling near the median horizontal. Whorls of conch 6 in number, increasing rapidly in diameter, asymmetrically convex, with a wide and sloping shoulder obscurely

defined. Body whorl strongly inflated medially, rather abruptly constricted into the short, broad pillar. Whorls closely appressed, separated by inconspicuous sutures crenulated by the costals of the preceding whorl. Protoconch rather small, smooth, highly polished, naticoid including 3 volutions; initial turn strongly inflated, immersed at the tip; remaining volutions convex, increasing rather rapidly both in height and diameter. Close of protoconch indicated by a slight thickening of the shell and by the first appearance of faint spiral lirae and sharp, crowded incrementals; Conchal sculpture dominantly axial; first half turn threaded with 3 fine spirals, the anterior just visible behind the suture, the medial slightly in front of the median horizontal and the posterior midway between the medial lira and the posterior suture. Axial sculpture on the early part of the initial whorl restricted to exceedingly fine, sharp, growth laminae, probably about a dozen to a quarter turn; character of sculpture changing rather abruptly near the close of the first half turn; 9 or 10 axials on each of the early whorls, exclusive of the initial half turn, narrow, sharply rounded, abruptly elevated, separated by concave intercostals of approximately their own width; axials on the later volutions rather broad, rounded, prominently elevated, somewhat nodose on the periphery and inclined to become obsolete on shoulder, usually 7 on the body. Spiral threading vigorous over the entire conch; posterior and medial of the 3 original spirals increasing rapidly in elevation but remaining narrow and rather angular and girding the periphery of the adult whorls; anterior spiral retaining its position at the anterior suture and partially concealed by it even to the close of the spire; 2 or 3 sharp, and narrow primaries developed behind the periphery of the adult whorls, and on some individuals approximating the peripheral primaries in prominence; filamentary secondaries usually intercalated on the later whorls between each pair of primaries. Posterior portion of the body sculpture is similar to that of the whorls of the spire; peripheral primaries augmented by the primary following the suture line; base of body and pillar girded with about 8 angular A-shaped spirals, more widely spaced upon the base of the body than upon the pillar. Anterior fasciole detached by the contour and by the more crowded sculpture, threaded with half a dozen lirations roughened by the incrementals. Aperture rather wide, spatulate in outline, obtusely angulated at the posterior extremity. Outer lip broadly arcuate, ribbed behind the margin but not varicose, thin and sharp at the margin and finely crenate in harmony with the spiral sculpture; lirae within, the lirae corresponding in position to the interprimary spaces and persisting far within the aperture. Labium excavated at the base of the body. Parietal wash not sufficiently heavy as a rule to entirely conceal the spiral sculpture.

Pillar flexed at the entrance to the canal and pinched into a moderately prominent marginal fold; two or three rugosities usually developed behind the outer extremity of the fold. Anterior canal short, twisted backward and a little to the left, rather broad owing to the slight flare of the outer lip and broadly and obscurely emarginate at its extremity. Anterior fasciole well differentiated, not exactly parallel to the canal. Umbilicus imperforate.

Dimensions of imperfect holotype: Height 21 millimeters; length of aperture 12.5 millimeters; maximum diameter 14.0 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 371795.

Type locality: No. 3742, Shell Bluff, Shoal River, Walton County, Fla.

Hesperisternia waltonia is the analogue of *H. chipolana*. The Shoal River species is a third again as large as the Chipola form and is decidedly stouter relatively as well as absolutely. This difference in relative dimensions is even more marked in the immature forms than in the adult, so that the smaller size of the Chipola species cannot be dismissed as an age character.

Occurrence: Shoal River formation, localities 3856^p, 3742^p, 2238^r, 3748^r.

Hesperisternia bainbridgensis Gardner, n. sp.

Plate XLIX, figure 13

Shell of moderate dimensions for the genus, rather thick, stout-fusiform in outline. Aperture a little more than half as long as the entire shell. Whorls of conch probably 5 or less, increasing rapidly in diameter. Outline obscured by the heavy ribbing. Whorls of spire broadly convex, the maximum diameter falling a little in front of the median horizontal. Body inflated, abruptly constricted into the short, broad pillar. Sutures distinct but inconspicuous, undulated in harmony with the axials. Protoconch broken away in all available material. Axial sculpture dominating the spirals. Axials rather narrow, well rounded, elevated, broadest and most prominent at the periphery, obsolete on the base of the body, 7 to the whorl, subequal and equispaced except on the body, separated by concave intercostals of approximately their own width. Spirals narrow, angular, sharply elevated; lirae 7 on the whorls of the spire and 13 or 14 on the body of the immature type, exclusive of the pillar; equal, equispaced, uniform in prominence on the costal and the intercostal areas. Secondaries regularly intercalated on the body of the fully adult. Interspaces, angular channels as wide or a little wider than the spirals. Pillar and anterior fasciole threaded with additional lirae more rounded than those behind them, the fasciolar lirae less elevated than those on the pillar. Aperture moderately wide, pyriform, obtusely angulated posteriorly. Outer lip strongly arcuate, the character of the interior concealed by the matrix. Inner lip smoothly excavated at the base of the

body. Parietal wall thin, probably due in part to the immaturity of the specimen. Pillar short, broad, straight, bearing a marginal fold. Anterior canal short, inclined to the left, truncate at its extremity.

Dimensions of imperfect and immature holotype: Height, 13.5 millimeters; length of aperture, 7.5 millimeters; maximum diameter, 8.6 millimeters.

Holotype: U. S. Nat. Mus. No. 371796.

Type locality: No. 7148, Gastropod Gulch, Decatur County, Ga.

Fragments clearly indicate individuals of this species that exceed 30 millimeters in height. When perfect, the species may well have been the finest representative of the genus in the Alum Bluff fauna. The outline of *H. bainbridgensis* resembles more closely that of *H. waltonia*, and the primary spirals, in individuals of the same age, are more numerous and more uniform in elevation in the Georgian species. Secondaries are intercalated in the adult forms, but their introduction apparently comes at a later stage than it does in the Chipola and Shoal River species.

Occurrence: Oak Grove sand, localities 3385^e, 7148^p.

Family FUSINIDAE

Genus FUSINUS Rafinesque

1815. *Fusinus* Rafinesque, *Analyse de la Nature*, p. 145. Substitute name for *Fusus* Lamarck, 1799; not *Fusus* Helbling, 1779.

=*Fusus* Brugière, 1789 (no species).

Type (by monotypy in Lamarck): *Murex colus* Linnæus. Recent in the Indo-Pacific.

Dall⁶ and Woodring⁷ have discussed the involved synonymy of the group, which has been prized for its beauty by collectors since very early days. The phylogeny of the genus was studied by Grabau,⁸ formerly of Columbia University.

Shell fairly large, many whorled, slender, spindle-shaped. Protoconch of about 1½ volutions, the first, large, smooth, and tipped up slightly, the last half turn axially costate and delimited from the conch by a varical riblet. Conch strongly threaded with spiral cords and axially rippled with obtuse ribs most prominent peripherally. Aperture obliquely lenticular, abruptly constricted anteriorly into an exceedingly slender canal, slightly warped toward the extremity, open only along a narrow slit and in the type half as long as the entire shell. Outer lip arcuate, finely crenate along the margin, lirate within. Inner lip adnate to the body wall terminating in a sharp edge that is continuous to the oblique anterior fasciole.

⁶ Dall, W. H., Contributions to the Tertiary paleontology of the Pacific Coast, I, Miocene of Astoria and Coos Bay, Oreg.: U. S. Geol. Survey, Prof. Paper 59, p. 36, 1909.

⁷ Woodring, W. P., Miocene mollusks from Bowden, Jamaica, Part 2, Gastropods and discussion of results; Carnegie Inst. Washington Pub. 385, p. 256, 1928.

⁸ Grabau, A. W., Phylogeny of *Fusus* and its allies: Smithsonian Misc. Coll., vol. 44, No. 1417, pp. 1-193, pls. 1-18, 1904.

The genus in its restricted sense has been recognized in the Eocene of the London and Paris Basins. All the species from the Eocene of this country, however, which have been commonly referred heretofore to the old *Fusus* have been assigned by Grabau to the genus *Falsifusus* because of the distinct characters of the protoconch. *Fusinus* is widely distributed in the tropical and subtropical seas of the present day. Most of the species are deep-water forms, though *F. eucosmius* Dall, the form to which *F. waltonensis* is most closely related, occurs in water no deeper than 27 fathoms.

Fusinus waltonensis Gardner, n. sp.

Plate XLIX, figures 7, 8

Shell of moderate dimensions for the group, heavy in substance, slender, and fusiform in outline. Aperture half or a little more than half as high as the entire shell, the maximum diameter falling near the median horizontal. Whorls of spire closely appressed, feebly inflated medially, increasing gradually in diameter. Body whorl sharply constricted into the rather broad straight pillar. Conchal turns probably 9 in a complete adult. Protoconch rather small, obtuse, including two smooth whorls and usually about half a whorl that bears an axial sculpture; initial turn inflated, immersed at the tip, coiled in a single plane; succeeding volution also tumid at its beginning, flattening toward its close, the axially sculptured portion feebly convex; riblets narrow but rather heavy, 15 or 16 of them crowded into half a whorl subequal and uniform in prominence between the sutures. Dividing line between the conch and protoconch clearly indicated by a varicose riblet and by the abrupt beginning of the post-nuclear sculpture. Both axial and spiral sculpture strongly developed on the conch. Axials broadly arched, most prominent on the medial portion of the whorl but persisting to the anterior suture, frequently evanescent near the posterior suture, 7 to 10 to the whorl, equal and equispaced on the spire but tending to flatten and evanesce on the body. Intercoastal areas narrower than the costals and often rather angular. Entire surface of conch spirally lirated. Initial spirals 4 to 6, the two medial the strongest and outlining the periphery, another directly behind the anterior suture, and 1 to 3 behind the periphery on the obscurely defined shoulder. Spirals on the later whorls broadly A-shaped, with the crest of the angle rounded off. Primary spirals on the later turns of the spire 5 or 6, on the body 11, those on the medial portion usually the most elevated; 1 or 2 less prominent lirae also developed between the posterior primary and the suture with very fine, sharp secondaries intercalated as early as the third whorl of the conch and, on the later volutions, tertiaries often symmetrically disposed between the major spirals; interprimary areas about double the width of the primaries; primaries on the base of

the body a little sharper and more distant than those on the medial portion. Pillar obliquely girded with 10 or 12 sharp and prominent lirae, equal and regularly spaced and usually without intercalated secondaries. Anterior fasciole lirated with about half a dozen crowded threadlets. Suture lines impressed, undulated by the axial costae of the preceding volution. Aperture lenticular behind the canal. Outer lip symmetrically arcuate, very strongly lirated within, the lirae equal and regularly spaced and corresponding in position to the interspiral areas of the external surface. Excavation at the base of the body rather feeble. Parietal wash very thin in the immature type, not sufficient to conceal the spiral threading of the base of the body and the pillar. Pillar long and straight and conspicuously heavy. Canal narrow, straight, the margins parallel and proximate. Anterior fasciole feebly arched, obliquely truncate at its extremity.

Dimensions of imperfect holotype: Height, 43.5 millimeters; length of aperture, 27.0 millimeters; maximum diameter, 15.0 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 371799.

Type locality: No. 3742, Shell Bluff, Shoal River, Walton County, Fla.

Fragments of larger individuals indicate a height of 70 or 80 millimeters. The closest affiliations of this species are with *Fusinus henekeni* (Sowerby) from the Tertiary of Santo Domingo. The West Indian species differs in the more rapidly tapering spire, the somewhat sharper axial and spiral sculpture, the absence of any but the finest secondary spirals, and the much more slender pillar. The Recent analog, *F. eucosmius* Dall, is more conspicuously fusiform in outline, the whorls are much more strongly constricted at the sutures, and the pillar is relatively longer and more slender. The nuclear characters, however, are strikingly similar.

Occurrence: Shoal River formation, localities 3856r, 3742p, 5080r, 5184r.

Genus *FALSIFUSUS* Grabau

1904. *Falsifusus* Grabau, Smithsonian Misc. Coll., vol. 44, No. 1417, p. 80.

Type (by original designation): *Fusus meyeri* Aldrich = *Fusus ottonis* Aldrich. Lower Eocene of Alabama.

Shells fusiform, with a long and slender spire, and a canal of about the same length. Protoconch merging into the whorls of the conch, no sharp line of demarcation being apparent. The first two whorls of the protoconch are generally smooth, the apical one minute, gradually increasing in size. The three to four whorls which constitute the apical series form a rather narrow cone. Third whorl with fine closely crowded, more or less oblique riblets, which in part are gently concave forward. These, after the completion of the third, or sometimes an additional whorl, quickly merge into the normal whorls of

the conch. A basal carina usually marks the ribbed whorls of the apical series, this carina appearing just above the suture. —Grabau, 1904.

The genus is restricted in its known distribution to the Eocene of the Gulf.

Falsifusus? sp.

Two young forms occur at Shell Bluff that are very similar in their postnuclear characters to *Fusinus waltonensis* Gardner but which, in their nuclear characters, suggest *Falsifusus? apicalis* (Johnson). The protoconch of the forms in question is slender and obtusely conical in outline and apparently includes $3\frac{1}{2}$ volutions. The two earliest whorls are probably smooth, although the surface is rather badly worn. The initial turn is low and immersed at the tip, the second whorl rudely trapezoidal in outline. The sculptured turns are relatively higher than the smooth turns and feebly convex. The riblets are very narrow, feebly arcuate, and closely crowded, subequal and approximately uniform in prominence between the sutures. The close of the nucleus, unlike that of the typical members of *Falsifusus*, is sharply defined by a subvaricose riblet and by the abrupt initiation of the postnuclear characters.

Family BUSYCONIDAE

Genus BUSYCON Roeding

1798. *Busycon* Roeding, Museum Boltinianum, pt. 2, p. 149.

Type (by subsequent designation, Gray, Zool. Soc. London Proc., pt. 15, p. 135, 1847): *Murex aruanus* Linnaeus = *Murex carica* Gmelin. Recent on the east coast of the United States from Cape Cod to Cape Canaveral, Fla.

Shell large, heavy, pyriform; the low spire terminated by a paucispiral, papillate nucleus. Body whorl very large, inflated. Pillar long and slender. Spiral sculpture generally developed. Axial sculpture usually in the form of more or less exaggerated growth lines and resting stages, often tuberculate or spinose upon the periphery of the whorl. Aperture pyriform. Anterior canal long, open, recurved.

The genus was begun in the Cretaceous and was represented in the Eocene by small and rather thin-shelled species. These rapidly evolved, however, into the large and ponderous conchs which constitute one of the most conspicuous elements in the east coast Tertiary faunas, particularly of the Middle Atlantic States. The Recent "whelks" are restricted to five or six very prolific species and are among the most prominent and best

characterized denizens of the Atlantic shores. Both the Tertiary and Quaternary forms are confined to the eastern Atlantic coast. It is probable that their limited distribution is, in large measure, due to the loss of the velum before the animal emerges from the egg capsule.

Busycon occurs in all three formations of the Alum Bluff group, although the representation in the Oak Grove is very meager. In that formation fragments of a large *B.* (*Sycotypus*), the canaliculate whelk, are abundant, though unfortunately none are sufficiently well preserved to serve as types. It is, in fact, futile to attempt anything like a general discussion of the *Busycons* of the Alum Bluff group from the species described, for at every horizon, even in the Oak Grove, remains of 1 to 3 species too imperfect to introduce into the literature show the presence of an important but inadequately known element in the fauna. There are, however, a number of interesting features to be noted. The Chipola fauna, as one might expect, is apparently much more closely related to that of the Vicksburg than is the fauna of either the Oak Grove or the Shoal River. The genus is common though not prolific during the Chipola, and practically all the individuals are members of the group represented in the Vicksburg by *B. spiniger* Conrad. Grabau⁹ considers the Chipola River species, *B. epispiniger* Gardner and *B. sicyoides* Gardner, as offshoots from the main branch and that they became extinct at the close of Chipola time. There is no evidence in the later collections to refute this theory, for there are no closely related members of the group in either the Oak Grove sand or the Shoal River formation. In the Shoal River there are apparently two groups, one of which is represented by *B. dasum* Gardner and related to *B. fusiforme* Conrad from the St. Marys of Maryland, and the other by *B. montforti* Aldrich and probably in a direct line with the later *B. filosum* Conrad and the Recent *B. eliceans* Montfort. Both of these groups are possibly present in the Oak Grove as well, though the exact affinities of the rare *B. atraktoides* Gardner are rather uncertain, and the forms apparently related to *B. montforti* are all very young. It seems remarkable that no more closely related forerunners of the prorean *B. maximum* Conrad of the upper Miocene have been found in the lower Miocene faunas. It may be that the development and differentiation of that group was accomplished farther to the northward. The species considered in this paper may be distinguished as follows:

⁹ Grabau, A. W., Studies of Gastropoda, II, *Fulgur* and *Sycotypus*: Am. Naturalist, vol. 37, pp. 526, 539, 1903.

Shoulder of later volutions not spirally lirate.

Outline more or less fusiform; periphery nodulated or obtusely spinose on both the earlier and the later volutions except occasionally upon the body-whorl of the adult.

Outline conspicuously fusiform; a feeble and irregular spiral sculpture developed directly in front of the periphery; threading upon the pillar coarse..... *Busycon atraktoides* Gardner, n. sp.

Outline not conspicuously fusiform; spiral sculpture not developed directly in front of the periphery.

Peripheral tubercles horizontally compressed on the later volutions into obtuse spines; threading upon the pillar fine and crowded..... *Busycon aldrichi* Gardner, n. sp.

Peripheral tubercles not horizontally compressed on the later turns, often becoming obsolete upon the body of the adult; threading upon the pillar rather coarse..... *Busycon dasum* Gardner, n. sp.

Outline pyriform; periphery of early whorls smooth or approximately so; tubercles upon the body-whorl obtuse, less than 10..... *Busycon foerstei* Gardner, n. sp.

Outline pyriform; periphery of early whorls sharply crenate; body-whorl very broadly and smoothly rounded.

Busycon radix Gardner, n. sp.

Shoulder of later volutions spirally lirate.

Spiral sculpture fine and sharp; spirals usually exceeding 4 upon the shoulder of the later whorls.

Suture falling in front of the periphery on the earliest whorls; periphery tuberculated in the apical region.

Spirals directly in front of the periphery approximately equal in number and elevation to those upon the shoulder.

Busycon montforti Aldrich.

Spiral sculpture absent between the periphery and the base of the body..... *Busycon epispiniger* Gardner, n. sp.

Suture coincident with the periphery on the earliest whorls; periphery sharply crenate in the apical region; spirals developed directly in front of the periphery but usually much more feeble than those upon the shoulder.

Busycon sicyoides Gardner, n. sp.

Spiral sculpture coarse, spirals rarely exceeding 4 upon the shoulder of the later whorls--- *Busycon burnsii* Gardner, n. sp.

***Busycon atraktoides* Gardner, n. sp.**

Plate XLIX, figures 9, 10

Shell small for the genus, not very heavy, fusiform in outline, the maximum diameter falling behind the median horizontal. Aperture approximately two-thirds the height of the entire shell. Spire regularly tapering, the whorls rather elevated, asymmetrically concave behind the periphery, which is just outside the anterior suture. Whorls of conch probably 5. Protoconch broken away but obviously small. Axial sculpture indicated only in the form of small and obtuse axial nodes, rounded, very close set, about 16 to the whorl on the earlier volutions; slightly elongated horizontally, less closely spaced, 12 or 13 to the whorl on the later turns. Spiral sculpture absent on the shoulder, except a few very obscure and irregular striations; body between the periphery and the base sculptured only with 3 or 4 irregular and ill-defined lirations; base of body and pillar, however, girded with 14 sharply elevated cords which become a little lower and a little more closely spaced anteriorly. Anterior fasciole cut off from the corded pillar by a narrow, nonlirate band, the fasciole itself threaded with about half a dozen fine lirae. Suture line distinct, impressed, following directly in front of the peripheral keel. Aperture narrow, obliquely pyriform, acutely angulated posteriorly. Outer lip thin, sharp, obtusely angulated at the shoulder, nonlirate within. Inner margin of aperture feebly excavated at the base of the body. Parietal wall not glazed in the type, which is probably not fully mature. Columellar twist at the entrance to the canal very slight, the fold exceedingly obscure. Anterior canal rather long, not very slender, straight; anterior extremity broken away.

Dimensions of imperfect holotype: Height, 33 millimeters; length of aperture, 23 millimeters; maximum diameter, 16 millimeters.

Holotype: U. S. Nat. Mus. No. 371800.

Type locality: No. 7055, old Senterfeit mill, 4½ miles southwest of Laurel Hill, Walton County, Fla.

B. atraktoides is higher and more slender than *B. dasum*, of the Shoal River fauna. The periphery is entirely free from the suture even upon the earliest turn, while in *dasum* it is more often partially concealed. The nodes are rounded or obtusely pointed in the Shoal River species and not horizontally compressed. *B. aldrichi* is still farther removed, for in that species the peripheral nodes are horizontally compressed into obtuse spines and the threading upon the pillar is very fine and crowded. *B. atraktoides* is apparently restricted in its distribution to the type locality.

Occurrence: Oak Grove sand, locality 7055.

***Busycon aldrichi* Gardner, n. sp.**

Plate XLIX, figures 11, 12

Shell probably attaining a height of about 100 millimeters, though the species is founded upon an individual of less than one-third that size. Spire moderately elevated for the genus, acutely tapering. Body constricted rather abruptly into the long and slender pillar. Whorls 6 in all in the type, which is not fully adult. Protoconch rather small, papillate, exhibiting slightly more than 1½ revolutions; initial turn tumid, immersed at the tip, slightly tilted; the succeeding volution becoming increasingly less elevated and less convex. Exact line of demarcation between the conch and protoconch obliterated by the weathering in the apical region, indicated apparently by the initiation

of faint axial riblets and an oblique shouldering of the whorl, the angle falling only a little behind the anterior suture. Evolution of the axial sculpture into a series of sharply rounded peripheral nodes concomitant with the increasing angulation of the whorl; the nodes equal in size and regularly spaced, 14 to 16 on the early whorls of the type, diminishing to 11 or 12 on the body, and compressed into obtuse spines slightly elongated horizontally; probably much more elevated and more acute in the fully adult individual. Shoulder on the later whorls sloping at an angle of approximately 45°, the posterior portion closely appressed directly in front of the periphery of the preceding whorl, so that the suture line is undulated by the peripheral nodes. Spiral sculptures restricted to a very fine but sharp and crowded liration girding the extreme base of the body, the pillar, and the anterior fasciole; lirae behind the labial entrance to the canal 15, with 10 finer and more closely spaced threadlets on the canal, and an equal number of still finer threadlets on the anterior fasciole. Aperture pyriform, acutely angulated posteriorly. Outer lip obtusely angulated at the shoulder, broadly arcuate in front of the shoulder; lirations upon the inner surface unequal and irregularly spaced. Inner margin of aperture smoothly excavated at the base of the body. Parietal wall glazed even in the immature type, with a ridge of callus developed upon the inner surface directly in front of the suture line. Columellar fold at the entrance to the canal broad and obscure, with a slight depression behind it. Canal very long, almost half the height of the entire shell, nearly straight except for the arching of the anterior fasciole, the margins proximate and parallel. Anterior extremity obliquely truncate or very obscurely emarginate.

Dimensions of holotype: Height, 27.8 millimeters; length of aperture, 22.5 millimeters; length of anterior canal, 13.0 millimeters; maximum diameter, 12.7 millimeters.

Holotype: U. S. Nat. Mus. No. 371801.

Type locality: No. 5079, half a mile below Shell Bluff, Shoal River, Walton County, Fla.

Busycon aldrichi is similar in general aspect to *B. epispiniger* from the Chipola. The shoulder of *B. epispiniger*, however, is strongly lirate, while that of *B. aldrichi* is altogether free from spiral sculpture; the threading on the pillar is more crowded in *B. aldrichi*, and the spire is usually lower than it is in *B. epispiniger*.

In neither the congenetic species *B. dasum* nor in *B. atraktoides* from the Oak Grove are the spines so compressed horizontally, nor is the spiral threading on the pillar so fine and so crowded.

I take pleasure in naming this species in honor of the late Truman H. Aldrich, of the Alabama Museum of Natural History, who both by his extensive collec-

tions and by his published writings upon the Tertiary strata and their contained faunas, greatly broadened the scope of knowledge of the Tertiaries of the Gulf.

Occurrence: Shoal River formation, localities 5079^r, 5193^r, ?5194^r.

Busycon dasum Gardner, n. sp.

Plate L, figures 10, 11

Shell small for the genus but rude and rather heavy; roughly biconic in outline, the maximum diameter falling behind the median line; the spire broad and rather acutely tapering, the body obliquely flattened medially and not abruptly constricted at the base. Whorls of spire somewhat concave, the suture line following the periphery and, as a rule, more or less concealing it. Volutions about 6 in all. Protoconch small, papillate, probably of not more than 1½ volutions; the initial turn lost in the holotype, on another individual somewhat tumid though slightly flattened posteriorly and immersed at the tip; the succeeding half turn moderately elevated, becoming decreasingly convex toward its close. Beginning of conch indicated apparently by the first of faint axial riblets and 2 or 3 fine intersecting spirals restricted to the anterior portion of the whorl and outlining the peripheral keel; keel well-developed at the end of the first postnuclear turn. Axial sculpture on the medial and anterior portion of the shell restricted entirely to a series of peripheral nodes; on the early whorls, nodes well-rounded, close set, 15 or 16 to the turn; on the later volutions obtusely pointed, more widely spaced, about 10, probably becoming fainter and, on the body of the adult, evanescent. Spiral lirae developed on the keel of the early turns but gradually evanescent; spiral sculpture on the shoulder of the adult whorls restricted to a microscopically fine spiral shagreening that persists over the periphery; medial portion of body bare; base of body and pillar girded with a dozen well-rounded, moderately prominent lirae that become a little finer and a little more closely spaced anteriorly; anterior extremity of pillar and anterior fasciole sculptured with incremental striae only. Whorls closely wound, the posterior portion appressed against the preceding volution; suture distinct, impressed, following close upon the periphery of the preceding whorl and, as a rule, in part concealing it. Aperture moderately wide, obliquely pyriform, acutely angulated posteriorly. Outer lip thin, sharp, obtusely angulated at the shoulder, smooth within. Inner margin of aperture feebly excavated at the base of the body. Parietal wall thinly glazed. Pillar reinforced; flexure at the entrance to the canal very feeble. Columellar fold ill-defined, the sulcus behind it also obscure. Anterior canal long, straight, moderately slender, with parallel, proximate margins, and truncate extremity.

Dimensions of imperfect holotype: Height, 20.5 millimeters; length of aperture, 15 millimeters; maximum diameter, 11.5 millimeters.

Holotype: U. S. Nat. Mus. No. 113618.

Type locality: No. 2238, Flourney's millrace, 2 miles east of Argyle, Walton County, Fla.

Busycon dasum is apparently the analog in the Shoal River fauna of the very rare *B. atraktoides* in the Oak Grove fauna. *B. dasum* is stouter relatively, the periphery is more frequently flush with the suture line, the nodes are more rounded than in *atraktoides*; the peripheral spirals are apparently not developed in *atraktoides* even upon the earliest turns, nor is the shoulder spirally shagreened. There are, on the other hand, obscure lirations developed on the medial portion of the body of *B. atraktoides* that are not present in *dasum*. *B. dasum* is the possible analog of *B. fusiforme* Conrad from the Miocene of St. Marys River, Md., a much larger shell and one in which the spiral sculpture is usually developed to a greater or less degree upon the shoulder and medial portion of the body.

Occurrence: Shoal River, formation, localities 3856^p, 3742^r, 3731^r, 2238^r, 3748^p.

***Busycon foerstei* Gardner, n. sp.**

Plate XLIX, figures 19, 20

Shell rather small for the genus but rather heavy, pyriform in outline. Spire low, broad, whorls few in number, obtusely shouldered. Body whorl compressed medially, rather abruptly but not very strongly constricted into the broad pillar. Whorls probably not more than 5. Protoconch lost. Earliest remaining whorl or two broadly rounded, an obtuse shoulder gradually developing, which on the final turn is set with 8 rounded tubercles, those nearest the aperture the most prominently elevated. Spiral sculpture restricted to very fine, obscure lirations on the extreme base of the body and the pillar; the anterior fasciole, sculptured only with the incrementals. Suture deeply impressed, the margin slightly raised in front of it. Aperture approximately four-fifths as high as the entire shell, pyriform in outline. Outer lip following the contour of the body, obtusely angulated at the shoulder and broadly and feebly arched in front of it. Parietal wall heavily glazed, the wash the thickest near the posterior commissure; marginal fold apparently very obscure. Canal not sharply differentiated, broad, open, and approximately straight. Umbilical opening probably entirely concealed in a perfect specimen by the reverted inner lip. Anterior extremity broadly truncate.

Dimensions of holotype: Height, 48.7 millimeters; length of aperture, 40 millimeters; maximum diameter, 29 millimeters.

Holotype: U. S. Nat. Mus. No. 371802.

Type locality: No. 7148, Gastropod Gulch, 5½ miles southeast of Bainbridge, Decatur County, Ga.

There is no described species in either the fossil or the Recent faunas which approaches very closely to this form. It is well characterized by its rugged outline, the absence of sculpture upon the early turns, the distant, knobby tubercles which beset the ill-defined periphery of the body, and the restriction of the spiral sculpture to the very fine and obscure threading upon the base and pillar.

I have the pleasure of naming this unusual form in honor of the late August F. Foerste, one of the earliest of the investigators of the type locality.

Occurrence: Oak Grove sand, locality 7148^r.

***Busycon radix* Gardner, n. sp.**

Plate XLIX, figures 17, 18

1903. *Busycon radix* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1590 (nomen nudum).

Shell of moderate dimensions for the group, pyriform in outline. Spire very low, the whorls increasing rapidly in diameter except at the apex. Body whorl broadly and obliquely shouldered, very smoothly rounded at the periphery, rather abruptly constricted into the broad pillar. Whorls of conch 5 to 6 in number. Protoconch not preserved in any of the material at hand. Axial sculpture manifested only in the form of a series of peripheral nodes, 14 or 15 to the whorl, which emerge just behind the suture line on the earliest turns of the conch but which are half concealed by it on the later volutions, so that they are indicated most clearly by the regular crenulations of the suture; these nodes become increasingly broad anteriorly and evanesce altogether on the penultimate or ultimate whorl. Incrementals faint, sinuous. Spiral sculpture restricted to the base of the body and the pillar, which are very finely lirated with subequal or alternating wavy threads, about 21 in the type, which is, however, an individual that has suffered severe injury near the anterior extremity. Sutures impressed, following the margin of the nodose periphery during its adolescent stage, deepening with the evanescence of the axials, and toward the aperture distinctly channeled. Aperture wide, the outer lip thin, sharp, faintly emarginate near the commissure, broadly and rather strongly arched medially, feebly sinuated by a broad and barely perceptible depression at the base of the body. Inner margin of the aperture loosely sigmoidal. Body symmetrically excavated at the base. Parietal wall and pillar narrowly but rather densely glazed, a heavy ridge of callus being laid down on the inner wall directly in front of the suture and parallel to it. Pillar twisted and slightly compressed at the entrance to the canal. Canal moderately long, broad, the margins parallel but not proximate.

Dimensions of imperfect holotype: Height, 73 millimeters; length of aperture, 63 millimeters; maximum diameter 44.5 millimeters.

Holotype: U. S. Nat. Mus. No. 371804.

Type locality: No. 2646, Oak Grove, Yellow River, Okaloosa County, Fla.

In meagerness of ornamentation *B. radiæ* suggests *B. planulatum* (Dall) from the Caloosahatchee Pliocene. The later form is much smaller, however, and the periphery falls at some distance behind the suture line. The broadly and evenly rounded body of *B. radiæ*, devoid of any sculpture excepting the spiral threading at the base, is unlike that of any of the coexistent species. There is, however, a single, similar, young individual at Shoal River, a form with a papillate, twice-coiled protoconch and 4 conchal turns, the last of which is obtusely angulated at the periphery but not nodulated. The nodes upon the other three whorls are similar in character to those upon the spire of *radiæ*, but they are farther removed from the anterior suture. The individual in question is only about 20 millimeters long and may be the young of a closely related but distinct species.

Occurrence: Oak Grove sand, localities 2646^r, ?7055.

Busycon montforti Aldrich

Plate L, figures 1, 2

1907. *Busycon montforti* Aldrich, *Nautilus*, vol. 20, p. 121, pl. 6 (two figures).

Shell large, solid. Whorls about seven; those of the spire with slight nodules, which on the body whorl develop progressively into small, medium, and then large spines, ten in number on the specimen figured; these spines are flattened above, and partly so below, and differ from those of *Busycon eliceans* Montf., by being filled by the successive growth additions. Surface covered with raised lines, except on the middle of the body whorl. Aperture within still yellowish-brown. Canal contracted and twisted somewhat to the left. Inner lip with a strong callus carrying a fold at the angle with the canal; outer lip corrugated within. The specimen has the spire slightly broken, but it is probably pointed like *Busycon eliceans*. The canal is considerably shortened by breakage.

Locality: Shoal River, Walton County, west Florida.

Remarks: The geological horizon is in the Upper Oligocene of Dall. [Middle Miocene of the current correlation.] This species is especially interesting because it shows that *Busycon eliceans* Montf. is a distinct form with an Oligocene (?) ancestor. There are a number of minor differences between the two species, but when placed side by side they show without question their intimate relations. The descent of the group will need to be considerably modified to conform to the new discovery.

—Aldrich 1907.

Figured specimen: U. S. Nat. Mus. No. 371798, from Shell Bluff, Shoal River, Walton County, Fla. Probably a topotype.

Dimensions of holotype not given but probably about 102 millimeters high by 71 millimeters in greatest diameter.

No specimens of dimensions comparable to those of the type have since been found, but there are a number

of well-preserved protoconchs included in the later collections. The initial turn and a half of the protoconch is smooth and rather broad but not greatly elevated. The tip is immersed, the posterior surface of the following whorl rather obliquely flattened (see pl. L, fig. 1), the lateral surface inflated but becoming increasingly less convex after the close of the first full turn of the protoconch. The sculpture is initiated in the form of half a dozen somewhat irregular axial riblets (pl. L, fig. 2), restricted for the most part to the periphery. With the introduction of the sculpture and, in many specimens, a little before it, an incipient shoulder is formed, which on the third whorl is sharply angulated. The dividing line between the conch and protoconch is obscure but probably occurs near the close of the second turn coincident with the beginning of the spiral sculpture and the increasing angulation of the shoulder. The spirals are exceedingly fine and faint near their origin, that outlining the shoulder the least so. They are absent altogether behind the periphery at the beginning of the conch but equal and linearly spaced in front of it. By the close of the first turn of the conch the shoulder is pinched into a narrow keel, which is first corrugated and then finely nodulated by the incremental sculpture. There are two or three low, equal lirae revolving directly in front of the keel and a smooth area a little wider than the spirally lirated area behind it at or a little in front of the medial portion of the body. The base of the body, the pillar, and the fasciole are also finely lirated, with about 15 crowded spirals which become increasingly fine anteriorly. The shoulder spirals are the last to develop and in most specimens are 4 or 5 in number on the third conchal turn. The spiral sculpture retains the same general character through the adolescent and adult stages. The lirations of the inner lip are commonly established on the third or fourth whorl of the conch. The axial sculpture, manifested on the early turns in the form of rather sharp and crowded peripheral nodes, begins on the fourth or fifth whorl of the conch to evanesce, so that apparently there is a stage intervening between the finely nodose periphery of the young and the coarsely spinose periphery of the adult, which is characterized by an almost smooth and less acutely angulated shoulder keel.

The unsculptured first whorls of *B. carica* (Gmelin) are more gibbous and more elevated than those of *B. montforti*, and the peripheral angulation is developed later than in the middle Miocene form. Grabau¹⁰ in his phylogenetic study of the group considered *B. flosom* Conrad from the Yorktown of Virginia as the direct ancestor of *B. eliceans* Montfort.

¹⁰ Grabau, A. W., *Studies of Gastropoda, II, Fulgar and Sycotypus*; *Am. Naturalist*, vol. 37, pp. 530, 539, 1903.

B. filosum is itself an advanced type, since a characteristic feature of the species is the dilation of the anterior siphon, one of the most reliable indications of senility. In the middle Miocene species the canal is approximately normal. There is also evidence of acceleration in *B. filosum* in the close though not immediate succession of the spines upon the nodes. In *B. montforti* the smooth and obtusely angulated periphery probably persists during a complete volution.

The young of *B. montforti* are quite similar in general aspect to the members of the group *B. epispiniger*. In *B. epispiniger*, however, no spiral lirae develop between the periphery and the base of the body; in *B. sicyoides* the early volutions are sharply crenate instead of nodose as in *B. montforti*, and the suture line is coincident with the periphery, while in *B. burnsii* the spiral threading is coarse and there are as a rule only 3 or 4 lirae upon the shoulder of the later whorls.

Occurrence: Shoal River formation, localities 3856^p. 3742^c.

***Busycon epispiniger* Gardner, n. sp.**

Plate L, figure 6

1890. *Fulgur spiniger* Conrad (part). Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 109.

Not *Fusus spiniger* Conrad, 1848, Acad. Nat. Sci. Philadelphia Jour., 2d ser., vol. 1, p. 117, pl. 11, fig. 32.

Shell rather small for the genus, not very heavy, pyriform in outline. Spire of moderate height, tapering rather rapidly to an acute apex. Whorls approximately 7 in all, including the 2 nuclear turns; those of the conch obliquely shouldered, converging as a rule at an angle of a little more than 45°, the suture falling in front of the periphery on the later turns so that the profile of the spire is interrupted by the peripheral sculpture. Body whorl flattened medially, rather abruptly constricted into the long and slender pillar. Initial whorl of protoconch low, flattened somewhat posteriorly, immersed at the tip; succeeding whorl more elevated, broadly rounded, becoming increasingly less convex toward the close of the protoconch; axial sculpture introduced on the final half turn of the protoconch in the form of half a dozen obtuse axial riblets, least feeble on the periphery, evanescent a short distance behind it. Dividing line between the conch and protoconch indicated by the development of a peripheral keel, the concomitant evolution of the axials into narrow peripheral nodes, and the initiation of the spiral sculpture. Axial sculpture upon the conch restricted entirely to the peripheral corona and the incrementals; nodes on the early whorls broadly rounded, closely and evenly spaced, 17 or 18 to the whorl, later becoming slightly elongated and compressed horizontally, the number decreasing to 15 or 16 and on the later volutions, with the increasing prominence and acuteness of the tubercles, to 13 or even in some individuals to 10. Shoulder

spirals appearing in the form of clearly defined cords subequal and subequispaced, usually 5; body sculpture absent upon the adult between the periphery and the dozen or so rather fine and not very closely spaced lirae that gird the base of the body and the pillar; threading apparently absent on the anterior fasciole. Aperture pyriform. Outer lip thin, sharp, obtusely angulated at the shoulder, broadly arched in front of it, rather abruptly constricted at the canal; inner surface sharply lirate from the posterior commissure to the entrance to the canal; lirae persistent far within the throat and almost but not quite to the outer margin, usually 4 or 5 on the inner surface of the shoulder and 15 or 16 in front of it. Inner margin of aperture smoothly excavated. Parietal wall very thin. Pillar not very heavily reinforced. Canal well differentiated, long and slender, the margins parallel and proximate; marginal fold obtuse, defined by a shallow sulcus a little behind the angle at the entrance to the canal. Anterior fasciole moderately arched, truncate at its extremity.

Dimensions of imperfect holotype: Height, 37 millimeters; length of aperture, 26.5 millimeters; maximum diameter, 22.5 millimeters.

Holotype: U. S. Nat. Mus. No. 112034.

Type locality: No. 2212, Tenmile Creek, 1 mile west of Baileys Ferry, Calhoun County, Fla.

Busycon epispiniger is characterized by the complete emergence of the peripheral keel behind the suture line on even the earliest volutions and by the absence of spiral sculpture between the periphery and the base of the body. A few individuals of *B. sicyoides* Gardner approach *B. epispiniger* in the sharpness of axial sculpture, but in all of them the early whorls of the conch are immersed so deeply that the periphery is wholly or in part concealed. The spiral threading on the shoulder is not so well developed as in *epispiniger* nor are the axial nodes so rounded and so regular. The Vicksburg analog, *B. spiniger* Conrad, is more sharply spinose, the spiral sculpture is much finer and closer on the shoulder, and the entire surface of the body is spirally lirate except for a narrow band on the anterior medial portion. *B. maximum* Conrad, so prominent in the later Tertiary, is probably a representative of this same general group though not a lineal descendant.

Occurrence: Chipola formation, locality 2212^p.

***Busycon sicyoides* Gardner, n. sp.**

Plate L, figures 7, 8

1890. *Fulgur spiniger* var. *nodulatum* Conrad. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. I, p. 110 (synonymy excluded).

Not *Fulgur nodulatum* Conrad, 1849, Acad. Nat. Sci. Philadelphia Jour., 2d ser., vol. 1, p. 207.

Spire low, whorls keeled, suture wound on or near the keel; shoulder flat, sloping; keel more or less nodulous, sometimes subspinous; striation fine, often obsolete on the periphery;

pillar with one groove; throat lirate; body with an internal ridge near the suture in adults.—Dall. 1890.

The shell is small for the genus and quite thin. The whorls are 6 in all, including the 2 component whorls of the protoconch. The initial turn is rather low, smooth, broadly rounded, somewhat flattened posteriorly and immersed at the tip. The succeeding turn is rather high, moderately inflated, obscurely angulated toward the close of the whorl, the keel migrating within the final half turn from the median horizontal almost to the anterior suture. Axial sculpture is introduced upon the final half or quarter turn of the nucleus in the form of very fine and irregular axial corrugations, least faint upon the periphery. The dividing line between the conch and protoconch is obscure and is indicated chiefly by a slight change in the contour of the shoulder and by the restriction of the axials almost entirely to the periphery. The whorls of the conch are acutely angulated at the periphery and are almost horizontal or gently sloping behind it, so that in those forms in which the suture line follows the keel the apical surface is a low, broad cone, the base of the cone sharply defined by the periphery of the body. The constriction at the base of the body is very abrupt, and the pillar and anterior canal so slender that they are rarely perfectly preserved. The axial sculpture is manifested only in the form of faint incrementals and of peripheral nodes or spines. The nodes in the first postnuclear turns are smoothly and symmetrically rounded, regularly spaced for the most part, and in many individuals run up to not less than 25 in number. On the second or third volution the nodes become more or less compressed horizontally, so that the periphery is finely and evenly crenulated. As a rule, the crenulations become increasingly broader and lower toward the aperture and in exceptional individuals evanesce altogether. More rarely the crenulations are produced into obtuse, horizontally compressed spines. The spiral sculpture is fine but distinct. There are usually from 5 to 7 rather sharp, subequal, and rather regularly spaced lirae behind the periphery, with an approximately equal number of somewhat more obscure lirations directly in front of the periphery. On the medial portion of the body, or a little in front of it, is a narrow band devoid of spiral sculpture.

Upon the base of the body and the pillar 20 to 25 threads may be present exclusive of the half dozen exceedingly faint lirations on the anterior fasciole. Finer threadlets are commonly intercalated on the base and the pillar, but on the canal, the sculpture may be obsolete. The aperture is moderately wide for the group. The outer lip is acutely angulated at the shoulder and flares in front of it both axially and incrementally. The inner labral surface is sharply lirated. Not only are there from 12 to 15 threads between the shoulder and the beginning of the canal, but there are

half a dozen on the inner surface of the shoulder itself. The constriction at the base of the body is abrupt. The parietal wash is rather thin, the glaze becoming more dense upon the pillar. The twist in the columella at the entrance to the canal is rather sharp, and the marginal fold is much more obscure than the sulcus behind it. The anterior canal is unusually long and slender, the margins proximate and parallel, and the anterior extremity obliquely truncate.

Dimensions of holotype: Height, 40 millimeters; length of aperture, 34 millimeters; length of canal, 19 millimeters; maximum diameter, 21.5 millimeters.

Holotype: U. S. Nat. Mus. No. 112032.

Type locality: No. 2213, 1 mile below Baileys Ferry, Chipola River, Calhoun County, Fla.

In its typical development *B. sicyoides* is readily isolated by the *Tudicula*-like outline, the very low, broad spire, acutely angulated periphery, the flattened medial portion of the body, and the abruptly constricted base. The maximum diameter is lower relatively in both *B. burnsii* and *B. epispiniger*, the spires in both are decidedly more elevated, and the early whorls are not immersed flush with the keel as in *B. sicyoides*. The spiral threading on the shoulder is sharper in *B. epispiniger* but is obsolete between the periphery and the base of the body. In *B. burnsii* the spirals are much coarser and rarely exceed 4 on the shoulder. The type of *B. burnsii* is from Alum Bluff. There are some puzzling forms from the Chipola River that have been referred to *B. burnsii* but that are probably referable to an undescribed species more closely allied to *B. sicyoides*. The forms in question are double the size of either *B. burnsii* or *B. sicyoides*, heavy, low-spined but not so low as in *B. sicyoides*, with obliquely sloping shoulders that are obtusely nodulated at the periphery and coarsely lirated behind it. The posterior margin of the whorl is slightly elevated and closely appressed against the preceding volution, and the suture line follows very closely upon the keel.

B. sicyoides bears little resemblance to the true *B. nodulatum* Conrad, which is rather a heavy shell, subfusiform in outline, with an elevated, steeply sloping spire, the profile of which is little or not at all interrupted by the obscure nodulation at the periphery. The spiral sculpture, furthermore, is coarse and crowded over the entire surface of the conch with the exception of a narrow band near the base of the body. There is a single fragmentary individual from Shoal River, doubtless new but apparently closely allied to the true *nodulatum*, from which it differs in the more regular outline of the spire, the greater concavity of the shoulder on the first and second post-nuclear turns, the restriction of the axial sculpture to a few fine and obscure nodes on the early whorls of the conch, and the fewer and more flattened spiral lirations.

The confusion in *B. nodulatum* arises from the fact that Conrad first described his species but did not figure it.¹¹ A little later he figured two individuals belonging to two species.¹² Only figure 7 agrees with his original description of *B. nodulatum* and must serve as the type.

Occurrence: Chipola formation, localities 7893^r, 2212^c, 7151^p, 2213^c, 2564^p, 3419^p.

***Busycon burnsii* (Dall)**

Plate L, figures 3, 4

1890. *Fulgur spiniger* var. *burnsii* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. I, p. 110.

Spire moderate; keel often nodulous or even faintly undulate, instead of spiny; shoulder flattish, with a thick band or swollen cord at the suture, which is deep, though not quite channelled; spiral sculpture sparse, but very coarse; periphery smooth; internal lirae prominent and continuous, rather sparse; infrasutural callus strong and sharp. Max. lon. observed, about 65 mm. The spire varies from depressed to slightly scalar. When spiny this variety has numerous (13–15) small spines on the last whorl, instead of few (10–13) large ones, as in var. *spiniger*.

Lower Miocene at Alum Bluff (lower bed) and the vicinity of Baileys Ferry, Chipola River, W. Florida.

This variety is named in honor of Mr. Frank Burns, of the U. S. Geol. Survey, to whose energy and faithfulness in collecting our paleontologists are greatly indebted.—Dall, 1890.

The shell is small for the genus but heavier than its closely related congeners. The whorls are probably as many as 8 in a complete adult, though only 6½ in the figured specimen. The protoconch is rather small, papillate, and probably includes 2 revolutions. The initial whorl is low, broadly rounded, flattened posteriorly, and immersed at the tip. The succeeding volution is higher and more inflated except toward its close, where it is increasingly less convex. The final half turn is feebly sculptured with irregular axial riblets that do not persist, as a rule, to the posterior suture. The dividing line between the conch and protoconch is indicated by a slight break in the shell, by the abrupt development of a peripheral keel, and by the evolution of the axial riblets into a series of symmetrically rounded peripheral nodes. The whorls of the conch are closely appressed. The shoulder is approximately horizontal, the upcurved peripheral nodes together with the slightly raised posterior margin lending to it, however, a slightly concave contour. The medial portion of the body is somewhat obliquely flattened, and the constriction at the base is rather abrupt. The axial sculpture aside from the incrementals is restricted to the peripheral corona. The axials on the earliest whorls of the conch appear as a series of equal, symmetrical, well-rounded nodes approximately 15 to the whorl. On the later turns these become more prominent, compressed, elongated hori-

zontally, and obtusely spinose. The spiral sculpture is very coarse for the group. There are 3 or 4 rather sharp and prominent lirae on the shoulder, that nearest the periphery commonly the strongest. In front of the periphery on the body are 5 or 6 subequal lirae, a little broader and less sharp than those on the shoulder but covering an area of approximately the same width. The anterior portion of the body is girded with an unsculptured band. On the base of the body and the pillar the lirae are coarser and rather widely spaced, becoming increasingly finer and more oblique anteriorly. The aperture is moderately wide, the outer lip obtusely angulated in front of it, contracting rather abruptly into the canal. The lirations upon the inner surface are very sharp and only slightly irregular in size and spacing. There are usually 4 on the inner surface of the shoulder and a dozen more or less in front of it. The inner margin of the aperture is smoothly excavated and the parietal wall and pillar rather thinly glazed. There is also a sharp thread of callus directly in front of the suture similar to the lirae on the inner surface of the labrum. The columellar twist at the entrance to the canal is rather sharp, though there is no well-defined fold—only a shallow groove a little behind the angle. The anterior canal is long, slender, and slightly bent, with parallel, proximate margins. The anterior fasciole is rather strongly arched, apparently devoid of spiral threading and obliquely truncate at its extremity.

Dimensions of cotype: Height, 44.3 mm.; length of aperture, 36.5 mm.; length of anterior canal, 22.0 mm.; maximum diameter, 20 mm.

Cotypes: U. S. Nat. Mus. No. 112038.

Type locality No. 2211, lower bed, Alum Bluff, Liberty County, Fla.

The specimens from the Chipola River that have been referred to this species are probably distinct and more closely related to *B. sicyoides*. The Chipola form is larger, the spire is much lower and broader, the suture line following the periphery for a greater distance, so that the scalariform outline is entirely lost. The peripheral nodes of the early whorls are not so sharp, and instead of developing on the later volution into obtuse spines, as in the forms from Alum Bluff, they evanesce and become more or less obsolete, as in the congenetic species *sicyoides*.

B. burnsii Dall is similar in dimensions and outline to *B. tampaense* Dall, and some of its subspecies, but the Tampa species is more finely sculptured and there is no smooth band, as in *B. burnsii*, girding the anterior portion of the body. *B. sicyoides* has a broader, lower, flatter spire and is more finely sculptured spirally and axially. *B. epispiniger* is also more finely sculptured spirally and is bare between the periphery and the base of the body.

Occurrence: Chipola formation, Alum Bluff, localities 2211^c, 73704^r.

¹¹ Conrad, T. A., Descriptions of new fossil and recent shells of the United States: Acad. Nat. Sci. Philadelphia Jour., ser. 2, vol. 1, p. 207, 1849.

¹² Conrad, T. A., Descriptions of one new Cretaceous and seven new Eocene fossils: Acad. Nat. Sci. Philadelphia Jour., ser. 2, vol. 2, p. 41, pl. 1, figs. 6 and 7, 1850.

Subgenus **SYCOTYPUS** Gill

1867. *Sycotypus* Gill, Am. Journ. Conchology, vol. 3, p. 147.
Type (by original designation): *Murex canaliculatus* Linnaeus. East coast of North America from Cape Cod to the Gulf of Mexico.

Sycotypus has been commonly credited to Browne,¹³ who applied it in 1756 to "the smaller, hairy fig-shell." It is uncertain from Browne's description whether he was referring, as Gill maintained, to *S. canaliculatus*, which has not been elsewhere recorded from Jamaica, or, as Gray¹⁴ maintained, to *Pyrula*, which is not hairy. That question is purely academic, however, since Browne was not binomial, and it is of no interest from a nomenclatorial standpoint whether he had before him *Sycotypus* or *Pyrula* or some other whelk. Gray merely cited Browne's name as a synonym of Lamarck's *Pyrula*, so that it was still available in 1867, when Gill designated the type and described the genus.

Like *Busycon* s. s., *Sycotopus* is restricted in its distribution to the Cenozoic faunas of the east coast of North and Central America.

The Recent canaliculate whelks may be grouped about the common Florida species *B. pyrum* Dillwyn, which does not range north of Hatteras, and the genotype, the common whelk of the cooler waters. The lower and middle Miocene representatives are apparently members of the *pyrum* group but in the relatively cool water of the upper Miocene Choctawhatchee there is a possible precursor of the genotype, *B. aepyrotum* (Dall) (see pl. L, fig. 12).

***Busycon (Sycotypus) proterum* Gardner, n. sp.**

Plate L, figure 5

Shell small for the group, rather thin. Spire low and broad, the whorls very gently sloping posteriorly, acutely angulated at the periphery and overhanging the sutural channel of the succeeding turn. Body obliquely compressed in front of the periphery, abruptly constricted at the base. Whorls probably 6 in a complete individual; the tip, including the initial turn or two, lost in the unique type. Protoconch small, apparently smooth, and probably of two coils. Dividing line between conch and protoconch obscure, indicated apparently by the development of an acute peripheral keel a little behind the anterior suture and by the crenulation of the peripheral margin. Sutural channel and spiral sculpture not initiated in the type until the penultimate whorl. Axial sculpture indicated merely by the piecrust crenulation at the peripheral margin, the scallops regular in size and spacing, about 18 to the whorl. Spiral threading fine, faint, evenly developed over the surface of the later volutions; lirae equal, closely spaced, 8 upon the shoulder of the body, not including the

heavier cord outlining the anterior margin of the sutural channel; lirae on the body in front of the periphery probably 30 to 40, least fine on the base and the pillar, faintest but not altogether obsolete on the anterior medial portion of the body. Sutural channel rather shallow, not developed till near the close of the ultimate whorl but widening before its finish to approximately one-fourth the width of the shoulder, delimited anteriorly by a rounded thread. Aperture wide, most of the characters obscured by the imperfect state of preservation. Outer lip acutely angulated at the shoulder. Inner wall of aperture strongly concave. Anterior extremity lost.

Dimensions of imperfect holotype: Height, 16.5 millimeters; maximum diameter, 13.5 millimeters.

Holotype: U. S. Nat. Mus. No. 371805.

Type locality: No. 3386, Roseland plantation, 3½ miles southeast of Bainbridge, Decatur County, Ga.

B. (Sycotypus) proterum is described from a unique mold to which a considerable portion of the shell substance still adheres. It is of interest, however, because it is one of the best preserved representatives of a little known fauna and because it is one of the earliest of the group of canaliculate whelks so conspicuous in the Miocene and Pliocene. There are no obvious affinities with any of the later species.

Occurrence: Oak Grove sand, locality, 3386.^r

Busycon (Sycotypus) sp.

There are two species of *Sycotypus* at Shoal River and two others at Oak Grove that are represented by material too imperfect to describe. This is most unfortunate, because the group has not before been definitely recognized in strata earlier than the Miocene and there is a peculiar interest in extending a genealogical line back another step. One of the Oak Grove species, which may be designated as *A*, attains dimensions comparable to those of *B. rugosum* and *B. coronatum* of the Chesapeake group of Maryland. In it the protoconch is rather elevated, papillate, and includes a little less than three coils. The sutural channel is initiated on the second turn of the conch. The spire is very low and broad, the shoulder horizontal, sharply crenulated at the margin and more than twice as wide as the area between the periphery and the anterior suture. On the later whorls, the peripheral nodes develop into prominent and rather acute spines. The body is compressed in front of the periphery and rather abruptly though not strongly contracted at the base into a broad pillar. Spiral sculpture, except for an exceedingly fine, irregular, and obscure lineation, is restricted to fine but rather distant lirations upon the base of the body. In the Chesapeake forms, *B. rugosum* and *B. coronatum*, the spire is higher and the spiral sculpture more uniformly developed. The lirae are not nearly so fine and obscure on the shoulder and in front of the periphery nor so

¹³ Browne, P., Civil and Natural History of Jamaica, p. 406, 1756.

¹⁴ Gray, J. E., A list of the genera of Recent Mollusca, their synonyma and types: Zool. Soc. London Proc., pt. 15, p. 135, 1847.

widely spaced on the pillar. Species *B* from Oak Grove is represented by a single fragment that indicates a shell of moderate dimensions with a rather low, broad spire. The shoulder slopes very gently and is wider than the side of the whorl. The peripheral angle is acute and crenate. Three or four rather sharp lirae are developed on the shoulder and an equal number of less elevated threads in front of it. The sutural channel is little more than a very deeply impressed linear sulcus outlined anteriorly by the elevated margin of the whorl, but it probably widens toward the aperture. Species *C* from Shoal River is also doubtless a member of the group of *B. coronatum* and *B. rugosum*, though it is apparently not an intermediate form between species *A* from Oak Grove and the Chesapeake species. It probably attains dimensions similar to the other members of the group. The spire is rather low and broad, though not so low as in species *A*, for the shoulder slopes very gently and on the later turns of the spire is no wider than the side of the whorl. The peripheral angle is acute and outlined by a fine crenulation, the notches running about 18 to the whorl on the medial portion of the spire. On the later volutions they apparently become irregular and more or less obsolete. The spiral sculpture is coarse but not very sharp or regular. There are about half a dozen threads on the shoulder, the anterior stronger than the posterior. The area in front of the periphery is also obscurely lirate. The sutural channel is deep but not wide and persists almost to the apex. The anterior margin of the channel is outlined by an elevated but not sharply defined cord. Species *D* from Shoal River is represented by young forms only. The adults are probably large. The spire is low, the shoulder broad and gently sloping, the suture falling directly in front of the periphery. The body is compressed in front of the shoulder and is rather gradually constricted into the broad pillar. The periphery is outlined by a narrow band, which on the early whorls, at least, is sharply and rather closely crenate. The incremental striae are unusually strong, especially in the sutural channel. A very fine spiral lineation is developed on the periphery and in rare individuals on the shoulder. In front of the periphery the shell is obscurely but macroscopically lirate, although there is a narrow area on the anterior medial portion of the body that is almost bare. The threading on the base of the body and the pillar is rather coarse and widely spaced. The sutural channel originates early on the conch, apparently on the third turn, and on the later volutions is probably rather wide though shallow. The anterior margin of the channel is sharply elevated, but there is no well-defined marginal cord. The aperture is moderately wide and pyriform in outline; the labrum is obtusely angulated at the shoulder and rather strongly constricted at the base of the body. The single labial fold, defined posteriorly by a shallow sulcus, is un-

usually strong within the aperture though probably evanescent at the opening. The anterior canal is apparently straight and moderately long.

There are two interesting features to be noted from these fragments, namely, that there is much variation among them and that the forms are far advanced in certain characters. Both of these features indicate a considerable degree of differentiation before the close of Alum Bluff time. Smith,¹⁵ in his phylogenetic study of the group, discriminated four stages, as follows: (1) The smooth and rounded stage, (2) the noded stage, (3) the keeled stage without well-defined nodes, and (4) the final, rounded stage. It is probable that at least one of the species from Shoal River passes through the first three of these stages and that all of them accomplish the first two. There is no evidence, however, that any of the four species reach the final, rounded stage attained by the accelerated type *B. incile* (Conrad) of the later Miocene and by *B. pyrum* (Dillwyn) of the Recent fauna (plate L, fig. 9). The development of the sutural channel on species *A* as early as the second whorl of the conch and on species *D* as early as the third whorl lends an added value to this character as a generic diagnostic. However, it is in many species intimately associated with the height of the spire and probably does not possess so much ontogenetic significance as has been granted it by Mr. Burnett Smith.

The collection of additional material from the Alum Bluff, particularly from its upper horizons, should serve to bring to light some interesting and definite facts bearing on the early evolution and phylogenetic relationships of this genus.

Family MELONGENIDAE

Genus MELONGENA Schumacher

1817. *Melongena* Schumacher, Essai d'un nouveau système des habitations des vers testacés, pp. 64, 212=*Galeodes* Thiele, 1931, not *Galeodes* Olivier, 1791.

Type (by tautonymy): *Murex melongena* Linnaeus. Recent in the West Indies and the Florida Keys.

Shell rather large, heavy, pyriform in outline. Spire relatively low, acutely tapering, the whorls usually angulated at the periphery and sharply nodulated or spinose; a row of spines commonly borne upon the base of the body or the pillar. Spiral sculpture irregular, as a rule, and ill-defined. Aperture rather wide, oblong, ovate or pyriform. Outer lip not thickened, smooth within. Columella simple. Parietal wall and pillar heavily calloused. Anterior canal rather short and broad, not sharply differentiated. Anterior fasciole very strongly and heavily corrugated by the growth lines, emarginate at its extremity. Umbilicus imperforate.

¹⁵ Smith, Burnett, Morphologic sequences in the canaliculate fulgurs: Acad. Nat. Sci. Philadelphia Proc., vol. 66, p. 569, 1914.

Melongena has been recognized both in the Oligocene formations of Mexico and of Italy. The earliest representative of the genus reported from this country is *M. crassi-cornuta* Conrad from the Vicksburg group of Mississippi. The species *M. ? potomacensis* Clark and Martin from the Eocene of Maryland is not referable to this genus. *Melongena* has never been a conspicuous element in any fauna, although, at present, it is rather widely distributed in the shallow inshore waters of the tropical seas.

***Melongena sculpturata* Dall**

Plate L, figures 13, 14

1890. *Melongena sculpturata* Dall (part). Wagner Free Inst. Sci. Trans., vol. 3, pt. I, p. 118 (fig. excluded).

1915. *Melongena sculpturata* Dall, U. S. Nat. Mus. Bull. 90, p. 68, pl. 11, fig. 1.

Shell of eight or nine whorls, rather elongated, with rather sharp, elevated, incremental lines, crossed by sharp-edged spiral threads of varying strength, so as to give a rather rasp-like surface-sculpture. The species exhibits two varieties, of which the extremes differ greatly from one another, though connected by minute gradations when a sufficient series is studied.

M. sculpturata var. *sculpturata* Dall. In this form the whorls are somewhat imbricated at the suture and decline with a rather steep slope to the series of spines at the shoulder, which are triangular and compressed; they number about eight on the last whorl; on the base a similar series of five or six shorter spines often encircles the canal about one-third of the way from the siphonal fasciole to the series at the shoulder; siphonal fasciole strong, arcuate, sometimes imbricated, but not spiny; aperture elongate, smooth inside; pillar with a moderate callus, reflected anteriorly as far as the fasciole, but without any umbilical chink; canal well defined, rather short and wide; whorls coiled rather closely just in front of the posterior series of spines, so that the even slope of the spire is a prominent feature. The spirals are alternated, from one to three sharp secondary threads between every two primaries; the earlier whorls have proportionately more spines than the later ones, as usual in this group. A young specimen measures, inclusive of 13 millimeters of spines, 50 by 80 millimeters, the aperture being 60 millimeters long. The adults, judging from fragments, will measure 160 millimeters in length occasionally.

This form was found at Chipola * * *.—Dall, 1890.

Holotype: U. S. Nat. Mus. No. 498893.

The protoconch is small, slender, and moderately elevated and includes two smooth turns and about a quarter of a whorl, upon which axial sculpture is developed. The initial turn is strongly inflated and immersed at the tip. The succeeding volution is also tumid, though less convex toward its close. Axial sculpture appears upon the last quarter turn of the protoconch in the form of subequal, microscopically fine, linear riblets, uniform in elevation between the sutures and 5 in number upon the figured specimen. The dividing line between the conch and protoconch is very sharp and is clearly indicated by a slight thickening of the whorl and by the abrupt beginning of the postnuclear sculpture, both axial and spiral. The earliest whorls of the conch are obliquely shouldered. The axial costae are rounded,

elevated, about 10 in number, a little more prominent at the periphery, persisting to the anterior suture but evanescent on the shoulder. The spiral outlining the periphery is flattened and a little more prominent than the 1 or 2 spirals in front of it. There are 3 or 4 still finer and rather sharp threadlets upon the shoulder.

Occurrence: Chipola formation, localities 2212^a, 7151^r, 2213^a, 2211^a.

***Melongena* sp.**

Melongena constitutes decidedly the most prominent element in the shallow-water fauna in the environs of Bainbridge, Decatur County, Ga. This rather remarkable locality was first discovered by Pumpelly; it was noted by Dall and Harris,¹⁶ and Foerste¹⁷ discussed it, listing from it about 30 species. A couple of other lists were later included in a report by Veatch and Stephenson.¹⁸ Foerste cited *Melongena* aff. *M. subcoronata* Heilprin, but none of the other investigators gave more than a generic determination. There are certainly two and possibly three species represented, all of them so imperfectly preserved, however, that they have not been described. The commonest form is most closely allied to the Chipola species *M. sculpturata* Dall, but is apparently smaller and relatively broader, with a broader, less elevated spire and a finer, sharper, and more uniform spiral sculpture. The second species, which may be nothing more than a variation of the first, is even closer to *M. sculpturata* in that the spire is relatively higher and more scalariform in outline. The spiral sculpture, however, seems to be constantly finer, sharper, and more regular than in *sculpturata*. The third species, which apparently is much larger than either of the other two, is characterized by a secondary row of spines directly in front of the primary and peripheral series.

The three forms were recovered from Gastropod Gulch, 4 miles southeast of Bainbridge, Decatur County, Ga., and from the Roseland plantation, 3½ miles southeast of Bainbridge.

Family BUCCINIDAE

Subfamily PHOTINAE

Genus PHOS Montfort

1810. *Phos* Montfort, Conchyliologie systématique, vol. 2, p. 495.

Type (by monotypy): *Murex senticosus* Linnaeus. Recent in the Indo-Pacific.

¹⁶ Dall, W. H., and Harris, G. D., Correlation papers. Neocene: U. S. Geol. Survey Bull. 84, p. 83, 1892.

¹⁷ Foerste, A. F., Studies on the Chipola Miocene of Bainbridge, Ga., and of Alum Bluff, Fla., with an attempt at correlation of certain Grand Gulf group beds with marine Miocene beds eastward: Am. Jour. Sci., 3d ser., vol. 46, pp. 244-254, 1893.

¹⁸ Veatch, Otto, and Stephenson, L. W., Preliminary report on the geology of the Coastal Plain of Georgia: Georgia Geol. Survey Bull. 26, p. 347, 1911.

The general assemblage of the Alum Bluff species resembles the mid-American forms rather than the faunas of the middle Atlantic slope. The representation of *Phos* in the faunas of the Chesapeake group, Duplin marl, and Waccamaw formation is meager, while *Ilyanassa* and large nassoid forms tentatively referred to *Ilyanassa* are widespread and fairly common. That brackish or shallow-water group is not recorded in the Alum Bluff, but *Phos* is well represented, and *Uzita* is, for the most part, small and squat, like the species most common in the Caribbean faunas. In the Chesapeake and Duplin faunas the species are larger and have relatively greater height.

The species of *Phos* described here may be distinguished as follows:

Height of adult usually exceeding 18 millimeters; shell ovate-conic in outline:

Spirals inclined to be a little more prominent upon the costal than upon the intercostal areas

Phos (Strongylocera) chipolanus Dall.

Spirals less prominent upon the costal than upon the intercostal areas.—*Phos (Strongylocera) tribakus* Gardner, n. sp.

Height of adult rarely exceeding 18 millimeters:

Shell squat; ovate-conic in outline; aperture deltoid, the outer lip flaring anteriorly; axials not exceeding 14 upon the body of the adult

Phos (Strongylocera) pedanus Gardner, n. sp.

Subgenus **STRONGYLOCERA** Mörch

1852. *Strongylocera* Mörch, *Catalogus Conchyliorum quae reliquit D. Alphonso D'Aguiarra & Gadea Comes de Yoldi*, fasc. 1, p. 80.

Type (by elimination): *Strongylocera textilina* Mörch = *Phos guadalupensis* Petit = *Nassa uncinata* Say. Recent in the West Indies.

The type designated by Cossmann¹⁹ and the only other species mentioned by Mörch in his original citation of the subgenus is *Buccinum cancellatum* Quoy and Gaimard from the Indo-Pacific which, according to Tryon, is a synonym of *Buccinum textum* Gmelin and a true *Phos*.

The subgenus is characterized by the broadly conic outline, rather full, posteriorly depressed whorls, short canal, and relatively broad aperture. The operculum, available only in the Recent shells, is distinct, for the nucleus is subcentral rather than terminal as in *Phos*, s. s.

Phos (Strongylocera) chipolanus Dall

Plate L, figure 20

1896. *Phos (Strongylocera) chipolanus* Dall, U. S. Nat. Mus. Proc., vol. 19, No. 1110, p. 311.

Shell acute, with 2 smooth, nuclear and 7 strongly sculptured whorls, somewhat appressed at the suture; spiral sculpture much as in *P. semicostatus* of small, stout, rounded, partly alternated ridges swollen where they pass over the ribs, sparser and

stronger on the base; transverse sculpture of (on the last whorl 7) strong, rounded ribs, evenly distributed and most prominent at the periphery; aperture wide, the outer lip liriate, the pillar keeled and reflected on the anterior edge; a sharp constriction and keel behind the siphonal fasciole, which is flexuously and imbricately sculptured transversely with a few small, spiral grooves; a moderate callus on the body and pillar. Lon. 25, lat. 13 mm.

Oligocene of the Chipola beds, Calhoun County, Florida, Dall. No. 114191, U. S. N. M. This species is most nearly related to *Phos solidulus* (Guppy as *Nassa*), *P. semicostatus* Gabb, and *P. guppyi* Gabb, all of which are well distinguished by sculptures and details of form. Among recent species *Phos uncinatus*, Say (as *Nassa*), is allied. I have already shown²⁰ that the last mentioned is distinguished both from *Phos* and *Nassa* by its operculum, which is lozenge-shaped, pointed in front and behind, with a subcentral nucleus and concentric elements. The shell is more like *Phos* than *Nassa*, and was named *Phos guadalupensis* by Petit in 1852. It is distinguished from the typical species of *Phos* by the excavation of the upper part of the whorls, and is one of the two species cited by Mörch under his undefined genus *Strongylocera*.—Dall, 1896.

Shell ovate-conic in outline. Nucleus small, naticoid, highly polished, including 2½ volutions; initial turn minute, flattened posteriorly, immersed at tip; succeeding turn and a half of the nucleus more elevated, strongly convex; no nuclear sculpture, except for a few arcuate incrementals developed on the last quarter turn. Close of the nucleus indicated by an irregular but rather pronounced thickening of the shell. Axial sculpture appearing abruptly at the beginning of the conch, but the spiral sculpture developing much more gradually. The 7½ postnuclear whorls of the type increasing in diameter regularly and gradually; their apparent convexity is heightened by the greater medial prominence of the axials. Axial sculpture tending to become slightly irregular upon the final half turn; one more costal as a rule on the penultimate whorl than on the body. Intercostal areas broad; and, on the later turns rather flattened and wider than the costals. Commonly 3 primary spirals on the antepenultimate whorl, 4 upon the final whorl of the spire, and 5 upon the medial portion of the body; secondaries regularly intercalated between each pair of primaries; behind the posterior primary 3 or 4 spirals, 1 of which approaches the primaries in prominence. On the base of the body, in the type, 4 primaries even stronger than those on the medial portion of the body and less prominently elevated on the anterior side than on the posterior; no secondaries intercalated between these spirals. Incremental sculpture on the intercostal areas of the later volutions strong enough to granulate the spirals. Suture lines distinct but not conspicuous, undulated by the costals of the preceding whorl. Aperture broadly lenticular in outline, acutely angulated posteriorly. Margin of the outer lip finely

¹⁹ Cossmann, Maurice, *Essais de paléonchologie comparée*, livr. 4, p. 141, 1901.

²⁰ Dall, W. H., *Mollusca*, pt. 2, *Gastropoda and Scaphopoda*, in Reports on the results of dredging, under the supervision of Alexander Agassiz, in the Gulf of Mexico (1877-78) and in the Caribbean Sea (1879-80) by the U. S. Coast Steamer *Blake*: Harvard Coll. Mus. Comp. Zoology Bull., vol. 18, p. 178, 1889.

crenulated in harmony with the spiral sculpture; rather faint internal lirae developed corresponding in position to the secondary spirals on the external surface. Excavation of the labium at the base of the body very strong, the marginal fold sharp and prominent, and the groove behind it broad. Anterior canal very short and sharply recurved. Anterior notch narrow but deep and obliquely directed, the produced posterior keel of the siphonal fasciole constituting the outer arm, the sinuous extremity of the fasciole the inner. Callus in front of the fasciole in the adult splayed in a crescentic area. Umbilicus imperforate.

None of the congenetic species nor of those from the abundant fauna of the Bowden closely resemble *Phos chipolanus*.

Phos trinitatensis Mansfield, from the Brasso beds of Trinidad, is smaller and more slender, with a larger protoconch and a stronger suggestion of an anterior canal. *Phos costatus* Gabb, from the Baitoa of the Dominican Republic, is more squat and nassoid in outline and has a cruder sculpture. None of the shells from the higher Miocene formations approach closely to *P. chipolanus*.

Phos chipolanus Dall is a conspicuous member of the univalve fauna at the single horizon at which it occurs.

Occurrence: Chipola formation, localities 7893^r, 2212^p, 7151^r, 2213^c, 2564^a, 3419^a.

Phos (Strongylocera) tribakus Gardner, n. sp.

Plate L, figure 22

Shell large, moderately heavy; spire elevated, the aperture not much more than half as high as the entire shell. Whorls closely appressed, not inflated medially, increasing regularly in diameter. Apex broken away in the type and in all other available material; remaining volutions 5, originally probably 6 or 7 in the conch. Protoconch entirely lost. Sculpture uniform in character over the extant surface. Axials rather narrow but well rounded, numbering 7 to the whorl, for the most part opposite and tending to form continuous, approximately vertical series, the costae broadest and most elevated medially, almost or completely evanescent on the appressed posterior portion of the whorl, persistent on the body to the anterior fasciole, the terminal rib wider than those behind it. Intercostal areas rather flat, broader than the costals upon the later turns. Spiral sculpture most prominent upon the summits of the costals, the primaries 3 in number on the whorls of the spire, equal and equispaced, low and obscure on the intercostal areas; 2 or 3 obscure lirae also developed between the posterior primary and the suture. Sculpture on the posterior and posterior medial portion of the body similar to that on the spire; 3 additional primaries similar in character and spacing, though not quite so strong as those behind them, developed on the anterior medial portion of the body, with 4 narrower but more sharply

elevated lirae uniform in strength on the costal and the intercostal areas girding the base of the body; a single obscure thread in the depression between the base of the body and the anterior fasciole. Margin of anterior fasciole raised into a sharp and prominent keel. Posterior portion of whorls creeping up a little upon the preceding volution, the sutures feebly impressed and undulated. Aperture wide, obtusely angulated at the posterior commissure. Outer lip dropping almost straight from the commissure, flaring a little anteriorly, lirae within; lirae 9 in number, approximately equal and equispaced, not persisting to the margin but produced far within the throat. Body whorl quite strongly excavated at the base. Parietal wall rather heavily glazed, especially toward the commissure. Columella plicate, the incipient posterior fold feeble, least so at its extremity, evanescent within the aperture, parallel to the rather strong, oblique, marginal fold. Anterior fasciole heavily corrugated incrementally, carinate along its posterior boundary. Anterior canal short, sharply recurved, emarginate at its extremity. Umbilicus imperforate or narrowly perforate.

Dimensions of imperfect holotype: Height, 24.5 millimeters; length of aperture, 12 millimeters; maximum diameter, 13.6 millimeters.

Holotype: U. S. Nat. Mus. No. 371806.

Type locality: No. 5632, Oak Grove, Yellow River, Okaloosa County, Fla.

Phos tribakus is well characterized by the broadly conic outline, the tendency of the costals to form continuous series, and the partial evanescence of the spirals upon the intercostal areas, so that the shell has the aspect of a rude, polyhedral cone, each side of which has been broadly and rather deeply gouged.

Occurrence: Oak Grove, sand, locality 5632^r.

Phos (Strongylocera) pedanus Gardner, n. sp.

Plate L, figure 19

Shell rather small but heavy, squat, ovate-conic in outline. Aperture approximately half as high as the entire shell. Body very broadly rounded and rather abruptly constricted at the base. Whorls probably about 5 in a complete conch. Nucleus and earliest post-nuclear turn lost in all available material. Conch both axially and spirally ornamented. Axials narrow, rounded upon their summits, persisting with approximately uniform strength from suture to suture, though weakening a little posteriorly, and, on the body, continuing to the anterior fasciole; ribs 11 in number upon the body of the type, 10 upon the final whorl of the spire, and 9 upon the antepenultimate whorl, equirized and regularly spaced except directly behind the aperture. Intercostal areas concave, of approximately the same width as the costals. Spiral sculpture developed as a regular banding over the entire surface of the conch; primary spirals 3 on the later whorls of the spire, twice

quite to the margin, 12 in number, corresponding in position to the intercostal areas. Labium excavated at the base of the body. Parietal wash heavy near the posterior commissure, an obscure plait commonly developed in the adult a little in front of the angle. Pillar reinforced. Marginal fold obtuse, outlined posteriorly by a broad and shallow sulcus. Anterior fasciole arched, acutely keeled behind, incrementally corrugated and spirally lirate. Anterior canal short, broad, recurved. Terminal notch deep, obliquely directed, the produced posterior margin of the fasciole constituting one arm, the sinuous extremity of the fasciole the other. Umbilicus imperforate.

Dimensions of holotype: Height, 16.0 millimeters; length of aperture, 7.0 millimeters; maximum diameter, 6.5 millimeters.

Holotype: U. S. Nat. Mus. No. 114193. Paratype: U. S. Nat. Mus. No. 371808.

Holotype locality: No. 2213, 1 mile below Baileys Ferry, Chipola River, Calhoun County, Fla. Paratype locality: No. 7257, Sexton's marl bed, Tenmile Creek, sec. 11, T. 1 N., R. 10 W., Calhoun County, Fla.

Engoniophos glyptus has much the aspect of *Uzita*, but the contour of the anterior extremity and the character of the marginal fold are more suggestive of *Phos*, in a broad sense. The posterior parietal fold is not constant in its development and is never very prominent. The diagnostic characters of the species are the slender outline, the oblique shouldering of the whorls, the cordate axial sculpture, and the very low, flat primaries with equally low, flat, and exceedingly fine secondaries crowded between them.

Engoniophos glyptus is a smaller, more slender, more delicately sculptured shell than the genotype, but a possible precursor.

The species has a rather wide distribution at the single horizon at which it occurs.

Occurrence: Chipola formation, localities 7151^r, 7257^r, 2213^r, 2564^r, 3419^r.

Engoniophos vadosus Gardner, n. sp.

Plate L, figure 18

Shell small, thin, slender, the spire elevated; whorls possibly 6 in the conch of a complete adult (between 4 and 5 in the holotype) moderately constricted at the sutures and tapering regularly to an acute apex; body whorl contracted at the base. Protoconch slender but elevated, rudely conic in outline, performing 4 complete volutions; initial turn minute and almost entirely immersed in the following whorl, the remaining turns broadly inflated medially, increasing rather rapidly in both altitude and diameter; surface smooth except for a few sharp, arcuated riblets, 3 in the type, which are de-

veloped upon the last quarter turn. Opening of conch indicated by a slight change in the texture of the shell and by the assumption of the postnuclear sculpture both axial and spiral. Axials narrow, rounded upon their summits, persisting with uniform prominence from suture to suture and, on the body almost to the anterior fasciole, about 10 to the whorl, inclined to be irregular near the aperture. Intercostal areas approximately double the width of the costals, broadly concave. Spiral sculpture developed over the entire surface of the conch, equally prominent upon the costal and intercostal areas. Primaries moderately broad, flat fillets, 3 or 4 in number upon the later whorls of the spire and about twice as many upon the body exclusive of the pillar; finer secondaries usually intercalated midway between each pair of primaries except the posterior and between the posterior primary and the suture line; base of body and pillar girded with 4 to 6 spirals usually a little narrower and a little more elevated than those behind them and separated one from another by squarely incised channels free from secondaries. Whorls closely appressed, the sutures undulated in harmony with the axials of the preceding whorl, often margined anteriorly by a low spiral band. Aperture lobate, obtusely angulated at the posterior commissure. Outer lip broadly arched, thin-edged and finely crenate in harmony with the external sculpture; internal lirae 9 or 10, corresponding in position to the interspiral areas, not persistent to the margin but produced far within the throat, inclined to expand at their outer extremity. Inner wall of aperture rather abruptly excavated at the base of the body. Parietal wash thin, the callus thickening along the pillar; obscure denticles commonly developed near the outer margin of the pillar glaze and, in some individuals a denticle on the body wall between the commissure and the pillar. Marginal fold obscure at its outer termination, both it and the sulcus behind it much more sharply defined within the aperture. Anterior canal moderately long, very slightly recurved at its extremity. Anterior fasciole sharply differentiated, cuneate, rather wide incrementally, striate and finely lirate, its sinuous extremity forming one arm of the obliquely directed U-shaped terminal notch, the produced posterior margin of the fasciole forming the other. Umbilicus imperforate.

Dimensions of holotype: Height, 12.2 millimeters; length of aperture, 5.5 millimeters; maximum diameter, 5.0 millimeters:

Holotype: U. S. Nat. Mus. No. 371807.

Type locality: No. 3742, Shell Bluff, Shoal River, Walton County, Fla.

Engoniophos vadosus offers the greatest range of variation in the relative and absolute width of the flat spiral bands which revolve about it. The shell is small

for the genus and very slender, but the cordate axial sculpture is characteristic of the group. *E. glyptus* from the Chipola fauna is similar in its general dimensions and in the character of the axial sculpture, but the primary spirals are much lower and the interprimary areas are crowded with 4 to 6 microscopically fine secondaries.

Engoniophos vadosus is possibly the antecedent of *Phos blountanus* Mansfield and *Phos blountanus laquannus* Mansfield from the upper part of the *Area* zone of the Choctawhatchee formation. *E. vadosus* is smaller and more slender than either of the later species and the axial ribs are less numerous and more cordate in the Shoal River form.

Occurrence: Shoal River formation, localities 3856^r, 3742^p.

Genus NASSARINA Dall

1889. *Nassarina* Dall, Harvard Coll. Mus. Comp. Zoology Bull., vol. 18, p. 181.

Type (by original designation): *Nassarina bushii* Dall. Recent from the Florida coast to Barbados.

Shell with the general characters of *Nassaria*, but more compact, spindle-shaped and small, and with the aperture long and narrowed anteriorly and the columella margin elevated and prominent and united in the adult by an elevated callus with the outer lip on the body whorl. Soft parts unknown. Type, *N. Bushii* Dall.

* * * The group goes to the Miocene, if *Columbella ambigua* Guppy proves to belong to it. * * *

—Dall, 1889.

Outline slender, as a rule, the ornamentation both axial and spiral, the outer lip thickened externally and lirate within, the parietal wall and pillar glazed, and the columella nonplicate, although denticles are developed along the margin of the wash. Anterior canal moderately long, slender, and emarginate at its extremity.

The genus is restricted in its distribution to the southern Atlantic and West Indian Tertiary and to the waters of tropical and subtropical America. Most of the Recent species, though not all of them, occur below the 50-fathom line, so that it is not surprising that the genus is represented in the shallow-water deposits of the Alum Bluff by a single rather rare form. The fact that it occurs both in the Oak Grove and the Shoal River may be due to its deeper-water habitat, a habitat much more constant than that of the near-shore waters in which most of the Alum Bluff species lived.

Nassarina trachea Gardner, n. sp.

Plate L, figure 21

Shell small but rather heavy, fusiform. Aperture approximately half the total height. Whorls closely coiled, increasing regularly in diameter, feebly convex; the body smoothly but rather abruptly constricted at

the base, conch including only $4\frac{3}{4}$ turns in the type but containing 5 in a less perfect adult. Protoconch rather small and slender, smooth, polished, conic in outline, the initial turn worn away but apparently minute and almost entirely submerged, the 3 extant nuclear whorls broadly rounded, all of them moderately elevated, and increasing rather rapidly in diameter. Dividing line between conch and protoconch sharply indicated by a change in the texture of the shell and by the abrupt assumption of the postnuclear sculpture, both axial and spiral. Axials broadly inflated, usually 8 on the earlier whorls, 7 on the later, persisting from suture to suture and, on the body, well down to the base, regular in size and spacing except on the last half turn in some adults. Interaxial areas sharply concave and narrower than the axials. Spiral sculpture overriding the axial; primary spirals rather narrow but prominently elevated, flattened upon their summits, 3 on both the earlier and the later whorls of the spire, the posterior spiral decidedly less prominent than the 2 in front of it, the anterior a little more prominent than the medial, thus lending to the whorl a somewhat trapezoidal outline. Primaries on the body and pillar 7 or 8, the 2 or 3 that gird the medial portion the most prominent; a single sharp, narrow, finely beaded secondary usually introduced between each pair of primaries, except on the medial portion of the body, where the secondary may be simple or where exceedingly fine tertiaries may be developed on either side of the primary. Incremental sculpture sufficiently strong to roughen the flattened interspiral channels and, on the base of the body and the pillar, roughening even the primaries themselves. Whorls closely appressed; the sutures distinct, undulated by the costae of the preceding whorl, in most individuals following a fourth primary on the later whorls and in some falling in front of it. Aperture lobate, obtusely angulated at the posterior commissure. Outer lip symmetrically arched between the commissure and the canal, finely crenate at the margin in harmony with the external sculpture, the inner surface reinforced with 4 or 5 elongated denticles, the medial the most prominent. Curvature at the base of the body rather strong. Parietal wall and pillar smoothly glazed, the pillar denticulate in the adult. Columella simple. Anterior canal not very long, the margins parallel and slightly recurved. Anterior fasciole sharply differentiated, incrementally striated, obscurely lirate, strongly arched, and obliquely emarginate at its extremity.

Dimensions of holotype: Height, 8.3 millimeters; length of aperture, 4.3 millimeters; maximum diameter, 4.1 millimeters.

Holotype: U. S. Nat. Mus. No. 371810.

Type locality: No. 3742, Shell Bluff, Shoal River. Walton County, Fla.

Uzita waltonensis (Gardner)

Plate LI, figures 1, 5

1936. *Alectrion waltonensis* Gardner, Florida State Dept. Cons. Geol. Bull. 14, p. 54, pl. 9, figs. 3, 4.

Shell of moderate dimensions, ovate-conic in outline. Whorls of spire trapezoidal, very narrowly tabulated posteriorly, the later whorls increasing a little more rapidly in diameter than the earlier; volutions between $9\frac{1}{2}$ and 10 in all, $3\frac{1}{2}$ of this number, being included in the smooth, naticoid protoconch. Initial turn minute, flattened posteriorly, almost entirely submerged in the succeeding whorl; remaining whorls broadly convex, flattening somewhat toward the close of the protoconch, increasing regularly and rather rapidly in height. Dividing line between conch and protoconch indicated by a slight change in the texture of the shell and by the abrupt initiation of the axial sculpture. Conchal sculpture cancellate, the spirals appearing later than the axials and dominated by them. Axials very narrow, sharply pinched, vertical or nearly so, 10 to 20 in number upon the first whorl of the conch, increasing to 23 upon the body of the type, persisting from suture to suture and well down to the base of the body, subnodose posteriorly upon the later whorls; intercostal areas, concave, a little wider than the costals. Presutural spiral initiated near the beginning of the second turn of the conch; other spirals not developed until the third or fourth whorl, appearing on the later whorls of the spire as low, broad, flattened bands separated from one another by linear sulci, the posterior of the three a little more prominent than the two in front of it and a little wider than that directly in front of the suture, from which it is separated by a channel of approximately its own width; presutural spiral strongly nodulated at the intersection with the axials; spirals upon the body of the type 9 in all, including the rather heavily nodulated posterior spiral, the less strongly nodose spiral in front of it, 4 equal and regularly spaced fillets upon the medial portion of the whorl, and 3 narrower, more distant and quite sharply nodulated basal spirals; posterior margin of basal sulcus defined by a narrow, corrugated thread. Basal sulcus narrow but sharply concave. Fasciole coarsely but not strongly lirate. Suture lines deeply impressed, crenulated by the costae of the preceding whorl. Aperture obliquely lenticular, acutely angulated and sulcated posteriorly. Outer lip thickened a little behind the margin, sharp-edged, denticulate within, the denticles elongated normal to the margin, alternating in size posteriorly, most prominent medially, persistent to the mouth of the canal. Inner margin of aperture strongly concave, the labium thickened, reverted, and spread in a broad arc over the parietal wall and pillar; denticles irregularly developed, that directly in front of the posterior commissure and the three or four upon the pillar heavier than the intermediate denticles; edge of pillar elevated into a sharp fold terminating at the mouth of the aperture in a rather prominent denticle. Anterior canal very short and sharply recurved. Fasciole rather wide, cuneate, its flexuous extremity forming one arm of the broad, obliquely U-shaped terminal notch, the base and outer arm of the U being formed by the raised posterior margin of the basal sulcus.

—Gardner, 1936.

Dimensions of holotype: Height, 12.7 millimeters; maximum diameter, 7.5 millimeters.

Type material: Holotype and juvenile paratype, U. S. Nat. Mus. No. 371811.

Type locality: No. 3742, Shell Bluff, on Shoal River, Walton County, Fla. Shoal River formation of the Alum Bluff group.

Uzita waltonensis, like most of the members of the genus, offers a wide range of variation in the details of the sculpture, especially of the spirals. The outline ranges from rather squat, ovate-conic to elevated-conic, much the same as *U. harrisi* (Maury), the analogous form in the Chipola fauna, though the latter is about a third smaller and is frequently more slender than any specimens of *U. waltonensis*. *U. dalli* (Maury) of the Oak Grove fauna, is also smaller and more coarsely and rudely sculptured. *U. berthae* (Maury) is taller relatively, and the posterior tabulation of the whorls is more pronounced. The number of the whorls both in the conch and protoconch of the four species in question is very nearly the same, although it is a little higher in the conch of *waltonensis* and a little lower in the conch and protoconch of *harrisi*. The axials of *waltonensis* range from 18 to 25 upon the body, and upon the first whorl of the conch there may be as many as 20; the axials are usually narrower and sharper, however, than in any of the analogous forms and, as a rule, more strongly nodose posteriorly. The axials upon the later whorls of the spire are less numerous than in *U. berthae* but more numerous than in either *U. dalli* or *U. harrisi*. The spiral sculpture and the resulting cancellation is much more marked in *waltonensis*, at least upon the body. The number of spirals in *U. waltonensis* does not range widely, though the difference in their relative width and in the degree of elevation is quite marked. In some individuals the interspirals are linear and not very deeply impressed; in others they are almost or quite as wide as the spirals and very squarely and deeply channeled. The second spiral in front of the posterior suture may be almost as prominent and almost as strongly nodose as the presutural spiral, or it may be similar in character to those in front of it.

The subspecies *deleta* has been isolated because of the late and feeble development of the spiral sculpture, the subdued axials, and the relatively slender, scalariform outline.

The Recent *U. trivittata* Say with a reported range from the Gulf of St. Lawrence to Florida, has a rather similar adult sculpture but is larger and more slender with relatively high, narrowly tabulated whorls and a much stronger and more regular spiral sculpture on the early volutions. The less elevated individuals among *U. waltonensis* resemble the Recent *U. hotessieri* d'Orbigny, a species reported from North Carolina to the West Indies but the ornamentation upon the Recent species is not so strong and the pattern upon the early whorls is not the same in the middle Miocene and Recent forms.

Uzita waltonensis is more abundant at the single horizon at which it occurs than any of its congeners or analogs at other horizons in the Alum Bluff group.

Occurrence: Shoal River formation, localities, 3856^r, 3732^r, 3733^r, 3742^a, 3731^r, 5080^r, 5184^r, 5195^r, 2238^r, 3748^p, 5618^p.

Uzita waltonensis deleta (Gardner)

Plate LI, figure 2

1936. *Alectrion waltonensis deleta* Gardner, Florida State Dept. Cons. Geol. Bull. 14, p. 56, pl. 9, fig. 5.

Shell of moderate dimensions, ovate-conic in outline, acutely tapering; aperture less than half as long as the entire shell. Whorls of conch 6 in number, trapezoidal, narrowly tabulated posteriorly, the body whorl broadly rounded at the base and abruptly constricted into the well defined basal sulcus. Suture lines inconspicuous, finely crenulated by the costals of the preceding whorl. Protoconch small, smooth, probably polished in fresh specimens, three-whorled; initial turn minute, immersed at the tip; succeeding volutions broadly rounded, increasing regularly both in diameter and altitude. Dividing line between conch and protoconch indicated by a slight change in the texture of the shell and by the abrupt appearance of the axial sculpture. Axials narrow, acutely rounded, abruptly elevated, approximately vertical, dissected by the posterior sulcus so that the extremities of the ribs form a circle of obtuse tubercles in front of the suture; axials 10 to 15 in number on the earliest whorls, increasing to 23 upon the body, uniform in elevation from the sulcus to the anterior suture and well down to the base of the body, subequal and equispaced, separated by broadly concave intercostals, slightly wider than the costals. Spiral sculpture incised rather than elevated, feeble excepting for the posterior sulcus which partially dissects the ribs; 3 low spiral fillets developed in the type between the posterior sulcus and the anterior suture; grooves equal and equispaced, restricted entirely to the intercostal areas, least feeble upon the body. Base of body girded with 4 low fillets which become increasingly narrow and decreasingly low anteriorly. Basal sulcus threaded with a single sharp lira. Anterior fasciole irregularly lirate, margined posteriorly with a sharply elevated ridge. Aperture narrow, obliquely lenticular, acutely angulated and sulcated posteriorly, narrowly constricted anteriorly. Outer lip flaring in front, abruptly contracted at the mouth of the canal, broadly varicose behind the thin, sharp margin; inner surface of labrum threaded with 6 or 7 lirae, the posterior corresponding in position to the posterior sulcus, the anterior indicating the entrance to the canal; medial lira the shortest and the most elevated, those behind it less prominent and more distant than those in front. Inner margin of aperture strongly concave, heavily reinforced, the wash spread in a broad, sharply defined arc from the posterior commissure to the anterior canal; a series of irregular, elongated denticles developed just within the margin, the posterior the most prominent and placed directly across from the posterior liration on the inner margin of the labrum; edge of pillar acute and proximate to the anterior liration on the inner margin of the labrum. Anterior canal short, recurved; terminal notch narrow and very oblique, its inner arm formed by the sinuous lateral margin of the anterior fasciole, its outer by the produced keel which outlines the posterior margin of the fasciole.

Dimensions of holotype: Height, 11.4 millimeters; length of aperture, 5.8 millimeters; maximum diameter, 6.5 millimeters.

Type material: Holotype, U. S. Nat. Mus. No. 371812.

Type locality: No. 5079, one-half mile below Shell Bluff, Shoal River, Walton County, Fla. Shoal River formation of the Alum Bluff group.—Gardner, 1936.

The subspecies is apparently a local variation of *U. waltonensis*, s.s., from which it differs in the somewhat

more slender, scalariform outline and in the more subdued sculpture, both axial and spiral. The axials are the same in number but are not so sharply pinched as a rule as in *waltonensis*, s.s. The spiral sculpture on the early whorls is restricted to the posterior sulcus, and even on the later whorls is very feeble except for the basal spirals and is seemingly impressed rather than elevated. Aside from the age variations, the subspecies is fairly constant at the single locality at which it is represented, although the number of incised lines between the posterior sulcus and the base of the whorl may be increased to 4 or even 5.

Occurrence: Shoal River formation, locality 5079^a.

Uzita dystakta (Gardner)

Plate LI, Figures 3, 4, 7

1936. *Alectrion dystakta* Gardner, Florida State Dept. Cons. Geol. Bull. 14, p. 58, pl. 9, figs. 6-8.

Shell rather small, thin, elongate-conic in outline. Basal sulcus ill-defined. Aperture in mature individuals less than half as high as the entire shell. Whorls of spire trapezoidal or feebly convex, the body broadly rounded. Number of whorls running up to 8 in the largest individuals, more frequently 7 or 6½. Protoconch of moderate dimensions, smooth, polished, naticoid, performing 3½ volutions; initial turn minute, somewhat inflated but almost entirely immersed in the succeeding whorl; remaining nuclear turns increasing in height and diameter with a moderate degree of rapidity. Line of demarcation between the conch and protoconch rather obscure, indicated by the gradual introduction of the axial sculpture. Axials very narrow, both at the summit and the base, obtuse, feebly arcuate, uniform in prominence between the sutures, more or less obsolete upon the base of the body, varying widely in number—from 15 to 25 or 26 upon the penultima, irregular in size and spacing upon the body; interaxial areas shallow, frequently wider than the axials. Spiral sculpture feeble and irregular; grooves usually 6 or 7 in number upon the penultima, the posterior sulcus deeply incised and in some individuals dissecting the ribs, the medial spirals very feeble but becoming increasingly less so toward the anterior suture; anterior spiral groove often almost as deeply impressed as the posterior. Base of the body sculptured with low, flattened bands 8 or 9 in number, as a rule, which become increasingly narrower and more sharply elevated anteriorly. Fasciole threaded with about half a dozen lirae equal in size and nearly spaced. Suture line distinct, finely crenulated by the costae of the preceding volution. Aperture obliquely lenticular in outline, obtusely angulated posteriorly. Outer lip almost vertical medially, often feebly emarginate at the base, possibly for the extension of the eye stalks, thin-edged but broadly varicated externally a little behind the margin, thickened and rather finely lirate internally. Inner wall of aperture quite strongly concave, washed with rather a heavy glaze, the margin of which extends in a broad arc from the commissure to the base of the pillar; an amorphous denticle or two sometimes developed upon the pillar and more rarely upon the parietal wall; edge of pillar acute, slightly elevated. Anterior canal incipient. Terminal notch very broad, not very deep, somewhat obliquely directed.

Dimensions of holotype: Height, 7.5 millimeters; length of aperture, 3.5 millimeters; maximum diameter, 3.8 millimeters. Paratype (an immature individual): Height, 5.3 millimeters; length of aperture, 2.7 millimeters; maximum diameter, 3.0 millimeters.

Type material: Holotype and 2 paratypes, U. S. Nat. Mus. No. 371815.

Type locality: No. 5618, $3\frac{1}{2}$ miles southwest of De Funiak Springs, Walton County, Florida. Shoal River formation of Alum Bluff group.—Gardner, 1936.

A certain irregularity of profile is a common characteristic of *Uzita dystakta*. The suture line tends to sag forward in front of the periphery of the preceding whorl, and the resulting outline is convex in form instead of trapezoidal, which is normal to the whorls of the spire.

U. dystakta offers a bewilderingly wide range in relative proportions, the number of axials, and in the character and relative prominence of the spirals. The small, thin shell and the numerous, arcuate, more or less irregular axials are usually sufficient to isolate the species. The spirals are numerous, usually 6 at least upon the penultimate whorl, appearing as unequally impressed, sublinear sulci. They may, however, be approximately equal, and the spiral sculpture as a whole may appear to be elevated rather than depressed. The terminal varix is conspicuously broad, and there are not uncommonly remnants of former varices to be seen upon the shell.

Uzita dystakta is apparently restricted in its distribution to the environs of the type locality.

Occurrence: Shoal River formation, localities 7261^r, 7264^p, 5618^c.

Uzita pedana Gardner, n. sp.

Plate LI, figures 12, 13

Shell rather small, low and squat in outline. Aperture approximately half the length of the entire shell. Whorls of spire feebly convex or obliquely flattened, abruptly constricted at the base; whorls 9 to $9\frac{1}{2}$ in all, $4\frac{1}{4}$ of this number included in the rather slender, highly polished protoconch. Initial turn of protoconch minute, strongly inflated, immersed only at the tip, the 3 succeeding volutions moderately elevated, broadly and smoothly rounded, and increasing rather rapidly in diameter; final quarter turn of protoconch sculptured with a few more or less irregular, strongly arcuate riblets, the last of which marks the close of the nuclear turn. Both the axial and spiral sculpture abruptly appearing at the opening of the conch. Axial sculpture dominant: axials on the early turns narrow, rounded, slightly retractive, sharply elevated, flattening a little directly in front of the posterior suture, 12 to 14 on the first whorl of the conch; axials on the later whorls less regular in size and spacing, expanding toward the anterior suture and on the medial portion of the body; only 10 on the later turns, including the varicose terminal rib; axials on the final half turn irregular in size and spacing; body axials relatively feeble on the base but persistent to the sulcus. Intercostal areas broadly concave and a little wider than the costals. Spiral

sculpture low, flat, and rather crowded but offering a wide range of detail; later whorls of the spire decorated in the type with 4 equal fillets, equally prominent upon the costal and intercostal areas, separated by narrower, squarely channeled interspaces; in front of and behind them 3 to 5 irregular spirals, the 2 or 3 directly in front of the posterior suture exceedingly narrow, crowded, and undulating, like the impressed suture in harmony with the costals of the preceding volution; sculpture of the posterior and medial portion of the body similar to that on the later whorls of the spire; base girded with 6 or 7 rather distantly spaced, flattened lirae that become increasingly narrower anteriorly. Aperture acutely angulated posteriorly, broadest just behind the abrupt constriction at the entrance to the canal. Outer lip varicose a little behind the sharp and finely crenate margin; inner margin of labrum corrugated with two orders of lirations, the first order corresponding in position and number of lirae to the spirals on the outer surface and extending for only a short distance inward from the margin, the second order in part continuous with the finer marginal lirae, including only about half a dozen much more prominent threads irregular in size and spacing, the medial the strongest, the anterior outlining the entrance to the canal; additional lirae introduced far within the throat. Inner margin of aperture strongly concave. Parietal wall and pillar heavily reinforced; a single elongated denticle borne on the wall a little in front of the commissure; a few irregular denticles also developed upon the pillar and in some individuals between the pillar and the elongated parietal tooth. Marginal plait sharp and prominent. Anterior fasciole cut off from the body by a smoothly concave furrow, sculptured only with very fine and sharp incrementals. Fasciole rather wide, arched, coarsely lirate, its extremity forming a part of the inner arm and base of the sharply recurved anterior canal; outer arm formed by the produced posterior margin of the canal.

Dimensions of holotype: Height, 8.7 millimeters; length of aperture, 4.5 millimeters; maximum diameter, 5.5 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 371813.

Type locality: No. 3742, Shell Bluff, Shoal River, Walton County, Fla.

Uzita pedana may be known by its squat outline, its rounded axials, and its very smooth and flat but rather irregular spiral sculpture. It recalls *U. cercadensis* (Maury) from the Cercado and Gurabo formations of the Dominican Republic and the Bowden beds of Jamaica. The ribbing is slightly heavier upon the Dominican species and the concentric sculpture decidedly sharper. *U. losquemadica* (Maury) from the Gurabo formation and *U. brassica* (Maury) from the Brasso formation of Trinidad display broader, more inflated ribs and more elevated spiral lirae.

Occurrence: Shoal River formation, localities 3856^p, 2645^r, 3742^c, 5184^r, 3748^r.

Uzita nanna Gardner, n. sp.

Plate LI, figures 10, 11

Shell small for the genus, rather heavy, irregularly elongate-conic in outline. Whorls of spire broadly rounded, the body abruptly constricted at the base, the contour obscured on all the later volutions by the heavy axial ribbing. Postnuclear whorls only $3\frac{1}{2}$ in number. Nucleus large, obtuse, smooth, highly polished, including 4 complete revolutions; initial turn of the protoconch minute, flattened behind, almost entirely submerged in the succeeding whorl; remaining whorls of the protoconch broadly convex, increasing rapidly both in height and diameter; final whorl constricted at the anterior suture as well as at the posterior; a couple of very narrow, almost vertical axial riblets commonly developed on the last quarter turn of the protoconch, while a third and similar riblet marks the boundary line between conch and protoconch. Both the true axial and the spiral sculpture initiated at the beginning of the conch. Axials narrow, acute, vertical or feebly retractive, obtusely rounded, tending to weaken at the posterior suture but persisting with uniform strength to the anterior suture and well down on the base of the body; 12 on the earliest whorl of the conch, 10 on the later volutions, including the terminal varix, for the most part regular and separated by slightly wider concave interaxials. Spiral sculpture of narrow, flattened lirae separated by squarely channeled interspirals, tending to expand slightly upon the summits of the ribs, commonly 5 on the penultimate whorl and 13 upon the body; the posterior spiral cut off from the suture and from the spiral in front of it by interspaces of double its own width; the other 4 spirals upon the penultimate whorl and those upon the medial portion of the body separated by channels of equal or less width than their own; the 7 spirals upon the base of the body finer and even more regular in size and spacing than those behind them. Sulcus at the base of the body not sharply defined. Fasciole threaded with about half a dozen not very regular lirae. Sutures feebly impressed, undulated in harmony with the costals of the preceding whorl. Aperture broadly and obliquely lenticular in outline, acutely angulated posteriorly, approximately half as long as the entire conch. Labrum broadly and symmetrically arched from the commissure to the entrance to the anterior canal, rudely varicose a short distance behind the margin, the margin itself sharp and simple; inner lirae about 10, not persistent to the outer edge though produced within the throat, the posterior threads often more prominent and less regular in size and spacing than the anterior, the foremost lira more elevated than those behind it and set at the entrance to the canal. Labium deeply excavated at the

base of the body. Parietal wall and pillar heavily glazed, the margin of the reverted callus acute and broadly arcuate; a feeble tooth occasionally developed directly in front of the commissure and on the pillar and less frequently on the intermediate area. Margin of pillar acute. Anterior canal short and sharply recurved. Terminal notch U-shaped, obliquely directed, the sinuous extremity of the fasciole forming the inner arm and the base of the U and the produced posterior margin of the fasciole the outer arm.

Dimensions of holotype: Height, 5.2 millimeters; length of aperture, 2.6 millimeters; maximum diameter, 3.3 millimeters.

Holotype: U. S. Nat. Mus. No. 371814.

Type locality: No. 3856, 5 to 6 miles west-northwest of Mossyhead, Walton County, Fla.

U. nanna and *U. watsoni* (Maury) are closely allied. The nuclear characters of these two forms are strikingly similar, but in *nanna* there is one more post-nuclear whorl, the axials are much broader, more prominent, and less numerous (*watsoni* has 14 or 15 upon the later whorls), and the spiral sculpture is stronger.

Occurrence: Shoal River formation, localities 3856^p, 3742^p, 3748^r, 7264^r.

Uzita watsoni (Maury)

Plate LI, figure 6

1910. *Phos watsoni* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 20, pl. 5, fig. 6.

Shell very small with five whorls of which the first three are smooth, the remainder sculptured. Spiral sculpture of fine groovings visible only with a lens. Longitudinal sculpture of strongly marked riblets (ten on the body whorl), which are very oblique on the dorsal side of the shell. Aperture oval; canal short. Length of shell 3; greatest width 2 millimeters.

Oak Grove, Santa Rosa County, Florida.

Mr. Aldrich's collection.

Dedicated to Professor Thomas Watson of the University of Virginia.—Maury, 1910.

Figured topotype: U. S. Nat. Mus. No. 371884.

The shell is thin, squat, and obtuse posteriorly. There are apparently not more than $2\frac{1}{2}$ volutions in the fully adult conch, but the protoconch, which is highly polished, relatively large, and for the most part smooth, includes 4 complete turns. The initial whorl is minute and almost entirely immersed, but the succeeding volutions increase regularly and rather rapidly both in height and diameter. In some individuals there are a couple of incremental riblets near the close of the protoconch, which is indicated by an irregular thickening of the shell and by the assumption of the post-nuclear sculpture, axial, and spiral. The axial riblets are narrow, sharply pinched upon their summits, retractively arcuate, subequal, subequispaced, persisting with approximately uniform strength from suture to suture and well down to the base of the body but

usually obsolete directly behind the aperture, commonly 14 to the later whorls, including the final rib upon the body, which is somewhat varicose. The intercostal areas are broadly concave and fully double the width of the costals. The spiral sculpture is very fine but developed over the entire surface of the conch, least faintly, however, upon the final whorl. On well-preserved adults a low but sharply defined fillet directly in front of the suture is equally prominent upon the costal and intercostal areas and is cut off both from the suture and from the spirals in front of it by channels of approximately its own width. The medial and anterior portions of the whorl are girded with even lower bands, equal in size except for those on the base of the body, separated one from another by linear sulci, 5 on the whorls of the spire and of the body exclusive of the sulci on the base. About half a dozen spirals on the base, the 3 on the outer margin less feeble and more widely spaced than those in front of or behind them; the 3 or 4 that circle the anterior extremity low, narrow, and crowded. The suture lines are impressed and undulated in harmony with the costals of the preceding volution. The aperture is broad and obtusely angulated at the posterior commissure. The outer lip is broadly arched, sharp and thin at the margin itself but thickened a little behind it. The lirae within are irregular, the medial threads the most prominent and the most widely spaced. The inner margin of the aperture is strongly excavated and a heavy coat of enamel is spread in a broad arc from the posterior commissure to the extremity of the anterior canal. The margin of the pillar is sharply folded, and there is a labial denticle behind it but no groove. The anterior canal is short and sharply recurved, the fasciole rather wide, cuneate in outline, somewhat arched and incrementally corrugated; its flexuous extremity forms one arm of the broad, obliquely directed terminal notch.

This small species has the general aspect of an immature form, but the characters of the last half whorl are those of a fully adult shell. The relatively large nucleus, the feebly convex whorls, and the sharp and narrow axial costae are sufficient to isolate this species from the young of the related congenetic species.

Occurrence: Oak Grove sand localities, 2646ⁿ, 5632^r, 5633^r, 7054^r, Aldrich collection, Johns Hopkins University; Cornell University collection.

Uzita cinclis Gardner, n. sp.

Plate LI, figure 8

Shell of moderate dimensions, rather thin, ovate-conic in outline. Whorls of spire rudely trapezoidal. Body rounded, rather abruptly constricted at the base. Whorls 8 in all, 3 included in the smooth, highly polished protoconch. Initial turn minute, flattened posteriorly but inflated laterally, immersed at the tip, the two

succeeding volutions increasing in height and diameter but decreasing in convexity; a few irregular incremental scratches developed near the close of the protoconch. Dividing line between the conch and protoconch clearly indicated by a slight thickening of the shell and by the abrupt initiation of the post-nuclear sculpture. Axials narrow, rounded on their summits, approximately vertical, uniform in prominence between the sutures and persistent well down on the base of the body, as many as 15 upon the earliest turns of the conch, reduced to 12 or 13 on the later whorls and inclined to be irregular in size and spacing on the final half turn; intercostal areas wider than the costals on the later whorls. Incremental striae unusually sharp and regular. Spiral sculpture reticulating the axials; primary spirals flattened cords, overriding the axials and slightly expanded on their summits, 3 on the whorls of the spire, the anterior suture following and often entirely concealing a fourth; anterior and medial portion of body girded with 5 primaries, the base with 2 additional cords; inter-spiral areas squarely channeled and about double the width of the spirals; fortuitous secondaries intercalated between the posterior and the medial primaries; 2 or 3 obscure threadlets also developed on the ill-defined basal sulcus and several coarser but not very regular lirae on the anterior fasciole. Suture lines distinct but inconspicuous, undulated in harmony with the costals of the preceding whorl. Aperture broadly lenticular in outline, acutely angulated posteriorly, rather abruptly constricted at the entrance to the canal. Outer lip arcuate, somewhat thickened behind the thin, sharp edge, the inner surface of the varix bearing half a dozen subequal lirae, the anterior placed at the entrance to the canal and a little more elevated than those behind it, none of them persisting to the outer margin. Inner margin of the aperture strongly excavated at the base of the body. Both the parietal wall and the pillar heavily glazed with a sharply defined wash of callus; a single elongated parietal denticle borne on the body wall a little in front of the commissure, and a couple of rather small, amorphous denticles on the pillar. Edge of pillar very sharp. Anterior canal short and recurved. Terminal notch broad but not very deep, somewhat obliquely directed.

Dimensions of holotype: Height, 6.0 millimeters; length of aperture, 2.8 millimeters; maximum diameter, 3.5 millimeters.

Holotype: U. S. Nat. Mus. No. 371803.

Type locality: No. 7151, Tenmile Creek, Calhoun County, Fla.

Uzita cinclis is the most common representative of a compact and prolific group, including also *U. dasynema* and its subspecies *cesta*, *U. anisonema*, and the less closely allied forms *U. owia* and *U. cystoides*. *U. cystoides* may be readily eliminated from the group because of the heavy, approximately equal spirals and the distant, undulatory axials of the later whorls. *U. owia* is

conspicuously taller and more slender than the other members of the group and includes one more volution. *Uzita anisonema* is characterized by its rather stout and heavy shell, moderately convex whorls, and close, unequal spirals. In both *cinclis* and *dasynema* the whorls of the spire are more or less flattened laterally, giving to the shell a broadly conic outline, and they differ further from the other members of the group in the uniformity of their spirals. *U. dasynema* differs, however, from *U. cinclis* in its coarser axial sculpture and its coarser and, except in its subspecies *cesta*, more numerous spirals. In *U. cinclis* the spirals are narrow, expanding little or not at all on the summits of the costals, and they number normally 3 on the penultima and 7 on the body. The spiral ornamentation of *dasynema* is heavier, especially on the summits of the costals, and the number of lirae is increased to 4 or 5 on the penultimate whorl and to 9, 10, or 11 on the body. *Uzita dasynema cesta* includes a number of perplexing individuals allied to *cinclis* in the number of the spiral lirae and to *dasynema* in the more fundamental features, such as the character of the spirals and the expansion on the summits of the costals, and in the relatively coarse axial sculpture. The distinguishing characteristics of *U. cinclis* are the broad, conical spire, rather narrow, acutely rounded axials, and narrow equal or subequal spirals, restricted for the most part to 3 on the penultimate whorl and to 7 or 8 on the body.

Uzita brassoënsis (Mansfield) from the probably synchronous Brasso fauna of Trinidad is similar in dimensions and outline and general sculpture pattern. The Brasso species is heavier than that from the Chipola formation, the axials are a little more inflated, and the spirals not so narrow as those of *U. cinclis*. In the delicacy of the sculpture pattern *U. brassoënsis* is intermediate between *U. cinclis* and *U. dasynema cesta*, another closely related Chipola species. *U. bidentata* (Emmons), from the later Tertiary of the southern Atlantic seaboard, is apparently among the descendants of the group.

Occurrence: Chipola formation, localities 7151^p, 7257^r, 2213^a, 2564^p, 3419^p, 2211^p.

Uzita dasynema Gardner, n. sp.

Plate LI, figure 9

Shell small, moderately heavy, ovate-conic in outline, constricted at the well-defined basal sulcus. Whorls of conch 5, those of the spire flattened laterally, rudely trapezoidal in outline, increasing regularly in diameter, the body whorl broadly rounded. Suture line impressed, crenulated in harmony with the costals of the preceding turn. Protoconch small, smooth, highly polished, thrice-coiled; initial turn minute, partially immersed in the succeeding turn; remaining volutions broadly rounded, increasing in both height and diameter rather rapidly. Opening of conch indicated by

the abrupt appearance of the axial sculpture; both axial and spiral ornamentation well developed. Axials rather narrow, obtuse, persistent from suture to suture and, on the body, well down to the basal sulcus, expanding toward the anterior suture and on the medial portion of the body; 9 to 11 on the later whorls; intercostal areas broadly concave and not quite so wide, as a rule, as the costals. Spiral sculpture evident within the first half turn of the conch, increasing in prominence gradually; primaries 4 or 5 on the whorls of the spire, 9 to 11 on the body, subequal and equispaced, angular, flat-topped, inclined to expand slightly and to increase in prominence in overriding the costals; interspiral areas squarely channeled and of approximately the same width as the spirals; secondaries not intercalated; basal sulcus threaded with two fine lirae and the anterior fasciole with about half a dozen rather coarse and irregular threadlets. Aperture a trifle less than half as high as the shell, rather wide, obliquely lenticular in outline. Outer lip arcuate, abruptly constricted at the base of the body, strongly lirate within. Labium concave, heavily reinforced from the posterior commissure to the anterior extremity of the pillar. Amorphous denticles developed in the adult forms toward the commissure and along the pillar. Anterior canal very short, recurved, strongly emarginate.

Dimensions of holotype: Height, 6.1 millimeters; length of aperture, 3 millimeters; maximum diameter, 3.5 millimeters.

Holotype: U. S. Nat. Mus. No. 371816.

Type locality: No. 3419, 1 mile below Baileys Ferry, Chipola River, Calhoun County, Fla.

Uzita dasynema differs from the subspecies *cesta* by the closer spiral sculpture. Instead of 3 primaries on the later whorls of the spire with an occasional secondary, there are 4 or 5 or rarely 6, whereas the number of primaries on the body is increased from 7 to 9, 10, or 11. There is also a tendency toward more crowded axial sculpture in *U. dasynema*, s. s. The fortuitous secondaries that occasionally appear in *U. cesta* are doubtless the reduced remnants of the more numerous primaries of *U. dasynema*, s. s. *U. anisonema* is also similar in general character to *U. dasynema*, although it differs in the regular introduction of secondary spirals. In the typical form *U. dasynema* is readily separable from *U. cinclis* by its heavier and more numerous spirals, but the subspecies *cesta* may approach confusingly close to *U. cinclis*. Typical *U. cinclis* and typical *U. dasynema* are, however, too distinct to be united under a single name.

U. dasynema presents the general outline and sculpture pattern of *U. cercadensis* (Maury), but the axial ribbing of the Dominican species is heavier and more oblique.

Occurrence: Chipola formation, localities 2213^c, 3419^p, 2211^r.

Uzita dasynema cesta Gardner, n. subsp.

Plate LI, figure 14

Shell small, moderately heavy, conic in outline, constricted at the well-defined basal sulcus. Whorls of spire flattened laterally, the body whorl broadly rounded. Protoconch rather small, smooth, highly polished, thrice-coiled; initial turn minute, almost entirely immersed in the succeeding turn; remaining volutions broadly rounded, increasing rather rapidly in both height and diameter. Opening of conch indicated by the abrupt appearance of the axial sculpture. Whorls of conch 5, those of the spire rudely trapezoidal, increasing regularly in diameter. Both axial and spiral ornamentation well-developed. Axials rather narrow, obtuse, persistent from suture to suture and, on the body, well down to the basal sulcus, expanding toward the anterior suture and on the medial portion of the body; 9 on each of the later whorls, including the terminal varix, 15 or 16 on the earliest turn of the conch. Spiral sculpture developed a little later than the axial and increasing in prominence very gradually; primaries 3 on each of the whorls of the spire, the anterior a little more prominent than the 2 behind it and the posterior often a little less elevated than the medial, all 3 of them overriding the costals and slightly expanded on their summits; spirals in the concave intercostal areas rather low and narrow but angular and flat-topped; primary spirals on the body 5, the anterior the least prominent; 3 additional spirals developed on the base, but lower and less sharply cut than the primaries; interspiral areas squarely channeled and a little wider than the primaries; a linear secondary occasionally developed between the posterior spiral and that next in front of it and between the posterior spiral and the suture. Sutures impressed, undulated in harmony with the costals of the preceding volution. Aperture a little less than half as high as the shell, rather wide and somewhat obliquely lenticular in outline. Outer lip feebly expanded medially, abruptly constricted at the base of the body, thin and sharp at the edge, reinforced within by about half a dozen lirae that extend well within the throat but abruptly disappear a short distance from the outer margin; medial lirae the most prominent; anterior lira outlining the anterior canal. Inner margin of aperture strongly concave. Parietal wall and pillar heavily washed with callus, the outer margin of the callus a symmetrical arc extending from the posterior commissure to the base of the pillar; an amorphous denticle usually developed in the adult upon the parietal wall directly in front of the commissure. Pillar edge acute. Anterior canal short and very sharply recurved, deeply emarginate. Anterior fasciole short but very wide, threaded with half a dozen somewhat irregular lirae; lateral margin of the fasciole constituting about half of the C-shaped terminal notch, the elevated and produced posterior margin forming the rest of the C.

Dimensions of holotype: Height, 6.6 millimeters; length of aperture, 3 millimeters; maximum diameter, 3.9 millimeters.

Holotype: U. S. Nat. Mus. No. 371817.

Type locality: No. 2564, McClelland farm, 1 mile below Baileys Ferry, Chipola River, Calhoun County, Fla.

Uzita dasynema cesta almost bridges the gap between *U. cinclis* and *U. dasynema*, s. s. It resembles the typical form of the species in the coarseness of the axials, in the heavy spirals, and in the relative prominence of the spirals on the summits of the axials. It differs from *dasynema*, s. s., in the reduced number of spirals, a character which it shares with *U. cinclis*. The spirals of the subspecies *cesta*, however, are coarser than those of *cinclis* and exhibit a stronger tendency to expand at the intersection with the costals. The subspecies is much less common than *U. dasynema*, s. s.

Occurrence: Chipola formation, localities 7893^r, 2213^p, 2564^p, 3419^p, 2211^r.

Uzita cystoides Gardner, n. sp.

Plate LI, figure 15

Shell very small but rather heavy, slender, elevated conic in outline. Aperture less than half the total height. Whorls of conch a trifle more than 4, increasing in diameter very slowly, somewhat compressed laterally, the outline obscured, however, by the heavy ribbing; constriction at the narrow basal sulcus abrupt. Suture line impressed, inconspicuous, undulated by the costals of the preceding volution. Protoconch rather small, smooth, turbinate, obtusely tapering; component volutions $3\frac{1}{4}$; initial turn minute, immersed at the tip, the succeeding whorls increasing rather rapidly in height and diameter. Opening of conch indicated by the appearance of the axial sculpture. Axials on the first whorl of the conch 12, narrow, abruptly elevated, persistent from suture to suture, tending to expand a little behind the anterior suture on the later portion of the whorl, subequal and subequispaced; axials upon the ultimate and penultimate whorls only 6, very broad, bulging, somewhat undulatory in character, quite strongly retractive, most elevated a little behind the anterior suture and on the medial portion of the body, persistent on the body to the basal sulcus. Intercostal areas not so wide as the costals, well-rounded. Spiral sculpture overrunning the axial but dominated by it; spirals rather low, flattened upon their summits, expanding slightly on the costals, normally 5 to the whorl, decreasing in prominence posteriorly, separated by little more than linear interspaces; 5 additional spirals developed on the anterior half of the body, narrower and lower than those behind them, with 2 or 3 fine lirae directly behind the basal sulcus. Anterior canal closely threaded with half a dozen subequal lirae. Aperture rather small, broadly lenticular in outline, acutely angu-

lated at the posterior commissure. Labrum arcuate, varicated a little behind the margin, sharply lirated within, the lirae 5 or 6 in number, the anterior lira defining the entrance to the canal. Labium sharply constricted at the base of the body, heavily reinforced; an amorphous parietal tooth usually developed a little in front of the posterior commissure, and 2 or 3 denticles near the base of the pillar. Margin of pillar acute. Anterior canal short, its margins proximate. Terminal notch rather narrow, deep, oblique.

Dimensions of holotype: Height 5.0 millimeters; length of aperture, 2 millimeters; maximum diameter, 2.8 millimeters.

Holotype: U. S. Nat. Mus. No. 371818.

Type locality: No. 3419, 1 mile below Baileys Ferry, Chipola River, Calhoun County, Fla.

Uzita cystoides is a rare but well-characterized species. It is smaller than most of its congeners and more slender. The axial sculpture is remarkable for the abrupt decrease in the number of costals on the later whorls, their decidedly retractive inclination, and their undulatory character. The spiral sculpture is rather heavy, crowded, and unusually uniform in character over the entire shell. *U. dasynema*, which is perhaps the most closely related form, is larger and much stouter, and exhibits a fairly uniform axial sculpture over the entire conch.

Occurrence: Chipola formation, localities 2213^r, 3419^p.

Uzita anisonema Gardner, n. sp.

Plate LI, figure 16

Shell small, moderately heavy, ovate-conic in outline. Aperture approximately one-half the total height. Whorls of the conch 5, those of the spire somewhat compressed laterally, the body broadly rounded and abruptly constricted at the basal sulcus. Sutures impressed and finely undulated by the costals of the preceding volution. Protoconch small, smooth, shining, thrice coiled, the initial turn minute, immersed at the tip, the two succeeding volutions well rounded and increasing rather rapidly in both diameter and height. Opening of conch marked by the appearance of the axial sculpture. Axials rather narrow, obtusely rounded, persistent from suture to suture, and, on the body whorl, to the basal sulcus, expanding slightly directly behind the anterior suture and on the medial portion of the body, subequal and subequispaced though slightly narrower and more widely spaced on the body than on the spire, from 7 to 9 in number on each of the later whorls. Intercoastal areas concave, not quite so wide, as a rule, as the costals on the whorls of the spire but a little wider than those on the body. Spirals crowded, somewhat flattened, unequal, tending to alternate on the later whorls, overriding the costals and slightly expanding on their summits; commonly 4 approximately equal spirals on the earliest whorls; the anterior spirals developing into the primaries of the

later volutions; a single secondary intercalated between each of the primaries on the later turns; 3 or 4 secondaries between the posterior primary and the suture line and 1 or 2 between the anterior primary and the suture; medial portion of body of typical forms girded with 4 equal, closely spaced secondaries, the basal portion with 4 or 5 slightly more prominent lirae, usually without intercalated secondaries. Anterior fasciole wide, threaded with half a dozen linearly spaced, rather coarse lirae. Aperture broadly lenticular, acutely angulated at the posterior commissure. Outer lip varicose a little behind the margin, sharp-edged, lirated within; usually 5 or 6 subequal lirations developed, disposed at subequal intervals from the commissure to the anterior canal, frequently with shorter secondaries intercalated. Curvature of inner wall of aperture higher than that of the outer; constriction at base of body abrupt. Parietal and pillar wash heavy, the outer edge sharply defined and forming a broad arc from the commissure to the canal; one or more amorphous denticles developed on the posterior portion of the body wall of the adults and on the pillar. Margin of pillar sharply pinched. Anterior canal short, recurved, broadly and deeply emarginate.

Dimensions of holotype: Height, 6.2 millimeters; length of aperture, 3.0 millimeters; maximum diameter, 3.5 millimeters.

Holotype: U. S. Nat. Mus. No. 371819.

Type locality: No. 2213, 1 mile below Baileys Ferry, Chipola River, Calhoun County, Fla.

Uzita anisonema has about the same dimensions as *U. cinclis* and *U. dasynema*. The outline of the spire is less regularly conic, however, than in either of the two other species, the axials are broader, and the spirals are more closely crowded and usually alternate in size.

Some of the smaller, more slender individuals referred to *Uzita consensa* (Ravenel) from the late Tertiary and Recent southeast coast faunas are similar to *U. anisonema*. The group of half a dozen related Chipola species, of which *U. anisonema* is one, possibly includes antecedent forms of *U. consensa* (Ravenel), *U. consensoides* (Olsson) (pl. LI, fig. 23), and of the larger, shouldered *U. ambigua* (Montagu).

Occurrence: Chipola formation, localities, 751^p, 2213^a, 2564^p, 3419^p, 2211^p, 7183^r.

Uzita oxia Gardner, n. sp.

Plate LI, figure 17

Shell of medium dimensions for the genus, rather thin, relatively tall, elevated conic in outline. Whorls of conch 5 to 5¼, those of the spire compressed laterally and increasing gradually in diameter, the body broad and abruptly constricted at the base. Sutures impressed, finely crenulated by the costals of the preceding volution. Protoconch small, for the most part smooth, highly polished, obtusely tapering, turbinate, including

3¼ whorls; initial turn minute, partially submerged in the succeeding volution; the second and third turns broadly convex, increasing rather rapidly in both diameter and height; last quarter turn sculptured with 4 narrow, arcuate riblets. Close of protoconch indicated by a change in the texture of the shell, the abrupt straightening of the axials, and a faint suggestion of a spiral sculpture. Axials narrow, obtusely rounded, moderately elevated, inclined to be somewhat irregular in size and spacing, persistent from suture to suture and well down to the base of the body, 10 or 11 on the early whorls, decreasing to 8 or 9 on the later whorls. Spirals rather fine; primaries low, narrow fillets equal and equispaced, normally 4 on the whorls of the spire, 6 on the body, but so disposed that 3, 4, or even 5 threadlets may be intercalated between the posterior spiral and the suture line; secondaries occasionally intercalated on the body and 4 equal angular lirae developed on the base. Anterior canal threaded with about half a dozen linearly spaced lirations. Aperture less than half as high as the shell, obliquely lenticular in outline, acutely angulated at the posterior commissure. Outer lip expanded toward the base, varicated directly behind the margin, thin-edged, sharply lirate within. Inner lip abruptly constricted at the base of the body. Parietal and pillar wash heavy; an amorphous denticle developed on the body wall near the posterior commissure. Edge of pillar acute. Anterior canal short, wide, sharply recurved. Terminal notch broad and rather shallow.

Dimensions of holotype: Height 6.6 millimeters; length of aperture, 3 millimeters; maximum diameter, 3.3 millimeters.

Holotype: U. S. Nat. Mus. No. 371820.

Type locality: No. 3419, 1 mile below Baileys Ferry, Chipola River, Calhoun County, Fla.

Uzita owia approaches more closely than any other species of the Chipola fauna to the group *U. dryas*, from Oak Grove. *U. dryas* is smaller than the Chipola analog, with a more delicate ornamentation and a more acutely tapering 4-whorled protoconch. *U. anisonema*, the most closely allied of the Chipola species, is relatively lower and stouter, with fewer conchal whorls and a heavier, more closely crowded spiral sculpture.

Uzita owia is much less common than the other members of the same general group.

Occurrence: Chipola formation, localities 2213,^p 3419.^r

***Uzita dryas* Gardner, n. sp.**

Plate LI, figure 18

Shell very small but rather solid, ovate-conic in outline, sharply constricted at the base. Aperture a little less than half as high as the entire shell; whorls 7¾ in all, including the 4½ nuclear turns. Initial whorl of protoconch minute but tumid, partially immersed in the succeeding volution; remaining whorls of protoconch broadly convex, increasing rather rapidly in both height

and diameter; surface of protoconch smooth except for a few, usually 2 or 3, feebly arcuate, sharply pinched axial riblets on the final half turn. Dividing line between the conch and protoconch indicated by a change in the texture of the shell, by a costal similar to those behind it, and by the appearance of 3 faint spiral fillets symmetrically spaced between the sutures. Axials very narrow, acute, and 11 or 12 on the first turn of the conch, broader, obtuse and only 8 or 9 on the body, persistent from suture to suture and to the basal sulcus; slightly less prominent posteriorly; intercostal areas concave, a little wider than the costals. Spiral sculpture less prominent than the axial though overriding it; primary spirals rather low and flat, expanding a little on the summits of the costae, 3 in number on the penultimate and antepenultimate whorls and 4 on the medial portion of the body; base girded with 4 additional lirae, similar in character but a little more closely spaced than those behind them; interspirals squarely channeled, almost double the width of the spirals. Sutures distinct but inconspicuous, undulated by the costae of the preceding whorl. Aperture rather broadly lenticular in outline, acutely angulated at the posterior commissure. Outer lip thin at the margin but thickened behind it both externally and internally; inner surface threaded with about 4 coarse lirae approximately equal and equispaced, continuous for some distance within the throat but abruptly evanescent a little behind the margin. Inner wall of aperture symmetrically concave, heavily washed with callus spread in a broad, sharply defined arc from the commissure to the canal; a single denticle usually developed on the body wall in front of the commissure and 2 or 3 on the pillar. Edge of pillar sharply plicate. Anterior fasciole short, moderately wide, threaded with about half a dozen crowded lirae. Anterior canal exceedingly short and sharply recurved, the sinuous extremity of the fasciole forming the inner arm and the base of the very deep, obliquely directed, U-shaped notch, and the produced posterior margin of the fasciole forming the outer arm of the notch.

Dimensions of holotype: Height, 4.3 millimeters; length of aperture, 2.0 millimeters; maximum diameter, 2.4 millimeters.

Holotype: U. S. Nat. Mus. No. 371821.

Type locality: No. 2646, Oak Grove, Okaloosa County, Fla.

Uzita dryas is the most abundant and the most characteristic of the smaller Uzitas of the Oak Grove fauna. The conchs exhibit a wide range of outline and sculpture, and even the protoconchs, though consistently large and multispiral, differ to an unusual degree in the development of axial sculpture. Most commonly there are 3 or 4 arcuate riblets on the last quarter turn of the nucleus, but on some specimens the ribbing extends over almost half a turn, and on others there is scarcely a trace of it. Normally the conch is rather slender, and

the profile is indented at the sutures, but some individuals are stout and regularly conic in outline, whereas others are abnormally slender. The axials are narrow, acutely rounded, 8 to 12 to the whorl.

As a rule they are less regular and less numerous on the body than on the spire. The spiral sculpture is low, flat, and rather delicate, the spirals tending to expand slightly on the summits of the costals. Primaries are 3 or, less commonly, 4 on each of the turns of the spire and twice as many on the body. Secondaries are not regularly intercalated in *U. dryas*, s. s., although fortuitous threadlets are occasionally visible in the shallow interspirals, especially in the space between the posterior spiral and the suture line. There are a number of Oak Grove Uzitas allied to *U. dryas* by the characters of both the conch and the protoconch. *U. dryas leptalea* differs consistently from *U. dryas*, s. s., in the development of a secondary spiral sculpture, a single sharp threadlet being introduced, as a rule between each pair of primaries, but not 3 or 4 threadlets as in *U. eutykta*. The subspecies is also more slender, as a rule, though both the species and the subspecies range widely in relative dimensions, so that the peripheral members overlap. In *U. eutykta*, a coexistent species with a similar protoconch and comparable dimensions and outline, the interprimary areas are sculptured with microscopically fine lirae, usually 3 or 4 and rarely 5 or even 6. *U. ischna* is a less closely affiliated member of the group. The protoconchal characters are much the same, but the conch is very much taller relatively and more slender and includes more whorls in the conch, each of which, with the exception of the body, is girded with fine, equal, equispaced spiral lirae. The group of *U. dryas* occupies in the Oak Grove fauna a position analogous to that of *U. cinclis* in the Chipola. *U. cinclis* and its allies are larger, as a rule, than the *U. dryas* group and more broadly conic, while the protoconchs include only 3 or at most $3\frac{1}{4}$ whorls instead of 4 and 5 as in the group of *U. dryas*. The details of the conchal sculpture vary with the species, but on the whole that of the *U. dryas* group is the more delicate.

Occurrence: Oak Grove Sand, localities 2646°, 5632°, 5631°, 5630°, 5633°, 7054°.

***Uzita dryas leptalea* Gardner, n. subsp.**

Plate LI, figure 19

Shell small and thin, rather elevated for the group and relatively slender. Aperture a little less than half as high as the entire shell. Whorls of spire broadly convex, the body constricted at the base; whorls of conch 3 in the type, which is probably not fully adult. Suture line distinct but inconspicuous, finely crenulated by the costals of the preceding whorl. Protoconch relatively large, including 5 volutions; initial turn exceedingly minute, partially immersed in the succeeding whorl;

other nuclear turns inflated medially, increasing rapidly in both height and diameter, polished and smooth except for the last half turn, which is axially ribbed with acute, asymmetrically arcuate costals, 9 on the type. Dividing line between conch and protoconch indicated by the appearance of the postnuclear axials and a feeble spiral sculpture. Axials rather narrow, obtusely rounded, equal and equispaced on the spire, inclined to be somewhat irregular on the body, 8 or 9 on the later whorls of the type; intercostal areas concave and commonly a little wider than the costals. Spiral sculpture varying widely in different individuals, commonly consisting of 4 low, narrow, flat-topped primaries with intercalated secondaries; a couple of secondaries also introduced between the anterior primary and the 4 or 5 oblique ridges that gird the extreme base of the body and the basal sulcus; anterior fasciole threaded with half a dozen or so linearly spaced, subequal lirae; interspaces between the primaries shallow and usually wider than the primaries. Aperture moderately wide, rudely lenticular, acutely angulated posteriorly. Outer lip thin and sharp at the margin, varicated a little behind the margin, expanded medially and flaring slightly directly behind the base of the body. Lirations on the inner surface sharp, somewhat irregular in size and spacing. Inner margin of aperture smoothly constricted at the base of the body, heavily glazed from the commissure to the canal; outer margin of the glaze sharply defined and broadly arcuate; irregular denticles developed in the adult on the body wall directly in front of the commissure and on the pillar. Margin of pillar pinched into a sharp fold. Anterior canal short, somewhat twisted, rather narrow. Terminal notch broad, shallow, oblique.

Dimensions of holotype: Height, 4.1 millimeters; length of aperture, 1.8 millimeters; maximum diameter, 1.9 millimeters.

Holotype: U. S. Nat. Mus. No. 371822.

Type locality: No. 2646, Oak Grove, Okaloosa County, Fla.

Uzita dryas leptalea is, as a rule, more slender than *U. dryas*, s. s.; the whorls of the protoconch are commonly more numerous by one and increase more rapidly in diameter; the axial sculpture is inclined to be less prominent and more irregular. The most constant differentiating character, however, is the development of a secondary spiral sculpture. Normally only a single secondary is intercalated between each pair of primaries. In *U. eutykta* the intercalated secondaries are microscopically fine and there may be as many as 5 between each pair of primaries. Furthermore, the outline of *U. eutykta* is similar to that of *U. dryas*, s. s., rather than to that of the subspecies *leptalea*.

The subspecies is less common than *U. dryas*, s. s.

Occurrence: Oak Grove sand, localities 2646°, 5631°, 5632°, 7054°.

Uzita eutykta Gardner, n. sp.

Plate LI, figures 20, 21

Shell very small, rather slender. The aperture approximating half the height of the entire shell. Whorls of spire very feebly convex; body broadly rounded, abruptly constricted at the base; basal sulcus clearly defined. Nuclear turns 4 to $4\frac{1}{4}$; initial whorl minute, inflated, though largely immersed in the succeeding turn; remaining whorls of the protoconch broadly convex, increasing in height and diameter rather rapidly; last half turn of nucleus sculptured with about half a dozen sharply pinched protractive riblets. Dividing line between the conch and protoconch indicated by the abrupt assumption of the postnuclear sculpture. Whorls of conch 3. Axial costae moderately elevated, broadly rounded, a little more prominent medially than anteriorly, inclined to become obsolete directly in front of the posterior suture and toward the basal sulcus, usually 8 or 9 to the whorl; intercostal areas concave and of approximately the same width as the costals. Spiral sculpture developed both on the axial and the interaxial areas, but a little less fine on the summits of the axials; primary spirals 3 or 4 on the whorls of the spire and 7 on the body, the suture following along or a little in front of the fourth primary; primaries rather low, flattened cords, slightly expanded on the summits of the costals, subequal and separated by flattened interspaces of a little less than twice their own width; 3 or 4 linear and linearly spaced secondaries intercalated between each pair of primaries upon the later whorls and frequently 5 between the posterior spiral and the posterior suture. Basal sulcus indistinctly threaded with 6 or 8 very fine and irregular lirae. Anterior fasciole rather coarsely threaded with 4 rather sharp and prominent lirae, not including the heavy and often double cord that outlines the posterior margin. Suture line distinct, impressed, undulated in harmony with the costals of the preceding whorl, the edge in front of it slightly beveled. Aperture rather broad, obliquely lenticular, acutely angulated at the posterior commissure. Outer lip arcuate, varicated a little behind the thin, sharp margin, coarsely lirate within, the 2 medial lirae the most prominent and more widely spaced than those in front, the anterior of which marks the entrance to the anterior canal. Inner wall of aperture excavated at the base of the body. Parietal wall and pillar heavily glazed, the callus spread in a broad arc from the commissure to the base of the pillar, the margin of the arc thick and sharply defined; a single amorphous tooth developed on the posterior portion of the parietal wall and a couple of ill-defined denticles on the pillar. Margin of the pillar acute. Anterior canal short and sharply recurved. Terminal notch broadly rounded, slightly constricted at the mouth, obliquely directed.

Dimensions of holotype: Height, 4.0 millimeters; length of aperture, 2 millimeters; maximum diameter, 2.3 millimeters.

Holotype: U. S. Nat. Mus. No. 371823.

Type locality: No. 2646, Oak Grove, Yellow River, Okaloosa County, Fla.

Uzita eutykta is best characterized by the exceedingly fine secondaries intercalated between the primary spirals, at least on the later whorls. The mere presence of a well-developed secondary sculpture is sufficient to separate it from *U. dryas*, s. s., and the number and exceeding fineness of the secondary lirae separate it from *U. dryas leptalea*, best characterized by the intercalation of a single secondary between each pair of primaries.

Occurrence: Oak Grove sand, localities 2646 °, 5632 °, 5631 °, 5633 °, 7054 °.

Uzita ischna Gardner, n. sp.

Plate LI, figure 22

Shell small, moderately heavy, slender. Aperture decidedly less than half as high as the entire shell. Whorls of conch $4\frac{3}{4}$ in the type, broadly rounded, the body rather sharply constricted at the base; sutures impressed, crenulated by the costals of the preceding volution. Protoconch relatively large, for the most part smooth and highly polished, including $4\frac{1}{4}$ component whorls; initial turn exceedingly minute, immersed at the tip; succeeding volution well-rounded, increasing rapidly in diameter but rather slowly in height; a few irregular, arcuate riblets developed just before the close of the protoconch. Beginning of conch indicated by a slight change in the texture of the shell, the establishment of the postnuclear axial sculpture, and the appearance of a faint spiral sculpture. Axials rather narrow, obtusely rounded, persistent from suture to suture and well down to the base of the body, slightly more elevated medially than toward the sutures, subequal and subequispaced, 10 or 11 on each of the later whorls; intercostal areas concave of approximately the same width as the costals. Spiral sculpture uniform in general character over the entire conch; spirals rather low, angular fillets, expanding slightly at the intersection with the costals, equal and equispaced, 5 on each of the whorls of the spire, 7 on the body; interspiral channels shallow and angular, those on the spire of approximately the same width as the spirals; those on the body a little wider. Extreme base of body and sulcus girded with secondary lirae. Anterior fasciole threaded with 5 closely and evenly spaced lirations. Aperture narrow, obliquely lenticular in outline, acutely angulated posteriorly. Outer lip varicated a little behind the margin, obscurely lirate within. Inner wall of aperture quite strongly concave, smoothly glazed from the commissure to the canal.

Edge of pillar pinched into an acute fold. Anterior canal short, rather broad. Terminal notch broad, rather shallow, obliquely directed.

Dimensions of holotype: Height, 6.7 millimeters; length of aperture, 2.9 millimeters; maximum diameter, 3.3 millimeters.

Holotype: U. S. Nat. Mus. No. 371824.

Type locality: No. 2646, Oak Grove, Yellow River, Okaloosa County, Fla.

Uzita ischna is remarkable for its slender outline and the uniformity of the spiral sculpture. None of the coexistent forms has 5 primaries to the whorl without intercalated secondaries. *U. chowanensis* Gardner of the Yorktown fauna of North Carolina displays much the same outline and sculpture pattern, but it is larger and the whorls are shouldered.

The type is the only adult form in the material available for study, although there are a number of juveniles probably referable to this species.

Occurrence: Oak Grove, sand, localities 2646^r, ? 5631^r.

***Uzita bimitrodita* Gardner, n. sp.**

Plate LI, figure 25

Shell small, thin, rather slender, subfusiform in outline when viewed from the front. Aperture approximately half as high as the entire shell. Post-nuclear whorls of spire feebly expanded medially, the body abruptly constricted into the rather obscurely defined basal trench. Whorls of conch $3\frac{1}{2}$ in number, separated by inconspicuous, feebly impressed suture lines which are finely crenulated by the costals of the preceding whorl. Protoconch moderately large for the genus, slightly decorticated at the tip of the unique type but probably including more than 3 volutions; initial turn minute, for the most part submerged in the succeeding whorl; remaining nuclear turns inflated medially and increasing rather rapidly in diameter; external surface smooth and polished except for the last quarter turn, which is ribbed with half a dozen narrow, arcuate costals. Dividing line between conch and protoconch inconspicuous, indicated by a slight change in texture and by the introduction of the postnuclear axial sculpture and two feeble spirals. Axials rather narrow, obtusely rounded, most elevated a little behind the suture line but persistent from suture to suture and, on the body, well down to the basal sulcus, 8 or 9 to the whorl in the type; intercostal areas broader than the costals and slightly concave. Incremental striations microscopically fine. Whorls of spire girded with 2 low, narrow fillets equally elevated on the costal and the intercostal areas, the anterior a little the stronger and placed slightly in front of the median line, the posterior set midway between the spiral in front and the posterior suture; anterior suture following and partially concealing a third primary fillet similar in character to those behind it; the 2 primary spirals aug-

mented on the body by 5 additional spirals, which become increasingly fine anteriorly; 1 or 2 fortuitous secondaries intercalated on the unique type between the posterior spiral, and the suture and a single faint threadlet developed between the primaries and the medial portion of the body. Anterior fasciole threaded with half a dozen fine, crowded lirae. Aperture narrow, lenticular in outline, acutely angulated at the posterior commissure. Outer lip broadly arcuate, varicated a short distance back from the margin, lirae within; lirae 5, restricted to the medial and anterior portions of the labrum, shorter medially, the anterior thread outlining the entrance to the canal and more prominent than those behind it. Inner wall of aperture strongly concave, heavily reinforced from the commissure to the canal. Outer margin of wash sharply defined, broadly arcuate. Edge of pillar acute. Anterior canal short, recurved. Terminal notch broad, shallow, obliquely directed.

Dimensions of holotype: Height, 3.9 millimeters; length of aperture, 1.8 millimeters; maximum diameter, 2.0 millimeters.

Holotype: U. S. Nat. Mus. No. 371825.

Type locality: No. 2646, Oak Grove, Yellow River, Okaloosa County, Fla.

Uzita bimitrodita is possibly a peripheral member of the group of *U. dryas*. The protoconch is smaller, however, than in *U. dryas* and less rapidly tapering, the outline of the conch is more fusiform, and there are only 2 primary spirals developed upon the whorls of the spire. Because of the greater prominence of the anterior spiral the whorls seem to slightly overhang the sutures. The type is unique.

Occurrence: Oak Grove sand, locality 2646^r.

***Uzita tribaka* Gardner, n. sp.**

Plate LI, figure 29

Shell small, elevated-conic in outline, slender, and tapering gradually to an obtuse apex. Aperture approximately half the length of the entire conch. Body whorl rather abruptly constricted at the base. Basal sulcus ill-defined. Whorls of spire flattened laterally or very feebly convex. Protoconch moderately large, smooth, highly polished, including $3\frac{1}{2}$ volutions; initial turn minute, flattened behind, almost entirely immersed in the succeeding volution; remaining nuclear turns broadly convex, increasing rather rapidly both in height and in diameter; 2 or 3 arcuate axial riblets occasionally developed on the last quarter turn. Close of protoconch indicated by a change in texture of the shell, a slight thickening, and the establishment of the axial sculpture. Postnuclear whorls 4. Axials narrow, moderately elevated, obtuse, approximately uniform in prominence between the sutures and well down on the base of the body, though somewhat inclined to weaken posteriorly, 12 or 13 to the whorl including the terminal varix,

somewhat irregular on the final half turn; interaxial areas broadly convex, a little wider than the axials on the medial and anterior portions of the shell. Spiral sculpture introduced near the close of the first half turn; spirals low and flat, 5 on the whorls of the spire and 7 on the body exclusive of the 4 narrower spirals that gird the base; fillets for the most part equal and equispaced, the posterior fillet, however, relatively sharp and relatively distant from the spiral in front of it; interspiral areas for the most part shallow but squarely channeled and a little narrower than the spirals; secondaries not intercalated, except for a single, fine, sharp lira developed in the basal sulcus. Fasciole closely threaded with half a dozen fine, linearly spaced lirae. Suture line distinctly impressed. Aperture rather narrow, somewhat obliquely lenticular, acutely angulated posteriorly. Labrum arcuate, sharp-edged but thickened externally a little behind the margin, lirae within, the lirae rather short and not persistent to the outer margin, the anterior threadlet defining the entrance to the anterior canal. Inner wall of aperture rather abruptly excavated at the base of the body. Parietal wall and pillar heavily glazed, the callus thickening on the pillar; a single elongated parietal tooth developed a little in front of the commissure, a single tooth also developed on the pillar, less prominent, however, than that on the body wall. Edge of pillar elevated, acute. Anterior canal short and sharply recurved. Terminal notch broad, moderately deep, somewhat obliquely directed.

Dimensions of holotype: Height, 6.0 millimeters; length of aperture, 2.8 millimeters; maximum diameter, 3.0 millimeters.

Holotype: U. S. Nat. Mus. No. 328846.

Type locality: No. 3419, 1 mile below Baileys Ferry, Chipola River, Calhoun County, Fla.

Uzita tribaka is characterized by its small size, slender outline, and the weather-worn aspect of its external sculpture. The axials are commonly only 11 but may be as many as 14, and there is a wide range in the relative prominence of the posterior spiral. The species is, however, rather unusually constant both in its general characters and in the details of the sculpture.

Occurrence: Chipola formation, localities 2213^p, 2564^r, 3419^p.

Uzita dasa Gardner, n. sp.

Plate LI, figure 26

Shell small, squat, heavy; the aperture less than half as high as the entire shell. Whorls of spire trapezoidal, the body obliquely flattened behind, rounded in front, and rather strongly constricted at the base. Basal sulcus not defined. Whorls of conch 3. Protoconch broken at the tip but probably including 3 or more revolutions; initial turn of protoconch minute and apparently immersed in the succeeding turn; remaining

whorls of protoconch broadly convex and increasing in diameter and height rather rapidly; 3 or 4 obtuse, axial puckers developed on the last quarter turn. Beginning of conch indicated by a thickening of the shell and by the assumption of the postnuclear axial sculpture. Axials narrow but obtuse on their summits, persistent from suture to suture and to the anterior fasciole, slightly expanded a little behind the anterior suture, 17 on the body of the type including the terminal varix, 16 on the penultimate whorl, 15 on the antepenultimate whorl. Spiral sculpture consisting of low, flattened cords overriding the axials and inclined to expand a little on their summits; not developed until toward the close of the first turn; 5 or 6 on the penultimate whorl and 14 on the body, the posterior sharper and narrower than the rest, the 2 anterior on the penultimate whorl the widest; spirals on the medial portion of the body equisized and separated one from another by squarely channeled interspaces of only about half their own width, the 2 posterior spirals cut off from those in front of them by an interspace of twice the usual width; spirals on the base of the body 6, becoming increasingly narrower and sharper anteriorly. Anterior fasciole coarsely and obscurely threaded. Suture lines inconspicuous, impressed, finely crenulated in harmony with the costals of the preceding volution. Aperture lobate, acutely angulated posteriorly. Labrum almost vertical medially, obtusely angulated at the base of the body and obscurely guttered; inner surface feebly and somewhat irregularly lirate. Inner wall of aperture smoothly excavated at the base of the body, evenly and heavily glazed from the commissure to the base of the pillar, very feebly denticulate just within the margin of the wash, the posterior denticle the least feeble. Pillar edge acute. Anterior canal short, sharply recurved. Terminal notch broad, moderately deep, obliquely directed.

Dimensions of holotype: Height, 5.1 millimeters; length of aperture, 2.1 millimeters; maximum diameter, 3.2 millimeters.

Holotype: U. S. Nat. Mus. No. 371826.

Type locality: No. 5079, 5 miles west of Mossyhead, and half a mile below Shell Bluff, Walton County, Fla.

Uzita dasa is readily isolated by its rather heavy shell, numerous narrow axials, and low, flattened, closely spaced spirals.

Occurrence: Shoal River formation, locality 5079^p.

Uzita paraprista Gardner, n. sp.

Plate LI, figure 27

Shell small, rather stout, ovate-conic in outline, the aperture more than half as high as the entire conch. Whorls not quite 6½ in the type, probably as many as 7 in some individuals; basal sulcus ill-defined. Nucleus large for the size of the conch, naticoid; component

volutions 4 or a trifle less than 4; initial turn minute, flattened behind, almost entirely immersed in the succeeding whorl; remaining nuclear turns broadly convex, increasing in both diameter and height rather rapidly; 2, 3, or 4 obscure axial riblets occasionally developed on the last quarter turn. Dividing line between the conch and protoconch ill-defined, indicated by the gradual assumption of the conchal sculpture. Ornamentation cancellate, the axials cordate, elevated, reticulating the spirals and 11 in number on the body including the terminal varix, uniform in prominence between the sutures and persistent on the body to the anterior fasciole. Intercostal areas much wider than the costals and broadly concave. Spiral sculpture manifested in the form of narrow, flattened, sharply defined threads that override the costals and are somewhat nodose at the intersections with them; lirae 3 on the antepenultimate whorl, 3 or 4 on the penultimate whorl, and 4 on the anterior and medial portion of the body; the 5 additional spirals on the base becoming increasingly narrow toward the fasciole; posterior spiral sharper than those in front of it, placed nearer to the suture line than to the spiral in front of it. Suture following the anterior spiral and in some individuals entirely concealing it; interspiral areas approximately double the width of the spirals on the anterior half of the whorl. Anterior fasciole moderately wide, sculptured with half a dozen sharp, closely spaced lirae. Suture line impressed, crenulated by the costae of the preceding whorl. Aperture rather wide, slightly oblique, acutely angulated posteriorly. Outer lip thin at the margin, varicated behind the margin, lirate within. Lirae subequal and equispaced, numbering about half a dozen, the posterior placed at some little distance in front of the commissure, the anterior marking the entrance to the anterior canal. Labium strongly and symmetrically concave, reinforced by a heavy, sharply defined wash of callus that extends from the commissure to the base of the pillar; an elongated parietal tooth developed a little in front of the commissure and a couple of elongated denticles on the pillar, the posterior the more prominent. Edge of pillar acute but not elevated. Anterior canal moderately wide, very short, and sharply recurved, deeply emarginate.

Dimensions of holotype: Height, 3.9 millimeters; length of aperture, 1.8 millimeters; maximum diameter, 2.5 millimeters.

Holotype: U. S. Nat. Mus. No. 371827.

Type locality: No. 5618, $3\frac{1}{2}$ miles southwest of De Funiak Springs, Walton County, Fla.

Uzita paraprasta is more sharply cancellated than the related *U. prista*. The axials are narrower and more cordate and the spirals are more angulated.

Occurrence: Shoal River formation, localities 7261^r, 7264^p, 5618^c.

Uzita prista Gardner, n. sp.

Plate LI, figure 28

Shell small, rather heavy, ovate-conic. Aperture a little less than half as high as the conch; whorls of spire trapezoidal, the body whorl broadly rounded and constricted at the base; volutions approximately $6\frac{1}{2}$ in all, between $3\frac{1}{2}$ and 4 of this number being included in the protoconch and a little less than 3 in the conch. Protoconch rather large, smooth, somewhat naticoid in outline, the initial turn minute, flattened posteriorly, and almost entirely immersed in the succeeding volution; the remaining whorls of the protoconch increasing in both diameter and height rather rapidly; later whorls of the protoconch broadly convex, buccinoid in outline. Dividing line between conch and protoconch indicated by a slight thickening of the shell and by the gradual introduction of the postnuclear sculpture. Axials A-shaped, broad at the base, obtusely angulated on the summits and in the intercostal channels, persistent from suture to suture and, on the body, to the basal sulcus, slightly wider toward the anterior suture; 10 in number on the penultimate and ultimate whorls of the type, including the terminal varix, 13 in another individual. Spiral sculpture of low, rather narrow, flattened, and inconspicuous fillets, 3 or 4 on each of the whorls of the spire and the anterior and medial portion of the body, and 4 narrower, sharper fillets on the base; spirals overriding the axials and slightly expanded on their summits; interspiral areas flattened, a little wider, as a rule, than the spirals; anterior fasciole threaded with 4 to 6 well-rounded, linearly spaced lirae. Suture line distinct, impressed, undulated by the costae of the preceding volution. Aperture obliquely lenticular in outline, acutely angulated at the posterior commissure. Outer lip varicose a little behind the thin, sharp margin, reinforced within by a few coarse denticles, the medial the most prominent. Inner wall of aperture strongly and symmetrically excavated, heavily coated with a sharply defined wall of callus, denticulated along its outer margin, the denticles on the pillar the heaviest. Anterior canal short, sharply recurved, somewhat constricted at the entrance, which is defined by the sharp margin of the pillar and the anterior denticle on the labrum. Terminal notch rather broad, deep, obliquely directed.

Dimensions of holotype: Height, 4.1 millimeters; length of aperture 1.8 millimeters; maximum diameter, 2.6 millimeters.

Holotype: U. S. Nat. Mus. No. 371828.

Type locality: No. 5079, half a mile below Shell Bluff, Shoal River, Walton County, Fla.

Uzita prista suggests *U. dalli* (Maury) in the general character of the ornamentation. Miss Maury's species is decidedly larger than *U. prista*, the nucleus is more slender, the axials are heavier and usually more num-

ous on the early whorls, and the spiral sculpture is much more obscure. *U. dryas*, another species of the same general dimensions and outline, is readily separable by the more slender protoconch, the more numerous conchal whorls, the more rounded axials, and the finer, sharper spirals. *U. paraprasta* is another small species of the same general outline, but the axials are cordate rather than Λ -shaped as they are in *prista*.

Occurrence: Shoal River formation, locality 5079^p.

Uzita veatchi (Maury)

1910. *Nassa Veatchi* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 22, pl. 5, fig. 10.

Shell small, resembling in size the recent *N. acuta*, slender, nuclear whorls three, smooth; subsequent whorls also three, rounded; transverse sculpture of nearly straight, narrow riblets, of which there are eight on the last whorl and a final, prominent varix; spiral sculpture (on the last whorl) of about ten raised threads, the upper six extending over nearly the whole whorl and forming nodular intersections with the ribs, the remaining four closely crowded at the base of the whorl, penultimate whorl with three spiral threads; outer lip of aperture with six lirations inside; columella with a slight callus.

Length of shell, 4.5; of last whorl, 2.5; of aperture, 1; greatest width, 2 millimeters.

Oligocene of the Chipola marls, Baileys Ferry, Fla.

Named in honor of Mr. Arthur Veatch, now of the United States Geological Survey, who some years ago ably aided Professor Harris in making the collection of Florida Oligocene fossils for Cornell University.

Cornell University collection.—Maury, 1910.

This species has not been recognized in the later collections.

Uzita dalli (Maury)

Plate LI, figure 24

1910. *Nassa Dalli* Maury, Bull. Am. Paleontology, vol. 4, No. 21, p. 21, pl. 5, fig. 8.

Shell rather small with seven whorls, of which the first two are smooth, the remainder sculptured; spire acute; transverse sculpture of fine subequal threads (visible without a lens) with wider interspaces. Longitudinal sculpture of strongly defined riblets (ten on the last whorl) and a terminal varix. Aperture elliptical; outer lip lirate within; canal short, recurved. Length of shell 7; greatest width 4 millimeters.

Named in honor of Dr. Dall of the Smithsonian.

Oak Grove, Florida.

Mr. Aldrich's collection.—Maury, 1910.

Figured topotype: U. S. Nat. Mus. No. 371870.

This species varies widely both in the contour and the sculpture. The outline is usually rather elevated conic, but squat individuals are not uncommon. The truncated posterior ends of the ribs form a narrow posterior tabulation, which varies in prominence with the strength of the axials. There are more than 5 volutions in the fully adult conch and $3\frac{1}{2}$ in the rather large, smooth, polished protoconch. The initial turn of the protoconch is minute and almost entirely immersed; the succeeding volution is also small but becomes increasingly higher and more strongly convex toward its

close. The remaining turns of the protoconch increase in height but decrease in convexity anteriorly. The close of the nucleus is indicated by an irregular thickening of the shell and by the initiation of the postnuclear axials. The axials are commonly 11 or 12 on the latter whorls of the spire, including the varicose terminal riblet. They are approximately uniform in prominence between the sutures and persist well down to the base of the body. The outline of the costals is that of a broad and obtuse Λ , while the intercostals, which are of approximately the same width, are rather deeply trenched. The spirals vary widely in prominence. The 4 or 5 very low and obscure fillets on the later whorls of the spire and the posterior and medial portions of the body, are least feeble on the sides of the costals, obsolete in the intercostal areas, and exceedingly faint on the summits of the costals. The interspiral channels are shallow but squarely cut and vary in relative width. The 4 or 5 spirals which gird the base of the body and the pillar are more elevated than those on the medial portion, especially on their posterior faces. The suture lines are impressed and undulated in harmony with the costals of the preceding turn. The aperture is obliquely lenticular in outline and angulated at the posterior commissure. The outer lip is thickened behind the margin and is inclined to flare in front. There are from 4 to 6 internal lirae, those upon the medial portion the most prominent. The inner margin of the aperture is strongly and symmetrically excavated. The callus along the inner wall is heavy and is spread in a broad arc from the commissure to the anterior extremity. In the adults, there are about half a dozen denticles disposed along the inner margin, those at the extremities usually the most prominent. The anterior canal is exceedingly short and sharply recurved. The anterior fasciole is rather wide, feebly arched, and coarsely lirate. Its sinuous extremity forms the base and inner arm of the deep, U-shaped, obliquely directed terminal notch.

Uzita dalli (Maury) is well characterized by its coarse, irregular, often subvaricose axial sculpture and a feeble spiral sculpture, which may be obsolete on the intercostal areas. The axials of *U. harrisi* (Maury), the Chipola analog, are sharper, more regular, and, as a rule, more strongly nodose posteriorly; the spirals are fewer and broader and, though very low and inconspicuous, are uniform in development on the costal and intercostal areas.

Occurrence: Oak Grove sand, localities 2646^c, 5631^p, 5632^p, 5633^r, 7054^p. Cornell University Collection.

Uzita harrisi (Maury)

Plate LI, figure 30

1910. *Nassa Harrisi* Maury, Bull. Am. Paleontology, vol. 4, No. 21, p. 22, pl. 5, fig. 9.

Shell rather small, stout, with an acute spire; nuclear whorls, two, smooth; subsequent whorls, five; transverse sculpture of

narrow, elevated ribs (ten to eleven on the last whorl) with wider interspaces; spiral sculpture of narrow, slightly raised bands (about eight on the last whorl), the band just beneath the suture forming nodular intersections with the ribs and thus giving the effect of a row of beads; outer lip with four or five lirations within; columella plicate, the upper fold being the stronger.

Adult shells of this species resemble in form half-grown specimens of *N. Berthæ* but the beading beneath the suture is more prominent and the ribs much fewer than in that species, and the spirals are not obsolete on the center of the body whorl.

Length of shell, 8; of last whorl, 5; of aperture, 3; greatest width, 4.5 millimeters.

Chipola Oligocene, Bailey's Ferry, Calhoun County, Florida, and also in the uppermost Oligocene of the Oak Grove sands, Santa Rosa County, Florida.

Dedicated to Professor G. D. Harris of Cornell University. Cornell University collection.—Maury, 1910.

Figured topotype: U. S. Nat. Mus. No. 371871.

The outline varies widely, as in many of the other members of this genus. At one extremity of the series the forms are elevated-conic, at the other they are squat individuals. The protoconch is smooth, highly polished, the initial turn minute and largely immersed, the succeeding volutions rounded and increasing regularly and rather rapidly in diameter. The dividing line between the conch and protoconch is clearly defined by a change in texture of the shell, a slight varical thickening, and the initiation of the postnuclear axials. The postnuclear whorls number $5\frac{1}{2}$ to $6\frac{1}{2}$ in the adults; those of the spire are trapezoidal in outline and tabulated narrowly posteriorly; the body is sharply contracted at the base. The 12 or 13 axials are uniform in prominence between the prosutural band and the anterior suture, and they persist on the body well down to the base. The spiral sculpture is feeble, as a rule, except on the base of the body, where the lirae are more sharply elevated, especially on the posterior face. The interspiral channels are shallow but squarely incised and a little narrower than the spirals except on the base of the body. The sutures are strongly impressed and undulated in harmony with the axials of the preceding whorl. The aperture is obliquely lenticular and angulated at the posterior commissure. The outer lip is almost vertical, obtusely angulated and feebly notched at the base, varicated a little behind the sharp margin, and lirate within, the three anterior lirae equisized and equispaced but less prominent than the medial lira. The inner margin of the aperture is a little more sharply curved than the outer and is evenly and heavily coated from the commissure to the canal. A rather heavy drop of callus is usually deposited directly in front of the commissure and another near the anterior extremity. Intermediate but less prominent denticles are also developed. The anterior canal is exceedingly short and sharply recurved, the margins at the entrance to the canal closely approximating each other. The anterior fasciole is arched and spirally lirate. It is cut off from the base of the body

by a well-defined sulcus, and its extremity forms one arm of the very deep, obliquely directed terminal notch. The other arm is formed by the produced and slightly reverted posterior margin of the fasciole.

The species from the Tampa limestone, cited by Mansfield, 1937, as *Alectrion* sp. b, aff. *A. Harris* Maury, is a small, ovate-conic species with no marked constriction at the ill-defined basal sulcus.

Uzita harrisi (Maury) is similar in general dimensions to *U. dalli* (Maury) from the Oak Grove. The axial ribbing of the latter is less regular, the tendency toward a posterior nodulation is less pronounced and the spirals in *U. dalli* are more numerous than those of *U. harrisi*.

Uzita harrisi (Maury) is one of the commonest representatives of the genus in the Chipola fauna.

Occurrence: Chipola formation localities, 7893^r, 2213^p, 2564^c, 3419^a, 2211^a. Cornell University Collection.

Uzita grapta (Gardner) Gardner

Plate LI, figure 32

193d. *Alectrion grapta* Gardner, Florida State Dept. Cons. Geol. Bull. 14, p. 60, pl. 9, fig. 9.

Shell rather small, slender, elongate-conic in outline. Whorls probably 5 in number in an adult conch but only a little more than 4 in the type. Protoconch not very large, obtuse, smooth, and highly polished; initial turn minute, broadly inflated, almost entirely submerged in the succeeding whorl; remaining $2\frac{1}{2}$ volutions increasing in height and diameter with a moderate degree of rapidity. Dividing line between the conch and protoconch rather obscure, indicated by the gradual initiation of the axial sculpture; spiral sculpture not developed until the last half of the first post-nuclear turn. Axials very narrow, acute, persisting from suture to suture and well down to the base of the body, approximately uniform in prominence throughout their extent though tending to be slightly nodose posteriorly; from 14 to 16 in number upon the later whorls of the spire and half as many again upon the earlier. Spiral sculpture, taking the form of more or less deeply incised linear grooves, very feeble upon the earliest turns; posterior sulcus broader and deeper than those in front of it, outlining a presutural fillet which is, in some individuals, strong enough to feebly nodulate the costals which it overrides; sulci between the posterior groove and the anterior suture 4 in number in the type, frequently 5, equal and equispaced, obsolete upon the summits of the costals; anterior and medial portion of the body sculptured like the later whorls of the spire; base of the body channeled with 5 increasingly wider and deeper grooves, the intervening areas becoming increasingly narrower and more elevated anteriorly; basal sulcus ill-defined. Fasciole coarsely threaded with 4 irregular lirae. Sutures distinct, impressed, crenulated in harmony with the costals of the preceding turn. Aperture rather narrow, obliquely lenticular, acutely angulated at the posterior commissure, broadest in front of the median horizontal. Labrum asymmetrically arcuate, abruptly constricted at the base, thickened externally a little behind the margin, reinforced within by rather prominent lirae (5 in number in the type), most prominent just before they abruptly evanesce a short distance within the margin. Inner wall of aperture smoothly but quite strongly concave; a heavy wash of callus spread in a broad, sharply defined arc from the posterior commissure to the anterior extremity of the pillar; a single rather prominent tooth developed upon the parietal wall directly in

front of the commissure; other less elevated denticles usually present upon the pillar wash of the adult and on the anterior portion of the body wall. Edge of pillar acutely elevated. Anterior canal moderately broad, very short, and sharply recurved. Terminal notch broad, moderately deep, obliquely directed.

Dimensions of holotype: Height, 6.0 millimeters; length of aperture, 2.5 millimeters; maximum diameter, 2.6 millimeters.

Type material: Holotype, U. S. Nat. Mus. No. 371829.

Type locality: No. 3742, Shell Bluff, Shoal River, Walton County, Florida. Shoal River formation of the Alum Bluff group.—Gardner, 1936.

Uzita grapta is characterized by the rather slender, elevated spire and the incised spiral sculpture.

Occurrence: Shoal River formation, localities 3742^p, 3748^r, 5618^p.

Uzita opeas Gardner, n. sp.

Plate LI, figure 31

Shell small, slender, acutely tapering. Aperture less than half the length of the shell. Whorls of spire trapezoidal in outline, the body whorl rather sharply constricted at the base; basal sulcus defined; whorls 8 in all, 3 of which are in the smooth, polished protoconch. Initial turn of protoconch minute and, for the most part, submerged in the succeeding turn; the two remaining nuclear whorls broadly convex, increasing in height and diameter rather rapidly. Line of demarcation between conch and protoconch indicated by the gradual beginning of the axial sculpture. Axials narrow, A-shaped, acutely rounded on their summits, feebly retractive, uniform in prominence between the sutures, persisting on the body to the anterior fasciole, rather abruptly terminating at the posterior suture and narrowly tabulating the whorl; number increasing from about a dozen on the earliest turns to 19 on the body including the terminal varix; intercostal areas wider than the costae and evenly concave. Spiral sculpture rather obscure and on the summits of the costals almost obsolete, manifested in the form of narrow, incised channels separated by low, flat interspiral areas. Posterior spiral the deepest, partially dissecting the costals and thus simulating a *Terebra*-like sutural band; a medial and an anterior spiral also developed, as a rule, the medial spiral feeble and sometimes absent altogether; 4 additional spirals developed on the base of the body, broader than those behind them and separated one from another by increasingly narrower interspiral areas. Suture line distinct, impressed, very finely crenulated by the costals of the preceding volution. Aperture narrow, lenticular, acutely angulated posteriorly. Labrum broadly convex, varicated, denticulate within, the denticle on the medial portion of the labrum the most prominent; surface between this denticle and the posterior commissure usually smooth, 3 subequal and equally spaced denticles commonly developed on the anterior half of the labrum, the foremost placed at the entrance to the anterior canal.

Labium excavated at the base of the body, heavily reinforced from the commissure to the anterior extremity of the canal, the outer margin of the callus describing a broad and well-defined arc; a single obscure denticle usually developed on the parietal wall and 2 somewhat coarser teeth on the pillar. Edge of pillar acute and slightly thickened at its extremity. Anterior fasciole rather wide and coarsely lirate. Terminal notch deep, obliquely directed, contracted at the entrance.

Dimensions of holotype: Height, 6.3 millimeters; length of aperture, 2.8 millimeters; maximum diameter, 3.3 millimeters.

Holotype: U. S. Nat. Mus. No. 371831.

Type locality: No. 3419, 1 mile below Baileys Ferry, Chipola River, Calhoun County, Fla.

Uzita opeas suggests a small slender variety of *U. harrisi* (Maury) with an unusually large number of axial ribs and an unusually well-developed spiral sculpture. The form described under the name of *U. opeas* is, however, so far removed from the present confines of *U. harrisi* that it seems impossible to include it under that name.

Uzita suffolkensis Gardner, from the Yorktown of Virginia, exhibits a somewhat similar incised spiral sculpture, but the axials in *U. suffolkensis* do not interrupt the spiral graving as they do in *U. opeas*.

Occurrence: Chipola formation, localities 2564^r, 3419^r.

Uzita berthae (Maury)

Plate LI, figure 33

1910. *Nassa Berthae* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 21, pl. 5, fig. 7.

Shell tapering regularly to an acute apex; whorls eight in mature shells, the two nuclear being smooth, the subsequent whorls bearing each about twenty very regular, straight transverse ribs, extending the full length of the whorls; beneath the suture the ribs are cut by an incised spiral line so that their ends appear as a series of beads crowning the summit of each whorl; lower half of the body-whorl with about six spirals which become obsolete above the center of the whorl; aged shells have the outer lip lirate within and the callus of the columella plicate.

Height of shell 13; of aperture 5; greatest width 5.5 millimeters.

The striking features of this unusually beautiful *Nassa* are the regular and elegant riblets and the absence of spirals except just beneath the suture and on the base of the body-whorl.

Oligocene of the Chipola marls, Bailey's Ferry, Calhoun County, Florida; and of the Oak Grove sands of Santa Rosa county, Florida.

Named in honor of Dr. Bertha Stoneman of the University of South Africa.

Cornell University and Mr. Aldrich's collection.—Maury, 1910.

Figured topotype: U. S. Nat. Mus. No. 371872.

The outline is more evenly conic than that of any of the congenetic species, and the posterior tabulation of the whorls is very narrow. There are 6 volutions in the adult conch and 3½ in the rather large, polished, poste-

riorly flattened protoconch. The initial turn of the protoconch is minute and almost entirely immersed. The succeeding volution is also small and rather low, while the final turn and a half increases rapidly in height but decreases in convexity toward the aperture. On some individuals, faint incremental riblets are developed on the final quarter turn of the nucleus. The close of the nucleus is indicated by an irregular thickening and by the initiation of the adult axial sculpture. The spirals are entirely restricted on the earliest nuclear turns to the base of the body. The axials of the conch are narrow, but rounded upon their summits and inclined to be a little flexuous. The spiral sculpture is incised and except for the prosutural sulcus, is restricted entirely to the anterior and basal portions of the whorl. There is usually a single groove visible directly behind the suture line on the later volutions, while on the base of the body, exclusive of the fasciole, there are about half a dozen grooves, which grow increasingly wider and deeper anteriorly, the interchannels appearing as rather sharply elevated bands. The suture lines are impressed and finely undulated by the costae of the preceding turn. The aperture is rather wide, obliquely elliptical in outline, and acutely angulated posteriorly. The outer lip drops almost vertically from the commissure, is varicated a little behind the margin, thin and sharp at the margin, and obtusely angulated anteriorly. The lirations on the inner surface of the labrum are usually 7 or 8 and are more prominent and most widely separated medially. The inner margin of the aperture is strongly and symmetrically concave and heavily reinforced. The parietal wash is widely spread over a triangular area, the enamel being produced in a line with the suture, its outer margin vertical and parallel to the outer lip, thickest near the commissure and the canal and very thin at the apex of the angle. There is usually quite a prominent denticle on the labial wall directly in front of the commissure and other less prominent and irregular denticles disposed along the medial and anterior portions of the labium. The anterior canal is short and sharply recurved, and the margins at the entrance to it are closely approximated. The anterior fasciole is rather wide, cuneate, feebly arched, and coarsely lirated. Its sinuous extremity forms the inner arm of the broadly U-shaped siphonal notch.

Uzita berthae (Maury) is the largest member of the genus in the Oak Grove sand and the most closely sculptured axially. *U. waltonensis* from the Shoal River formation, though stouter and more narrowly tabulated posteriorly, is of comparable dimensions and approximates *U. berthae* also in the number of the axials. The costae of *U. berthae* are, however, more obtuse than those of *U. waltonensis* and less nodulated posteriorly.

The spiral sculpture, well-defined at least on the body, will also serve to isolate the Shoal River form. The two species further resemble each other in that both are conspicuous members of the group because of their relatively large size and abundance.

Uzita rabdota Gardner, from near Bainbridge, Ga., is more closely allied to *U. berthae* than any of the Florida species, but it is a little more slender, the whorls, especially the penultimate whorl, are more flattened laterally, the axials are only 15 or 16 to each of the later whorls and show no tendency to become irregular or obsolete toward the aperture, the posterior extremities of the axials are more obscurely nodulated, the posterior spiral is more feeble, and the spirals that gird the base are, as a rule, only 2 or 3 in number instead of 5 or 6.

Occurrence: Oak Grove sand localities, 2646°, 56°2', 5631', 5633°, 7054°; Aldrich collection, Johns Hopkins University; Cornell University collection.

Uzita rabdota Gardner, n. sp.

Plate LI, figure 34

Shell of moderate size for the genus, rather slender, acutely tapering. Apical region somewhat worn. Whorls approximately 8, 2 of which are included in the small, smooth protoconch. Initial turn of protoconch flattened and almost entirely immersed in the succeeding volution. Whorls of conch flattened laterally or feebly convex, narrowly tabulated posteriorly, increasing slowly in diameter. Body whorl well-rounded, abruptly constricted at the base. External surface closely and regularly fluted with narrow, sharply rounded axial costae, most of which are smooth and subequal in size and spacing, a few, however, varicose and irregularly spaced; 12 or 13 on the earliest postnuclear turn, increasing to 16 on the body, uniform in elevation between the sutures except at their slightly nodose posterior extremities. Spiral sculpture usually obsolete on the spire and the posterior and medial portions of the body. Base of the body girded with 2 or 3 flattened fillets, most elevated along their posterior margins. Anterior fasciole threaded with 4 rather coarse lirae. Suture lines distinct, impressed, finely undulated by the costae of the preceding volution. Aperture rather narrow, obliquely lenticular, acutely angulated posteriorly. Outer lip varicose, expanded medially, lirated along the inner margin. Labium quite strongly excavated at the base of the body, a heavy wash of callus spread in a broad, sharply defined arc over the parietal wall and pillar from the commissure to the anterior canal. Parietal wall and pillar denticulated near the outer margin of the wash. Anterior canal short and sharply recurved. Terminal notch narrow, rather shallow, and obliquely directed, the inner arm and base formed by the extram-

ity of the fasciole; the outer arm by the continuation of the posterior margin of the fasciole, which merges with the terminal varix.

Dimensions of holotype: Height, 11.1 millimeters; length of aperture, 5.0 millimeters; maximum diameter, 6.0 millimeters.

Holotype: U. S. Nat. Mus. No. 371830.

Type locality: No. 7148, Gastropod Gulch, 5½ miles southeast of Bainbridge, Ga.

Uzita rabdota is a very close analogue of *U. berthae* (Maury) of the Oak Grove fauna. *U. berthae* is a little stouter relatively than *U. rabdota*, and the axials are more numerous; varices are less commonly and less conspicuously developed on the spire of *U. berthae*, and the

axial sculpture is less regular on the body. The spiral sculpture is even more feeble in the species from Georgia than in that from Florida. The posterior spiral, which cuts off the nodular ends of the costals, is ill-defined or obsolete in *U. rabdota*, and the nodose corona is consequently less conspicuous. The spirals that gird the base of the body are usually 5 or 6 in *U. berthae* and 2 to 4 in *U. rabdota*, and the fine, sharp lirae that occur fortuitously but rather commonly in *U. berthae* have not been observed on any individual from Georgia.

Uzita rabdota is one of the most abundant species of the restricted fauna in which it occurs.

Occurrence: Oak Grove sand, localities 3336^a, 3385^c, 7148^c.

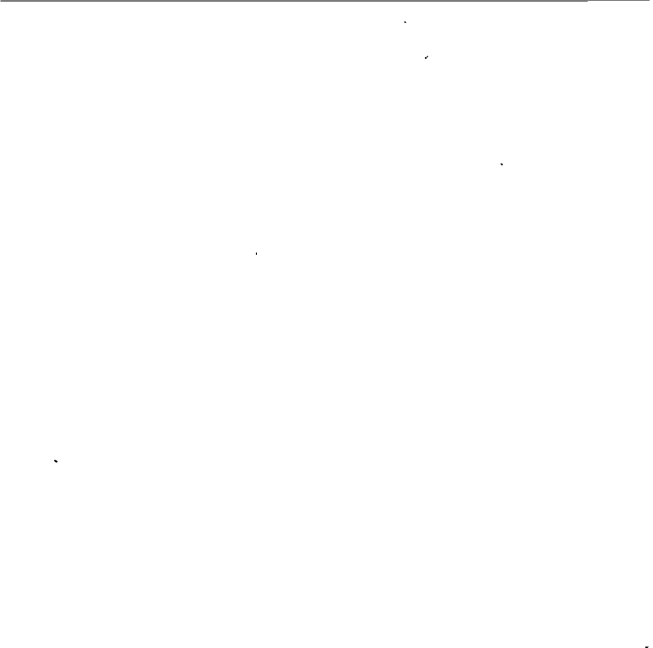
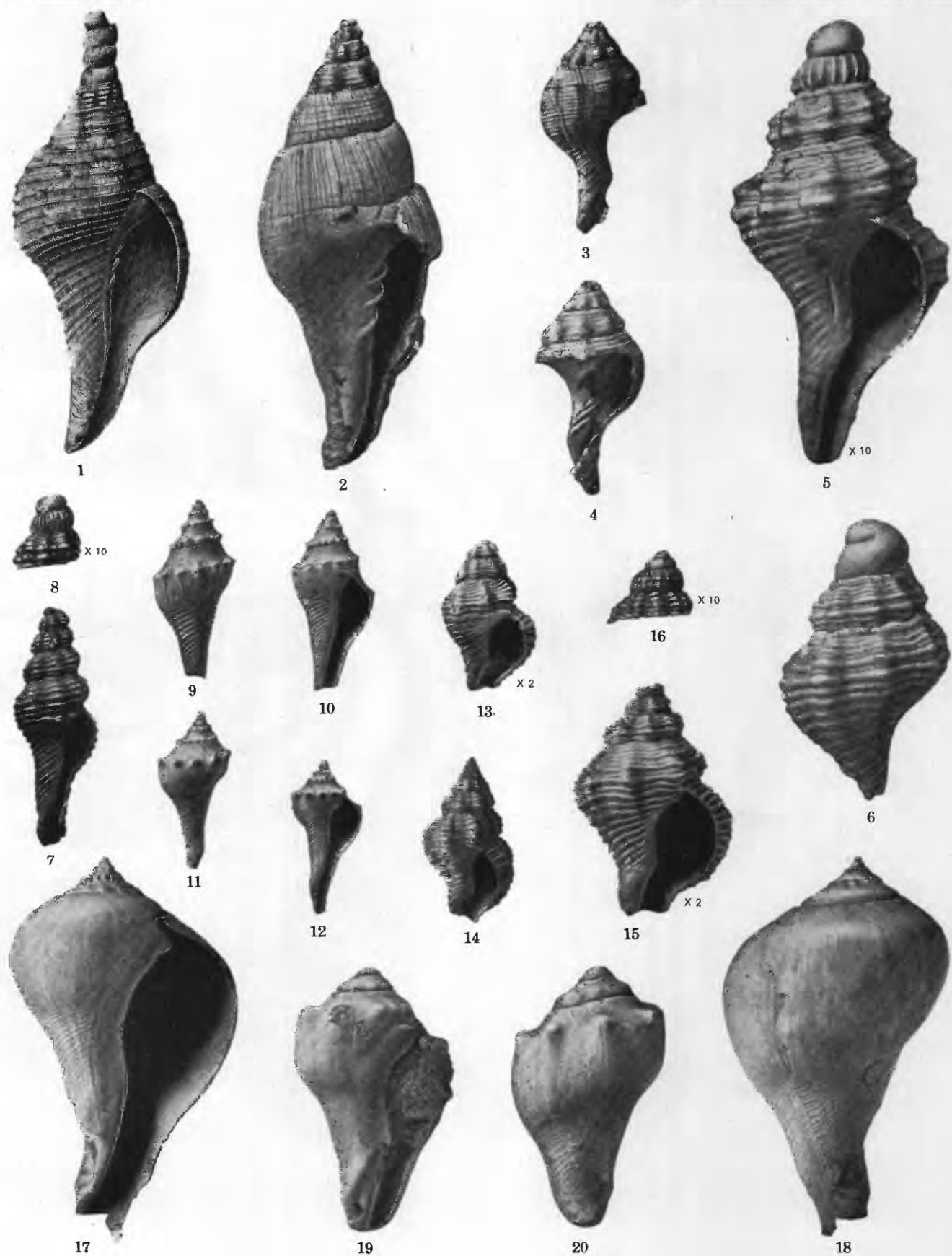
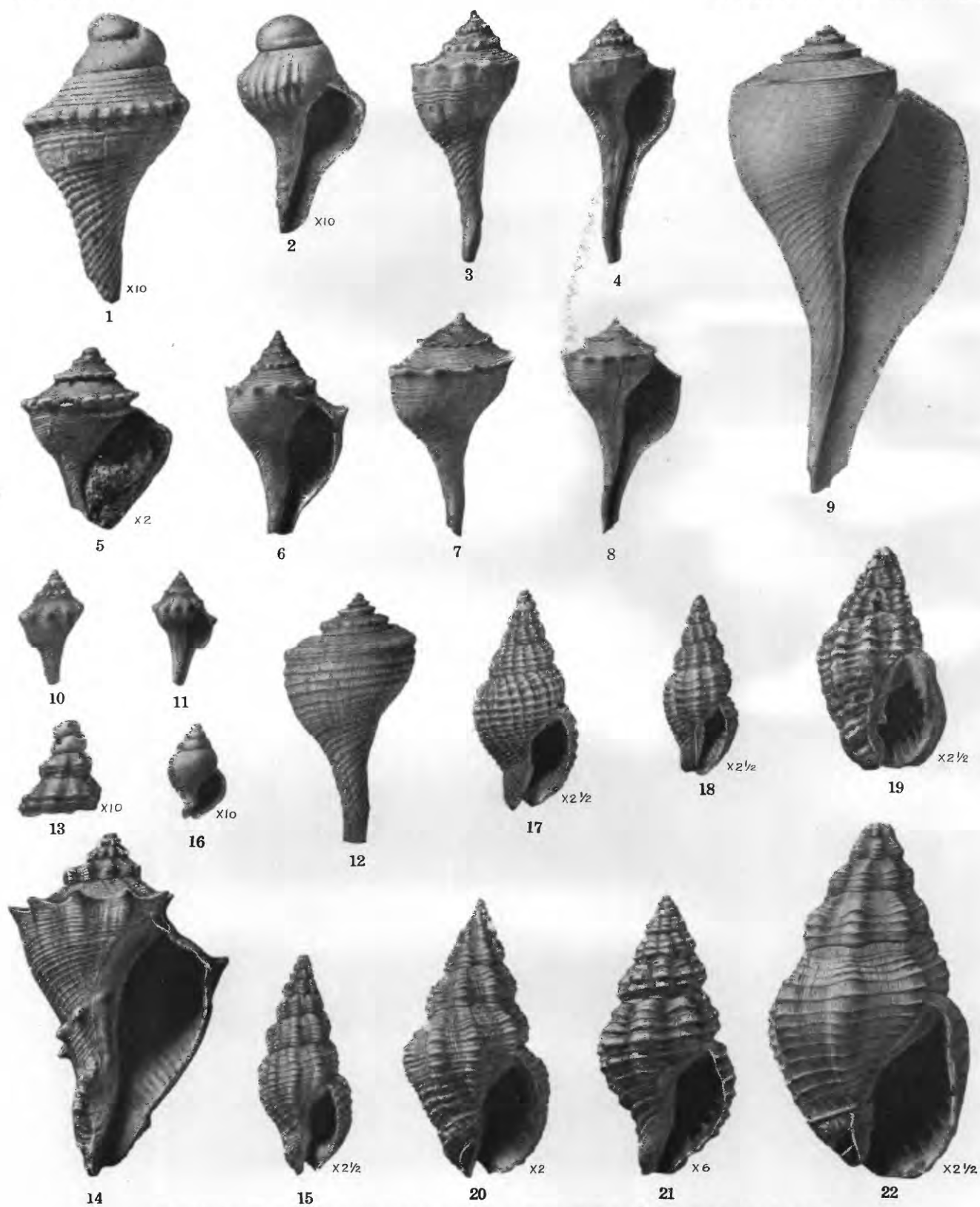


PLATE XLIX

- FIGURE 1. *Xancus chipolanus* (Dall) (p. 439). Apertural view of immature cotype; height, 45.0 millimeters. (After Dall.)
- FIGURE 2. *Xancus dodonaius* Gardner, n. sp. (p. 440). Apertural view of holotype; height, 90 millimeters.
- FIGURES 3, 4. *Mazzalina costata* Dall (p. 444).
3. Apertural view of holotype; height, about 43 millimeters.
4. Rear view of holotype.
- FIGURES 5, 6. *Fasciolaria kindlei* Maury (p. 443).
5. Apertural view of juvenile topotype; height, 8.6 millimeters.
6. Tip of second topotype, $\times 10$.
- FIGURES 7, 8. *Fusinus waltonensis* Gardner, n. sp. (p. 448).
7. Apertural view of imperfect holotype; height, 43.5 millimeters.
8. Tip of paratype, $\times 10$.
- FIGURES 9, 10. *Busycon atraktoides* Gardner, n. sp. (p. 450).
9. Rear view of imperfect holotype; height, 33 millimeters.
10. Apertural view of imperfect holotype.
- FIGURES 11, 12. *Busycon aldrichi* Gardner, n. sp. (p. 450).
11. Rear view of holotype; height, 27.8 millimeters.
12. Apertural view of holotype.
- FIGURE 13. *Hesperisternia bainbridgensis* Gardner, n. sp. (p. 447). Apertural view of imperfect and immature holotype; height 13.5 millimeters.
- FIGURE 14. *Hesperisternia chipolana* Gardner, n. sp. (p. 445). Apertural view of holotype; height, 15 millimeters.
- FIGURES 15, 16. *Hesperisternia waltonia* Gardner, n. sp. (p. 446).
15. Apertural view of imperfect holotype; height, 21 millimeters.
16. Tip of paratype, $\times 10$.
- FIGURES 17, 18. *Busycon radix* Gardner, n. sp. (p. 452).
17. Apertural view of imperfect holotype; height, 73 millimeters.
18. Rear view of holotype.
- FIGURES 19, 20. *Busycon foerstei* Gardner, n. sp. (p. 452).
19. Apertural view of holotype; height, 48.7 millimeters.
20. Rear view of holotype.



XANCIDAE, FASCIOLARIIDAE, FUSINIDAE, BUSYCONIDAE OF THE ALUM BLUFF GROUP



BUSYCONIDAE, MELONGENIDAE, BUCCINIDAE, NASSARIIDAE OF THE ALUM BLUFF GROUP.

PLATE L

FIGURES 1, 2. *Busycon montforti* Aldrich (p. 453).

1. Tip of topotype, $\times 10$.

2. Tip of another topotype, $\times 10$.

FIGURES 3, 4. *Busycon burnsi* (Dall) (p. 456).

3. Rear view of cotype; height, 44.3 millimeters.

4. Apertural view of cotype.

FIGURE 5. *Busycon (Sycotypus) proterum* Gardner, n. sp. (p. 457). Apertural view of holotype; height, 16.5 millimeters.

FIGURE 6. *Busycon epispiniger* Gardner, n. sp. (p. 454). Apertural view of imperfect holotype; height, 37 millimeters.

FIGURES 7, 8. *Busycon sicyoides* Gardner, n. sp. (p. 454).

7. Rear view of holotype; height, 40 millimeters.

8. Apertural view of holotype.

FIGURE 9. *Busycon (Sycotypus) pyrum* Dillwyn (p. 458). Recent specimen; height, 82.5 millimeters.

FIGURES 10, 11. *Busycon dasum* Gardner, n. sp. (p. 451).

10. Rear view of imperfect holotype; height, 20.5 millimeters.

11. Apertural view of imperfect holotype.

FIGURE 12. *Busycon (Sycotypus) aepynotum* (Dall) (p. 457). Rear view of holotype; height, 46.0 millimeters. (After Mansfield 1930, Florida State Geol. Survey Bull. 3, pl. 8, figs. 1, 6.)

FIGURES 13, 14. *Melongena sculpturata* Dall (p. 459).

13. Tip of topotype, $\times 10$.

14. Apertural view of holotype; height, 60.0 millimeters. (After Dall.)

FIGURES 15, 16. *Engoniophos glyptus* Gardner, n. sp. (p. 463).

15. Apertural view of holotype; height 16.0 millimeters.

16. Tip of paratype, $\times 10$.

FIGURE 17. *Tritiaria (Antillophos) dictyola* Gardner, n. sp. (p. 462). Apertural view of holotype; height, 15 millimeters.

FIGURE 18. *Engoniophos vadosus* Gardner, n. sp. (p. 464). Apertural view of holotype; height, 12.2 millimeters.

FIGURE 19. *Phos (Strongylocera) pedanus* Gardner, n. sp. (p. 461). Apertural view of holotype; height, 18 millimeters.

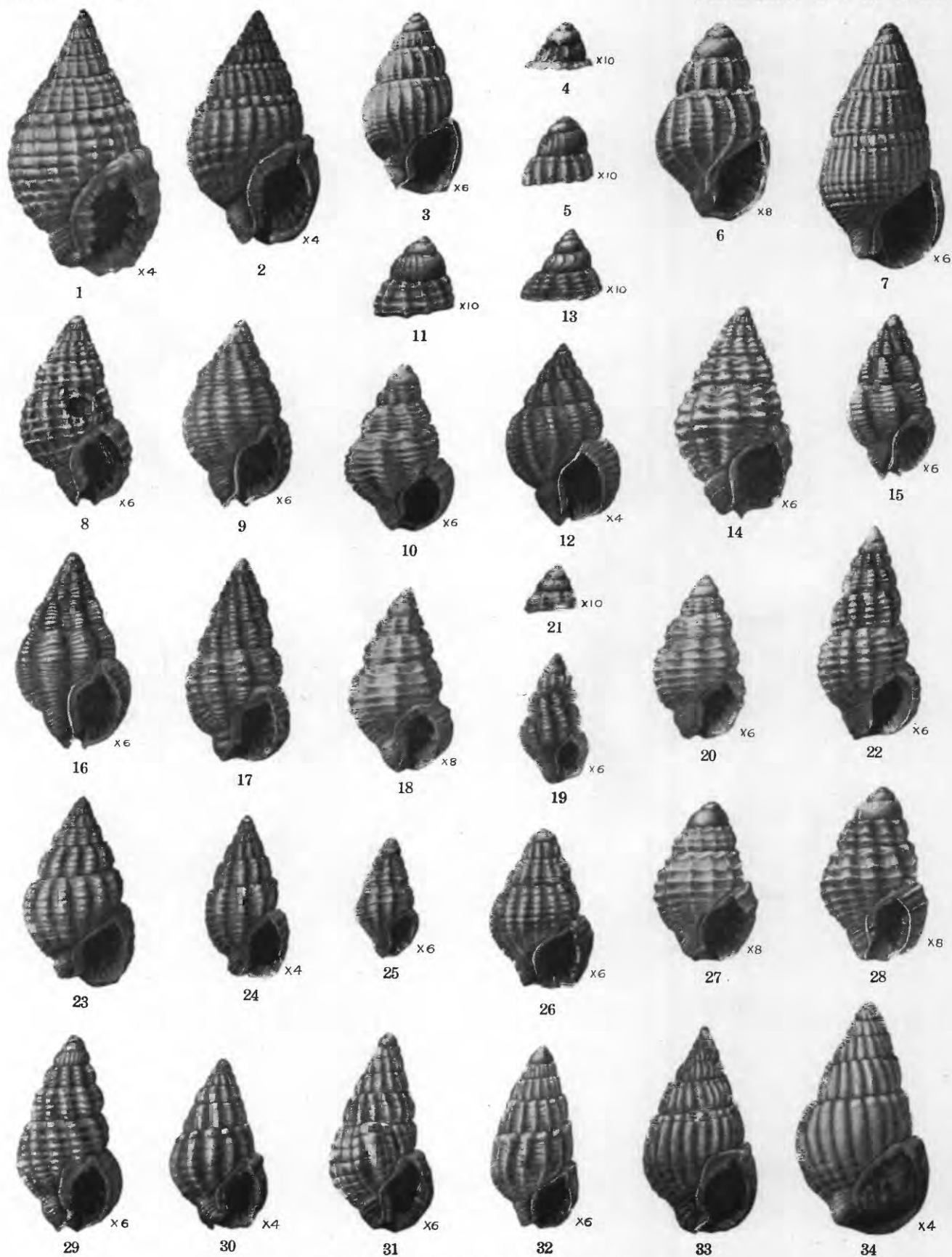
FIGURE 20. *Phos (Strongylocera) chipolanus* Dall (p. 460). Apertural view of holotype; height, 25.4 millimeters.

FIGURE 21. *Nassarina trachea* Gardner, n. sp. (p. 465). Apertural view of holotype; height, 8.3 millimeters.

FIGURE 22. *Phos (Strongylocera) tribakus* Gardner, n. sp. (p. 461). Apertural view of holotype; height, 24.5 millimeters.

PLATE LI

- FIGURE 1. *Uzita waltonensis* (Gardner) (p. 468). Apertural view of holotype; height, 12.7 millimeters.
- FIGURE 2. *Uzita waltonensis deleta* (Gardner) (p. 469). Apertural view of holotype; height, 11.4 millimeters.
- FIGURES 3, 4. *Uzita dystakta* (Gardner) (p. 469).
3. Apertural view of holotype; height, 7.5 millimeters.
4. Tip of smaller paratype, $\times 10$.
- FIGURE 5. *Uzita waltonensis* (Gardner) (p. 468). Tip of paratype, $\times 10$.
- FIGURE 6. *Uzita watsoni* (Maury) (p. 471). Apertural view of topotype; height, 4.3 millimeters.
- FIGURE 7. *Uzita dystakta* (Gardner) (p. 469). Apertural view of paratype; height, 5.3 millimeters.
- FIGURE 8. *Uzita cinclis* Gardner, n. sp. (p. 472). Apertural view of holotype; height, 6.0 millimeters.
- FIGURE 9. *Uzita dasynema* Gardner, n. sp. (p. 473). Apertural view of holotype; height, 6.1 millimeters.
- FIGURES 10, 11. *Uzita nanna* Gardner, n. sp. (p. 471).
10. Apertural view of holotype; height, 5.2 millimeters.
11. Tip of paratype, $\times 10$.
- FIGURES 12, 13. *Uzita pedana* Gardner, n. sp. (p. 470).
12. Apertural view of holotype; height, 8.7 millimeters.
13. Tip of paratype, $\times 10$.
- FIGURE 14. *Uzita dasynema cesta* Gardner, n. subsp. (p. 474). Apertural view of holotype; height, 6.6 millimeters.
- FIGURE 15. *Uzita cystoides* Gardner, n. sp. (p. 474). Apertural view of holotype; height, 5.0 millimeters.
- FIGURE 16. *Uzita anisonema* Gardner, n. sp. (p. 475). Apertural view of holotype; height, 6.2 millimeters.
- FIGURE 17. *Uzita ozia* Gardner, n. sp. (p. 475). Apertural view of holotype; height, 6.6 millimeters.
- FIGURE 18. *Uzita dryas* Gardner, n. sp. (p. 476). Apertural view of holotype; height, 4.3 millimeters.
- FIGURE 19. *Uzita dryas leptalea* Gardner, n. subsp. (p. 477). Apertural view of holotype; height, 4.1 millimeters.
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21. Tip of type, $\times 10$.
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- FIGURE 31. *Uzita opeas* Gardner, n. sp. (p. 484). Apertural view of holotype; height, 6.3 millimeters.
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