UNITED STATES DEPARTMENT OF THE INTERIOR

MOLLUSCA FROM THE MIOCENE AND LOWER PLIOCENE OF VIRGINIA AND NORTH CAROLINA

PART 2. SCAPHOPODA AND GASTROPODA

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BY
JULIA GARDNER

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MOLLUSCA FROM THE MIOCENE AND LOWER PLIOCENE OF VIRGINIA AND NORTH CAROLINA

PART 2. SCAPHOPODA AND GASTROPODA

By JULIA GARDNER

INTRODUCTION

Part 2 of the Systematic Report continues and concludes the study of the Mollusca from the Miocene and lower Pliocene of Virginia and North Carolina. One hundred and nineteen species, only a fraction of the known fauna, are reviewed and 66 additional species are described and figured. (See faunal chart, pp. 180–183.)

The report upon the gastropods suffers from the same shortcomings obvious in the work on the pelecypods. Most of the material is from old collections made before the importance of the exact placing of the fossil locality both areally and vertically was recognized. Many of the citations of outcrops are vague and the sections generalized. Detailed field studies, particularly on the zoning of the Yorktown formation in southern Virginia and northern North Carolina, were begun later by Wendell P. Mansfield, but he died in the summer of 1939 before the completion of the work.

SYSTEMATIC DESCRIPTIONS

Phylum MOLLUSCA

Class SCAPHOPODA

Family DENTALIIDAE

Genus DENTALIUM Linnaeus

1758. *Dentalium* Linnaeus, Systema naturae, ed. 10, p. 785.
1897. *Dentalium* Linnaeus. Pilsbry and Sharp, Manual of conchology, vol. 17, p. xxix.
1920. *Dentalium* Linnaeus. Henderson, U. S. Nat. Mus. Bull. 111, p. 8.

Type by subsequent designation (Schmidt, C. F., Versuch über die beste Einrichtung, etc., pp. 151, 178, 181, 1818): *Dentalium elephantinum* Linnaeus. Recent, off Amboyna and the Philippine Islands.

Subgenus ANTALIS H. and A. Adams

1854. *Antalis* H. and A. Adams, Genera of Recent Mollusca, vol. 1, p. 457.
1897. *Antalis* H. and A. Adams. Pilsbry and Sharp, Manual of conchology, vol. 17, p. 37.
1920. *Antalis* H. and A. Adams. Henderson, U. S. Nat. Mus. Bull. 111, p. 34.

Type by subsequent designation (Pilsbry and Sharp, idem, 1897): *Dentalium entalis* Linnaeus. Recent, in the North Atlantic and south to Spain.

Dentalium (Antalis?) waccamawense Gardner, n. sp.

Plate 24, figure 1

Shell rather small, thin, delicate, slender; an evenly rounded, gently arcuate tube, tapering gracefully to an acute apex. Extreme tip not preserved. Anterior extremity circular in cross section, slightly oblique. Apical region in adolescent shell closely fluted by 16 equisized and equispaced axial cords which begin to evanesce within the posterior third and become altogether obsolete on the anterior half of the shell. Incrementals strong; resting stages numerous and defined by the relatively feeble axial sculpture, thus lending to the tube an obscurely undulated aspect recalling that of *Dentalium armillatum* Toula, 1911, from the Gatun formation at Mount Hope, Canal Zone.

Dimensions of holotype: Length 32.5 mm. maximum diameter 3.6 mm.

Holotype: U.S.N.M. 325479.

Type locality: Robinsons Landing on the Cape Fear River, 50 miles above Wilmington, Bladen County, N. C. Waccamaw formation.

Dentalium (*Antalis?*) *waccamawense* is perhaps related to *D. carolinense* Conrad (pl. 24, figs. 3, 4). It is, however, a more slender and delicate shell than the Miocene form and more evenly arcuate in outline. The axial sculpture, furthermore, differs from that of *D. carolinense* in the closer spacing and the restriction of the elevated lirations to the anterior third of the adult shell. The apparent undulation of the shell by the growth stages is a character not shared by any other Tertiary shells of the middle Atlantic seaboard. *Dentalium* (*Antalis?*) *pliocenum* Tuomey and Holmes (pl. 24, fig. 2) is a smaller, more delicate shell than *D. waccamawense*, with a sculpture so fine that it might almost be referred to *Graptacme*.

Distribution: North Carolina: Waccamaw formation, Robinsons Landing, Cape Fear River, Bladen County.

Geologic range of species of

	Virginia					
	Miocene					
	St. Marys			Yorktown		
	Zone 1	Zone 2	Undifferentiated	Zone 1	Zone 2	Undifferentiated
Dentalium carolinense Conrad					X	
Diodora redimicula virgilina Gardner, n. subsp					X	
Diodora catilliformis (Rogers and Rogers) Pilsbry		X			X	
Calliostoma cheopsi Gardner, n. sp						
Calliostoma basicum Dall					X	
Calliostoma carolinense Gardner, n. sp						
Calliostoma virginicum gizehi Gardner, n. subsp					X	
Calliostoma conradi Gardner, n. sp					X	
Littorina irrorata (Say)					X	
Turritella pilsbryi Gardner				X		
Turritella alticostata Conrad					X	
Turritella etiwanensis (Tuomey and Holmes)						
Turritella plebeia carinata Gardner, n. subsp	X	X				X
Turritella (Torculoidella) duplinensis Gardner and Aldrich						
Turritella (Torcula) terstriata Rogers and Rogers				X		
Architectonica (Pseudotorinia) nupera (Conrad) Conrad					X	
Lemintina granifera (Say)		X			X	
Lemintina virginica (Conrad)		X				
Vermicularia spirata (Philippi)						
Caecum virginianum Meyer					X	
Caecum regulare Carpenter						
Caecum stevensoni Meyer					X	
Cerithiopsis (Laskeya) emersonii persubulata Gardner, n. subsp					X	
Triphora dupliniana (Olsson)					X	
Epitonium (Cinctiscala) antillarum (DeBoury)						
Epitonium (Pictoscala) pratti Gardner, n. sp					X	
Strombiformis dalli Gardner and Aldrich					X	
Strombiformis (Polygireulima) eborea (Conrad)					X	
Niso dalli Gardner, n. sp						
Sinum fragile (Conrad)					X	
Cypraea (Cypraeorbis) carolinensis Conrad						
Trivia pediculus (Linnaeus)						
Sconsia hodgii (Conrad)						
Ficus papyratia caloosahatchiensis (Smith)						
Murex (Phyllonotus) pomum Gmelin						
Eupleura caudata (Say)						X
Urosalpinx trossula (Conrad)					X	
Urosalpinx phrikna Gardner and Aldrich						
Urosalpinx stimpsoni Gardner, n. sp						
Urosalpinx suffolkensis Gardner, n. sp					X	
Mitrella lunata (Say)					X	
Anachis (Thiarinella) virgilina Gardner, n. sp	X					
Anachis (Costoanachis) avara caloosaensis Dall						
Ptychosalpinx altilis (Conrad) Gill					X	
Ptychosalpinx laqueata (Conrad) Conrad					X	
Ptychosalpinx multirugata (Conrad) Conrad				?	X	X
Ptychosalpinx tuomeyi (H. C. Lea)					X	X
Pisania (Celatoconus) nux Dall					X	
Ilyanassa irrorata (Conrad) Conrad						
Ilyanassa sexdentata (Conrad)						
Ilyanassa granifera (Conrad)					X	
Ilyanassa schizopyga Dall						
Ilyanassa johnsoni (Dall)					X	
Ilyanassa scalaspira (Conrad)					X	
Ilyanassa harpuloides (Conrad)					X	
Uzita smithiana (Olsson)					?	
Uzita neogenensis (Gardner and Aldrich)					X	
Uzita chowanensis Gardner, n. sp					X	

scaphopods and gastropods

North Carolina					Other occurrences
Miocene				Pliocene	
Yorktown			Duplin	Croatan and Waccamaw	
Zone 1	Zone 2	Undifferentiated			
	X				Duplin marl of South Carolina; *Ecphora* and *Cancellaria* zones of Choctawhatchee formation of Florida.
	X				
	X				
	X				
	X				
	X				
	X		X	X	Choptank of Maryland; Waccamaw of South Carolina; "Nashua marl" of Florida; Pleistocene of South Carolina and Florida; Recent from Vineyard Sound to Jamaica.
	X				
			X		Duplin marl of South Carolina; *Cancellaria* zone of Choctawhatchee of Florida.
			X	X	Duplin marl of South Carolina and Georgia; *Cancellaria* zone of Choctawhatchee of Florida.
			X		
	X		X	X	Tampa limestone of Florida; Calvert formation of New Jersey; Calvert, Choptank and St. Marys of Maryland; Oak Grove sand of Florida; *Ecphora* and possibly the *Cancellaria* zone of Choctawhatchee of Florida.
					Calvert of Maryland; Choptank? and St. Marys? of Maryland.
			X	X	*Cancellaria* zone of Choctawhatchee of Florida; Caloosahatchee of Florida; Miocene and Pliocene of West Indies; Recent from New England to Bahia, Brazil.
	X				
	?			X	*Cancellaria* zone of Choctawhatchee of Florida; Caloosahatchee of Florida; Recent in the Antilles.
	X		X		
			X	X	Caloosahatchee of Florida; Pleistocene of South Carolina; Recent from the Carolinas to the Antilles in shallow water?
			X		
X	X				Waccamaw of South Carolina; Caloosahatchee of Florida; Recent from Cape Hatteras to Anguilla Island.
	X		X	X	
			X		Duplin of South Carolina and Caloosahatchee of Florida.
	X				Calvert and St. Marys formations of Maryland.
				X	
					Calvert, Choptank, and St. Marys formations of Maryland.
	X		X		Duplin of South Carolina; *Cancellaria* zone of Choctawhatchee of Florida.
				X	Caloosahatchee of Florida; Miocene of Bowden, Jamaica, and Pliocene of Costa Rica; Recent from St. Augustine, Fla., to Brazil and east to Bermuda.
			X		Duplin of South Carolina; *Ecphora*? and *Cancellaria* zones of Choctawhatchee of Florida.
				X	Caloosahatchee of Florida.
				X	*Cancellaria* zone of Choctawhatchee of Florida; Caloosahatchee of Florida; Miocene of Bowden, Jamaica, and of Colombia (Pilsbry and Brown); Recent from Beaufort, N. C. to Venezuela.
	X			X	Waccamaw of South Carolina; Caloosahatchee of Florida; Pleistocene from Massachusetts to Florida; Recent from Cape Cod to the West Indies and east to Bermuda.
	X		X	X	*Cancellaria* zone of the Choctawhatchee of Florida?; Caloosahatchee of Florida.
		X	X		Duplin of South Carolina.
	X		X	X	
	X		X		
	X		X	X	Duplin of South Carolina; Pliocene of the Carolinas and Florida; Pleistocene from New England to Florida; Recent from Cape Ann to Brazil.
		X			
				X	Caloosahatchee marl of Florida.
	X				
	?				Duplin of Sumter County, S. C.; *Ecphora* zone of Choctawhatchee of Florida.
	X	X	X		
	X	X	?		
	X		X	X	Duplin marl of Sumter County, S. C.
			X	X	Waccamaw formation of S. C.
	X		X	X	
	X		X		Duplin marl of Sumter County, S. C.; "Nashua marl" of Putnam County, Fla.
			X	X	
	X		X	X	Duplin marl of Sumter County, S. C.
			X	X	Duplin marl of Sumter County, S. C.; "Nashua marl" of Putnam County, Fla.
	X		X		
			X		
	X		X	X	Duplin of Sumter County, S. C.
	X		X		

Geologic range of species of

	Virginia					
	Miocene					
	St. Marys			Yorktown		
	Zone 1	Zone 2	Undifferentiated	Zone 1	Zone 2	Undifferentiated
Uzita consensoides (Olsson)						
Uzita caloosaensis cornelliana (Olsson)						
Fasciolaria sparrowi Emmons						
Fusinus burnsii (Dall)					X	
Fusinus rappahannockensis Gardner, n. sp	X					
Oliva eborea (Conrad)	X	X				
Aurinia obtusa (Emmons)					X	X
Marginella (Bullata) antiqua Redfield					X	
Cypraeolina lachrimula (Gould)					X	
Clavatula cornelliana (Olsson)					X	
"Drillia" emmonsi Olsson					X	
"Drillia" pyrenoides (Conrad)					X	
"Drillia" polygonalis Dall ms., n. sp						
Kurtziella eritima (Bush)					X	
Terebra (Strioterebrum) carolinensis (Conrad)					X	
Terebra (Strioterebrum) neglecta (Emmons)					X	

Class GASTROPODA

Order ASPIDOBRANCHIA

Suborder RHIPIDOGLOSSA

Superfamily ZEUGOBRANCHIA

Family FISSURELLIDAE

Genus DIODORA Gray

1821. *Diodora* Gray, London Medical Repository, Monthly Jour. and Rev., vol. 15, p. 233.

1915. *Diodora* Gray. Iredale, Malacol. Soc. London Proc., vol. 11, p. 331.

Type by monotypy: *Patella apertura Montagu=Patella graeca* Linnaeus, *juvenis*. (Fide Iredale.) Recent, off the coast of southern England and the Channel Islands and, according to some authors, south into the Mediterranean and Adriatic Seas.

Diodora redimicula virgilina Gardner, n. subsp.

Plate 24, figures 23, 24

Shell of moderate dimensions for the genus; moderately elevated. Ovate in basal outline, the sides raised a little; shorter and more narrow in front of the foramen than behind it. Anterior and lateral slopes approximately uniform. Posterior slope slightly convex. Surface sculptured with radiating threads, 15 or 20 to the centimeter, usually subequal, though every fourth or fifth thread is commonly a little stronger; new radials introduced by intercalation; interspaces linear. Incremental sculpture manifested in the minute imbrication of the radials; 2 to 4 marked resting stages usually present. Foramen not very large, roundish, set in a plane gently inclined to the horizontal axis. Interior foraminal callus ellipsoidal, more or less truncated and indented behind. Pallial line distinct, rather distant from the margin. Inner margins minutely crenate.

Dimensions of holotype: Height 13.7 mm., length 32.6 mm., width 25.3 mm.

Holotype: U.S.N.M. 325477.

Type locality: Six miles below Greenville, Pitt County, N. C. Yorktown formation.

Diodora redimicula virgilina partially bridges the gap between *Diodora redimicula* (Say) from the Yorktown formation and *Diodora catilliformis* (Rogers and Rogers) Pilsbry (pl. 24, figs. 10, 19) from zone 2 of the St. Marys formation and zone 2 of the Yorktown formation. It is relatively lower and larger than Say's species, and while it exhibits a variation in sculpture comparable to that of *D. redimicula* and its subspecies *alticosta*, the disparity in the radials is never so great as that in the subspecies nor the concentric imbrications so pronounced. On the other hand, the sculpture in the new species never exhibits that peculiarly smooth and flattened aspect which characterizes the Rogers form.

Diodora redimicula virgilina is recorded in the Yorktown formation of southern Virginia and North Carolina. It is a guide fossil of zone 2.

Distribution: Virginia: Yorktown formation, Yorktown, York County; Petersburg, Dinwiddie County; 2 miles northwest of Smithfield and at Benns Church, Isle of Wight County; 1 mile northeast of Suffolk and half a mile below the Suffolk waterworks dam, Nansemond County.

North Carolina: Yorktown formation, 3 miles south of Farmville, 6 miles below Greenville, 6¾ miles below Greenville at Taft's Landing, and 9 to 10 miles south of Greenville, Pitt County; 1 mile north of Castoria, half a mile east of Lizzie on the property of Mr. T. N. Lassiter, 4 miles east of Lizzie in

scaphopods and gastropods—Continued

North Carolina					Other occurrences
Miocene				Pliocene	
Yorktown			Duplin	Croatan and Waccamaw	
Zone 1	Zone 2	Undifferentiated			
------	X	--------	X	?	
------	------	--------	X	X	Waccamaw of Horry County, S. C.; *Cancellaria* zone of Choctawhatchee of Florida.
------	------	--------	X	X	*Ecphora* zone of Choctawhatchee of Florida.
------	X	--------	------	--------	
------	------	--------	------	--------	
------	------	--------	------	--------	
------	X	X	X	X	Calvert and St. Marys formations of Maryland; Waccamaw of South Carolina.
------	X	--------	X	--------	Duplin marl of Sumter County, S. C.
------	X	--------	X	--------	Caloosahatchee marl of Florida; Recent from Hatteras to Florida Straits.
------	X	--------	X	X	
------	------	--------	X	X	Miocene, the Duplin marl, 5 miles southeast of Mayesville, Sumter County, S. C. *Ecphora* and *Cancellaria* zones of the Choctawhatchee formation of Florida; Pliocene, Waccamaw formation, S. C.
------	X	--------	------	--------	
------	------	--------	X	--------	Duplin marl of Sumter County, S. C.
------	X	--------	X	X	Duplin marl of Sumter County, S. C.; Waccamaw formation of S. C.; Caloosahatchee marl of Fla.; Recent from Hatteras to Yucatan and the West Indies in less than 50 fathoms.
------	X	--------	X	--------	Duplin marl of Sumter County, S. C.
------	------	--------	X	--------	Duplin marl of Sumter County, S. C.

Dog Swamp on the property of Mr. O. W. Frizelle, and 8 to 9 miles southeast of Lizzie, Greene County.

Diodora carolinensis (Conrad)

Plate 24, figures 14, 18

1875. *Fissurella carolinensis* Conrad in Kerr, North Carolina Geol. Survey Rept., app. A, p. 22 pl. 4, fig. 1.

1892 (January). *Fissuridea carolinensis* Conrad. Pilsbry and Johnson, Nautilus, vol. 5, p. 106.

1892 (December). *Fissuridea carolinensis* Conrad. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 425 (part, figure excluded).

Shell suboval, sides compressed, 39 very prominent flat-sided ribs, rugose-crenulated. Fissure oblong narrow.—Conrad, 1875.

Shell but little elevated. Basal outline elongate-ovate, raised slightly anteromedially. Posterior slope decidedly more produced and consequently more gentle than the anterior. Shell compressed and slightly contracted laterally. Sculpture of 38 equal, strongly elevated, angular radials; summits of radials uniformly flat; interradials squarely channelled, and approximately equal in width to the radials; both costals and intercostals regularly corrugated by the incremental sculpture. Foramen decidedly anterior; shaped like a keyhole. Inner callus with the outline of a miniature Gothic window; depression deep behind the truncated posterior margin. Muscle impressions obscure. Inner rim strongly denticulated in harmony with the radials.

Dimensions of figured specimen: Height 7.3 mm.; length 20.0 mm., maximum width 12.5 mm.

Figured specimen: U.S.N.M. 325478.

Type locality: Not given. Locality of figured specimen: Rock Landing on the Neuse River, 16½ miles above New Bern, Craven County, N. C. Yorktown formation.

The specimen from the Caloosahatchee marl figured by Dall (see synonymy above) is distinct from the upper Miocene species and I propose for it the name *Diodora floridana*. The Pliocene form attains a length of more than 50 millimeters; primary radials number only about 20 but secondaries are intercalated in forms so young that the embryonic whorls are still retained, and, on the larger individuals, tertiaries are introduced. So far as the Museum records go, the species figured by Dall is restricted to the Caloosahatchee marl of Florida, while *D. carolinensis* is confined to the Yorktown formation, the Duplin marl, and possibly the Waccamaw formation of North Carolina.

Distribution: North Carolina: Yorktown formation, Rock Landing, Craven County. Duplin marl, Natural Well, Duplin County. Duplin marl or Waccamaw formation, Cape Fear River (Pilsbry and Johnson, 1892).

Superfamily TROCHACEA

Family TROCHIDAE

Subfamily CALLIOSTOMATINAE

Genus CALLIOSTOMA Swainson

1840. *Calliostoma* Swainson, Treatise on malacology, pp. 218, 219, 351.

Type by subsequent designation (Herrmannsen, Indicis generum malacozoorum, primordia, vol. 1, p. 154, 1846); *Trochus conulus* Linnaeus. Recent, in the Mediterranean Sea.

Calliostoma cheopsi Gardner, n. sp.

Plate 26, figures 20, 21

Outline regular, closely approximating that of an equilateral triangle. Volutions flat sided, six, including possibly the entire conch, separated by distinct

but inconspicuous sutures. Nuclear whorls wanting. Each of remaining turns sculptured with 4 approximately equisized and equispaced spirals, very low, broad, and straplike, mounted with close-set, squarish tubercles, about 2 to each linear millimeter on the body whorl; the foundation bands on the earlier whorls almost or altogether obsolete, the tubercles sharper and more rounded, thus lending a beaded aspect to the sculpture of the posterior portion of the shell; a simple secondary introduced on the penultima at the medial line of the whorl, midway between the second and third primaries, later becoming wavy and inconspicuously beaded. Peripheral keel angular but not sharp, outlined by a broad, simple, spiral band. Base flattened, sculptured by strong, slightly rounded spirals varying somewhat in width and spacing, tending to become stronger and more distant in the umbilical region; interspaces sculptured with radiating incrementals. Aperture badly broken, probably angular, broader than it is high. Pillar smooth, concave, strengthened by the reflected callus. Umbilicus imperforate.

The species, though described from a unique type, is sharply separated from all other forms of this area by the monotonous pyramidal outline, unbroken by any angularities or convexities of the whorls and by the 4 rather than 3 primary spirals upon the adolescents and the squarish tubercles which adorn the adult spirals. Among the Recent species, its nearest kin is perhaps *Calliostoma apicinum* Dall of the West Indian fauna, a slightly smaller, more elevated conch with a much finer, sharper sculpturing.

Dimensions of holotype: Height 11.1 mm., maximum diameter 10.0 mm.

Holotype: U.S.N.M. 325470.

Type locality: Eight to 9 miles southeast of Greenville, Pitt County, N. C. Yorktown formation, zone 2.

In the *Calliostoma philanthropum* group, including the subspecies *pontoni* Mansfield (pl. 26, fig. 15) and *C. basicum* Dall (pl. 26, fig. 11), a guide fossil of zone 2 of the Yorktown formation in Virginia and North Carolina, *C. mitchelli* (Conrad) (pl. 26, figs. 19, 23), and *C. ruffinii* (H. C. Lea) (pl. 26, fig. 18), the posterior suture is overhung by the beaded peripheral keel of the preceding whorl. The group is further removed from *C. cheopsi* by the 3 primary spirals on the early whorls and by the sharp well-rounded beads of the adult ornamentation.

Distribution: Yorktown formation, 8 to 9 miles southeast of Greenville, Pitt County, N. C.

Calliostoma carolinense Gardner, n. sp.

Plate 26, figures 3, 4

Shell heavy, moderately low; the regularity of the pyramidal outline broken by the strong spiral cording. Whorls narrowly tabulated, 6 in number, including the protoconch, which is very small, probably of not more than one turn, and, in its decorticated condition, not readily differentiated from the conch. Initial sculpture on the conch of 3 spiral lirae, equal in size and spacing; a fourth spiral introduced on the next to the last whorl of the spire between the posterior and medial lirae, increasing somewhat in strength and persistent but not attaining the prominence of the original primaries; no other lirae intercalated: on adult whorls original posterior primary outlining the shoulder; the anterior, together with the stronger outer basal spiral, forming the double peripheral keel; and the medial of the 3 original spirals, together with a fourth, symmetrically disposed between the peripheral and shoulder spirals. Base flattened, heavily sculptured with 4 additional broad straplike cords extending far within the aperture, separated by interspaces of approximately their own width; umbilical keel outlined by a similar spiral. Incremental sculpture microscopically fine. Suture distinct but not conspicuous, following the anterior of the peripheral cords, which is commonly partially visible as a thin, sharp thread directly behind the suture.

Aperture transversely ovate. Outer margin imperfect, crenulated by the strong spirals. Parietal wall thinly glazed. Columellar margin concave, simple, reflected. Umbilical region excavated but not perforate.

Dimensions of holotype: Height 9.8 mm., maximum diameter 11.2 mm.

Holotype: U.S.N.M. 325472.

Type locality: Hamilton Bluff on the Roanoke River, Martin County, N. C. Yorktown formation, zone 2.

Calliostoma carolinense is characterized by the prominence of the primaries and the reduced number of the secondaries. It is, apparently, an end member of the *C. virginicum* group.

Calliostoma harrisianum Olsson, 1916, seems from the description and the rather poor illustration to be intermediate between *C. carolinense* and *C. virginicum* s. s. In *C. carolinense* the regularity of the profile is broken by the heavy spirals, but the profile of *C. harrisianum* more closely resembles that of *C. virginicum*. The number of spirals is more reduced in *C. carolinense* than it is in either of the two species from Virginia and, with the possible exception of the peripheral spirals, they seem to be stronger than those of *C. harrisianum*.

The North Atlantic species *Calliostoma occidentale* Mighels and Adams, 1842, is similar in general aspect, but the 3 primary spirals are beaded on the juvenile shells, and the sculpture on the base of the adult is irregular and tends to become obsolete except toward the periphery and the umbilical area.

Distribution: Yorktown formation, Hamilton Bluff on the Roanoke River, Martin County, N. C.

Calliostoma virginicum (Conrad)

Plate 26, figure 12

1875. *Zizyphinus virginicus* Conrad, North Carolina Geol. Survey Rept., vol. 1, app. A, p. 22, pl. 4, fig. 4.

Type locality: Suffolk, Va.

Calliostoma virginicum gizehi Gardner, n. subsp.

Plate 26, figures 16, 17

Shell moderately low, pyramidal. Whorls trapezoidal, regularly increasing in size, 5 to 6 in number. Protoconch decorticated, minute, probably of not much more than 1 volution. Initial sculpture of 3 equal and equidistant spirals, the anterior and posterior of which gradually become more prominent relatively and absolutely; intercalaries introduced on early whorls. Sculpture when fully developed, consisting of a single broad, simple, moderately elevated cord in front of the posterior suture, a similarly broad and elevated cord directly behind the anterior suture and, on the intermediate area, 4 to 8 fine, sharp lirae tending to alternate in size when numerous; 2 simple and moderately strong cords girdling the periphery and a fine, sharp threadlet intercalated between them. Suture line distinct but inconspicuous, following the anterior spiral of the double keel but rarely completely covering it, so that the carina is partially visible as a fine, sharp thread directly behind the suture. Base flattened, sculptured with 9 to 11 simple lirae, those nearer the axis the broader and the more irregular in size and spacing. Aperture somewhat broken, rudely rhomboidal; outer margin imperfect but obviously angulated at the periphery. Inner margin concave, reflected. Umbilical region slightly excavated but imperforate.

Dimensions of holotype: Height, 9.2 mm.; maximum diameter, 10.5 mm.

Holotype: U.S.N.M. 325467.

Type locality: Yorktown, Va. Yorktown formation, zone 2.

Calliostoma virginicum gizehi exhibits a tendency toward an increase in the number of lirations accompanied by a corresponding decrease in their prominence. The subspecies, though distinct from *C. virginicum* in general aspect, is merely the result of a relative and an absolute increase in the strength of the sculpture between the anterior and posterior carinae and a relative and absolute decrease in the strength of the spirals delimiting the carinae. In some individuals, indeed, the spiral outlining the posterior keel is reduced until it is scarcely more prominent than the lira in front of it. In *C. labrosum* (Conrad) (pl. 26, fig. 10), a low and broadly biconic member of the same group, the general sculpture plan is constant, but the sculpture is greatly subdued.

Distribution: Yorktown formation, Yorktown, York County, Va.

Calliostoma hertfordense Gardner, n. sp.

Plate 26, figures 13, 14

Shell depressed, pyramidal, terminating obtusely. Volutions 5. Protoconch not well differentiated, very small, of probably not more than 1 coil, smooth, immersed in the succeeding turn. Earliest whorls of conch ornamented with 3 strong spirals. Posterior spiral increasing in prominence with the establishment of the later sculpture, becoming wavy and finally beaded, and outlining the narrow shoulder. Anterior of the 3 spirals increasing similarly in strength, gradually assuming a beaded character, and delimiting the anterior peripheral keel. Median spiral flattening; 2 low intercalaries introduced on the spire, 3 on the body whorl. A single, rather prominent, rounded thread revolving midway between the anterior keel and the anterior suture line on all but the earliest whorls. Suture not very distinct, separated from the posterior carina of the succeeding whorl by a shallow but well-defined channel. Peripheral keel obtuse, outlined by a rather strong, simple spiral; a second spiral, similar in strength and character, placed midway between it and the anterior beaded spiral. Base flattened, sculptured with about 9 rather feeble and irregular spirals; the 2 or 3 spirals in the umbilical region the strongest and separated by the widest interspaces; remaining lirae tending to fuse near the inner lip but becoming more distinct toward the labrum. Incrementals well developed on the body whorl both behind the periphery and on the base. Aperture subquadrate. Pillar slightly excavated, heavily calloused. Umbilical pit small, possibly pathologic.

Dimensions of holotype: Height 7.3 mm., maximum diameter 8.8 mm.

Holotype: U.S.N.M. 325469.

Type locality: One and one-half miles above Murfreesboro, Hertford County, N. C. Yorktown formation.

The diagnostic features of the species are the low, turbinate outline, the sutural channel separating the whorls, and the characteristic sculpture of 2 not very prominent, beaded spirals—the one posterior, the other anterior—and 3 or 4 low, subequal intermediate lirae.

The early whorls and the general sculpture plan of the adult are similar in *C. hertfordense* and in *C. virginicum* (Conrad). *Calliostoma virginicum* is the larger shell and, relatively as well as absolutely, higher; the channelling between the sutures is deeper than in *C. hertfordense*, and all the spirals are simple. The small umbilical perforation in the North Carolina species may be the result of the injury recorded by the scar. *C. virginicum* is imperforate. *C. virginicum gizehi* is more closely comparable, but in the subspecies, also, the spirals are simple and the apical angle smaller.

The type is unique.

Calliostoma nottowayense Gardner, n. sp.

Plate 26, figures 1, 2

Shell low, rudely pyramidal, tapering to an acute apex. Whorls probably 6, broadly rounded. Protoconch minute but so badly decorticated that an exact determination of its characters is impossible. Surface sculpture very flat on the early whorls, finer and sharper on the body. Lirations low, 11 to 12 on the final whorl of the spire, separated by linear interspaces; lira directly in front of the suture less feeble than those anterior to it. Incrementals for the most part microscopic, parallel to the outer lip, and obliquely intersecting the spirals. Suture line distinct, the whorls closely wound. Periphery of body obtusely angulated. Base flattened, feebly sculptured by some 18 to 20 lirations, least feeble in the umbilical region; microscopically fine and linearly spaced toward the periphery. Aperture transversely elliptical. Outer lip sharp, strongly arcuate. Parietal wall thinly veiled with enamel. Columella concave, simple, thickened, and reflected. Umbilicus depressed but not perforate.

Dimensions of holotype: Height 9.3 mm., maximum diameter 11.1 mm.

Holotype: U.S.N.M. 325466.

Type locality: Sycamore, on the Nottoway River, Southampton County, Va. Yorktown formation.

Calliostoma nottowayense is closely related to the Yorktown species *Calliostoma harrisii* Dall (pl. 26, fig. 22). However, because of the convexity of the whorls, the slope of the spire is less uniform, the spiral sculpture less crowded, and the liration directly in front of the suture is not emphasized. *Callistoma nottowayense* is known only from the type locality.

Section LEIOTROCHUS Conrad

1862. *Leiotrochus* Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 288.

Type by monotypy: *Leiotrochus distans* Conrad. Miocene, of Maryland (St. Marys formation).

Shell perforate in normal adults.

Calliostoma conradi Gardner, n. sp.

Plate 26, figures 5, 9

1902. *Calliostoma* (*Eutrochus*) *distans* Conrad. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 402 (part). [Not *Leiotrochus distans* Conrad, 1862.]

Shell perforate, low, trochiform; contour of spire somewhat irregular. Volutions 6, feebly convex, flattened slightly in front of the suture; the final whorl rounded to obtusely angulated at the periphery. Surface sculptured with submicroscopically fine lirations, 15 to 20 on the sides of the later whorls and 20 or more on the base, the lirae tending to be finest and most crowded on the periphery and least fine in front of the suture and particularly in the umbilical area. Suture distinct, slightly impressed, tending to drop a little below the periphery of the preceding whorl. Base flattened, spirally sculptured, the lirae becoming increasingly fine and crowded toward the periphery. Aperture transversely ovate. Outer lip thin, sharp, strongly arcuate. Columellar lip simple, concave, reflexed. Umbilicus small, funicular, persistent almost to the apex.

Dimensions of holotype: Height 9.8 mm., diameter 11.9 mm.

Holotype: U.S.N.M. 325468.

Type locality: Yorktown, Va. Yorktown formation.

Calliostoma conradi has been confused in the collections with the St. Marys species *C. distans* Conrad, a somewhat larger, more elevated shell with less gently and more uniformly sloping sides. The sculpturing of the two forms is distinct; that of *C. distans* is restricted to some half a dozen sharp striations with relatively distant spacing and fortuitous secondaries intercalated in the interspaces; that of *C. conradi* consists of numerous crowded lirae subequal in size and spacing though tending to be least fine and most crowded toward the periphery of the whorl.

Calliostoma humile Conrad is a larger, relatively lower, more uniformly sloping cone, with impressed sutures. The sculpture is equally fine but tends to be least inconspicuous toward the anterior suture line.

Closely related to *C. conradi* is *C. armillatum* (Tuomey and Holmes) (pl. 26, fig. 6), described from the Waccamaw formation of South Carolina and recognized in the Waccamaw and also in the Duplin of North Carolina. The later and more southern species resembles *C. humile* in outline and differs both from *C. conradi* and from *C. humile* in the obscure beading of the posterior spiral, in the flatter, more evenly though faintly sculptured base, and in the beading of the umbilical margin. *C. armillatum* has been most commonly compared to *C. cyclum* Dall (pl. 26, figs. 7, 8), from the Yorktown formation and Duplin marl of North Carolina, which it resembles in no detail except possibly the relatively large size of the umbilicus. The low regular biconic outline of *C. cyclum* and the strong, bicarinate periphery will serve to isolate that small shell.

Distribution: Virginia: Yorktown formation, Yorktown, York County; Benns Church, Isle of Wight County; Sycamore on the Nottoway River, Southampton County; 1 mile northeast of Suffolk, Nansemond County.

North Carolina: Yorktown formation, 1½ miles above Murfreesboro, Hertford County; 15½ miles above Bells Bridge on the Tar River, Edgecombe County.

Subfamily GIBBULINAE

Genus GIBBULA Risso

1826. *Gibbula* Risso, Histoire naturelle des principales productions de l'Europe Méridionale, vol. 4, p. 134.

Type by subsequent designation (Herrmannsen, Indicis generum malacozoorum, primordia, vol. 1, p. 473, April 1847):

Trochus magus Linnaeus. Recent, from the Shetland Islands to the Azores and the Mediterranean.

Gibbula americana yorktownensis Gardner, n. subsp.

Plate 24, figure 20; plate 28, figure 30

Shell small, turbinate, the 4 component volutions regularly but rapidly increasing in size. Adolescent whorls broadly tabulated; later whorls of adult evenly rounded. Protoconch of 1¼ turns, the initial quarter turn immersed, the succeeding volution rather strongly inflated, flattening, however, toward the cicatrix which forms the dividing line between the conch and protoconch. Sculpture developed very slowly, exceedingly faint and meager on the first whorl of the conch; penultima with 3 or 4 elevated spiral lirations with finer secondaries intercalated midway between the primaries; final whorl closely threaded, the peripheral spiral more prominent than those in front of it on the rostrate young but decreasing in relative prominence on the well-rounded body of the adult. Basal primaries sharply elevated, 7 to 9 in number, with regularly intercalated secondaries. Incremental sculpture very strong, forming a very fine and regular oblique retractive grating upon the interspiral areas and, in the young, overriding the spirals as well. Suture lines faintly channelled. Aperture rudely semielliptical in outline, the outer lip obscurely angulated at the periphery of the young, broadly and evenly rounded in the adults. Inner lip sharply rounded. Pillar and parietal wall washed with callus. Umbilicus small but deep, striated within by the incrementals only.

Dimensions of holotype: Height 4.5 mm., maximum diameter 4.7 mm. Dimensions of juvenile paratype: Height 2.5 mm., maximum diameter 3.0 mm.

Holotype: U.S.N.M. 325463. Paratype: U.S.N.M. 325465.

Holotype locality: One mile northeast of Suffolk, Nansemond County, Va. Paratype locality: Colerain Landing, Chowan River, Bertie County, N. C. Both holotype and paratype localities in the Yorktown formation.

The representatives of the group are so few in number that it is impossible to determine with any assurance the relations between *Gibbula americana* Dall from the Duplin marl and *G. yorktownensis* from the Yorktown formation. The Yorktown species differs from the Duplin form by its relatively higher spire, finer and more crowded lirae, and coarser incrementals.

In his description of *Gibbula americana*, Dall noted that *americana* was the first *Gibbula*, Recent or fossil, to be recorded from western Atlantic faunas. The genus is characteristic of the eastern Atlantic and Mediterranean, and there are several Pacific and Indo-Pacific species. The American individuals do not clearly show the nacreous inner layer which is a characteristic feature of the genus and the family.

Distribution: Virginia: Yorktown formation, Benns Church, Isle of Wight County 1 mile northeast of Suffolk, Nansemond County.

North Carolina: Yorktown formation, Colerain Landing on the Chowan River, Bertie County.

Subfamily SKENEINAE

Genus TEINOSTOMA A. Adams

1853. *Teinostoma* A. Adams, Zool. Soc. London Proc., pt. 21, p. 183.

Type by monotypy: *Teinostoma politum* A. Adams. Recent, off the coast of Ecuador.

Section IDIORAPHE Pilsbry

1922. *Idioraphe* Pilsbry, Acad. Nat. Sci. Philadelphia Proc., vol. 73, pt. 2, p. 398.

Type by original designation: *Cyclops angulatus* Gabb. Miocene, of the Dominican republic.

The section is characterized "by having the whorls enveloping, the suture at first closely coiled, but in the last whorl deviating abruptly." The periphery on the first half of the body whorl in the type is distinctly carinate, and the apical surface is domed. These last characters are apparently not essential, for *Teinostoma depressum*, the only other species referred to *Idioraphe* in the original description, is depressed and the periphery is rounded.

Teinostoma smikron Gardner, n. sp.

Plate 25, figures 18–20

Shell imperforate, polished, compressed, minutely auriculate. Whorls approximately 4, rapidly increasing in size, so that the earlier are largely concealed by the later. Earliest whorls feebly convex, the later volutions flattened posteriorly, the final whorl faintly depressed in front of the suture line. Surface smooth except for feeble incremental striations and exceedingly fine and fortuitous spiral shagreening. Sutures closely appressed, exaggerated and not very accurately shown in the illustration. Periphery of final whorl narrow but evenly rounded. Aperture holostomous, somewhat sinuous, rudely elliptical transversely, the posterior portion feebly expanded, the anterior feebly constricted. Umbilicus entirely closed by a heavy pad of enamel, which forms a smooth semi-elliptical area slightly sunken below the surrounding surface. Parietal wall thinly glazed.

Dimensions of holotype: Height 0.7 mm., maximum diameter 1.8 mm.

Holotype: U.S.N.M. 325473.

Type locality: Neills Eddy Landing, Cape Fear River, 3 miles north of Cronly, Columbus County, N. C. Waccamaw formation.

Teinostoma smikron is separated from *T. nanum* (Isaac Lea) (pl. 25, figs. 23–24) of the St. Marys formation of Maryland and the Yorktown formation of Virginia and North Carolina by the more compressed outline, the exposed whorls of the spire, and the greater

disparity between the maximum and minimum diameters. From *T. milium* Dall (pl. 25, fig. 21) of the Pliocene Caloosahatchee formation, *T. smikron* is readily isolated by the flattening of the apical surface, and the greater tendency in *T. smikron* toward coiling in a single plane.

Teinostoma umbilicatum (H. C. Lea) (pl. 25, figs. 29, 30) may be nothing more than a *T. nanum* in which the enamel has been broken through in the apical region, producing a minute pit which was mistaken for a specific character. Mansfield, however, regarded *T. umbilicatum* as a subspecies of *T. nanum*, separable by reason of its less open spire and less impressed line at the margin of the basal callus. He reported *T. umbilicatum* from the *Ecphora* zone of the Choctawhatchee formation [now the Duplin marl], in the upper bed at Alum Bluff in Liberty County, and from the locality half a mile northeast of Clarksville, Calhoun County, Fla. Two apparently young individuals of the *T. nanum* group from the Waccamaw formation of Neills Eddy Landing, N. C., are more compressed than any of the young observed from the Miocene and may prove to be specifically distinct. *T. miocenicum* Olsson,[1] 1916, is somewhat less compressed and faintly striate spirally. It has been recognized only at the type locality, Natural Well in Duplin County, N. C.

Teinostoma carinatum (H. C. Lea) (pl. 25, figs. 35, 36, 39) does not seem to fall within the exact limits of any prescribed section. It resembles *Idioraphe* in the domed apical surface and the carinate periphery, but it differs in the regular coiling of the exposed apical whorls. The shell is moderately heavy, the early whorls exposed and increasing regularly in diameter, the apical surface smoothly domed, the periphery conspicuously carinate, and the base convex from the periphery to the slightly sunken umbilical area. The type is from Petersburg, Va. *T. lenticulare* (H. C. Lea) (pl. 25, figs. 25, 26), also from Petersburg, is closely allied and possibly nothing more than a subspecific variant. Mansfield [2] has reported *T. carinatum* from the *Ecphora* zone of the Choctawhatchee formation in Calhoun County, Fla.

Teinostoma subconicum (H. C. Lea) (pl. 25, figs. 27–28) may be referable to the group commonly known as *Pseudorotella* Fischer, 1857. The illustration indicates the deplorable state of the holotype.

The droop in the suture line in *Teinostoma smikron* is less pronounced than in typical *Idioraphe*, but the affinities of the species seem to be with that division.

Distribution: Waccamaw formation, Neills Eddy Landing. Cape Fear River, Columbus County, N. C.

[1] Olsson, Axel, New Miocene fossils: Bull. Am. Paleontology, vol. 5, no. 27, p. 21, pl. 3, figs. 14, 15, 1916.

[2] Mansfield, W. C., Miocene gastropods and scaphopods of the Choctawhatchee formation of Florida: Florida Geol. Survey Bull. 3, p. 134, pl. 20, figs. 10–12, 1930.

Genus "PSEUDOROTELLA" Fischer

Pseudorotella Fischer [3] has been commonly regarded as a subgenus or section of *Teinostoma*. The type by monotypy is *Rotella semistriata* D'Orbigny, Recent, off the Florida Keys and the West Indies. Woodring, in 1928, considered the differences between *Pseudorotella* and *Teinostoma* of generic importance and mentioned as characteristic features of *Pseudorotella* the exposed spire, heavy parietal callus, relatively small umbilical pad, and sinuous aperture.

The east coast Tertiary species commonly referred to *Pseudorotella* are not congeneric with the genotype, and the name is therefore quoted in this paper. *Pseudorotella semistriata* is a very compact and compressed little shell, with an obliquely flattened base and an umbilical pad that completely closes the umbilical opening and is laid smoothly upon the base of the body. In "*Pseudorotella*" *alexanderi* (Olsson) (pl. 25, figs. 12–14) the flattening of the whorl in front of the suture breaks the rounded contour of the apical surface, the body is broadly rounded, and there is no umbilical pad, merely a thickening of the pillar which partially conceals the umbilicus. If there is a superspecific name available for these small forms, I have been unable to find it.

"*Vitrinella*" *regularis* C. B. Adams, described from Panama and figured by Pilsbry and Olsson (Acad. Nat. Sci. Philadelphia Proc., vol. 97, pl. 28, figs. 2, 2a, 2b, 1945) is rather similar to "*Pseudorotella*" *alexanderi* in the characters of the aperture and umbilicus but the spire is depressed turbinate rather than rounded.

Olsson referred his species to *Ethalia* H. and A. Adams, 1854, but the type of *Ethalia* is *Rotella guamensis* Quoy and Gaimard, and the species is restricted, according to Pilsbry, 1889, to the vicinity of Guam. It is a larger shell than *Pseudorotella*, attaining 15 millimeters or more in greatest diameter, it is nacreous and turbinate, and the aspect of the apical surface is not unlike that of some of the species of *Leiotrochus*.

Genus SOLARIORBIS Conrad

1865. *Solariorbis* Conrad, Am. Jour. Conchology, vol. 1, p. 20.

Type by subsequent designation (Dall, W. H., Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 414, 1892): *Delphinula depressa* Isaac Lea. Claiborne sand of Alabama.

Very small, discoidal, moderately thick shelled. Nucleus small but fairly prominent, smooth, shining, paucispiral. Surface of conch finely punctate spirally. Aperture subcircular. Peristome angulated and feebly sulcate at the commissure. Parietal wash thin to rather heavy. Umbilical area sharply defined; perforation small but deep, partially concealed by the thickening of the umbilical carina toward the aperture.

Dall granted *Solariorbis* only sectional value under

[3] Fischer, P., Études sur un groupe de coquilles de la famille des Trochidae: Jour. conchyliologie, t. 6 (2e sér., t. 2), p. 52, 1857.

Teinostoma and described the species *steirata* (pl. 25, fig. 34) as a *Teinostoma*. The features are distinct from those of *Teinostoma* and deserve generic recognition. The soft parts are not known and probably never will be since both the American and the European species seem to be restricted to the Atlantic Tertiary faunas.

Solariorbis includes a compact group of species exceptionally well characterized by the depressed apical surface, finely punctate spiral sculpture and rather large umbilical area surrounding the small umbilical pit. From the shell characters alone *Solariorbis* seems more closely related to *Circulus* and *Cyclostremiscus* than to *Teinostoma*.

The height of the figured individual (U. S. N. M. 112649) is 1.0 mm., the maximum diameter 2.6 mm. It was collected on the Cape Fear River from the "Newer Miocene," which includes both the Duplin marl and the Waccamaw formation.

Family CYCLOSTREMATIDAE

Genus CYCLOSTREMISCUS Pilsbry and Olsson

1945. *Cyclostremiscus* Pilsbry and Olsson, Acad. Nat. Sci. Philadelphia Proc., vol. 97, p. 266.

Type by original designation: *Vitrinella panamensis* C. B. Adams. Recent, off the West Coast of Panama and Mazatlan.

The shell is small or minute (usually less than 3 mm. in diameter), solid or moderately strong, depressed or discoidal, much wider than high, umbilicate, of few (about 3 more or less) whorls, of which the first 1⅓ to 2 form a smooth nuclear shell. Last whorl typically having several spiral angles or carinae, their intervals typically with lower axial riblets or striae. Aperture subcircular or modified by the angles of the shell, the peristome continuous, not thickened externally. Type *Vitrinella panamensis* C. B. Adams.

We introduce this genus for a series of small or minute species, abundantly represented in the west American tropics. Some of them have been described in the genera *Vitrinella* and *Cyclostrema*, but in our opinion the differences outweigh such similarity as may be traced * * *.

The living animal, operculum and radula have not been observed.—Pilsbry and Olsson, 1945.

Circulus Jeffreys is available for the small discoidal spirally keeled forms and *Cyclostremiscus* may be restricted to the cancellate shells at least until the animals have been studied.

Cyclostremiscus obliquè-striatus (H. C. Lea)

Plate 25, figures 31, 32

1843. *Delphinula obliquè-striata* H. C. Lea, Am. Philos. Soc. Proc., vol. 3, p. 164 (n. n.).
1846. *Delphinula obliquè-striata* H. C. Lea, Am. Philos. Soc. Trans., n. ser., vol. 9, p. 261, pl. 36, fig. 72.
1892. *Adeorbis*? *obliquistriata* (H. C. Lea). Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 347

Shell orbicular, depressed, thick, diaphanous, sub-cancellate; spire very short, ovate, longitudinally and deeply sulcate near the apex; sutures impressed, linear; whorls four, convex; sulculi longitudinal, nearly obsolete at the lower suture; straie obliquely transverse, small, numerous; last whorl sometimes carinate, sometimes angulate, smooth near the suture; base striate, deeply sulcate; umbilicus large, deep, margined with a carina, smooth within; mouth round.

Length .04. Breadth .10 of an inch.

Remarks.—The longitudinal sulci are quite large on the upper whorls, but become smaller and closer as they approach the last whorl, while on the base they again increase. The striae are very oblique, but are more nearly transverse than longitudinal. On the last whorl, they form cancellations with the sulci, and are obsolete near the suture as they approach the mouth. The umbilicus is carinate and scalariform, decreasing from whorl to whorl in rectangular steps. The periphery of the last whorl is extremely variable, being in some specimens almost round, and in others angular and carinate. The mouth is almost a perfect circle.—H. C. Lea, 1846.

Holotype: Acad. Nat. Sci. Philadelphia 1541.

Type and sole locality: Petersburg, Dinwiddie County, Va. Yorktown formation.

Apparently the cancellate forms were already established along the Middle Atlantic coast in the middle part of Tertiary time.

Genus CIRCULUS Jeffreys

1865. *Circulus* Jeffreys, British Conchology, vol. 3, p. 315 =*Adeorbis* Searles Wood (part).

Type by monotypy: *Delphinula duminyi* Requien=*Adeorbis striatus* Searles Wood, *fide* Bush, 1897. Recent, in European waters.

Very small, circular, nearly flat-spired with an exceedingly wide and open umbilicus.

Operculum circular with about a dozen volutions which wind spirally and gradually and converge to the centre.—Jeffreys, 1865.

In the typical species the apical surface of the shell is decorated with a few sharp evenly spaced spiral lirae.

"Circulus" (?supra-nitidus Wood subsp.) orbignyi (Fischer)

Plate 25, figure 33

1857. *Adeorbis orbignyi* Fischer, Jour. conchyliologie, vol. 6 (2e sér., vol. 2), pp. 173, 286.
1889. *Adeorbis supranitidus* var. *orbignyi* Fischer. Dall, Harvard Coll. Mus. Comp. Zoology Bull., vol. 18, p. 278 (part).
1892. *Adeorbis supranitidus* var. *orbignyi* Fischer. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 344 (part).

Shell minute, subdiscoidal. Whorls inflated medially and anteriorly, flattened or slightly depressed posteriorly, about 5 in all. Protoconch smooth, of approximately 1½ turns, differentiated from the conch by its greater convexity and less regular coiling. First 2 whorls of conch smooth except for microscopically fine incremental striations. Spiral sculpture initiated, as a rule, on the second whorl of the conch by 3 equal and equispaced lirations; a fourth lira finer than those in front of it, but rapidly increasing in prominence, introduced within the first quarter turn of the sculptured conch. Sculpture on posterior and rounded peripheral portions of body consisting in figured specimen of 8 primary lirations, subequal in size and spacing; secondaries regularly developed in the umbilical region and fortuitously on the outer basal surface, particularly toward the aperture. Incrementals faint but regular, least

feeble in the interspiral areas. Suture line distinct, impressed. Aperture holostomous, subcircular, the axis not deviating greatly from the plane of the shell; peristome adnate to the body wall. Umbilicus funicular, persistent to the apex, feebly lirate within.

"*Circulus*" (*?supra-nitidus* Wood subsp.) *orbignyi* (Fischer) is closely related to "*Circulus*" *costulatus* (H. C. Lea) of the Yorktown formation of Virginia and the Duplin marl of North Carolina. It differs in the greater flattening and depression of the whorls in front of the suture and the consequent lower spire; the lower average in the number of primary lirations; and the presence, in the majority of individuals, of a smooth basal area between the umbilical funnel and the periphery.

The figured specimen is U.S.N.M. 112345, from the Waccamaw formation at Tilly Lake, Waccamaw River, Horry County, S. C. It is 1.2 mm. high and 2.9 mm. in diameter.

The species was described from Cuba.

Distribution: Duplin marl, Magnolia and Natural Well, 2 miles southwest of Magnolia, Duplin County, N. C., Waccamaw formation, Wilmington, New Hanover County, N. C.

Family LIOTIIDAE

Genus LIOTIA Gray

1842. *Liotia* Gray, Synopsis of the contents of the British Museum, 44th ed., p. 57 (genus without species). *Fide* Iredale, 1913.

1847. *Liotia* Gray, Zool. Soc. London Proc., pt. 15, p. 145.

Type by original designation: *Delphinula cancellata* Gray. Recent, on the Pacific coast from Peru to Chile.

Subgenus ARENE H. and A. Adams

1854. *Arene* H. and A. Adams, Genera of Recent Mollusca, vol. 1, p. 404.

Type by subsequent designation (Woodring, Carnegie Inst. Washington Pub. 385, p. 422, 1928): *Turbo cruentatus* Megerle von Mühlfeld. Recent, in the West Indies.

Liotia (Arene) pergemma Gardner, n. sp.

Plate 28, figures 31, 36, 37, 40, 41

Shell feebly nacreous within, rather heavy, of moderate size for the genus, depressed turbinate, the apparent angularity of the shell increased by the prominence and position of the spirals. Whorls 4½ in all. Initial turn of the protoconch partially immersed, the succeeding volution inflated and differentiated from those of the conch only by its lesser though constantly increasing angularity. Posterior tabulation of conchal turns broad and sharply defined, meeting the sides of the whorl at an angle of not far from 90°, except on the final half turn, where the angles are rounded off. Initial spiral developed at the margin of the shoulder, a second spiral introduced within half a revolution, midway between the shoulder and the anterior suture, followed by a third developed along with the sutural channel, which it margins; a fourth, the peripheral spiral, exposed near the aperture directly behind the posterior suture; all 4 of the primaries heavily corrugated or annulated by incrementals and becoming increasingly prominent toward the aperture; the 3 anterior primaries and intercalated secondaries evenly distributed upon the body and separated by a wide, more or less concave interspace from the posterior primary and by a wide, flattened interarea from the prominent beaded spiral outlining the umbilical keel; fortuitous secondaries, either simple or annulate, commonly developed upon the shoulder and upon the base of the body, particularly within the final half-turn; very fine and faint spiral striations sometimes visible upon the primaries. Axial sculpture of two types—the retractive, ill-defined axial wrinkles, which override the spirals and annulate them and are most prominent on the shoulder of the whorl; and, in addition, an axial shagreening from the microscopically fine but sharp incremental laminations, slightly oblique to the wavy axials, least fine in the interspiral areas, particularly in the sutural gutter. Sutures sunk in a deep but rather narrow channel, which is evanescent toward the apex. Gerontic character suggested by a tendency toward a looser coiling in the body of the adults so that the last quarter turn frequently droops in front of the periphery of the final whorl of the spire, and the posterior commisure is in some individuals halfway between the anterior peripheral spiral and the umbilical carina. Aperture entire, subcircular, the outer lip more broadly and evenly rounded than the inner. Peristome continuous. Outer lip thickened within. Pillar feebly reinforced. Parietal wall heavily glazed. Umbilicus deep, wide, scalariform, the carina strongly defined and annulated, visible within the funnel; sides of umbilicus minutely striated incrementally.

Dimensions of holotype: Height 4.8 mm., maximum diameter 5.9 mm. Dimensions of paratype: Height 3.8 mm., maximum diameter 5.0 mm.

Holotype: U.S.N.M. 497853. Paratype: U.S.N.M. 325475.

Holotype locality: Cronly, Columbus County, N. C. Waccamaw formation. Paratype locality: Neills Eddy Landing, Cape Fear River, 3 miles north of Cronly, Columbus County, N. C. Waccamaw formation.

Liotia (*Arene*) *pergemma* is intermediate in size and in sculpture characters between *L.* (*Arene*) *major* Gardner and Aldrich and *Liotia gemma* (Tuomey and Holmes). The North Carolina species is smaller and the sculpture more subdued than that from South Carolina. The differences, however, may be no more than subspecific.

Liotia (*Arene*) *pergemma* is separated from the coexistent *L.* (*Arene*) *gemma* (Tuomey and Holmes) (pl. 28, figs. 38, 39) by its larger size, more depressed,

right-angled, discoidal outline, the more heavily annulated spirals, and the deeper sutural channel.

Distribution: North Carolina: Yorktown formation, Mount Gould Landing and half to three-fourths mile above Edenhouse Point on the Chowan River, Bertie County; 5 miles below New Bridge over the Tar River, Edgecombe County; and 1½ miles west of Greenville, Pitt County. Waccamaw formation, Lake Waccamaw, Cronly and Neills Eddy Landing, 3 miles north of Cronly on the Cape Fear River, Columbus County.

Genus DIDIANEMA Woodring

1928. *Didianema*, Woodring, Carnegie Inst. Washington Pub. 385, p. 447.

Type by original designation: *Didianema tytha* Woodring. Miocene, of Bowden, Jamaica.

Didianema recalls *Mölleria* Jeffreys in the development of the small opercular shelf and may well be the southern representative of that genus. The northern form commonly exhibits a crude axial sculpture of which there is no trace in *Didianema*, and it is not carinate at the margin of the umbilicus. The type of *Mölleria* is *Margarita costulata* Möller, widespread in the North Atlantic and reported off Fernandina, Fla., in 294 fathoms. It is probable that a number of the Tertiary species from the South Atlantic now referred to *Mölleria* are more properly referable to the southern genus, but the absence of the beading on the umbilical keel and of the spirals within the umbilical funnel may be of more than specific importance.

Didianema? carolinae Gardner, n. sp.

Plate 25, figures 15–17

Shell minute, naticoid, relatively heavy, lacking luster. Whorls 3½ in all, the line between the nuclear and postnuclear turns obscure, indicated only by a change in the texture of the shell but probably falling within the first half of the second complete turn, so that about 1¼ turns are nuclear, 2¼ turns postnuclear. Whorls of conch broadly rounded, separated by distinctly impressed sutures. Aperture subcircular, thin edged, obscurely sulcated at the posterior commissure and at the umbilical keel. Peristome adnate to the body wall from the commissure to the keel, free but slightly reverted along the inner margin of the funnel, broadly and symmetrically arcuate from the keel backward to the posterior commissure. Umbilical funnel crescentic, widening anteriorly, margined by a sharply defined keel, incrementally striate but without spiral sculpture. Outer surface roughened but showing no sculpture pattern.

Dimensions of holotype: Height 1.6 mm., maximum diameter 1.6 mm.

Holotype: U.S.N.M. 325476.

Type locality: Walkers Bluff, Cape Fear River, Bladen County, N. C. Waccamaw formation.

Didianema? carolinae lacks the polish and the beaded umbilical carina of the genotype from the Bowden formation of Jamaica, but it more closely resembles *D. tytha* than it does the axially ribbed *D. costulata* which has no umbilical keel. "*Mölleria*" *duplinensis* Dall (pl. 25, fig. 22) is strongly keeled and should probably be referred to *Didianema* rather than to the cold-water *Mölleria*. It differs from *D. carolinae* in the heavier shell and wider umbilical funnel, but, like it, lacks the beaded carina of the genotype.

The type is unique.

Order CTENOBRANCHIA

Suborder MESOGASTROPODA

Superfamily LITTORINACEA

Family LITTORINIDAE

Genus LITTORINA Férussac

1822. *Littorina* Férussac, Tableaux systématiques des animaux mollusques, pp. xi, xxxiv.

Type by tautonymy: *Turbo littoreus* Linnaeus.

Shell imperforate, solid, turbinate. Spire relatively low and of few volutions. Spiral sculpture usually dominant. Aperture entire, oval or subcircular. Columella simple, only slightly excavated. Outer lip simple, acute.

This large genus of fresh-water or brackish-water shells was initiated in the Mesozoic. The Recent representatives, the so-called "periwinkles," are among the most prolific denizens of the littoral zone.

Littorina irrorata (Say)

Plate 24, figure 16

1822. *Turbo irroratus* Say, Acad. Nat. Sci. Philadelphia Jour., 1st ser., vol. 2, p. 239.

1856. *Littorina irrorata* L. R. Gibbes. Tuomey and Holmes, Pleiocene fossils, South Carolina, p. 119, pl. 26, fig. 5.

1858. *Litorina lineata* Emmons, North Carolina Geol. Survey Rept, pp. 256, 271, fig. 170.

1860. *Littorina irrorata* Gray. Holmes, Post-Pleiocene fossils of South Carolina, p. 91, pl. 14, fig. 5.

1863. *Littorina carolinensis* Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 567.

1875. *Littorina carolinensis* Conrad, in Kerr, Geol. Survey North Carolina Rept., app. A, p. 23, pl. 4, figs. 10, 11.

1892. *Litorina irrorata* Say. Dall Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 320.

1904. *Littorina irrorata* (Say). Martin, Maryland Geol. Survey, Miocene, p. 240, pl. 58, fig. 1.

1906. *Littorina irrorata* Say. Rogers, Shell book, p. 175, pl. opp. p. 180, fig. 2.

1937. *Littorina irrorata* Say. Maxwell Smith, East coast marine shells, p. 99, pl. 37, fig. 20.

Shell thick, greenish or pale cinereous, with numerous revolving, elevated, obtuse, equal lines, which are spotted with abbreviated brownish lines; suture not indented; spire acute; labium incrassated, yellowish-brown; labrum within white and thick, at the edge thin, and lineated with dark brownish; throat white; columella with an indentation; operculum coriaceous.

Length four-fifths of an inch.

Inhabits the coast of the United States.

Cabinent of the Academy and Philadelphia Museum.

This has the general appearance of *T. littoreus*, but is sufficiently distinct by the above characters; the calcareous deposit on the labium is copious.

An inhabitant of our estuaries of the middle and southern states.—Say, 1822.

Shell heavy, turbinate. Whorls approximately 6, closely appressed, decreasing rapidly in size. Conch and protoconch not sharply differentiated. Spirals low, for the most part fillets of equal size, approximately 8 on the later whorls of the spire and twice as many on the body. Interspaces linear. Incrementals microscopically fine. Suture distinct but inconspicuous. Aperture holostomous, obliquely ovate. Inner lip gently excavated. Outer lip more strongly arcuate, somewhat flaring anteriorly, the edge sharply bevelled. Parietal wall heavily calloused.

The character of the sculpture of *Littorina irrorata* (Say) is very similar to that of *Ilyanassa isogramma* Dall.

The species had rather a meagre representation during the Tertiary, although it is exceedingly prolific in the Recent waters. The common periwinkle, as it is called, was formerly limited largely to the Gulf of Mexico, but, of late years, has been creeping rapidly up the east coast until it has now reached the New England shores.

Dimensions of figured specimen: Height, 22.5 mm.; diameter, 16.0 mm.

Figured specimen: U.S.N.M. 59695.

Locality of figured specimen: Hog Island, Va.

Distribution: Virginia: Yorktown formation, Yorktown, York County.

North Carolina: Yorktown formation, 9 to 10 miles southeast of Greenville, Pitt County. Duplin marl, 4 to 5 miles below Lumberton, Robeson County. Waccamaw formation, Walkers Bluff on the Cape Fear River, Bladen County; Neills Eddy Landing, 3 miles north of Cronly; Lake Waccamaw, Columbus County, City Rock Quarry near Wilmington, New Hanover County.

Outside distribution: Miocene, Choptank formation, Choptank River, Md. Pliocene, Waccamaw formation, Tilly Lake, Horry County, S. C. Caloosahatchee marl, Nashua, Putnam County, Fla. Pleistocene, Simmons, Waccamaw, and Cainhoy, S. C.; Orange City, Volusia County, Fla. Recent, Vineyard Sound to Jamaica along muddy beaches.

Superfamily RISSOACEA

Family RISSOIDAE

Genus RISSOA Fréminville

1813. *Rissoa* Fréminville, Soc. philomatique Paris Nouv. Bull. Sci., vol. 3, No. 72, pp. 340, 341.

1814. *Rissoa* Fréminville. Desmarest, idem, vol. 4, p. 7.

Type by subsequent designation (Bucquoy, Dautzenberg and Dollfus, Mollusques marins du Roussillon, vol. 1, p. 262, 1884): *Rissoa ventricosa* Desmarest. Reported from the Pliocene and Pleistocene of northern Italy. Recent, in the Mediterranean and Adriatic Seas.

Section ONOBA H. and A. Adams

1854. *Onoba* H. and A. Adams, Genera Recent Mollusca, vol. 1, p. 331.

Type by subsequent designation (Nevill, Hand List Mollusca Indian Museum, pt. 2, p. 119, 1885): *Turbo striata* John Adams. Recent, along the European shores from Norway to the Mediterranean; fossil in the Crag of England.

Rissoa geraea Dall

Plate 29, figure 21

1892. *Rissoa (Onoba) geraea* Dall, Wagner Free Inst. Sci. Trans. vol. 3, pt. 2, p. 340, pl. 21, fig. 13a.

Shell thin, subovate, with a subacute apex and five or six gently rounded whorls; suture distinct, but not deep; apical whorl very minute, smooth; subsequent whorls evenly spirally striated, with the interspaces slightly wider than the striae, the latter a little more distant and slightly coarser on the base, especially near the umbilical region; the striae increase by intercalation, and hence appear alternate here and there; base produced; aperture ovate, angular behind, the inner lip a little concavely flexuous, reflected against the body, producing a more or less conspicuous chink, but with no perforation behind it; margin in the fully adult obtuse and internally thickened, continuous over the body; in the young the anterior end of the reflected pillar-lip projects slightly; in the adult this projection is hidden by the lip-deposit. Alt. 4.5; max. diam. 2.5 mm.—Dall, 1892.

Holotype: U.S.N.M. 113572.

Type locality: Mrs. Purdy's marl bed on the Cape Fear River, N. C.

The protoconch is of 2¼ smooth, highly polished volutions, the initial half-turn largely immersed, the succeeding volutions gibbous, the convexity growing increasingly less, however, toward the aperture. It is differentiated from the conch by the feeble cicatrix and by the initiation of the spiral sculpture of the latter. Spiral striations are very fine and regular over the entire conch, about 15 to the millimeter, inclined to be more crowded toward the suture lines, and coarser and more distinct in the umbilical region.

The figured specimen from Neills Eddy Landing, Cape Fear River, 3 miles north of Cronly, Columbus County, N. C., differs from the type of *Rissoa geraea* Dall in the less elevated spire consequent upon the more rapid increase in the size of the whorls, the relatively finer spiral striations in proportion to the interareas, the narrower aperture, and the more deeply impressed suture lines.

It also shows a tendency for the suture lines to drop in front of the periphery of the preceding whorl, thus producing a slight overhang. However, these characters are probably not of taxonomic significance.

Height of figured specimen (U.S.N.M. 325464), 3.0 mm.; diameter, 1.5 mm.

Distribution: Waccamaw formation, Mrs. Purdy's marl bed, Cape Fear River, Bladen County, N. C., according to Emmons; Neills Eddy Landing, Columbus County.

Family RISSOINIDAE

Genus RISSOINA D'Orbigny

1840. *Rissoina* D'Orbigny, Voyage dans l'Amérique Méridionale, vol. 5, pt. 3 (Mollusques), p. 395.

1928. *Rissoina* D'Orbigny. Woodring, Carnegie Inst. Washington Pub. 385, p. 362. An exhaustive treatment of the Bowden *Rissoina* fauna with particular emphasis upon the superspecific groups.

Type by monotopy: *Rissoina inca* D'Orbigny. Recent, off the west coast of South America from Peru to the Island of Chiloe.

Outline rissoiform, turriculate. Whorls numerous, tapering gradually to the mammillar apex. Surface axially or spirally ribbed, or cancellated, rarely smooth. Aperture semielliptical. Outer lip retrocurrent, thickened, slightly reflected, effuse, or faintly channelled anteriorly. Columella nonplicate. Operculum thick, horny, semilunar in outline, paucispiral, bearing a claviform process upon the internal face.

The form of the operculum, the sinous outer lip, and the depression of the anterior portion of the aperture are distinguishing features of this genus. Like the closely related *Rissoa*, which is usually more squat in outline with a vertical instead of a retrocurrent outer lip, *Rissoina* frequents the shallower waters where there is abundant vegetation.

Subgenus SCHWARTZIELLA Nevill

1885. *Schwartziella,* Hand List Mollusca Indian Museum, pt. 2, pp. 73, 82.

Type by original designation: *Turbo bryereus* Montagu. Recent, off the Florida Keys and in the West Indies.

The characteristic features of the subgenus are the strong, protractive axials, the absence of a spiral sculpture and the obscurely defined basal cord. *Eurissolina* Woodring is similarly sculptured, but the basal cord is much stronger, nicking the margin of the aperture, and a second, much shorter cord is included between it and the anterior extremity. The type of *Eurissolina* is *E. ditomus* Woodring, from the Bowden beds of Jamaica.

Rissoina (Schwartziella) harpa Gardner, n. sp.

Plate 29, figure 20

Shell minute, lustrous, white, elongate-conic in outline. Whorls 7½, including the 2½ smooth, nuclear turns. Whorls of the spire feebly convex but rendered somewhat pseudoscalariform by the character of the external sculpture; body gently rounded, feebly constricted at the base. Axial sculpture only developed; axials in the form of sharp, elevated, protractive ridges, opposite in arrangement, extending from the anterior suture almost, but not quite to the posterior, except on the first sculptured volution; on the body whorl gracefully recurved anteriorly and persistent to the margin of the aperture; interradial areas broadly and evenly concave, microscopically shagreened by the incrementals. Whorls very closely appressed; the suture line strongly undulated by the axials of the preceding whorl. Basal cord distinct but not sharply defined. Aperture holostomous, obliquely ovate, obtusely angulated posteriorly, evenly rounded anteriorly. Outer lip flaring, slightly patulous in front. Inner lip nonplicate; aperture lined uniformly throughout with a heavy glaze which is reverted upon the pillar and along the anterior margin.

Dimensions of holotype: Height 3.7 mm., maximum diameter 1.6 mm.

Holotype: U.S.N.M. 325446.

Type locality: Walkers Bluff, Cape Fear River, Bladen County, N. C. Waccamaw formation.

Rissoina harpa is the possible antecedent of the later Pliocene and Recent *Rissoina chesnelii* (Michaud) and of the more slender, more closely ribbed subgenotype *R. bryerea* (Montagu). It is most readily separated by the character of the axial sculpture. The costae in the Waccamaw form are more sharp and more prominent than in either of the later species and instead of persisting with undiminished vigor to the posterior suture and impacting against the corresponding costae of the preceding volution, they are abruptly constricted directly in front of the suture line, thus lending to the shell a pseudoscalar outline. The basal cord is possibly better defined in the Waccamaw species than it is in the Caloosahatchee and Recent forms, but this character offers a rather wide range in individual variation.

The species has been recognized at the type locality only.

Family VITRINELLIDAE

Confusion is prevalent throughout the skeneid and vitrinellid taxonomy. A knowledge of the animals is essential for a correct classification, and without that it seems hardly worth while to attempt an interpretation of the tangled relationships of the genera included under the Vitrinellidae and other families of small discoidal forms. Two important series of papers are coming out at the present time.[4] They are concerned exclusively with the Recent species but are sure to throw light on the relationships of their Tertiary ancestors.

Genus COCHLIOLEPIS Stimpson

1858. *Cochliolepis* Stimpson, Boston Soc. Nat. History Proc., vol. 6, p. 307.

Type by monotypy: *Cochliolepis parasitica* Stimpson. Recent, in Charleston Harbor (type) and off the shores of the Carolinas.

Cochliolepis includes a small group of minute shells, much compressed and paucispiral. The whorls increase rapidly in diameter and are coiled like a ram's horn.

[4] Pilsbry, H. A., and McGinty, Thomas L., Cyclostrematidae and Vitrinellidae of Florida: Nautilus, vol. 59, No. 1, pp. 1–13, pls. 1, 2, July 1945; No. 2, pp. 52–59, pl. 6, October 1945; No. 3, pp. 77–83, pl. 8, January 1946; vol. 60, No. 1, pp. 12–18, pl. 2, July 1946; to be continued. Pilsbry, Henry A., and Olsson, Axel A., Acad. Nat. Sci. Philadelphia Proc., vol. 97, pp. 249–278, pls. 22–30, December 27, 1945.

The spire is very low and in the type species is partially enveloped by the final whorl as in the section *Idioraphe* of *Teinostoma*. The umbilicus is open to the apex revealing the rounded basal surface of the component whorls. A growth striation is the only sculpture. The suture line is distinct and, on the later whorls, the flattened band in front of the suture is well defined. The aperture is entire, asymmetric, feebly guttered posteriorly and rather sharply rounded and faintly constricted at the periphery. The outer lip is thin and sharp; the inner lip adnate only along the body wall and broadly and rather strongly constricted. The type species is very thin, smooth, and shining.

Cochliolepis concava (H. C. Lea)

Plate 25, figures 2, 4, 38, 40, 44

1843. *Delphinula concava* H. C. Lea, Am. Philos. Soc. Proc., vol. 3, p. 164 (n. n.).

1846. (December). *Delphinula concava* H. C. Lea, Am. Philos. Soc. Trans., n. ser., vol. 9, p. 261, pl. 36, fig. 70.

1892. *Adeorbis concavus* H. C. Lea. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 346 (part).

Shell concave, orbicular, depressed, flattened above, thin, shining, substriate; spire very short, obtuse; sutures linear; whorls four, rapidly increasing, flattened; striae longitudinal, very few, small; last whorl somewhat angular; base striate; umbilicus large, deep, striate within; mouth large, ovate.

Length .08. Breadth .20 of an inch.

The umbilicus is wide and open, exposing the spire, nearly to the apex. The lines of growth are very infrequent and irregular, both as to size and direction.—H. C. Lea, December 1846.

Holotype: Acad. Nat. Sci. Philadelphia 1538.

Type locality: Petersburg, Dinwiddie County, Va. Yorktown formation.

Shell a minute, much depressed, tightly coiled cornucopia. Whorls 4 to 4½, flattened posteriorly, rapidly increasing in size, the later whorls closely embracing and largely concealing the earlier. Nuclear characters obscure, the nucleus apparently including about 1½ minute turns largely immersed in the succeeding volution. Macroscopic sculpture wanting; entire external surface, however, rasped by the fine, crowded growth lamellae and shagreened near the sutures and periphery with traces of microscopically fine spiral lirae. A rather wide, depressed, and sharply delimited band in front of the suture. Periphery of final whorls somewhat flattened. Aperture obliquely lenticular, the outer lip expanded behind the periphery, the inner lip constricted. Posterior commissure angulated, obscurely sulcate. Peristome adnate to body wall only in peripheral region. Umbilicus broadly funicular, persistent to the apex.

Dimensions of figured topotype: Height, 2.0 mm.; maximum diameter, 5.0 mm.

Topotype: U.S.N.M. 156078.

The specimens of Duplin, Waccamaw, and Caloosahatchee age identified with *C. concava* in the U. S. National Museum collections do not seem to be conspecific. The form from Virginia is not so smooth and shining, the umbilicus is a little wider and the surface more rasped by the incremental sculpture than in the specimens from the Carolinas and Florida.

Delphinula lipara H. C. Lea (pl. 25, figs. 6–8) was considered by Meyer to be a juvenile *C. concava*. The shell is very small, and the diameter of the holotype is only half the diameter of the holotype of *D. concava*. It is true that the juvenile whorls of *Cochliolepis* are rounded and increase but slowly in diameter, and the aspect is distinctly different from that of the adults. In the description of *D. lipara*, Lea mentions "a very high polish," which might be a juvenile character. On the other hand, the whorls in the holotype of *D. lipara* are more numerous than in *D. concava*, and the general aspect of the shell is similar to that of some of the species assigned to *Vitrinella*. *Cochliolepis holmesii* (Dall) (pl. 25, fig. 5), reported from the Waccamaw of North Carolina, is depressed in front of the posterior suture of the later whorls and resembles a minute disc with a sunken medial area.

The type of *Cochliolepis leai* (Dall) (pl. 25, fig. 37) remains unique. It is well characterized, however, in spite of its fragmentary condition by the large size, almost double that of any of its associates, the convexity of the whorls, and the numerous, fine, though macroscopic, linear spirals that cover the external surface.

The ram's-horn coiling and the width of the umbilical funnel are probably superspecific characters. The genotype, *Cochliolepis parasitica* (pl. 25, fig. 1), exhibits the same rapid increase in the size of the whorls, but it is much compressed, the early whorls are largely concealed by the overlap of the later, and the umbilical funnel is less open than it is in *C. concava*.

Distribution: Virginia: Yorktown formation, Yorktown, York County; Petersburg, Dinwiddie County.

Family VITRINELLIDAE?

Genus MACROMPHALINA Cossmann

1888. *Macromphalina* Cossmann, Soc. royale malacol. Belgique Annales, vol. 23, p. 184.

1896. *Gyrodisca* Dall, U. S. Nat. Mus. Proc., vol. 18, p. 44. Type by original designation: *Fossarus depressus* Seguenza. Recent, in the Mediterranean. Pliocene of Messina.

1945. *Chonebasis* Pilsbry and Olsson, Acad. Nat. Sci. Philadelphia Proc., vol. 97, p. 258.

Type by original designation: *Sigaretus problematicus* Deshayes. Middle Eocene (Lutetien), of the Paris Basin.

Shell very small, thin, calcareous, auriform. Whorls few, the final volution disproportionately large, tending toward a lax coiling. Nucleus small but prominently elevated, commonly set oblique to the axis of the conch. Surface very finely threaded spirally. Incremental and axial sculpture may be strong. Base cymbiform. Aperture relatively large, obliquely patulous. Umbilicus wide, funicular, open to the apex.

Deshayes'[5] description and somewhat diagrammatic figure of the genotype of *Macromphalina*, *Sigaretus problematicus*, indicates a minute shell of 3 smooth, narrow, erect nuclear turns and 2 rapidly widening and decorated postnuclear turns. The measurements given are 2¼ millimeters in length and a little less than 2 millimeters in diameter. No specimens are available for comparison, but from the illustrations alone it is not possible to separate *Macromphalina* Cossmann from *Chonebasis* Pilsbry and Olsson, 1945. Cossmann's genotype seems to fall within the limits of variation of *Chonebasis* in outline, characters of the protoconch, and sculpture pattern of the conch.

Megalomphalus Brusina considered by Thiele to be synonymous with *Macromphalina*, which it antedates, is according to the illustration in Thiele, an erect shell of naticoid outline. The protoconch is said to be spirally striate, and the umbilicus is relatively small. The characters of the radula ally *Megalomphalus* to the Fossaridae.

The genotype of *Gyrodisca* Dall was taken during the Lightning and Porcupine Expeditions, 1868–70, and was described by Jeffreys in the Proceedings of the Zoological Society of London for January 20, 1885. He noted that:

> This pretty little shell, examined under the microscope, is exquisitely sculptured by close-set longitudinal folds and intermediate spiral striae, or thread-like lines. Some specimens have the whorls more or less disunited in cornucopia fashion.

Macromphalina has been recognized in the Eocene of the Paris Basin, the Miocene of North Carolina, the Miocene and Pliocene of southern Europe (Cossmann), and it is now living in the Mediterranean.

Macromphalina pierrot Gardner, n. sp.

Plate 25, figures 41–43

Shell minute, thin, fragile, auriculate. Protoconch of 1½ minute, highly polished, naticoid whorls, the first half turn bulbous, largely immersed, coiled in a plane at approximately 45° to the plane of the conch. Whorls of conch 3, evenly rounded, rapidly increasing in diameter. Surface badly decorticated but shagreened by faint traces of crowded, linear spirals, separated by equally narrow interareas and minutely wrinkled by the heavy growth lines. Sutures deeply impressed, channelled slightly near the aperture owing to the lax coiling. Periphery of body whorl obtusely angulated, forming with the labrum a fairly regular ellipse, the inner lip dividing this ellipse into two unequal portions, of which the semilunar aperture is the greater. Outer lip dilated both horizontally and vertically, thin, sharp, and simple, rounding evenly into the straight pillar. Peristome adnate to the body wall between the peripheral and umbilical keels. Pillar not reinforced. Umbilicus obliquely funicular, persisting to the apex, vertically striated within by the vigorous incrementals.

Dimensions of holotype: Height, 2.0 mm.; maximum diameter, 3.2 mm.

Holotype: U.S.N.M. 325462.

Type locality: Neills Eddy Landing, Cape Fear River, 3 miles north of Cronly, Columbus County, N. C. Waccamaw formation.

Macromphalina pierrot is well characterized in the perfect adult by the jaunty tilt of the protoconch, a detail which may well be of superspecific value. It is further separated from *Macromphalina?* sp. by the more auriculate outline, the more sharply rounded periphery, and the obliquely funicular umbilicus.

Macromphalina pierrot is known from the type locality only.

Macromphalina? sp.

Plate 25, figures 9–11

Shell very thin and small, depressed-turbinate. Whorls rounded, 3 to 3¼ including the nucleus, rapidly increasing in diameter. Protoconch minute, coiled in the same plane as the conch, smooth, hyaline, slightly inflated, not very clearly differentiated but consisting of more than a single turn. Surface of conch wrinkled incrementally and shagreened by faint, crowded, spiral lirations, separated by linear interspaces. Suture distinct, feebly impressed toward the aperture. Body whorl gibbous, rounded at the periphery, the base a minute cornucopia. Inner lip dividing the basal ellipse into two approximately equal parts. Outer lip dilated both along the vertical and the horizontal axis, evenly rounding both anteriorly and posteriorly into the feebly concave columella. Peristome adnate to the body wall for a short distance in front of the periphery. Umbilical funnel wide, persistent almost to the apex.

Dimensions of figured specimen: Height, 1.8 mm.; maximum diameter, 1.9 mm.

Figured specimen: U.S.N.M. 325461.

Sole locality: Natural Well, 2 miles southwest of Magnolia, Duplin County, N. C. Duplin marl.

In the outline and exceedingly faint spiral sculpture, the shell resembles *Macromphalina*, but no axial sculpture is developed, and even the incrementals are rather feeble. *Macromphalina duplinensis* (Dall) (pl. 25, fig. 3) exhibits the type of axial sculpture commonly developed in the group.

Superfamily CERITHIACEA

Family TURRITELLIDAE

Genus TURRITELLA Lamarck

1799. *Turritella* Lamarck, Prodrome d'une nouvelle classification des coquilles, Soc. histoire nat. Paris Mém., p. 74.

Type by monotypy: *Turbo terebra* Linnaeus. Recent, in the China Sea and the Gulf of Siam.

A slender, imperforate, polygyrate form, spirally sculptured. Aperture holostomous, oval, subcircular

[5] Deshayes, Animaux sans vertèbres, vol. 3, p. 90, Atlas, vol. 2, pl. 64, figs. 7, 8, 1866.

or subquadrate. Outer lip thin, simple, sinuous, retractive posteriorly, slightly produced anteriorly in most species. Columella simple, concave. Posterior portion of shell vacant and partitioned at each half turn.

Before the end of the Cretaceous, *Turritella* had become one of the more conspicuous elements in the gastropod faunas of North America. The genus culminated during the Tertiary, and was represented at that time by a large number of prolific species. In the Recent seas, it is relatively meager and restricted, largely to the warm waters of the Old World.

Turritella terebra (Linnaeus), the type of the genus, is a slender form of 30 to 35 rounded whorls. The maximum height may exceed 150 millimeters, and a height of 120 millimeters is common.

No Tertiary species from the east coast is sufficiently like the genotype to be placed with it in a restricted subgenus.

Turritella pilsbryi Gardner

Plate 27, figures 11, 25

1928. *Turritella pilsbryi* Gardner, Washington Acad. Sci. Jour., vol. 18, No. 20, p. 561, fig. 1.

Shell very large, heavy, acutely conical in outline. Spire elevated. Whorls probably about 25, laterally compressed, the lower whorls slightly overhanging at the anterior suture. Protoconch not strongly differentiated from the conch; first half turn tilted almost at right angles to the normal plane of coiling. Incipient medial carina initiated on the second whorl, becoming sharper and more elevated anteriorly and migrating from the median horizontal toward the anterior suture. Two equal and equispaced spiral lirations initiated on the fourth whorl between the keel and the posterior suture; spirals overridden by microscopically fine incremental striae, retractive on the posterior portion of the whorl, protractive on the anterior portion. Usual sculpture in adolescent stages of 3 narrow, obtuse but prominently elevated lirae, equisized and symmetrically spaced with respect to the sutures; tendency toward an anterior migration of the prominent spiral sculpture fulfilled on the adult whorls. Characteristic adult sculpture of 2 to 4 primary spirals, the anterior directly behind the suture line, and commonly (as in the type) much lower and less sharply defined than the one or two in back of it; the posterior a little behind the median horizontal and often ill-defined or evanescent in maturity; the two intermediate spirals vigorous, rounded, strongly elevated cords, the continuations of the medial and posterior spirals of the earlier whorls; secondary striations frequently developed, particularly on the anterior portion of the whorl; base of body whorl sculptured with crowded, linear lirae. Growth lines strongly retractive posteriorly; feebly protractive anteriorly. Sutures impressed on the earlier whorls, slightly undercut on the later. Aperture holostomous, transversely ovate; outer lip simple, obtusely angulated at the base; the inner strongly arcuate. Parietal wall glazed. Umbilicus imperforate.

Dimensions of holotype (incomplete): Height, 110.5 mm.; diameter, 22.9 mm.

Holotype and embryonic paratype: U.S.N.M. 325457.

Type locality: Schmidts Bluff, 4½ miles in an air line below Claremont Wharf, James River, Surry County, Va. Zone 1 of Yorktown formation, 26 to 34 feet above the base of the bluff.

Turritella pilsbryi is remarkable for its large, heavy shell, ornamented with coarse spiral lirae, of which two are characteristically more prominent than the rest, the posterior of the pair located near the median horizontal and the anterior approximately midway between the median horizontal and the anterior suture.

Turritella alticostata Conrad (pl. 27, fig. 17), a diagnostic species of zone 2 of the Yorktown formation, resembles *T. pilsbryi* in the nepionic characters and in the trace of the growth lines.

T. pilsbryi is comparable in size and outline to *T. alumensis* Mansfield, from the upper bed of Alum Bluff, Liberty County, Fla., but the early whorls of the Florida species are bilirate, whereas those of *T. pilsbryi* are trilirate.

T. etiwanensis (Tuomey and Holmes) (pl. 27, fig. 20) closely resembles the more slender and delicate varieties of *T. alumensis*. It has been recovered from beds of Duplin age in both North and South Carolina and from the *Cancellaria* zone of the Choctawhatchee formation of northern Florida.

An interesting suggestion of the viviparous habit of the genus is offered in the material on which this species is based. In cleaning one of the larger individuals, a sandy core was shaken out in which 47 embryos were embedded. As they are obviously the larvae of the same species, and as no other shells were present in the core, there seems to be no reasonable doubt that they are the young of the individual which contained them.

This fine form was named in honor of Dr. Henry A. Pilsbry, for many years the Curator of Mollusca in the Academy of Natural Sciences of Philadelphia.

Distribution: Mansfield has reported *Turritella pilsbryi* at a number of localities in the Yorktown formation of Virginia. It is, apparently, a dependable guide fossil for zone 1.

Turritella plebeia carinata Gardner, n. subsp.

Plate 27, figures 15, 22

Shell moderately small and slender, probably of about a dozen volutions. Whorls convex, obliquely shouldered posteriorly. Character of protoconch obscured. Adolescent whorls bicarinate. Spiral striae simple, 8 to 10; the equatorial spiral usually more prominent than those in front of or behind it; spirals behind the periphery low, subequal, 3 to 5; spirals in front of the

periphery 3 to 5, unequal in size; a liration second only in elevation to the medial cord placed a little more than midway between the carina and the anterior suture. Incrementals chasing the spirals, sinuous, retractive on the shoulder, broadly arcuate medially, but anteriorly bent slightly backward away from the aperture. Suture line distinct, impressed. Aperture holostomous. Columella simple. Parietal wall glazed.

Dimension of holotype: Height (apical whorls only), 20 mm.; maximum diameter, 6 mm.

Dimensions of figured specimen: Height of incomplete specimen, 26.9 mm.; maximum diameter, 10.5 mm.

Holotype: U.S.N.M. 325453; figured specimen, U.S.N.M. 325454.

Holotype locality: One fourth of a mile below Jones Point, Essex County. St. Marys formation. Figured specimen, half a mile below waterworks dam at Suffolk, Nansemond County, Va. Yorktown formation.

The subspecies is characterized by the development of a pronounced peripheral keel. With the emphasis of the equatorial spiral there is a marked tendency toward a greater convexity. Individuals in which the spiral is relatively feeble seem closely allied to the true *Turritella plebeia* of Say. Mansfield has considered this variant a guide fossil of the St. Marys formation. The specimen figured from Suffolk is unlike any other *Turritella* in our collections from the Yorktown formation, but there is nothing but the unique character of the shell and the fact that it was collected 30 years ago to indicate an error in the locality label.

The end members of the northern group of *T. plebeia* indicate a relationship to a characteristic species of the Gatun formation, *Turritella gatunensis* Conrad from the Canal Zone, and to its subspecies *blountensis* Mansfield from the lower part of the Choctawhatchee formation of Florida.

Distribution: Virginia: St. Marys formation, half a mile below Bowlers Wharf and a quarter of a mile below Jones Point, Essex County. Yorktown formation, half a mile below Suffolk waterworks dam, Nansemond County.

Subgenus TORCULOIDELLA Sacco

1895. *Torculoidella* Sacco, I Molluschi dei Terreni Terziarii del Piemonte e della Liguria, pt. 19, p. 28.

Type by original designation: *Turbo varicosus* Brocchi. Miocene and Pliocene, of Italy.

Smallish to medium size, slender, acutely tapering, rather thin-shelled. Protoconch minute, including a few smooth, narrow, lustrous whorls. Early whorls of conch medially keeled; finer spirals introduced both before and behind the keel. About the sixth whorl or later the keel flattens, and the spiral outlining it becomes no more prominent than the other primary thread; carinal spiral continued in two species at least in the primary next behind the anterior primary. An obscure axial rippling of the primary spirals perceptible on the medial and anterior portion of the shell. Growth lines exceedingly faint, feebly arcuate. Aperture subquadrate. Outer lip nearly vertical, angulated anteriorly; inner lip strongly concave.

Torculoidella, elegantly sculptured by the crowded spirals and the faint axial rippling, is well represented in the upper Tertiary of northern Italy and in the Carolinas and Florida. Cossmann has recorded it from the middle Miocene (Helvetian) of Aquitaine, France. *Turritella nodulosa* King, a Recent species recorded on the west coast from San Diego, Calif., to Panama is similarly adorned though more strongly sculptured axially.

The differences characterizing *Torculoidella* may be overvalued by considering it as a subgenus, but there is no established genus to which it can be referred as a section.

Turritella (Torculoidella) duplinensis Gardner and Aldrich

Plate 27, figures 24, 28

1919. *Turritella duplinensis* Gardner and Aldrich, Acad. Nat. Sci. Philadelphia Proc., p. 41, pl. 2, fig. 4.

1930. *Turritella duplinensis* Gardner and Aldrich. Mansfield, Florida Geol. Survey Bull. 3 p. 108, pl. 15, fig. 7.

Shell a uniformly tapering pyramid, relatively more slender in the immature stages than in the adult. Volutions approximately 15; the earliest coils unicarinate, prominently keeled at the periphery; the later, trapezoidal, or slightly overhanging. Protoconch small, smooth, twice-coiled, with slightly tilted tip. Axial sculpture absent or restricted to faint, irregular, incremental wrinkles on the later whorls of the adult. Spiral sculpture fairly constant for the genus; the beginning whorls of the conch girded with a single strong medial spiral; in a typical, half-grown individual a single, well-rounded primary, posterior to the suture line, and strong enough to subcarinate the later whorls; secondaries 2, as a rule, the one outlining the equatorial region, the other a little behind it; the latter increasing in prominence away from the apex, the former crowning the periphery of the earlier whorls, decreasing in relative elevation anteriorly; a tertiary intercalated about midway between the suture and the posterior secondary, and another, the circumbasal lira, directly in front of the primary; quaternaries 12 to 15, subequal, and separated by equal interspaces; 3 between the posterior tertiary and the suture; 1 to 3 between the posterior tertiary and the posterior secondary; 3 or 4 between the 2 secondaries; 5 between the anterior secondary and the primary; 1 to 3 between the primary and anterior tertiary and occasionally 1 or 2 between the anterior tertiary and the suture. Basal lirae 15 to 20, the majority of them fine, but with coarser threads irregularly interspaced. Suture lines distinct, the later whorls of the adult feebly constricted; peripheral angle

approaching 90°. Base flattened to slightly convex in adult. Aperture holostomous, subquadrate. Outer lip straight. Inner lip strongly arcuate.

Dimensions of holotype: Height, 24.0 mm.; diameter, 6.5 mm. Specimen figured by Mansfield: Height, 27.5 mm.; diameter, 7.9 mm.

Holotype: U.S.N.M. 499110. Specimen figured by Mansfield: U.S.N.M. 370359.

Type locality: Strickland farm, 1½ miles northwest of Magnolia, Duplin County, N. C.; given in Gardner and Aldrich, 1919, as the Natural Well, which is nearby and of the same formation.

Specimen figured by Mansfield: U.S.G.S. Sta. 3421. Harveys Creek, half a mile above abandoned mill, Leon County, Fla. Choctawhatchee formation. *Cancellaria* zone.

Turritella (*Torculoidella*) *duplinensis* bears a strong resemblance, particularly in the young and adolescent stages, to the laterally compressed races of *T. subannulata* Heilprin from the Choctawatchee and Caloosahatchee of Florida. It is doubtless closely related to it and may prove to be a precursor of that species.

In the single adult *T. duplinensis* in the U. S. National Museum from the Cape Fear River, the systems of spiral lirations have broken down, and the lirae are numerous, equisized, irregularly alternating, and tending to concentrate on the anterior portion of the whorl. This suggests a possible identity with *T. carolinensis*, vaguely described and badly figured by Conrad in 1875. It is probable, however, that the latter is characterized by a relatively broader base, and a consistently more uniform spiral sculpture. Unfortunately, Conrad's type is not available.

Turritella holmesii Dall (pl. 27, fig. 23) [=*Terebellum striatum* Tuomey and Holmes, 1856, not Isaac Lea, 1833] may be a badly figured specimen of some member of the *T. subannulata* group. Although the illustration does not indicate such an outline, Tuomey and Holmes refer in their description to "the large whorls flattened, those near the apex more convex." They refer also to "transverse wrinkles distinct only on the lower whorls." Their type is from Darlington, S. C., and presumably from the Duplin marl.

Distribution: North Carolina: Duplin marl, 1½ miles northwest of Magnolia, Duplin County. Waccamaw formation, Neills Eddy Landing, 3 miles north of Cronly, Columbus County.

Outside distribution: Miocene: Duplin marl at the Muldrow Place, Sumter County, S. C. and Porters Landing, Savannah River, Effingham County, Ga. Choctawhatchee formation, *Cancellaria* zone, Leon County, Fla.

Subgenus TORCULA Gray

1847. *Torcula* Gray, Zool. Soc. London Proc., pt. 15, p. 155.

Type by original designation: *Turbo exoletus* Linnaeus. Recent, in the Gulf of Mexico and the West Indies in 45 to 170 fathoms (C. W. Johnson); Dry Tortugas in 30 to 35 fathoms (C. W. Merriam).

Shell rather small, slender, polygyrate. Apical angle very small, not far from 15°. Only about two narrow, polished nuclear whorls, the initial whorl tilted slightly, the second turn inflated but tending to flatten toward its close. Line between conch and protoconch obscure, indicated by duller texture of shell of conch. The four or five earliest whorls of conch inflated and keeled anteriorly, the whorls rapidly flattening and the anterior keel becoming a low anterior spiral; posterior spiral introduced on about the fourth or fifth whorl of the genotype. Original spirals increasingly strong, becoming the prominent anterior and posterior cords in the adult; cords rarely simple, usually beaded by the growth lines which override them. Growth lines strongly arcuate and symmetrically disposed between the sutures.

Torcula includes a number of Tertiary and a few later species. The Tertiary forms are prolific in the warm temperate and tropical waters of the Province of the Gulf of Mexico and the West Indies. The Recent species are not so common and live in deeper water. *Torcula* probably reached the peak of development during the middle Miocene. It includes *T. altilira* and allied forms, prolific in the Canal Zone and Costa Rica, allied species in Jamaica and the Dominican Republic, in northern South America, and in Ecuador and Peru on the Pacific coast, and the "*T. inezana* stock" of Merriam in central and southern California and in Lower California.

Turritella (Torcula) terstriata Rogers and Rogers

Plate 27, figures 18, 19

1837. *Turritella ter-striata* W. B. and H. D. Rogers, Am. Philos. Soc. Trans., vol. 5, n. ser., p. 331.

1839. *Turritella ter-striata* W. B. and H. D. Rogers, idem, vol. 6, n. ser. p. 377, pl. 26, fig. 1.

1884. *Turritella ter-striata* W. B. and H. D. Rogers, in Reprint, Ann. Rept. Geol. The Virginias, p. 661.

1937. *Turritella terstriata* Rogers. Mansfield, Jour. Paleontology, vol. 11, p. 608, pl. 85, fig. 9.

Whorls strongly angulated by three principal revolving elevated spiral ridges; the lowest, being about one-third from the base, is the most prominent; the second, which closely adjoins and almost coalesces with the first, is much feebler; the third, which is nearly one-third the height of the whorl from the summit, is more distinct and is separated from the second by a deep and wide channel; next the base of each whorl are three fine spiral striae; others to the number of four or five, occupy the space between the principal ridge and the summit; crossing these are very fine indistinct tranverse arcuated wrinkles.

This shell is obviously distinct from the *variabilis* in the great inequality of the three principal ridges, the depth of the central channel, and the greater delicacy of the transverse wrinkles.

Locality, vicinity of Williamsburg; in the Miocene shell marl. Length about two inches.—W. B. and H. D. Rogers, 1837.

The type material is in the collection of the Boston Society of Natural History. Mansfield in 1937 figured a specimen from U. S. Geological Survey sta. 11783 (Watkins Mill, King and Queen County, Va.; zone 1 of

the Yorktown formation) that closely follows Rogers' detailed description of their poorly figured shell. He figured a second shell intimately or specifically identical with *T. terstriata* from the *Ecphora* zone of the Choctawhatchee formation, 1 mile northwest of Clarksville, Calhoun County, Fla.

Shell heavy, of moderate size, elevated, multispiral, very gradually tapering. Total whorls probably 15 or 20. Spiral sculpture very prominent. Whorls profoundly sulcate a little behind the median horizontal; the sulcus margined posteriorly by an obtuse, strongly elevated cord, anteriorly by a broader elevation, bisected by a rather shallow linear groove. Fortuitous striations occasionally present between the primary sulcus and the anterior suture. Sutures impressed but not so deep as the median grooves. Base flattened, devoid of sculpture except for the low, rounded liration outlining the periphery. Aperture holostomous, subcircular. Outer lip strongly arcuate, simple. Parietal wall glazed. Umbilicus imperforate.

Figured specimens: U.S.N.M. 325456.

Dimensions of larger figured specimen: Height, 33.5 mm. (probably between two-thirds and one-half of total height); diameter, 9.6 mm. Smaller figured specimen: Height, 21.0 mm.; diameter, 7.3 mm.

Locality: Three miles northeast of Walkerton, King and Queen County, Va. Yorktown formation.

In general aspect *Turritella (Torcula) terstriata* Rogers and Rogers resembles *T. (Torcula) terebriformis* (Dall) (pl. 27, figs. 26, 27), but it differs in the detail of the sculptural pattern. The whorls of *T. terstriata*, instead of being merely convex medially as they are in *T. terebriformis*, are deeply sulcate; and in *T. terebriformis*, in place of a pair of spirals between the medial area and the posterior suture, there is only the single lira; furthermore, the base of *T. terstriata* is simple; in *T. terebriformis*, it is trilirate.

In its known distribution *Turritella (Torcula) terstriata* is restricted to zone 1 of the Yorktown formation.

Distribution: Virginia: Yorktown formation, 3 miles northeast of and at Watkins Mill, King and Queen County; "vicinity of Williamsburg" (Rogers and Rogers), James City County.

Section EURYTORUS Gardner

1947. *Eurytorus* Gardner, U. S. Geol. Survey Prof. Paper 142–H, p. 596.

Type by original designation: *Turritella mixta* Dall. Chipola formation (lower Miocene), of Florida.

Eurytorus resembles *Torcula* in the juvenile characters and in the direction of the growth lines. It differs from *Torcula* in the broader apical angle and base and the flat-sided, trapezoidal whorls forming an evenly tapering cone.

The Duplin species, *Turritella (Torcula) burdeni* (Tuomey and Holmes), is referable to the section *Eurytorus*.

Family ARCHITECTONICIDAE

Genus ARCHITECTONICA "Bolten" Roeding

1798. *Architectonica* "Bolten" Roeding, Mus. Boltenianum, pt. 2, p. 78=*Solarium* Lamarck, 1799, Prodrome d'une nouvelle classification des coquilles, Soc. histoire nat. Paris Mém., p. 74.

1909. *Architectonica* Bolten. Dall, U. S. Geol. Survey Prof. Paper 59, p. 80.

Type by subsequent designation (Gray, Zool. Soc. London Proc., pt. 15, p. 151, 1847): *Trochus perspectivus* Linnaeus. Recent, in the Indo-Pacific.

Subgenus ARCHITECTONICA s. s.

1798. *Architectonica* "Bolten" Roeding, Museum Boltenianum, pt. 2, p. 78. Type by subsequent designation (Gray, Zool. Soc. London Proc., pt. 15, p. 151, 1847): *Trochus perspectivus* Linnaeus. Recent, in the Indo-Pacific.

The outline is that of a low beehive. The nucleus dips vertically downward at the apex so that only the final small, well-rounded nuclear whorl is visible. The spiral bands on the earlier part of the shell are trenched by very strong and strongly retractive incrementals but on the later volutions become lower, less regular and almost obsolete. The periphery is subacute, the aperture subquadrate, and the umbilicus wide and encircled by the dentate umbilical keel, which can be traced to the apex.

The West Indian *A. nobilis* is remarkably close to the genotype. It is a much smaller shell, and the umbilicus is rather wider and more conspicuously funicular. The general outline and sculpture plan are, however, the same.

Architectonica nobilis "Bolten" Roeding

Plate 24, figures 9, 13

1781. *Trochus perspectivus* Linnaeus. Chemnitz, Conchylien-Cabinet, vol. 5, pp. 121–127 (part), pl. 172, figs. 1695, 1696.

1798. *Architectonica nobilis* "Bolten" Roeding, Mus. Boltenianum, pt. 2, p. 78.

1799. *Trochus perspectivus* Linnaeus as type of *Solarium* Lamarck, Soc. histoire nat. Paris Mém., p. 74.

1822. *Solarium granulatum* Lamarck, Animaux sans vertèbres, vol. 7, p. 3.

Neither Roeding nor Lamarck figured their species, but they both referred to figures of Lister published in 1685. Thus Roeding's *Architectonica*, 1798, supplants the *Solarium*, 1799, of Lamarck, and his *nobilis*, the *granulatum*; and *Solarium granulatum* Lamarck becomes *Architectonica nobilis* "Bolten" Roeding. Woodring, 1928, used *Architectonica nobilis quadriseriata* (Sowerby) for the shell from the West Indies and discussed at length the closely related variants in the mid-Americas. Dall, 1892, noted that the fossil individuals were more granulose than the Recent forms, but he included the Duplin and Waccamaw specimens under the Recent *granulata*; and Mansfield, 1930, referred to it the specimens from the *Ecphora* and the *Cancellaria* zones of the Choctawhatchee formation of Florida.

The group is scantly represented in the Duplin marl of both North and South Carolina. The proper evaluation of the differences which separate the Duplin forms from the Recent shells can hardly be made on so short a series. The figured specimen is a living form (U. S. N. M. 83685), taken from 49 fathoms, 17 miles east-southeast of Cape Hatteras, N. C. The height is 19 mm., the diameter 35 mm.

Subgenus PSEUDOTORINIA Sacco

1892 *Pseudotorinia* Sacco, I Molluschi dei Terreni Terziarii del Piemonte e della Liguria, pt. 12, p. 66.

Type by original designation: *Solarium obtusum* Bronn. Miocene and Pliocene, of northern Italy.

Gray in 1840 established *Torinia* (type, *Trochus variegatus* Gmelin from the Indo-Pacific) to include a group of *Architectonica* characterized by a small top-shaped operculum. The name was published in the Check List of the shells of the British Museum, 1840. Sherborn considered it a nomen nudum. Sacco indicated the difficulty of recognizing, in the fossil state, a group identifiable by peculiarities of the operculum and proposed the name *Pseudotorinia* for the fossil shells which share with *Torinia* a rounded periphery and an ornate sculpture.

Architectonica (Pseudotorinia) nupera (Conrad) Conrad

Plate 24, figures 8, 11, 15

1834. *Solarium nuperum* Conrad, Acad. Nat. Sci. Philadelphia Jour., 1st ser., vol. 7, p. 141.
1863. *Architectonica* (*Phillipia*) *nupera* Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 566.
1867. *Architectonica nupera* Conrad, Am. Jour. Conchology, vol. 3, p. 260, pl. 19, fig. 8.
1892. *Solarium nuperum* Conrad. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 329.

Shell discoidal, with spiral crenulated lines; that which crowns the whorls largest; suture deeply channelled; umbilicus moderate; base convex, with crenulated lines; aperture suborbicular. Length one-third of an inch.

Locality: Same as the preceding [Suffolk, Va.].—Conrad, 1834.

The whorls number approximately 5, and regularly increase in size. Finely granulated spirals separated only by linear interspaces sculpture the entire external surface. On the later whorls of the spire the lirae number from 4 to 6, and that nearest the posterior suture usually exceeds in prominence those in front of it. Secondaries are commonly intercalated on the body. The periphery is usually well rounded and ill defined, though in some individuals it is emphasized by the conspicuous strength of the spirals that outline it. The aperture is roughly semielliptical; the parietal wall thinly glazed; the outer margin broadly convex, thin and sharp. The umbilicus is rather large, and the heavily beaded cord that defines it mounts to the apex like a miniature spiral staircase.

Dimension of figured specimen: Height, 8.0 mm.; diameter, 13.8 mm.

Figured specimen: U.S.N.M. 325471.

Locality of figured specimen: Nottoway River, 2½ to 3 miles below the Seaboard Air Line Railroad bridge, Southampton County, Va. Yorktown formation.

Mansfield, 1930, described from the *Ecphora* zone of the Choctawatchee formation a subspecies *watsonensis*, characterized by a relatively coarse ornamentation.

The group is represented in the Recent seas of the West Indies by *Architectonica bisulcata* (D'Orbigny).

Distribution: Virginia: Yorktown formation, Yorktown, York County; Dillard's Wharf, Surry County; Sycamore and the Nottoway River, 2½ to 3 miles below the Seaboard Air Line Railroad bridge, Southampton County.

North Carolina: Duplin marl, 2 miles below Lumberton, Robeson County.

Family VERMETIDAE

The family includes aberrant, vermiform mollusks which exhibit external irregularity in growth and sculpture. In outward appearance, they are very near to some of the annelid worms. The Vermetidae are characterized, however, by a spiral nuclear shell, internal septae, and a tube composed of three calcareous layers instead of only two as in the genus *Serpula* of the annelids. The septae are considered by Carpenter and Mörch to be analagous to the internal cup of *Crucibulum* and to the diaphragm of *Crepidula*. Mörch's "Review" [6] is still the most exhaustive published study of the family, but he over-valued individual and specific variations. In the fossil forms, however, specific and even generic separations are difficult, for the best diagnostic features, the nucleus and the operculum, are usually lacking, and even the septae are frequently concealed or absorbed.

Genus LEMINTINA Risso

1826. *Lemintina* Risso, Histoire naturelle des principales productions de l'Europe Méridionale, vol. 4, p. 114.
1845. *Anguinella* Conrad, Fossils of the medial Tertiary or Miocene formation of the United States, p. 77. No generic description but monotype, *Anguinella virginiana* Conrad=*Serpula virginica* Conrad, described and figured. Chesapeake group (Miocene) of Virginia and North Carolina.

Type by monotypy: *Lemintina cuvieri* Risso=*Serpula arenaria* Linnaeus. Recent, in the Mediterranean.

The shell is tubular, and irregularly coiled or twisted and attached or free. The external surface is usually lirate and often more or less granulose. No longitudinal laminae are developed, but the tube is commonly chambered by perpendicular partitions or pouches concave forward. The operculum is absent.

The genus is widely distributed in the warmer waters of the Recent seas.

[6] Mörch, Otto A. L., Review of the Vermetidae, Zool. Soc. London Proc., pp. 145–181; 326–365, 1861; 54–83, 1862.

Lemintina granifera (Say)

1824. *Serpula granifera* Say, Acad. Nat. Sci. Philadelphia Jour., 1st ser., vol. 4, p. 154, pl. 8, fig. 4.
1892. *Serpulorbis granifera* Say. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 303.
1894. *Anguinella virginiana* Conrad. Whitfield, U. S. Geol. Survey Mon., vol. 24, p. 132, pl. 24, figs. 1–5.
Not *Anguinella virginiana* Conrad, Fossils medial Tertiary of the United States, p. 77, pl. 44, fig. 4, 1845.
1896. *Serpula granifera* Say. Harris, Reprint of Say, 1824: Bull. Am. Paleontology, vol. 1, No. 5, p. 60, pl. 8, fig. 4.
1904. *Vermetus graniferus* (Say). Martin, Maryland Geol. Survey, Miocene, p. 232, pl. 55, figs. 14, 15.
1909. *Vermetus graniferus* (Say). Grabau and Shimer, North American index fossils, vol. 1, p. 737, figs. 1072a–b. (After Martin.)
1915. *Serpulorbis granifera* Say. Dall, U. S. Nat. Mus. Bull. 90, p. 95.
1930. *Serpulorbis granifera* (Say) Dall. Mansfield, Florida Geol. Survey Bull. 3, p. 102, pl. 14, fig. 4.
1937. *Serpulorbis granifera* (Say)? Mansfield, Florida Dept. Conservation, Geol. Bull. 15, p. 160.

Covered with longitudinal, contiguous, slightly elevated, granulated striae.

Shell subcylindric, contorted, inferior side flat; the whole surface is composed of very numerous, small, contiguous striae, each consisting of a single row of granules; these series are alternately smaller.

Diameter of the larger end three-tenths, of the largest specimen two-fifths of an inch.

The continuity of the tube within, is interrupted by oblique diaphragms. It sometimes approaches the spiral form, and one specimen has three complete volutions of much regularity.—Say, 1824.

Lemintina granifera was described from one of the shells in the Finch collection, made presumably in Maryland. All that is known of these shells, is Say's statement concerning them, namely:

The following descriptions were made out from specimens in a very large and fine collection of fossil shells which Mr. John Finch obtained with much labour and some expense in Maryland, and which that gentleman with great liberality submitted to my examination.

Mansfield believed from internal evidence that they came not from Maryland but from Virginia. Among them is *Pecten clintonius* Say, which has not since been recorded from Maryland and which is otherwise restricted to zone 1 of the Yorktown formation in Virginia and North Carolina. Mansfield also expressed some doubt that the tubes from the Choctawhatchee formation of Florida which are referred to *L. granifera* are specifically identical with those from the Chesapeake group.

The species is characterized by loose but intricate coiling, granular axial lirations, and numerous little pouches, concave anteriorly, set into the tube at right angles to the axis. In abundance and wide distribution in the Miocene deposits of North Carolina and Virginia, it is outstripped only by *Petaloconchus sculpturatus* H. C. Lea, a larger, more angular, more closely and regularly coiled form, with fewer and more coarsely granular, axial lirations. The character which separates the two species generically, the development of internal, axial laminae in the latter is so commonly absent that it is necessary to supplement it with criteria of no generic significance.

Distribution: Virginia: St. Marys formation, Urbanna Cliffs on the Rappahannock River, Middlesex County; Union Mills, 2½ miles south of Farnham, Richmond County. Yorktown formation, Yorktown, York County; 1½ miles northeast of Smithfield; 12 to 14 miles south of Zuni on the Blackwater River, Isle of Wight County; Sycamore on the Nottoway River; and a half to three-fourths of a mile above the lower Seaboard Air Line Railroad bridge, Meherrin River, Southampton County; a quarter of a mile north of Chuckatuck, 1½ miles north of Suffolk, and 1 mile northeast of Suffolk, Nansemond County.

North Carolina: Yorktown formation, 1 mile above Branchs Bridge, Northampton County; 15½ miles above Bells Bridge and half a mile above Bells Bridge over the Tar River, Edgecombe County; Tar Ferry, on Wiccacon Creek opposite Harrellsville and 1½ miles below Tar Ferry, and at Mount Pleasant Landing on the Chowan River, Hertford County; Colerain Landing on the Chowan River, Bertie County. Duplin marl, Natural Well, 2 miles southwest of Magnolia, Duplin County. Waccamaw formation, Wilmington, at the City Rock Quarry, New Hanover County.

Outside distribution: Miocene, Tampa limestone, Ballast Point, Hillsboro County (Dall and Mansfield?); White Beach near Osprey, Manatee County (Dall), Fla. Calvert formation, Jericho, N. J. Plum Point on Chesapeake Bay, Calvert County; 3 miles west of Centerville, Queen Annes County, Md. Choptank formation, Jones Wharf, Governors Run (lower bed), Calvert County; Greensboro, Caroline County, Md. St. Marys formation, St. Marys River, St. Marys County, Md. Oak Grove sand, Oak Grove?, Okaloosa County, Fla. Choctawhatchee formation, *Ecphora* zone and possibly the *Cancellaria* zone in Leon County, Fla.

Lemintina granifera tenera (Dall)

Plate 24, figure 7

1892. *Serpulorbis granifera* var. *tenera* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 303.
1917. *Serpulorbis granifera* Say? Maury, Bull. Am. Paleontology, vol. 5, No. 29, p. 127, pl. 2, fig. 9.

This differs from the creeping and decumbent form of the type in being aggregated in masses, with the tubes nearly vertical, in having the surface more distinctly granular and the substance of the tubes much thinner, which, as they mutually support each other, is not detrimental to the individuals composing the mass. These tubes measure about 6.0 mm. in diameter at the aperture and reach a length of over 83 mm.—Dall, 1892.

Cotype: U.S.N.M. 112274.

Type locality: Natural Well, 2 miles southwest of Magnolia, Duplin County, N. C. Duplin marl.

Miss Maury remarked that "our Dominican specimens are very like *S. granifera tenera* Dall from the Upper Miocene of North Carolina."

Lemintina granifera tenera exhibits a growth habit similar to that of "*Vermicularia?*" *nigricans* Dall (pl. 24, fig. 6), a reef-making species that includes a large part of the "worm-rock" along the west Florida coast.

The generic relationships of *V. nigricans* are dubious.

It is an operculate form and was first described as a subspecies of *lumbricalis*, the type of *Vermicularia*. Dall, 1889, in his report upon the "Blake" dredgings speaks of a faint median ridge which he thought he detected on a few of the tubes near the apex. As *Vermicularia* is characterized by the absence of both longitudinal laminae and transverse septae *V. nigricans* must be transferred, if the internal laminae prove to be a characteristic feature of the species. I could find none of them in the Recent specimens which I examined. In a few of the fossil forms that seem otherwise similar to the Recent *V. nigricans* distinct, well-developed transverse septae similar to those in *L. granifera* are present but are less common than in *L. granifera*. It seems reasonable to suppose in the absence of tips and operculi, that the masses of tubes from the Duplin marl at the Natural Well, Duplin County, and 1½ miles east of Fairmont in Robeson County, in spite of their surficial resemblance may be distinct from the Recent *nigricans* and referable to non-operculate *Lemintina*, whereas the Recent species should be retained in one of the operculate groups, either *Vermicularia* or *Vermetus*.

Distribution: North Carolina: Duplin marl, Natural Well, 2 miles southwest of Magnolia, Duplin County; 1½ miles northeast of Fairmont, Robeson County.

Lemintina virginica (Conrad)

Plate 24, figure 12

1839. *Serpula virginica* Conrad, Fossils of the medial Tertiary of the United States, cover of No. 1, p. 3.
1845. *Anguinella virginiana* Conrad. Fossils of the medial Tertiary United States, p. 77, pl. 44, fig. 4.
1892. *Vermetus?* (*Anguinella*) *virginica* Conrad (part). Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 306.
1904. *Vermetus virginicus* (Conrad)?. Martin, Maryland Geol. Survey, Miocene, p. 232, pl. 55, fig. 16.
1909. *Vermetus virginicus* (Conrad)?. Grabau and Shimer, North American index fossils, p. 738, fig. 1072c. (After Martin.)

Shell terete, slender, adhering in large groups, occasionally angulated, with sessile spiral convolutions; surface with acute prominent transverse wrinkles.

Type locality: Near Urbanna, Virg[inia].—Conrad, 1839.

Terete, slender, adhering, with strong annular wrinkles; towards the apex are contiguous convolutions, somewhat angular or subcarinated; the whorls with obsolete revolving lines and subcarinated near the base; internally furnished with vaulted septa.

Loc. Near Urbanna, Middlesex Co. Virg[inia].—Conrad, 1845.

If the illustrations are indicative of constant characters in the sculpture, *Lemintina virginica* differs from *L. granifera* in the absence of longitudinal striations. There is no satisfactorily determined material in our collections.

Distribution: Virginia: St. Marys formation, 2½ miles south of Farnham, Richmond County; Urbanna, Middlesex County.

Outside distribution: Miocene, Calvert formation, Plum Point and Chesapeake Beach, Md. ?Choptank formation, ?Jones Point, ?Greensboro, and ?Cordova, Md. ?St. Marys formation, ?St. Marys River, Md.

Genus VERMICULARIA Lamarck

1799. *Vermicularia* Lamarck, Prodrome d'une nouvelle classification des coquilles: Soc. hist. nat. Paris Mém., p. 78.

Type by monotypy: *Serpula lumbricalis* Linnaeus. Recent, in the Indo-Pacific.

Vermicularia is considered the least aberrant of the genera of Vermetidae. The initial portion of the shell is coiled as regularly as a *Turritella* and the sculpture is equally regular. The *Turritella*-like stage is succeeded by a lax spiral or merely a somewhat warped tube on which the sculpture is as irregular as the growth. There are no laminae and no internal septae. The operculum is as large as the mouth.

Vermicularia is recorded from the Mesozoic to the Recent. The living species are largely confined to the warm waters.

Vermicularia spirata (Philippi)

Plate 24, figure 5

1836. *Vermetus spiratus* Philippi, Archiv für Naturgeschichte, Band 1, p. 224; Band 2, pl. 7, figs. 1a–b–c.
1841. *Vermetus lumbricalis* (Linnaeus). Gould, Invertebrata Massachusetts, p. 246. Not *Vermicularia lumbricalis* Lamarck, 1799=*Serpula lumbricalis* Linnaeus, 1758.
1892. *Serpulorbis* (*Vermicularia*) *spirata* Philippi. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 304.
1912. *Vermicularia spirata* Philippi. Cossmann, Essais paléoconchologie comp., vol. 9, p. 143, pl. 10, fig. 3.
1925. *Vermicularia spirata* Philippi. Maury, Bull. Am. Paleontology, vol. 10, No. 42, p. 227, pl. 41, fig. 13.
1928. *Vermicularia spirata* (Philippi). Woodring, Carnegie Inst. Washington Pub. 385, p. 344, pl. 26, fig. 5.
1930. *Vermicularia spirata* (Philippi) Dall. Mansfield, Florida Geol. Survey Bull. 3, p. 103, pl. 14, fig. 11.

Tubes solitary, or intertwined, attaining 10 millimeters in diameter. Tip turritelloid, the whorls contiguous, and regularly increasing in size, in some individuals, through the thirteenth volution, the tube later becoming loosely and irregularly coiled, although commonly preserving through the greater portion of life the angularity inherited from its turritelloid youth. Axial sculpture of rather prominently elevated lirations minutely corrugated by the incrementals. A corneus operculum present in the Recent individuals.

This species is the best characterized of any of the east coast Tertiary Vermetidae.

Figured specimen: U.S.N.M. 53487.

Locality of figured specimen: Living off Key Largo, Fla., in grass below low water.

Distribution: North Carolina: Duplin marl, Natural Well, 2 miles southwest of Magnolia, Duplin County; 1½ miles northeast of Fairmont, Robeson County. Croatan sand, 13 miles below New Bern, Neuse River, Craven County; Waccamaw formation, Neills Eddy Landing, 3 miles north of Cronly, Columbus County.

Outside distribution: Miocene, Choctawhatchee formation (*Cancellaria* zone), Leon County, Fla. Cercado and Gurabo

formations, Dominican Republic. Pliocene, Caloosahatchee marl, Caloosahatchee River, Shell Creek, Alligator Creek, and Myakka River, Fla. Pliocene undifferentiated, Costa Rica and Trinidad. Recent, New England to Bahia, Brazil, and east to Bermuda in 3 to 175 fathoms; dredged by the Woods Hole Survey in the eastern half of Vineyard Sound and Buzzards Bay in 3 to 13 fathoms chiefly on gravel and sand bottoms.

Family CAECIDAE

Genus CAECUM Fleming

1813. *Caecum* Fleming, Brewster's Edinburgh Encyclopedia, vol. 7 (1), p. 67 (fide Sherborn).

Type by subsequent designation (Gray, Zool. Soc. London Proc., pt. 15, p. 203, 1847): *Dentalium trachea* Montagu. Recent, from the British Isles to the Mediterranean.

Shell a small, gently arcuate tube. Protoconch caducous, planorboid, coiled two or three times. Nuclear and adolescent shells successively outgrown and discarded; a septum or "plug" serving to close the posterior extremity of the shell. Form and position of "plug" constant and characteristic of the species. Outer surface of arcuate adult tube dorsal, the inner surface ventral. Adult shell smooth, axially sulcate, annulate or reticulate. Aperture circular, entire.

The genus is rather abundant in the Tertiary and more than a hundred species have been listed from the warm waters of the Recent seas.

Caecum flemingi Gardner and Aldrich

Plate 28, figure 26

1919. *Caecum flemingi* Gardner and Aldrich, Acad. Nat. Sci. Philadelphia Proc., vol. 71, pt. 1, pp. 17–53, 4 pls.

Shell a gently arcuate tube, slightly larger at the anterior end than at the posterior. Surface smooth except for microscopically fine, irregular, incremental striae. Plug ungulate, a minute, truncated cone set dorsal to the median vertical. Anterior aperture oblique to the horizontal axis, the margin faintly, but perceptibly, contracted at the obscure apertural ring.

Dimensions of holotype: Height, 3.7 mm.; diameter of anterior aperture, 1.0 mm.; diameter of posterior aperture, 0.8 mm.

Holotype: U.S.N.M. 325448.

Type locality: Neills Eddy Landing, Cape Fear River, Columbus County, N. C. Waccamaw formation.

No apertural ring has been detected in *C. virginiamum* Meyer (pl. 28, fig. 17), of the Yorktown formation. Though not true of the figured examples, the Yorktown forms average a little larger, and are perhaps a little less arcuate than *Caecum flemingi*. *Caecum virginianum* has been recovered from the Yorktown formation at Yorktown and at Benns Church in Isle of Wight County, Va., and from the Yorktown at Rock Landing in Craven County, N. C.

Another unsculptured species, the minute *Caecum glabrum* Montagu (pl. 28, fig. 19) was reported from the Yorktown by Meyer, but the report has not been verified. *Caecum putnamense* Mansfield, 1924, is also minute (2.5 millimeters in height), and the plug is mammillate instead of ungulate.

Distribution: North Carolina: Waccamaw formation, Neills Eddy Landing on the Cape Fear River, 3 miles north of Cronly, Columbus County.

Outside distribution: Miocene, Duplin marl at the Muldrow Place, 5 miles southeast of Mayesville, Sumter County, S. C.

Caecum regulare Carpenter

Plate 28, figure 18

1858. *Caecum regulare* Carpenter, Zool. Soc. London Proc., p. 428.

1892. *Caecum regulare* Carpenter. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 299.

1930. *Caecum regulare* Carpenter. Mansfield, Florida Geol. Survey Bull. 3, p. 102, pl. 14, fig. 5.

Caecum regulare is a short squat species with a low curvature, expanding slightly toward the anterior extremity. The shell is closely annulated, usually with 20 to 25 rings, regularly spaced except near the aperture where they become wider and less crowded. The apertural ring is heavier than those behind it, wider and set apart by a wider interspace. Within the ring is a thin and narrow flange. The plug is low and mucronate near the dorsal margin.

Dimensions of figured specimen: Height, 3.0 mm.; diameter at anterior extremity, 0.7 mm.

Figured specimen: U.S.N.M. 325449.

Locality of figured specimen: Neills Eddy Landing, Cape Fear River, Columbus County, N. C. Waccamaw formation.

Mansfield (U. S. Nat. Mus. Proc., vol. 66, no. 2259, p. 50, pl. 8, fig. 6, 1925) described a much smaller but similarly sculptured species, *C. properegulare*, from the Brasso beds of Trinidad. *Caecum floridanum* Stimpson (pl. 28, fig. 27) and the subspecies *compactum* Dall are more closely annulated than *C. regulare* and exhibit a faint and more or less fortuitous longitudinal striation. *Caecum patuxentium* Martin, from the Choptank formation of Maryland, is likewise more closely annulated but lacks the longitudinal striation of *C. floridanum*.

Caecum regulare was apparently established along the Atlantic seaboard not later than the upper Miocene. Mansfield reports it from the *Cancellaria* zone of the Choctawhatchee formation in Florida. In the Recent seas, the American records are restricted to the West Indies.

Distribution: North Carolina: Yorktown formation, ?Rock Landing on the Neuse River, Craven County. Waccamaw formation, Neills Eddy Landing, 3 miles north of Cronly, Columbus County.

Outside distribution: Miocene, Choctawhatchee formation, *Cancellaria* zone in Leon and Washington Counties, Fla. Pliocene, Caloosahatchee marl, Caloosahatchee River, Shell Creek, and Alligator Creek, Fla. Recent, West Indies; reported also from Singapore and Australia, but such records should be carefully checked.

Caecum stevensoni Meyer

Plate 28, figure 28

1888. *Caecum stevensoni* Meyer, Am. Philos. Soc. Proc., vol. 25, p. 139, pl. 127, fig. 4.

1892. *Caecum stevensoni* Meyer. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 297.

Relatively large; regularly and well curved. Shell thick. Surface closely covered by strong longitudinal costae, which are usually alternating. Septum mucronate.

If the shell is kept horizontal, its convexity towards the observer, the mucronation of the septum appears on the left side. Its size and position is variable, sometimes it is nearly marginal, sometimes subcentral. The costae are usually broader than the interstices between them and alternating, but in some specimens they are nearly equal. The younger part of two specimens shows indications of rings, producing a very slight cancellation. There is a contraction at the aperture, but it is confined to the margin of the aperture and nearly imperceptible. Besides the regular form there occur smaller specimens of equal ornamentation, but different shape. They have a less cylindrical tube, the increase in width towards the aperture being much larger. * * * Specimens of the recent *Caecum cooperi* Smith [pl. 28, figs. 20, 29] were compared and proved to be somewhat similar, but specifically different. They have fewer and thinner ribs, are distinctly cancellate and have a different shape. *C. stevensoni* is quite common in Yorktown.—Otto Meyer, 1888.

Dimensions of figured specimen: Height 4.4 mm.; diameter at anterior extremity, 1.0 mm.

Figured specimen: U.S.N.M. 325450.

Locality of figured specimen: Drainage ditch, 1 mile northeast of Suffolk, Nansemond County, Va.

Caecum stevensoni Meyer differs from *C. coronellum* Dall in the more slender, tapering outline, the lower number of ribs, usually 15 to 20 instead of 21 to 25, their coarser and less uniform character, and the absence of a strongly developed annulation around the aperture of the adult.

Examples of *Caecum cooperi* S. Smith from the Waccamaw formation at Neills Eddy Landing, Cape Fear River, 3 miles north of Cronly, Columbus County, N. C., are illustrated on plate 28, figures 20 and 29.

Caecum ibex Dall (holotype, U.S.N.M. 113421, pl. 28, fig. 16) described from the Waccamaw formation at Mrs. Guion's marl pit, Cape Fear River, N. C., is more produced and attenuated posteriorly that *C. stevensoni.* It exhibits a similar axial sculpture; but apparently it does not develop the annular rings that are commonly present near the anterior aperture of *C. stevensoni;* and, furthermore, the mucro is more produced, much more sharply conical, and more nearly central in position than that of the more northern form. *Caecum ibex* is restricted in its known distribution to the Waccamaw of the Carolinas.

Distribution: Virginia: Yorktown formation, Yorktown, York County (Otto Meyer); 1 mile west of Suffolk and 1 mile northeast of Suffolk, Nansemond County.

North Carolina: Yorktown formation, Mount Pleasant Landing on the Chowan River, Hertford County; Colerain Landing, Bertie County; Rock Landing, Craven County. Duplin marl, 2 miles southwest of Magnolia at the Natural Well, Duplin County.

Family CERITHIOPSIDAE

Genus CERITHIOPSIS Forbes and Hanley

1853. *Cerithiopsis* Forbes and Hanley, British Mollusca, vol. 3, p. 364.

Type by monotypy: *Murex tubercularis* Montagu. Recent, along the European coasts from the British Isles to the Mediterranean.

Subgenus LASKEYA Iredale

1868. *Eumeta* Mörch, Faunula molluscorum Islandiae, Naturhist. Foren. Kjöbenhavn Medd., p. 208. Type by monotypy: *Cerithium (Eumeta) arctica* Mörch=*Turritella? costulata* Möller=*Cerithiopsis costulata* Jeffreys. Recent, in the North Atlantic.

Not *Eumeta* Walker, 1855. Lepidoptera.

1918. *Laskeya* Iredale, Malacol. Soc. London Proc., vol. 13, p. 30.

The type is that of *Eumeta* which *Laskeya* replaces.

Laskeya differs from *Cerithiopsis* in the shorter, more obtuse nucleus, the more tesselate sculpture and, usually, in the more elevated and slender outline.

A large part of the species referred to *Laskeya* are from the cooler waters. Dall has erected a Section *Onchodia*, characterized by a swollen nucleus, that includes a group of deep-water species from off the Georgia and north Florida coasts.

Cerithiopsis (Laskeya) emersonii (C. B. Adams)

1839. *Cerithium Emersonii* C. B. Adams, Boston Jour. Nat. History, vol. 2, p. 284, pl. 4, fig. 10.

Type locality: Recent, New Bedford harbor on the Fairhaven side, Mass.

Cerithiopsis subulata Montagu is, perhaps, the name more commonly used for this species. Montagu's shell was collected on the east coast of Scotland.

Cerithiopsis (Laskeya) emersonii persubulata Gardner, n. subsp.

Plate 27, figure 4

Shell a slender obelisk of possibly 17 whorls, including the slender, polyspiral nucleus which is imperfectly preserved in all available material. Typical sculpture on early portion of conch of 2 prominent rounded, spiral lirae, nodulated by the axials which they override, the one overhanging the anterior suture, the other a little in front of the posterior. Axial riblets simple, flattened threads, 16 to 20, persistent from suture to suture, thus cutting the interspiral areas into a series of squarish or rectangular pits and forming a series of minute pockets between the spirals and the sutures; typical sculpture on the later whorls of 3 spiral lirae, symmetrically placed, the medial spiral less prominent than those before and behind; axials more feeble than on the earlier whorls, particularly on the interspiral areas so that the spirals are sharply undulated rather than nodose at the intersections. Suture lines indistinct, margined on either side by a microscopically fine threadlet. Base of body whorl flattened or slightly convex, sculptured only

by exaggerated incrementals. Aperture subquadrate. Outer lip straight, thin, sharp, simple within, crenulated in harmony with the external ribbing, abruptly constricted at the mouth of the anterior canal. Inner lip strongly concave, nonplicate. Canal open, very short, sharply recurved, truncate anteriorly.

Dimensions of incomplete holotype: Height, 12.4 mm.; diameter 3.2 mm.

Holotype: U.S.N.M. 325445.

Type locality: Bolten Phosphate Company's pits, Stono River, Charleston County, S. C. Pleistocene.

Cerithiopsis (*Laskeya*) *emersonii persubulata* differs from *L. emersonii* s.s. in the more slender, attenuated outline. Among the Recent forms commonly referred to the species s.l., the New England representatives seem consistently less slender than those in the South Atlantic waters. The fossil representatives, even those from the Yorktown formation, are all referable to the more slender race.

Distribution: Virginia: Yorktown formation, Yorktown, York County; half a mile below Suffolk waterworks dam, Nansemond County.

North Carolina: Duplin marl, Natural Well, and Magnolia, Duplin County. Waccamaw formation, Cronly, half a mile east of the factories, Columbus County.

Outside distribution: Pliocene: Caloosahatchee marl, Caloosahatchee River, Fla. Pleistocene, Simmons Bluff and Bolten Phosphate Company's pits, Stono River, S. C. Recent, The Carolinas to the Antilles in shallow water?

Family TRIPHORIDAE

Genus TRIPHORA Blainville

1828. *Triphora* Blainville, Dictionnaire sci. nat., vol. 55, p. 344.

Type by monotypy: *Triphora gemmatum* Blainville=*Cerithium tristoma* Blainville. Recent, off Mauritius.

The sinistral coiling characterizes the genus and the family.

Triphora dupliniana (Olsson)

Plate 27, figure 3

1916. *Triphoris dupliniana* Olsson, Bull. Am. Paleontology, vol. 5, No. 27, p. 18 pl. 3, fig. 8.

Shell sinistral, elongate-conic, with nearly straight sides; nuclear whorls 1+, the last turn with transverse ribbing and 2 peripheral carinae; post-nuclear whorls 11, suture indistinct; the 1st 5 whorls, with 2 subequal spirals, on the 6th whorl, an intermediate spiral makes its appearance and increases gradually in strength; on the body-whorl, the uppermost spiral is the strongest; spirals tuberculated by 22 riblets which moreover extend somewhat diminished across the interspiral spaces; base sloping with 3 smooth spirals; columella smooth; anterior canal moderately long, closed or nearly so and bent both to the right and backwards; mouth small, rounded; outer lip oblique, with a deep anal notch bordering the suture.

Length 5.75 breadth 1.75 mm.

This species belongs to the group of *Triphoris*, such as *T. melanura*, which have only 2 spirals on the earlier post-nuclear whorls, later 3, with the last spiral coming in between the other 2. The open, anal sinus and bent, tubular anterior canal are the main diagnostic characters of this species.

Duplin formation; Natural Well, N. C.

Yorktown formation; James river, north of Smithfield, Va.—Olsson.

Dimensions of topotype: Height, 5.8 mm.; maximum diameter, 1.7 mm.

Topotype: U.S.N.M. 114256.

Triphora apania Woodring (Carnegie Inst. Washington Pub. 385, p. 329, pl. 25, fig. 2, 1928) from Jamaica, and *Triforis calypsonis* Maury (Bull. Am. Paleontology, vol. 5, no. 29, p. 122, pl. 21, fig. 13, 1917) from the Dominican Republic, are closely related forms.

In *Triphoris bartschi* Olsson (pl. 27, fig. 5), the posterior of the 3 spirals is the least elevated and the last to appear. The type, like that of *T. dupliniana*, comes from the Duplin marl at the Natural Well, and like *T. dupliniana*, the species occurs also in the Yorktown formation on the James River above Smithfield.

Distribution: Virginia: Yorktown formation, "James River north of Smithfield" (Olsson).

North Carolina: Duplin marl. Natural Well and 1½ miles northwest of Magnolia, Duplin County.

Superfamily PTENOGLOSSA

Family EPITONIIDAE

Genus EPITONIUM "Bolton" Roeding

1798. *Epitonium* "Bolten" Roeding, Museum Boltenianum, pt. 2, p. 91.

Type by subsequent designation (Suter, Manual New Zealand Mollusca, p. 319, 1913): *Turbo scalaris* Linnaeus=*Scalaria pretiosa* Lamarck. Recent, in the western Pacific.

The genus has been gradually increasing in prominence since the Triassic and is represented in the Recent seas by some 150 to 200 species of "wentle traps" distributed from the polar regions to the tropics and from between tides to abysmal depths.

Subgenus HYALOSCALA De Boury

1890. *Hyaloscala* De Boury, Soc. malacol. italiana Boll., vol. 14, p. 90 of separate.

Type by original designation: *Scalaria clathratula* Adams. Recent, in the western Atlantic from Marthas Vineyard to Key West.

Hyaloscala includes small, thin shells, usually of slender outline, made up of convex whorls separated by moderately impressed sutures, sculptured by laminar axials not fused at the sutures into a continuous series. The aperture is oval, broadening anteriorly, and the reflected inner lip completely closes the umbilical chink.

A number of species from the European Tertiary have been referred to this subgenus, and the Recent forms, though not very numerous, have a wide distribution both in longitude and latitude.

Epitonium (Hyaloscala) carolinae Gardner, n. sp.

Plate 28, figure 50

Shell small, delicate, slender. Imperforate. Whorls probably 8, contiguous, convex, tapering to an acute

apex; maximum diameter of all except the body lying in front of the median line, thus giving to the posterior portion of the whorl a more gentle slope than to the anterior. Nuclear whorls lost. Sculpture restricted to the axial varices; varices very thin, low, for the most part equispaced, sinuous, 30 to 35 on the body; retractive posteriorly and continuous with the next varix to the left on the preceding whorl, the series thus describing a little more than half a complete revolution. Sutures impressed, partially filled with the flexed extremities of the varices. Aperture broken in all available material, rounded, with an evenly arcuate inner and probably a thin semicircular outer lip. Umbilicus concealed by heavy coating of enamel.

Dimensions of incomplete holotype: Height, 7.0 mm.; maximum diameter, 2.7 mm.

Holotype: U.S.N.M. 114155.

Type locality: Natural Well, 2 miles southwest of Magnolia, Duplin County, N. C. Duplin marl.

The species is described from imperfect material, but the crowded, sinuous, equisized, and equispaced varices are so diagnostic that there should be no difficulty in recognizing the form. In some of the Recent species, such as *Epitonium sericifilum* (Dall), described from Honduras, the varices are more or less sigmoidal but in addition a faint, though well-defined, spiral sculpture is usually present. *Epitonium junceum* Gardner is very much more slender, with even thinner varices which increase very rapidly in number so that on the final volution they number between 50 and 60.

Epitonium (Hyaloscala) junceum Gardner, n. sp.

Plate 28, figure 34

Shell minute, exceedingly slender and graceful, imperforate. Nuclear whorls 4, polished, smooth, acutely tapering, followed by 5 gently convex, closely contiguous volutions. Sculpture axial only; varices sigmoidal, of tissue paper thinness, and becoming increasingly crowded toward the aperture so that on the body, fully 15 are contained within the space of half a millimeter; posterior ends of varices slightly elevated, retractive. Suture impressed, partially filled by the flexed extremities of the varices. Aperture imperfect. Inner margin less strongly arcuate than outer. Parietal wall heavily enameled.

Dimensions of holotype: Height, 4.2 mm.; maximum diameter, 1.4 mm.

Holotype: U. S. N. M. 114157.

Type locality: Natural Well, 2 miles southwest of Magnolia, Duplin County, N. C. Duplin marl.

Epitonium junceum far exceeds in delicacy and slenderness of outline any other known Tertiary species.

It is known from the type locality only.

Epitonium (Hyaloscala?) fasciatum Gardner, n. sp.

Plate 28, figure 35

Shell very small, slender, imperforate. Nuclear coils 3, the first 2 very small, flattened, and acutely tapering, the third much larger and evenly convex. Whorls of conch 4, gently convex, the maximum diameter falling a little in front of the median horizontal. Axial varices 15 on the final volution, broad, retractive posteriorly and closely appressed against varices of preceding whorl; the series describing about a fourth of a complete revolution; intervarical areas subequal to varices in width and filled with crowded, spiral, linear striations separated by linear interspaces. Aperture broken away, probably subelliptical; inner margin evenly arcuate. Parietal well glazed with an enamel which conceals the umbilical chink.

Dimensions of holotype: Height, 3.6 mm.; diameter, 1.5 mm.

Holotype: U. S. N. M. 114156.

Type locality: Natural Well, 2 miles southwest of Magnolia, Duplin County, N. C. Duplin marl.

This minute, but apparently adult univalve is unusually well characterized by the broad, flatly appressed varices which swathe it from the protoconch to the base. No other known Tertiary or Recent species of the east coast exhibits a similar sculpture. The protoconch, however, is similar to that of *E. junceum*.

Epitonium (*Hyaloscala?*) *fasciatum* has been recognized at the type locality only.

Subgenus SPINISCALA De Boury

1909. *Spiniscala* De Boury, Jour. conchyliologie, vol. 57, p. 257.

Type by original designation: *Scalaria frondicula* Wood, subsp.? Pliocene, of Italy. De Boury specified the form from the Pliocene of Italy rather than that from the Crag of England, the area from which the type was described.

Spiniscala includes forms of rather low, somewhat turbinate outline made up of convex contiguous whorls, pseudo-tabulated by the axials, increasing rapidly in diameter, and separated by deep sutures. The axials are heavy, laminar, not crowded, prominently elevated, and produced at the shoulder angle into a coronal of short, trigonal spines. Behind the spines the axials are relatively low and retractive, abutting against the axials of the preceding whorl but not fused with them. The spiral sculpture is altogether absent or reduced to microscopically fine, fortuitous striae. The base of the body is smoothly rounded and not reinforced. The aperture is ovate or subelliptical, the peristome continuous. The inner margin of the aperture is reverted, completely closing the umbilical chink.

This group like many of the others has not been very well segregated and may have a wider distribution than is apparent from the check lists. It is certainly well represented in the middle and late Tertiary of central

and southern Europe and is recorded both in the Atlantic and the Pacific Oceans.

Epitonium (Spiniscala) edgecombense Gardner, n. sp.

Plate 28, figure 21

Shell small, moderately heavy, slender, imperforate. Whorls contiguous, regularly and rather strongly convex, probably about 8. Apex broken away. Sculpture axial only; varices 14 on the body of the type, rather heavy, elevated, equisized and equispaced, tabulated and subspinose posteriorly; varices flexed on the shoulder, abutting on the varix to the left on the preceding whorl, the series thus making a complete revolution around the axis. Suture impressed. Aperture subrotund, the outer margin a little more arcuate than the inner, the anterior margin slightly patulous.

Dimensions of incomplete holotype: Height, 6.3 mm.; maximum diameter, 3.0 mm.

Holotype: U.S.N.M. 325431.

Type locality: Half a mile above Bells Bridge, Tar River, Edgecombe County, N. C. Yorktown formation.

Epitonium edgecombense suggests *E. bolteni* Gardner in general outline. It differs in the fewer, thinner, sharper, and more elevated laminae and the obscure tabulation of the varices in front of the suture. *Epitonium robesonense* Gardner is relatively less slender, and its fewer and more elevated varices are concave posteriorly instead of flattened, thus forming in front of the suture a corona of sharp and prominent spines in place of the circlet of minute, subspinose processes which outline the margin of the whorl in *E. edgecombense*.

Distribution: North Carolina: Yorktown formation, half a mile above Bells Bridge on the Tar River, and 5 miles below New Bridge on the Tar River, Edgecombe County.

Epitonium (Spiniscala) robesonense Gardner, n. sp.

Plate 28, figure 32

Shell small, slender, delicate, imperforate. Whorls contiguous, convex, probably 6. Sculpture axial only; varices 9 or 10 on the final volution, equisized and equispaced, thin, strongly elevated, laminar, the outer edges reflected away from the aperture; posterior margins of the varices concave on the shoulder and drawn out to form a spinose crown around the suture; varices retractive posteriorly and impacted against the varix to the left on the preceding whorl, the series thus performing a little less than a complete revolution around the axis of the shell. Suture impressed. Aperture subrotund, the inner margin a little less strongly arcuate than the outer. Parietal wall heavily enameled.

Dimensions of holotype: Height 5.2 mm.; maximum diameter, 2.6 mm.

Holotype: U.S.N.M. 325437.

Type locality: One and a half miles northeast of Fairmont, Robeson County, N. C. Duplin marl.

Epitonium robesonense is conspicuous for the coronated aspect of the whorls. The varices increase in elevation toward the aperture, thus increasing the apparent stoutness of the outline of the shell.

The species is known only from the type locality.

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Subgenus CINCTISCALA De Boury

1909. *Cinctiscala* De Boury, Jour. conchyliologie, vol. 57, p. 258.

Type by original designation: *Scalaria antillarum* De Boury= *Scalaria turrita* Nyst, 1871, not Blainville, 1827=*Scalaria turricula* Sowerby, 1844, not Cantraine, 1842. Recent, in the West Indies and north to Hatteras.

Cinctiscala is characterized by the elevated, acutely tapering spire, the convex whorls separated by deeply impressed sutures, the rather numerous, moderately elevated, commonly unequal axials, and the very fine spiral threading which crowds the interaxial areas. The base of the body is smoothly rounded. There is a slight change in the character of the spiral sculpture on the base but no other indication of a disk. The peristome is continuous, and, in the subgenotype, the reverted inner margin does not entirely conceal the narrow umbilical chink.

Epitonium (Cinctiscala) antillarum (De Boury)

Plate 28, figures 42, 49

1844. *Scalaria turricula* Sowerby, Thesaurus conchyliorum, I: 9 *Scalaria*, p. 92, pl. 33, fig. 61, pl. 34, fig. 88.
Not *Scalaria turricula* Cantraine, Acad. Royale, Belgique Mém., vol. 9, p. 345, 1842.
1873. *Scalaria turrita* Nyst, Tableau synoptique et synonymique gen. *Scalaria*, Annales Soc. Malacologique Belgique for 1871, vol. 6, pp. 142, 143.
Not *Scalaria turrita* Blainville, Dictionnaire des Sciences Naturelles, vol. 48, p. 17, 1827.
1876. *Scala* (*Amaea*) *turricula* Sowerby. Mörch, Acad. Nat. Sci. Philadelphia Jour., vol. 8, p. 200.
1890. *Scala turricula* Sowerby. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1 p. 157.
1909. *Scalaria* (*Cinctiscala*) *antillarum* De Boury, Jour. conchyliologie, vol. 57, p. 258.
1913. *Scalaria* (*Cinctiscala*) *antillarum* De Boury, Jour. conchyliologie, vol. 61, p. 75.
Not *Epitonium turriculum* (Sowerby). Mansfield, Florida Geol. Survey Bull. 3, p. 88 pl. 12, fig. 6, 1930.

Nyst in 1873 attempted to replace Sowerby's preoccupied *turricula*, but he selected a name in good standing since 1827.

The type is a Recent shell from an undesignated locality in the West Indies.

Shell of medium size, moderately slender. Imperforate. Whorls of conch 8, strongly convex, tapering to the acute, 3-whorled protoconch. Axial costae usually blunt, commonly inequisized and inequispaced, 10 to 13 to the whorl, retractive posteriorly and usually impacted at the suture against the varix to the left on the preceding whorl, the series thus describing less than half a revolution around the axis. Spiral sculpture of flat, sublinear lirae, separated by linear interspaces varying rather widely in degree of prominence. Aperture rudely

semielliptical. Anterior margin slightly patulous. Parietal wall heavily washed with an enamel that completely conceals the umbilicus.

Dimensions of figured specimen: Height, 12.0 mm.; maximum diameter, 4.8 mm.

Figured specimen: U.S.N.M. 325432.

Locality of figured specimen: One and a half miles below Tar Ferry, Wiccacon Creek, Hertford County, N. C. Yorktown formation.

The species is rather widely distributed in the Tertiary as well as in the Recent faunas and recognizable among its Miocene and Pliocene associates by the very low, obtuse costals. *Epitonium santodomingonum* Pilsbry, 1921, is closely related but the outline seems more slender and the aperture less oblique and more rotund.

Distribution: North Carolina: Yorktown formation, Halifax, Palmyra Bluff, and 3½ miles below Palmyra Bluff on the Roanoke River, Halifax County; Hamilton Landing and 4 miles northwest of Williamston, Martin County; 1½ miles below Tar Ferry on Wiccacon Creek and Mount Pleasant Landing, on the Chowan River, Hertford County; Colerain Landing on the Chowan River, Bertie County.

Outside distribution: Pliocene, Waccamaw formation, Tilly Lake, Horry County, S. C. (Dall). Caloosahatchee marl, Caloosahatchee River, Shell Creek, Fla. Recent, Cape Hatteras to Anguilla Island, West Indies, in 16 to 22 fathoms.

Subgenus CLATHRUS Oken

1815. *Clathrus* Oken, Lehrbuch der Naturgeschichte, Theil 3, Abtheil. 1, Fleischlose Thiere, pp. ix, 256.

Type by tautonymy: *Turbo clathrus* Linnaeus (ed. 10) renamed *Clathrus spurius* Oken=*Scalina communis* Lamarck (Hanley). Recent, along the European shores from Scandinavia to the Mediterranean.

Clathrus s. s. is unrepresented in the Miocene fauna of the Atlantic coast.

Section NITIDISCALA De Boury

1909. *Nitidiscala* De Boury, Jour. conchyliologie, vol. 57, p. 257.

Type by original designation: *Scalaria unifasciata* Sowerby. Recent, in the West Indies.

The shells included under *Nitidiscala* are smaller and more delicate than those of *Clathrus* s. s.

Epitonium (Clathrus) muldrowi Gardner and Aldrich

Plate 28, figure 47

1919. *Epitonium muldrowi* Gardner and Aldrich, Acad. Nat. Sci. Philadelphia Proc., p. 36, pl. 2, fig. 10.

The type locality is the Muldrow Place, 5 miles southeast of Mayesville, Sumter County, S. C. The marl is of Duplin age.

Scala sheldoni Olsson, 1916, from the Yorktown at Kings Mill, Va., exhibits, according to the illustrations and description, similar but more numerous varices. The horizons represented by the 2 species are not far from synchronous. A very fine specimen recovered from the marls 1 mile northeast of Suffolk, in Nansemond County, Va., is probably referable to *E. sheldoni*.

Epitonium (Clathrus) bolteni Gardner, n. sp.

Plate 28, figure 43

Shell heavy, slender, elevated, imperforate. Whorls contiguous, regularly convex, approximately 8. Apex broken away. Sculpture axial only; varices 12 on the body of the type, stout, abruptly elevated, the free edges showing the constituent growth lamellae; retractive posteriorly and impacted at the impressed suture against the varix to the left on the preceding whorl. Aperture holostomous, obliquely ellipsoidal; the outer edge varicose and more strongly arcuate than the inner. Parietal wall heavily glazed. Umbillicus closed.

Dimensions of holotype: Height, 8.5 mm.; maximum diameter, 3.8 mm.

Holotype: U.S.N.M. 325438.

Type locality: Nine to ten miles south of Greenville on the Tar River, Pitt County, N. C., Yorktown formation.

Epitonium bolteni recalls *E. sayana* (Dall) of the late Tertiary to Recent faunas of the southeastern United States. It differs in the smaller size, more slender outline and more tightly coiled whorls; the varices are more numerous and much less tightly fused at the sutures than those of *E. sayana*.

Epitonium bolteni has been recognized only at the type locality.

Section GYROSCALA De Boury

1887. *Gyroscala* De Boury, Étude sur les sousgenres de Scalidae, p. 15.

Type by original designation: *Scalaria commutata* Monterosato. Recent, in the Mediterranean.

Gyroscala is similar to *Clathrus* s. s. in the general contour of the whorls, and the character of the varices, but the ribs are not fused across the suture as they are in *Clathrus* s. s. The cordon encircling the base is characteristic of the section.

Epitonium (Clathrus) microstoma (H. C. Lea)

Plate 28, figure 48

1846. *Scalaria microstoma* H. C. Lea, Am. Philos. Soc. Trans., n. ser., vol. 9, p. 260, pl. 36, fig. 68.

Shell subulate-conical, thin, imperforate, costate; spire conical, very attenuate, obtuse; sutures impressed, interrupted; whorls seven, very convex; costae few, elevated, reflexed; last whorl rounded; base sub-carinate; mouth small, oblique subrotund; outer lip very much thickened.

Length .28. Breadth .12 of an inch.

Remarks.—The carina of the base is very small; it does not cross the costae, which continue to the columella. The mouth is unusually small and nearly round. The costae are ten in number on the last whorl, quite prominent, and reflexed. In full grown specimens the one which forms the outer lip is much thicker than the rest. The ribs of one whorl do not join those of the next, but lap over very closely. This causes the sutures to be continually interrupted.—H. C. Lea, 1846.

Holotype: Acad. Nat. Sci. Philadelphia 1537.

Type locality: Petersburg, Va. Yorktown formation.

Epitonium alaquaënse Mansfield from the lower part of the Choctawhatchee formation in northern Florida is similar in outline and in the character of the varices but it lacks the basal cord which in *E. microstoma* connects the varices but does not override them.

Epitonium microstoma has been recognized only at the type locality.

Subgenus PICTOSCALA Dall

1917. *Pictoscala* Dall, U. S. Nat. Mus. Proc., vol. 53, p. 477.

Type by subsequent designation (De Boury, Jour. conchyliologie, vol 64, p. 37, 1919): *Scalaria lineata* Say. Recent, from Vineyard Sound to the Gulf of Mexico.

In spite of the numerous sections proposed by M. de Boury, he does not seem to have designated one to receive shells of the type of *Scalaria lineata* Say, 1822 (not of Kiener, 1838). These forms have a more or less dark colored body with a feebly developed basal disk, fine spiral striation, rather numerous small varices, and a few irregularly distributed very much heavier varices, including the terminal one. A single species of this group occurs at Panama. In allusion to the coloration I propose *Pictoscala* for these forms.—Dall, 1917.

Heilprin, 1880, figured very badly a species that he called *Scalaria unilineata* and cited as the locality, Jackson, Miss. Aldrich, 1897, refigured the species, which is an excellent example of *Pictoscala*. If Heilprin was correct in giving his type locality as Jackson, Miss., and there is no reason to doubt him, the subgenus runs back at least to the upper Eocene. We have a scattered representation of characteristic species through the Tertiary of the eastern seaboard, and in the Recent faunas *Pictoscala* occurs both in the Atlantic and the Pacific seas. It ranges farther south on the west coast than on the east coast.

Epitonium (Pictoscala) pratti Gardner, n. sp.

Plate 28, figures 44–46

Shell moderately heavy, relatively stout, imperforate. Whorls contiguous, convex, probably about 10. Apex broken away in all available material. Axial varices very low, blunt, continuous, feebly retractive, separated by regularly convex intervarical areas; ends of varices bent at right angles at the suture and appressed against the preceding whorl. Traces of a very faint microscopic spiral striation sometimes present. Suture impressed, partially filled on the later whorls by the recurved ends of the varices. Base of body whorl delimited by a faint but distinct cingulum. Aperture holostomous, obliquely elliptical; inner margin less strongly arcuate than the outer. Parietal wall heavily calloused. Labrum subvaricose. Umbilicus concealed.

Dimensions of holotype: Height, 14.8 mm.; maximum diameter, 6.4 mm. Dimensions of imperfect paratype: Height, 20.6 mm.; maximum diameter, 8.5 mm.

Holotype: U.S.N.M. 325434; paratype, U.S.N.M. 325435.

Type localities: Holotype, 1 mile southeast of Chocowinity, Beaufort County, N. C.; paratype, 1 mile northeast of Suffolk, Nansemond County, Va. Both holotype and paratype localities in the Yorktown formation.

The varices present a rather wide range in number, as low as 16 or 17 and as high as 25. The other characters are so constant, however, that there seems to be no advantage in isolating subspecies on the number of varices alone.

Epitonium pratti strikingly suggests the subgenotype *E. lineatum* (Say) in the general character of the ornamentation and is probably the ancestor of that species. It is distinct in that it is constantly stouter and exhibits more convex whorls, usually more numerous varices, and a less rotund peristome.

Distribution: Virginia: Yorktown formation, Yorktown, York County; 1½ miles west of Smithfield, and Benns Church, Isle of Wight County; 1¼ miles north of Suffolk, 1 mile west of Suffolk, 1½ miles northeast of Suffolk, 1 mile northeast of Suffolk, Nansemond County.

North Carolina: Yorktown formation, Branchs Bridge on the Meherrin River, Northampton County; 8 to 9 miles southeast of Greenville, and 1 mile northwest of Galloway crossroads, Pitt County; Hominy Swamp, 1 mile west of Wilson, Wilson County; 1 mile southeast of Chocowinity, Beaufort County. Duplin marl, 4 miles north of Lumberton on the Lumber River, and 1½ miles northeast of Fairmont, Robeson County; Waccamaw formation, City Rock Quarry near Wilmington, New Hanover County.

Superfamily GYMNOGLOSSA

Family MELANELLIDAE

Genus STROMBIFORMIS DaCosta

1778. *Strombiformis* DaCosta, British conchology, p. 107.

Type by subsequent designation (Iredale, Malacol. Soc. London Proc., vol. 11, p. 293, 1915): *Strombiformis glaber* DaCosta= *Turbo subulatus* Donovan, fide Jeffreys. Recent, from the British Isles to the Mediterranean.

These shells have nothing to do with *Strombus*, the giant conch, but are the "needle shells" from the Greek word meaning spindle. They are exceedingly slender little forms with long drawn out spires and bodies, a narrow lobate aperture and a reflected and closely appressed inner lip. The Recent shells are banded in color.

Strombiformis dalli and *S. juncea*, described below, are typical. In *Strombiformis biconica*, *S. bartschi*, and *S. lina* the outline is less slender, and the body less attenuated than in the typical form. Perhaps they should be excluded from the restricted section of the genus.

Strombiformis dalli Gardner and Aldrich

Plate 27, figure 8

1890. *Eulima* (*Leiostraca*) *rectiuscula* Dall (part), Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 160.

1919. *Strombiformis dalli* Gardner and Aldrich, Acad. Nat. Sci. Philadelphia Proc., vol. 71, p. 39, pl. 2, fig. 5.

Shell imperforate, moderately tall and exceedingly slender. Spire subulate, faintly undulated by the barely perceptible medial convexity of the whorls; height of

body approximately half that of the entire shell. Whorls closely appressed, slightly flattened dorsoventrally, feebly constricted at the suture lines, and 10 to 11 in number, including the small, nuclear turns which are differentiated only by their relative inflation. Surface smooth, lustrous. Sutures very indistinct. Body whorl evenly and gently curved. Base and aperture drawn out. Aperture holostomous, lobate, acutely angulated posteriorly. Outer lip approximately vertical, patulous and feebly reflexed anteriorly. Inner lip oblique, reflexed, fused with the parietal callus.

Dimensions of holotype: Height, 9.8 mm.; maximum diameter, 1.95 mm.

Holotype: U.S.N.M. 112196.

Type locality: Pliocene, Caloosahatchee marl, Caloosahatchee River, Fla.

Strombiformis dalli is separated from *S. juncea* Gardner by the slightly less slender outline, the more numerous whorls, the somewhat more convex body, and the more strongly reflected outer and inner lips.

In 1889 Dall[7] referred to *Eulima* (*Liostraca*) *stenostoma* Sars a form collected off Fernandina, Fla.; in 1890 he separated it under the name of *Eulima* (*Leiostraca*) *rectiuscula* and united with it some forms collected from the Caloosahatchee marl of Pliocene age. The Tertiary shells, however, are distinct from the Recent individual in question; the whorls of the latter are more numerous, probably 15 in a perfect specimen instead of 11 or 10 as in the fossil, and the spire includes fully two-thirds of the total height of the shell instead of approximately half of it.

Melanella (*Eulima*) *cercadica* Maury (=*Eulima acicularis* Gabb, 1873, not A. Adams, 1861) is almost equally slender, but the body is less attenuated in the Dominican species than it is in that from the Carolinas.

Distribution: Virginia: Yorktown formation, zone 2, half a mile below Suffolk waterworks dam, Nansemond County.

North Carolina: Duplin marl. Natural Well, Duplin County.

Outside distribution: Miocene, Duplin marl, the Muldrow Place, 5 miles southeast of Mayesville, Sumter County, S. C. Pliocene, Caloosahatchee marl, Caloosahatchee River, Fla.

Strombiformis juncea Gardner, n. sp.

Plate 27, figure 10

Shell imperforate, straight, very small and exceedingly slender. Spire subulate, height of body probably a little more than half of the entire shell. Whorls closely appressed, faintly constricted at the sutures with a barely perceptible dorsoventral flattening; 4 in the imperfect type, probably 7 or 8 originally. Surface smooth, lustrous. Sutures very indistinct. Body whorl evenly arcuate. Base and aperture much attenuated. Aperture holostomous, lobate, acutely angulated at the commissure. Outer lip feebly constricted posteriorly, approximately vertical, patulous anteriorly. Columella very slightly concave. Inner lip reflexed, fused with the parietal callus.

Dimensions of incomplete holotype: Height, 4.5 mm.; maximum diameter, 1.2 mm.

Holotype: U.S.N.M. 325444.

Type locality: Neills Eddy Landing, Cape Fear River, 3 miles north of Cronly, Columbus County, N. C. Waccamaw formation.

Strombiformis juncea exceeds all other representatives of the genus within the area under discussion in the degree of slenderness and in the attenuation of the body whorl. Its volutions are less numerous than those of *S. dalli* and the reflection of the outer and inner lips less pronounced.

The species is reported from the type locality only.

Strombiformis biconica Gardner, n. sp.

Plate 27, figures 9, 21

Shell imperforate, straight, rudely biconic; the maximum diameter in the fully adult forms falling just within the anterior third; spire subulate. Volutions closely appressed; a scarcely perceptible medial convexity, least feeble in the apical region. Whorls 10 or 11, including the 1½ to 2 small, smooth, inflated coils of the protoconch. Surface smooth, polished. Suture lines distinct, especially toward the apex. Body whorl almost half as high as the entire shell, broadly depressed in front of the posterior suture, conspicuously produced and attenuated in front of the obtuse periphery. Aperture obliquely lobate, sharply angulated posteriorly. Outer lip approximately vertical behind, abruptly rounded and slightly patulous in front. Columella broadly concave, the inner lip reflected and fused with the parietal callus.

Dimensions of holotype: Height, 5.6 mm.; maximum diameter 1.7 mm. Dimension of paratype: Height, 2.3 mm.; maximum diameter, 0.8 mm.

Holotype: U.S.N.M. 114167. Paratype: U.S.N.M. 325439.

Localities: Holotype, Natural Well, Duplin County, N. C. Duplin marl. Paratype, Neills Eddy Landing, Cape Fear River, 3 miles north of Cronly, Columbus County, N. C. Waccamaw formation.

Strombiformis biconica is rather variable in relative dimensions and the individual selected for figuring rather more slender than the average. The species is well characterized, however, by the broad constriction of the body whorl in front of the posterior suture, and the produced and obliquely truncated outline in front of the periphery. The minute individual illustrated (pl. 27, fig. 9) is probably a juvenile.

The species does not exhibit the regularity in the profile of the spire which characterizes the typical *Strombiformis*.

[7] Dall, W. H., Preliminary Catalogue of the shell-bearing marine mollusks and brachiopods of the southeastern coast of the United States, with illustrations of many of the species: U.S.N.M. Bull. 37, p. 126, 1889.

Distribution: North Carolina: Duplin marl, Natural Well, Duplin County. Waccamaw formation, Neills Eddy Landing, Cape Fear River, 3 miles north of Cronly, Columbus County.

Strombiformis bartschi (Gardner and Aldrich)

Plate 27, figures 12, 13, 16

1919. *Melanella bartschi* Gardner and Aldrich, Acad. Nat. Sci. Philadelphia Proc., p. 37, pl. 2, fig. 1.

Dimensions of holotype: Height 16.0 mm.; maximum diameter, 4.2 mm.

Adult but incomplete paratype: Height, 10.2 mm.; diameter, 3.0 mm.

Possibly immature paratype: Height, 5.9 mm.; diameter, 2.0 mm.

Holotype: U.S.N.M. 114163. Paratypes: Adult individual, U.S.N.M. 325443; possibly immature individual, U.S.N.M. 325441.

Type localities: Holotype, Strickland farm, 1½ miles northwest of Magnolia, Duplin County, N. C.; adult paratype, Rock Landing, Craven County, N. C.; paratype, possibly immature, 2 miles below Yorktown, York County, Va.

Distribution: Virginia: Yorktown formation, 2 miles below Yorktown on the York River, York County; 1 mile northeast of Suffolk, Nansemond County.

North Carolina: Yorktown formation, Rock Landing on the Neuse River, Craven County, Duplin marl. Magnolia and the Natural Well, Duplin County.

Outside distribution: Miocene, Duplin marl, the Muldrow Place, 5 miles southeast of Mayesville, Sumter County, S. C.

Strombiformis lina Gardner, n. sp.

Plate 27, figure 14

Shell imperforate, straight, of moderate size, rather stout for the genus, elongate-conic. Spire subulate; the body rather short for the genus, well rounded, not attenuated anteriorly. Whorls closely appressed, flattened, regularly increasing in size, 6 in the imperfect type, possibly 10 originally. Surface smooth, polished. Sutures distinct, but inconspicuous. Aperture holostomous, obliquely lobate, acutely angulated posteriorly. Peristome not continuous; outer lip arcuate, the edge broken away but probably slightly contracted directly in front of the posterior suture. Inner margin of aperture broadly concave, the inner lip reflexed and fused with the parietal callus.

Dimensions of incomplete holotype: Height, 9.0 mm.; maximum diameter, 3.5 mm.

Holotype: U. S. N. M. 325442.

Type locality: Natural Well, Duplin County, N. C. Duplin marl.

Strombiformis lina differs from its associate *Strombiformis bartschi* in the fewer whorls and the relatively stouter outline. The well-rounded periphery and the parietal callus bear witness to the maturity of the unique type.

Subgenus POLYGIREULIMA Sacco

1892. *Polygireulima* Sacco, I Molluschi dei Terreni Terziarii del Piemonte e della Liguria, pt. 11, p. 10.

Type by original designation: *Melania spina* Grateloup. Lower and middle Miocene, of southern France.

There may well be some earlier name for the less slender, nonarcuate and polygyrate melanelids. Several of the better known names seem, however, to be unavailable.

The type by monotypy of *Melanella* Bowdich,[8] according to the illustration, is a strongly flexed shell, *Melanella dufresnii* Bowdich.

Risso[9] proposed *Eulima* and cited four species, *E. elegantissima* Montagu and Donovan, *E. glaberrima* Risso, *E. striata* Brocchi, and *E. subulata* Brocchi. The first type designation that I have noted is that of Herrmannsen,[10] who cited *Turbo subulatus* Donovan, 1803, which Sacco considers synonymous with *Helix subulata* Brocchi, 1814. Donovan's *T. subulatus* is the type of *Strombiformis* DaCosta, 1778, and also of *Subularis* Monterosato, 1884. *Acicularia* Monterosato, 1884, is preoccupied by *Acicularia* Archiac, 1843.

Strombiformis (Polygireulima) spatulata Gardner, n. sp.

Plate 27, figure 2

Shell, imperforate, straight, moderately large for the genus, elongate-conic; whorls of the spire showing a barely perceptible medial convexity. Only 8 volutions preserved in the unique type, probably 12 or 14 originally. Surface smooth, highly polished. Suture lines distinct, even a little impressed. Body whorl relatively low, well rounded. Aperture holostomous, obliquely lobate, acutely angulated posteriorly. Peristome not continuous. Outer lip imperfect, probably feebly contracted directly in front of the posterior suture and expanded away from it. Columella contracted at base of body whorl. Inner lip widely reflected, fused with the parietal callus. Anterior portion of aperture reflected and strongly patulous.

Dimensions of incomplete holotype: Height, 7.9 mm.; maximum diameter, 2.7 mm.

Holotype: U.S.N.M. 114166.

Type locality: Natural Well, Duplin County, N. C. Duplin marl.

Strombiformis spatulata is separated from *Strombiformis magnoliana*, which it most closely resembles in general outline and proportions, by the somewhat more slender outline, the more numerous less flattened whorls, the much more conspicuous suture lines, the relatively shorter, more rounded body and the more patulous outer lip.

The species is reported from the type locality only.

[8] Bowdich, T. E., Elements of conchology, p. 27, pl. 6, fig. 17, 1822.

[9] Risso, Antoine, Histoire naturelle des principales productions de l'Europe méridionale, vol. 4, p. 123, 1826.

[10] Herrmannsen, A. N., Indicis generum malacozoorum, primordia, vol. 1, p. 431, 1847.

Strombiformis (Polygireulima) eborea (Conrad)

Plate 27, figure 6

1846. *?Pasithea laevigata* H. C. Lea, Am. Philos. Soc. Trans., n. ser., vol. 9, p. 252, pl. 35, fig. 47.

1846. *Eulima eborea* Conrad, Acad. Nat. Sci. Philadelphia Proc., vol. 3, p. 20, pl. 1, fig. 21.

1863 *Eulima eborea* Conrad, Acad. Nat. Sci. Philadelphia Proc., for 1862, p. 566.

Subulate, whorls 9; suture slightly defined; aperture somewhat oblique, ovate-acute.

Locality: Suffolk, Virginia.—Conrad, 1846.

Pasithea laevigata H. C. Lea, 1846, is nothing more than a broken spire, too fragmentary to be determined but it may well be referable to this species.

Shell imperforate, straight, of moderate size, rather stout for the genus, elongate-conic. Spire subulate, the body whorl relatively short and smoothly rounded. Whorls closely appressed, regularly increasing in size, flattened, except near the apex, where there is a suggestion of a feeble convexity, 11 or 12 in number; first turn or two broken away so that nuclear characters are not determinable. Surface smooth, highly polished. Sutures distinct. Aperture holostomous, lobate, slightly oblique, acutely angulated posteriorly. Peristome not continuous. Outer lip feebly contracted directly in front of the posterior suture, slightly expanded away from the suture, patulous anteriorly. Columella broadly concave at base of body. Inner lip reflected, fused with the parietal callus.

Dimensions of figured individual: Height, 8.4 mm.; maximum diameter, 2.8 mm.

Figured specimen: U.S.N.M. 325440.

Locality of figured specimen: A half to three-fourths of a mile above Edenhouse Point, Chowan River, Bertie County, N. C.

The stouter body and more rapidly dwindling spire will serve to separate this species from the larger *Strombiformis bartschi*. From the even more closely related *Strombiformis* (*Polygireulima*) *magnoliana* (Gardner and Aldrich) (pl. 27, fig. 7) it is distinguished by the lesser number of whorls in proportion to the height, and by the less widely reflected and less patulous peristome.

Distribution: Virginia: Yorktown formation, zone 2, Suffolk, Nansemond County.

North Carolina: Yorktown formation, 2 miles east of Grifton, Pitt County; Wilson, Wilson County; half to three-fourths of a mile above Edenhouse Point, Bertie County.

Outside distribution: Miocene, Calvert formation, Plum Point and Church Hill, Md. St. Marys formation, St. Marys River, Md.

Genus NISO Risso

1826. *Niso* Risso, Histoire nat. des principales productions de l'Europe Méridionale, vol. 4, p. 218.

Type by monotypy: *Niso eburnea* Risso. Pliocene, of northern Italy.

Shell turriculate, subulate, polygyrate. Volutions usually flattened. Surface highly polished and devoid of any pronounced sculpture. Aperture holostomous, oval or lenticular, more or less angulated both anteriorly and posteriorly. Outer lip thin, sharp, simple; columella nonplicate. Umbilical pit profound, commonly persistent almost to the apex of the spire.

The genus is separated from *Strombiformis* primarily by the development of an umbilicus. The species referable to *Niso* are not numerous, nor are they very abundant, although they have a wide distribution in the tropical and warm temperate waters.

Niso dalli Gardner, n. sp.

Plate 27, figure 1

1892. *Niso lineata* Conrad. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 245 (synonymy and locality list excluded), pl. 20, fig. 4.

Not *Bonellia lineata* Conrad, 1841.

Shell differing from * * * the young *N. Willcoxii* and *splendidula* in exhibiting beside the usual peripheral and umbilical keels several raised lines (one to three) behind the periphery and (one or two) on the base of the last whorl, beside having the entire surface obscurely spirally striate with semi-obsolete microscopic striae; the basal keel is more rounded than in any other American species, recent or fossil, and the aperture shows hardly any angle corresponding to the peripheral keel. The largest specimen has (without the lost nucleus) eleven whorls, with a total length of 12 and diameter of 5 [5.2] mm.

The characters by which this shell is distinguished from others of the genus are not so feeble as would seem at first sight, when the remarkable uniformity of the species is taken into consideration. There are no well-marked remains of color-pattern, but narrow flammules alternately opaque and more translucent, which are visible on very close examination, may correspond to a vanished color-pattern.—Dall, 1892.

Holotype: U.S.N.M. 113282.

Dall's description was drawn up from the figured specimen collected by Johnson at Mrs. Guion's marl pit on the Cape Fear River, Columbus County ?, N. C. This form differs from the type of Conrad's *N. lineata*, collected at Calvert Bluffs, Md., by the lower spire and consequently higher apical angle, the more uniform slope of the whorls, the absence of the sutural channel, so distinct and so characteristic of Conrad's species, and the slightly larger umbilical funnel.

Distribution: North Carolina: Waccamaw formation, Mrs. Guion's marl pit near Neills Eddy Landing on the Cape Fear River, Columbus County.

Superfamily NATICACEA

Family NATICIDAE

Genus SINUM "Bolten" Roeding

1798. *Sinum* "Bolten". Roeding, Mus. Boltenianum, pt. 2, p. 14=*Sigaretus* Lamarck, Prodrome d'une nouvelle classification des coquilles: Soc. histoire nat. Paris Mém., p. 77, 1799.

1909. *Sinum* Bolten. Dall, U. S. Geol. Survey Prof. Paper 59, p. 91.

Type by subsequent designation (Dall, idem, 1909): *Helix haliotoidea* Linnaeus. Recent. in the west Pacific.

Sinum fragile (Conrad)

Plate 24, figures 17, 21–22

1830. *Natica fragilis* Conrad, Acad. Nat. Sci. Philadelphia Jour., 1st ser., vol. 6, p. 222, pl. 9, fig. 3.

1842. *Sigaretus fragilis* Conrad, Nat. Institution for the Promotion of Science Proc., Bull. 2, p. 181.

1846. *Natica aperta* H. C. Lea, Am. Philos. Soc. Trans., vol. 9, p. 254, pl. 36, fig. 51.

1858. *Natica fragilis* Emmons, North Carolina Geol. Survey Rept., p. 267, fig. 153.

1863. *Sigaretus (Naticina) fragilis* Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, vol. 14, p. 565.

1904. *Sigaretus fragilis* Conrad. Martin, Maryland Geol. Survey, Miocene, p. 255, pl. 60, figs. 5a–5b.

Shell ovate, thin, fragile, smooth, with fine revolving impressed striae; spire very small; apex acute; aperture extending about four-fifths of the length of the shell; columella much narrowed and arcuated, exhibiting the internal volutions.—Conrad, 1830.

Dimensions of holotype: Height, 16.8 mm.; greatest diameter, 16.5 mm.

Holotype: Acad. Nat. Sci. Philadelphia 1551.

Type locality: St. Marys River, Md.

Shell thin, fragile, ovate. Whorls 3 to 4, those of the spire very small. Body auriform and, for the genus, rather strongly elevated and broadly rounded at the periphery. Surface sculptured with flattened lirae, minutely crenulated by the incrementals, linear, separated by linear interspaces upon the spire and near the suture and umbilicus, somewhat irregular in size and spacing behind the periphery of the body whorl. Suture line distinct. Aperture dilated, obliquely ovate. Outer lip thin, sharp, patulous anteriorly. Columellar margin sigmoidal. Umbilicus reduced to a linear chink or entirely concealed by the parietal callus.

In *Sinum fragile* the height slightly exceeds the diameter; while in the only other representative of the genus within the area under discussion, *S. perspectivum* Say, the diameter is greater than the height.

The species is rare in the Miocene of Virginia and Maryland.

Distribution: Virginia: Yorktown formation, Yorktown, York County; 5 miles northeast of Smithfield, Isle of Wight County.

Outside distribution: Maryland: Calvert formation, Plum Point, Calvert County. Choptank formation, Governor Run (lower bed), Calvert County. St. Marys formation, St. Marys River and Cove Point, St. Marys County.

Superfamily CYPRAEACEA

Family CYPRAEIDAE

An enormous amount of monographic work was done on the family by F. A. Schilder during the 1920's and the 1930's. Most of his papers were published in the Archiv für Naturgeschichte (Berlin) and the Proceedings of the Malacological Society of London.

Genus CYPRAEA Linnaeus

1758. *Cypraea* Linnaeus, Systema naturae, 10th ed., p. 718.

Type by subsequent designation (Montfort, Conchyliologie systématique, vol. 2, p. 631, 1810): *Cypraea tigris* Linnaeus. Recent, in the Indo-Pacific.

Shell solid, ovoid, ventricose. Spire slightly elevated in the young, involved in the adult forms. Surface highly polished, smooth, lirate or tuberculate. Aperture long, narrow, canaliculate at each extremity; both outer and columellar lips crenulated.

Subgenus CYPRAEORBIS Conrad

1865. *Cypraeorbis* Conrad, Am. Jour. Conchology, vol. 1, p. 31.

Type by monotypy: *Cypraeorbis sphaeroides* Conrad. Vicksburg Oligocene, of Mississippi.

Shell of medium size, flattened on the apertural face, asymmetrically arched dorsally, the posterior inflation greater than the anterior. Surface smooth, enameled. Aperture narrow, the margins subparallel and following the curvature of the body dorsally. Fossula shallow, distinct. Dentition rather fine (between 20 and 25 in both the labral and the labial series in the subgenotype), restricted to the apertural margins. Posterior notch U-shaped with flattened parallel sides. Anterior notch narrow, sinistrally inclined, the inner margin pinched and a sulcus behind it; the base of the outer lip also pinched and flattened.

Section AKLEISTOSTOMA Gardner, n. sect.

Type by original designation: *Cypraea carolinensis* Conrad. Upper Miocene, of the Carolinas and Florida.

Shell fairly large for the genus, inflated medially, commonly depressed laterally; the posterior slope shorter and steeper than the anterior. Spire entirely concealed in the adult; indicated by an apical dimple in the immature shells. Apertural face flattened. Aperture fairly wide posteriorly and medially, expanding anteriorly with the slight contraction of both the outer and the inner lips. Outer lip coarsely ridged. Ridges on inner apertural face feeble or obsolete posteriorly and medially; about 6 or 8 slightly oblique, irregular rugae on the anterior half of the shell; not extending within the aperture. Fossula obscure, shallow, smooth. Margin of inner lip pinched into a sharp fold; both outer and inner lips sharp and compressed anteriorly. Terminal anterior notch deep, inclined toward the left. Posterior terminal notch, oblique; the sides flattened.

The section differs from *Cypraeorbis* by the widening of the aperture anteriorly and by the feeble or obsolete wrinkling on the anterior and medial portion of the inner lip. A similar tendency is evident in *Cypraea mus*, a tropical species living on the Venezuelan coast and reported from the tropical waters of

the Eastern Hemisphere. The species has been referred by Schilder to *Siphocypraea* Heilprin, 1887, but Heilprin's genus was described from a cylindrical shell strongly rugose the length of the straight inner lip and with a curious hook shaped opening at the posterior extremity.

Cypraea (Cypraeorbis) carolinensis Conrad

Plate 29, figures 2, 7

1841. *Cypraea carolinensis* Conrad, Am. Jour. Sci., 1st ser., vol. 41, p. 346, pl. 2, fig. 6.
1856. *Cypraea carolinensis* Conrad. Tuomey and Holmes, Pleiocene fossils of South Carolina, p. 126, pl. 27, figs. 1, 2.
1858. *Cypraea carolinensis* Conrad. Emmons, North Carolina Geol. Survey Rept., p. 260, fig. 131.
1890. *Cypraea carolinensis* Conrad. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, pp. 165, 167.
1903. *Cypraea (Umbilia) carolinensis* (Conrad). Cossmann, Essais paléoconchologie comp., vol. 5, p. 160, pl. 7, figs. 5, 9.
1930. *Cypraea carolinensis* Conrad. Mansfield, Florida Geol. Survey Bull. 3, p. 94.

Ovate, ventricose, superior margin of the labrum prominent at the apex; base plano-convex.—Conrad, 1841.

Type locality: Natural Well, 2 miles southwest of Magnolia, Duplin County, N. C.

Shell thick, solid, semiovoid in outline; involute. Maximum dorsal inflation a little behind the median line; ventral surface flattened, somewhat thickened at the lateral margins; exterior smooth, polished. Aperture narrow, slightly expanded anteriorly. Outer lip broadly arcuate, very heavy, its inner margin armed with some 20 denticles. Inner lip also heavy, rugosely plicate, somewhat sinuous in outline. Posterior extremities of both labrum and labium thickened, forming the straight, solid walls of the pronounced posterior emargination. Anterior canal short, with thickened, parallel margins. Anterior notch less profound than the posterior, relatively broader, and inclined toward the columella.

Cypraea carolinensis Conrad strongly suggests both by its outline and surface finish a longitudinal section of an egg shell. The species is very rare in the Yorktown formation and, though rather widely distributed in the Duplin, is relatively common only at the Natural Well in Duplin County, N. C.

Mansfield, 1930, has reported "a nearly perfect specimen" from the *Cancellaria* zone at Jackson Bluff, Leon County, Fla. The horizon is at the top of the upper Miocene.

Distribution: North Carolina: Yorktown formation, Rock Landing on the Neuse River, Craven County. Duplin marl, 2½ miles south of Clinton on Gum Chimney Branch on the property of Mr. Hugh Moore, Sampson County; 2 miles northeast of Warsaw, and at the Natural Well, 2 miles southwest of Magnolia, Duplin County; 4 miles north of Lumberton on the Berry Godwin plantation, and 1½ miles northeast of Fairmont, on the property of Mr. Andrew Jones, Robeson County.

Outside distribution: Miocene, Duplin marl, the Muldrow Place, Sumter County and the Pee Dee River, Florence? County, S. C. Choctawhatchee formation, Jackson Bluff, Leon County, Fla.

Genus TRIVIA "Gray" Broderip

1837. *Trivia* "Gray" Broderip, Penny Cyclopaedia, vol. 8, p. 256.
1916. *Trivia* (Gray MS) Broderip. Iredale, Malac. Soc. London Proc., vol. 12, p. 35.

Type by subsequent designation (Gray, Zool. Soc. London Proc., pt. 15, p. 142, 1847); *Cypraea europ[a]ea* Montagu= *Voluta jonensis* Pennant. Reported off the coast of Europe from Trondhjem Fjord to the Mediterranean and Aegean Seas; reported also from the Pleistocene of western Europe and from the Pliocene Crag of England and the Vienna Basin.

Trivia has been commonly attributed to J. E. Gray, Descriptive Catalogue of Shells, 1832. Mr. C. D. Sherborn of the British Museum unearthed the information that only proof sheets of the "Descriptive Catalogue" were printed in 1832 and that the paper had no status. Shaw, 1909 (Malac. Soc. London Proc., vol. 8, p. 289) and Iredale idem, 1916, have discussed the fact.

Shell small, ovoid or subspherical. Spire involute. Sculpture vigorous, a medial antero-posterior dorsal depression commonly marking the line of union of the recurved mantle lobes. Transverse sulcations deep, simple or ramose, continuous with the apertural teeth. Aperture narrow, conforming in outline to the shape of the body whorl. Fossula shallow, the dentition continued across it. Columellar lip crenulated. Labrum thickened, inflected, transversely sulcated within, the thickening continued around the extremities of the aperture. Anterior extremity truncate or obscurely emarginate.

The genus is first recognized at the beginning of the Tertiary. The Recent species are for the most part confined to the warmer waters.

Trivia pediculus (Linnaeus)

Plate 29, figures 8, 9

1758. *Cypraea pediculus* Linnaeus, Systema Naturae, 10th ed. p. 724.
1827. *Cypraea pediculus* Linnaeus. Gray, Zool. Jour. London, vol. 3, p. 370.
1856. *Cypraea pediculus* Linnaeus. Tuomey and Holmes, Pleiocene fossils of South Carolina, p. 127, pl. 27, figs. 3, 4.
1885. *Trivia pediculus* Linnaeus. Tryon, Manual Conchology, vol. 7, p. 201, pl. 21, figs. 94–97.
1890. *Trivia pediculus* Linnaeus. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 168.
1892. *Trivia pediculus* Linnaeus. Dall, idem, pt. 2, p. 263.
1908. *Trivia pediculus* Linnaeus. Rogers, Shell book, p. 133, pl. opp. p. 134, fig. 2.
1928. *Trivia (Trivia) pediculus* (Linnaeus). Woodring, Carnegie Inst. Washington Pub. 385 p. 320, pl. 22, figs. 6–11.

1937. *Trivia pediculus* Linnaeus. Maxwell Smith, East coast marine shells, p. 110, pl. 40, figs. 7a–c.

Type locality: Jamaica.

Hanley, in "Ipsa Linnaei Conchylia," p. 196, 1855, has discussed the source of the Linnaean shells assembled under *T. pediculis*. Two species are involved, the European and the West Indian, and the choice of the West Indian shell that was made by Reeve and followed by Hanley is frankly one of expediency.

Shell ovoid, inflated dorsally, flattened on the ventral surface; the maximum diameter a little behind the median line, and the posterior slope a little steeper than the anterior. Spire entirely concealed, its presence indicated in some individuals by a very slight posterior bulge. Axial furrow clearly defined but not persistent to either the anterior or the posterior extremity of the shell. Ridges transverse to the axis, 15 to 20, with occasional intercalaries, in character more or less irregular and minutely undulatory, tending to be slightly bulbous at the dorsal termination. Aperture narrow, the margins subparallel. Outer lip somewhat expanded, thickened and incurved, both the outer and inner lips corrugated by the primary costals, which persist for a short distance within the aperture. Aperture emarginate both anteriorly and posteriorly, the anterior notch the broader and deeper.

Dimensions of figured specimen: Height, 6.6 mm.; length, 11.5 mm; lateral diameter, 8.0 mm.

Figured specimen: U. S. N. M. 325430, from Neills Eddy Landing, Cape Fear River, 3 miles north of Cronly, Columbus County, N. C.

Trivia pediculus (Linnaeus) is most nearly related to *T. suffusa* Gray, a somewhat smaller, more evenly inflated shell. Furthermore, the transverse ridges of *T. suffusa*, though irregular in spacing, are uniform in width throughout their extent, whereas in *T. pediculus* they tend alternately to expand and contract in width except near the periphery of the shell, thus giving to the sculpture an irregularly undulatory aspect which is readily diagnostic. The expansion of the outer lip also is rather broader but much less sharply defined than in *T. suffusa*.

The species is rare in the Waccamaw formation.

Distribution: North Carolina: Waccamaw formation, Cronly, and Neills Eddy Landing, 3 miles north of Cronly, Columbus County; Mrs. Guion's marl pit, Cape Fear River, Columbus County?

Outside distribution: Miocene, Bowden, Jamaica. Pliocene, Waccamaw(?) formation, Smith's, Goose Creek, Berkeley County, S. C. Caloosahatchee marl, Caloosahatchee River, Fla. Pliocene undifferentiated, Costa Rica. Recent, St. Augustine, Fla., to Fernando de Naranha, Brazil, and east to Bermuda, in less than 50 fathoms.

Superfamily DOLIACEA

Family CASSIDIDAE

Genus SCONSIA Gray

1847. *Sconsia* Gray, Zool. Soc. London Proc., pt. 15, p. 137.

Type by original designation: *Cassidaria striata* Lamarck. Recent, in the West Indies.

The genus has been discussed by Dall,[11] Pilsbry,[12] Woodring,[13] Wrigley,[14] and a number of other authors.

Section GALEODOSCONSIA Sacco

1890. *Galeodosconsia* Sacco, Mus. Zool. Anat. Comp. R. Univ. Torino Boll. 82, vol. 5, p. 17.

Type by subsequent designation (Cossmann, Essais paléoconchologie comp., vol. 5, p. 133, 1903). *Cassidaria striatula* Bonelli. Helvetian of northern Italy.

The group is characterized by the swelling of the anterior fasciole. Woodring, 1928, was the first to refer the Duplin species *Sconsia hodgii* to *Galeodosconsia*.

Sconsia hodgii (Conrad)

Plate 29, figure 3

1841. *Cassis Hodgii* Conrad Am. Jour. Sci., 1st ser., vol. 41, p. 346, pl. 2, fig. 10.
1854. *Galeodia Hodgii* Conrad, Acad. Nat. Sci. Philadelphia Proc., vol. 7, p. 30.
1856. *Galeodia Hodgii* Conrad. Tuomey and Holmes, Pleiocene fossils of South Carolina, p. 138, pl. 28, fig. 10.
1858. *Galeodia hodgii* Conrad. Emmons, North Carolina Geol. Survey Rept., p. 257, fig. 128.
1863. *Sconsia Hodgii* Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, vol. 14, p. 564.
1903. *Sconsia Hodgei* Conrad. Cossmann, Essais paléoconchologie comp., vol. 5, p. 133, pl. 6, fig. 3.
1928. *Sconsia hodgei* (Conrad). Woodring, Carnegie Inst. Washington Pub. 385, p. 310.
1930. *Sconsia hodgei* (Conrad). Mansfield, Florida Geol. Survey Bull. 3, p. 93.

Elliptical, with numerous spiral lines most prominent towards the base. Spire conical, volutions convex.—Conrad, 1841.

Type locality: Natural Well, 2 miles southwest of Magnolia, Duplin County, N. C.

Shell stout, heavy, rudely elliptical, the maximum diameter not far from the median line. Aperture more than two-thirds the total height. Whorls 5 to 6; those of the spire broadly convex, decreasing rapidly in size towards the apex; protoconch not well differentiated. Sculpture dominantly spiral; revolving lirae subequal, for the most part, and subequispaced, low, little prominent, separated by slightly wider interspirals; sculpturing of the external surface produced far within the

[11] Dall, W. H., Contributions to the Tertiary paleontology of the Pacific coast; I. The Miocene of Astoria and Coos Bay, Oregon: U. S. Geol. Survey Prof. Paper 59, p. 66, 1909.

[12] Pilsbry, H. A., Revision of W. M. Gabb's Tertiary Mollusca of Santo Domingo: Acad. Nat. Sci. Philadelphia Proc., vol. 73, pp. 361–362, 1922.

[13] Woodring, W. P., Miocene mollusks from Bowden, Jamaica, pt. 2: Carnegie Inst. Washington Pub. 385, pp. 308–309, 1928.

[14] Wrigley, Arthur, English Eocene and Oligocene Cassididae, with notes on the nomenclature and morphology of the family: Malacol. Soc. London Proc., vol. 21, pp. 114–116, 1934.

interior; lirae about 8 on the later whorls of the spire, 3 or 4 times as many on the body; the 4 to 6 spirals at the base of the body broader and more elevated than those behind them. Axial sculpture restricted to incrementals and more or less exaggerated resting stages. Suture distinct, impressed. Aperture slightly expanded anteriorly. Outer lip thickened, dentate within. Columella excavated at the base of the body, rugose. Parietal wall washed with enamel but so thinly that the spiral sculpture may be imperfectly concealed. Anterior fasciole swollen, closely lirate. Anterior canal short, recurved, deeply emarginate.

Sconsia hodgii Conrad is the sole representative of the genus within the Virginia and North Carolina Tertiary. It is readily isolated by its heavy shell, stocky outline, uniform spiral sculpture, and denticulate outer and rugose inner lip.

Mansfield reports the species in Florida, from both the *Ecphora* zone in the middle of the Choctawhatchee formation and from the *Cancellaria* zone at the top of it.

Distribution: North Carolina: Duplin marl, Natural Well, Duplin County; 1½ miles northeast of Fairmont (Ashpole), Robeson County; Cape Fear River, (Emmons).

Outside distribution: Miocene, Duplin marl of Sumter County and the Pee Dee River, Florence? County, S. C.; Jackson Bluff, Leon County; Alum Bluff (upper bed), Liberty County, Fla.

Family COLUBRARIDAE

Genus COLUBRARIA Schumacher

1817. *Colubraria* Schumacher, Essai d'un nouveau système des vers testacés, p. 251.

Type by subsequent designation (Herrmannsen, Indicis generum malacozoorum, primordia, vol. 1, p. 270, 1847): *Murex maculosus* Gmelin=*Buccinum maculosum* Chemnitz. Recent, in the Indo-Pacific region.

Shell of moderate dimensions, rather thick and solid. Spire elevated, the axis commonly arcuate. Whorls broadly convex, increasing slowly in diameter. Sculpture reticulate or granular, with occasional axial varices. Aperture shorter than the spire, narrow, obliquely lenticular. Outer lip varicose, dentate within. Inner lip concave. Parietal and pillar wash heavy. Anterior canal short, recurved with parallel, proximate margins.

No name has been found for the small group of warm water Tertiary and Recent species from the southeastern Gulf Province and the West Indies. They have in common and distinct from *Colubraria* s. s. a small, slender, delicate shell tapering anteriorly into a canal decidedly longer than that of the type of the genus; a narrow lobate aperture, the outer margin varicose but not denticulate, the inner parietal wall and pillar washed with a smooth but heavy callus. *Colubraria lanceolata* (Menke), the Recent species, is even more slender and elegant than the Tertiary forms and the anterior canal more sharply defined.

Colubraria aclinica Tucker and Wilson

Plate 29, figures 5, 6

1933. *Colubraria aclinica* Tucker and Wilson, Bull. Am. Paleontology, vol. 18, No. 66, p. 70 (8), pl. 11 (2), fig. 14.

Shell small, whorls somewhat inflated, sutures impressed. Early whorls? Spiral sculpture of about eight or nine primary threads, interspaces on body whorl have a less strong secondary between weak tertiary threads. On the whorls of the spire only the single secondary is present. Axial threads about the same size as the primary spirals. At their intersection they form low beads. Axials become obsolete toward the base. Aperture slender; margin of the inner lip elevated to form a thin lamella. Outer lip varical, internally carries faint lirations arranged in pairs. Anterior canal sharply recurved; columella smooth. Dimensions of holotype.—Height 14, diameter 5 mm.

This species differs from *C. floridana* Tucker and Wilson (Bull. Am. Pal., vol. 18, No. 65, p. 11, pl. 4, figs. 3, 4) in not having strong axial ribs as well as in the character of the spiral sculpture.

Age.—Miocene?

Locality.—Acline, Fla.—Tucker and Wilson, 1933.

The following description was drawn up from a less imperfect specimen (U.S.N.M. 114089) from the Duplin marl, Duplin County, N. C.:

Shell small for the genus, thin, delicate, very slender and fusiform. Body whorl a little less than two-thirds, and aperture almost one-half the total height. Spire elevated, tapering gracefully to a flattened apex. Whorls probably about 7 in number; those of the spire feebly inflated at the periphery. Body whorl broadly rounded, attenuated anteriorly. Protoconch smooth except for incrementals, thrice-coiled; initial volution wound in a single plane, thus producing the flattened apex; second whorl rounded posteriorly, but increasingly compressed anteriorly; final turn only feebly convex. Both axial and spiral sculpture abruptly initiated at the beginning of the conch. Axial sculpture of 2 or 3 obtuse varices, and 20 to 30 narrow, rounded, moderately elevated riblets, more or less irregular in size and spacing, approximately uniform in strength from suture to suture, evanescent at the base of the body whorl. Spiral sculpture of low, flattened fillets, much more regular in size and spacing than the axials and overriding though not nodulating them; primaries 6 to 8 on the whorls of the spire; occasional linear or sublinear secondaries intercalated midway between the primaries; spirals on body whorl broader and relatively lower than on the spire; secondaries more prominent relatively and absolutely, often scarcely less wide than the primaries; an occasional tertiary introduced in the interspaces. Incrementals on the otherwise unsculptured areas regular and crowded, visible under high magnification as a finely filamented grating. Suture line distinct, impressed, finely crenulated by the axials of the succeeding whorl. Aperture narrow, lenticular. Outer lip subvaricose, the edge sharp and often feebly crenulated in harmony with the spirals, nonlirate within. Inner lip broadly excavated, re-

versed, standing apart from the pillar wall. The margin of the glaze a smooth curve. Anterior canal moderately long, gracefully recurved. Anterior fasciole slightly swollen, broadly and deeply emarginate at the extremity.

Dimensions of immature figured specimen from the Duplin marl, 1½ miles northwest of Magnolia, Duplin County, N. C.: Height, 9 mm.; maximum diameter, 3.3 mm. The body whorl of the imperfect adult is 13 mm. high and 6.7 mm. in maximum width.

The stratigraphic position of the pit outcrop from which *Colubraria aclinica* was collected has never been satisfactorily established. When Mansfield later visited the area the pits were filled with water. The fauna was earlier referred to the Buckingham marl which was assigned to the Miocene, but it is now regarded as nothing more than a facies of the fauna of the Caloosahatchee marl. In view of the character of the fauna at Acline and the doubt surrounding the exact position of the bed from which it was collected, no fixed age determination has been made. Certainly the small species in question is affiliated with the Duplin examples rather than with *Colubraria lanceolata* of the Caloosahatchee and Recent faunas.

The upper Miocene species may well be the antecedent of *C. lanceolata* (Menke). The growth of the Miocene form is more regular and apparently less prone to distortion. The spirals are broader in the former, too, and relatively lower, particularly on the body whorl, so that the delicately tessellated aspect, which is so characteristic of the Recent species, is largely lost on the later whorls of the fossil. The canal of the recent form is more sharply recurved, and the fasciole more swollen. Both the fossil and the Recent representatives seem to have rather a wide range in relative dimensions.

A closely related species in the Chipola formation of Florida is indicated by a few fragments. The sculpture pattern of the Chipola individuals, more closely resembles that of the Recent species than that of the later Miocene form.

Distribution: North Carolina: Duplin marl, 1½ miles northwest of Magnolia and the Natural Well, 2 miles southwest of Magnolia, Duplin County.

Outside distribution: Upper part of the Tertiary, Acline, Charlotte County, Fla.

Family FICIDAE

Genus FICUS "Bolton" Roeding

1798. *Ficus* "Bolten" Roeding, Mus. Boltenianum, pt. 2, p. 148.
1799. *Pyrula* Lamarck, Prodrome d'une nouvelle classification des coquilles: Soc. hist. nat. Paris Mém., p. 73. Type by monotypy: *Bulla ficus* Linnaeus.
1810. *Pirula* Montfort, Conchyliologie systématique, vol. 2, p. 486. Type by monotypy: *Murex ficus* Linnaeus.

Type of monotypy: *Ficus communis* (Bolten) Roeding=*Ficus varicgata* (Bolton) Roeding=*Bulla ficus* Gmelin=*Murex ficus* Linnaeus. Recent, in the East Indies. The only other species cited by Roeding is *Ficus picta*, a nomen nudum.

The thin, delicately cancellated "fig shells" adorn most of the cabinets of Mollusca from the southeastern Seaboard. The genus has been reported from the Cretaceous but Smith[15] challenges all records of *Ficus* earlier than the late Eocene. He considers it a monophylletic group. The grosser morphological features of the conchs vary little but the degree of development of the genus may be traced through the protoconchs. The number of nuclear whorls decreases as the group advances through the Tertiary and into the Recent but the size of the initial whorl increases. Clench[16] reported 18 Recent species and subspecies, 3 of them from the western Atlantic. Only *Ficus papyratia* is found in coastal waters; the other two have been taken in water of 175 fathoms or over.

Ficus papyratia caloosahatchiensis (Smith)

Plate 29, figures 1, 4

1907. *Pyrula papyratia caloosahatchiensis* Smith, Acad. Nat. Sci. Philadelphia Proc., p. 212.
Pyrula papyratia and *Ficus papyratia* of authors in part.

The differences separating the Pliocene species of the Carolinas and Florida from *Ficus papyratia* which has inherited the same habitat are of questionable subspecific value. They are interesting, however, in that they conform to the general trend of development of the *Ficus papyratia* group. The early whorls of the Pliocene forms seem less sunken than those of the Recent individuals, the nucleus is not so much off center, and there is a scarcely perceptible increase, possibly an eighth of a turn, in the number of nuclear whorls. The identity of the Waccamaw and Caloosahatchee species has not been questioned.

Smith's original description is comparative:

> A critical study of the Florida Pliocene form demonstrates that it is extremely close to the recent species. In fact its cancellated stage is similar in every respect. The apex is likewise almost the same but differs in having the cancellated stage begin a little later in the ontogeny. The first whorl is also perhaps a trifle smaller in the fossil form. Altogether this Florida Pliocene type is specifically identical with the recent *P. papyratia*. Nevertheless the author believes that it may with propriety be designated as the subspecies *Pyrula papyratia caloosahatchiensis*. The Waccamaw Pliocene forms have an apex similar to that of *P. papyratia caloosahatchiensis*. The individuals examined are, however, all immature, and it is therefore impossible to note the sculpture of the later cancellated stage. It is probable that a better series of specimens will establish the identity of this race with the one from the Florida Pliocene.

Ficus pilsbryi (Smith) (idem) from the Cercado formation of the Dominican Republic and the Bowden formation of Jamaica is smaller than *Ficus papyratia* and its subspecies; the early whorls of the conch seem

[15] Smith, Burnett, A Contribution to the Morphology of Pyrula; Acad. Nat. Sci. Philadelphia Proc., 1907, pp. 208–219, tables 1–3, text figs. 1, 2, pl. 17, June 20, 1907.

[16] Clench, W. J., The Genus *Ficus*, in the western Atlantic; Johnsonia, No. 2, pp. 1, 2, 3 text figs., Feb. 15, 1942.

to be more evenly rounded and to increase more regularly, and the protoconch is decidedly lower and more symmetrically placed. In the same paper Smith described the subspecies, *Pyrula pilsbryi duplinensis*, named from Duplin County where the form was collected. It may be recognized by the very long and slender anterior canal and the relatively sharp spiral lirae. The subspecies is not represented in our collections.

Distribution: Waccamaw formation, Neills Eddy Landing, 3 miles north of Cronly on the Cape Fear River, Columbus County, N. C.

Outside distribution: Pliocene, Caloosahatchee marl, Caloosahatchee River, Fla.

Suborder STENOGLOSSA

Superfamily MURICACEA

Family MURICIDAE

Genus MUREX Linnaeus

1758. *Murex* Linnaeus, Systema naturae, ed. 10, p. 746.

Type by monotypy: *Ficus communis* (Bolten) Roeding=*Ficus* systématique, vol. 2, p. 619, 1810): *Murex pecten* Montfort=*Murex tribulus* Linnaeus. Recent, in the South Pacific and Indian Oceans.

Shell oblong, oval, pyriform or fusiform in outline. Spire usually elevated, acutely tapering. Protoconch rather small, smooth, paucispiral. Ornamentation of conch elaborate; axial varices 3 in the restricted *Murex*, usually continuous, commonly spinose at the intersection with the spirals, less commonly foliaceous; simple costals may be reduced on the later whorls to peripheral tubercles; spiral sculpture developed, as a rule, over the entire conch, overriding the axials; primary spirals modified into spinose processes. Aperture subcircular, elliptical or ovate. Labrum varicated, lirate, or denticulate within. Labium nonplicate, heavily glazed, often rugose or denticulate in front of the commissure and along the pillar. Anterior canal long and straight or short and recurved, generally roofed over in the adult.

Murex has a limited representation in the Cretaceous. In the succeeding Tertiary and later faunas the genus becomes increasingly abundant, and the Recent species number well over 200, most of them tropical and subtropical from between tides to a depth of 50 fathoms.

Subgenus CHICOREUS Montfort

1810. *Chicoreus* Montfort, Conchyliologie systématique, vol. 2, p. 610.

Type by monotypy: *Murex wamosus* Linnaeus. Recent, in the Indo-Pacific.

The subgenus is characterized by the foliaceous or digitated varices, 3 in number, and the recurved canal, usually shorter and broader than in *Murex* s. s. and almost or completely closed.

Murex (Chicoreus) rufus Lamarck

Plate 29, figure 23

1822. *Murex rufus* Lamarck, Animaux sans vertèbres, 1st ed., vol. 7, p. 162.

1858. *Murex sexcostata* Emmons, North Carolina Geol. Survey Rept., p. 248, fig. 106.

1890. *Murex* (*Chicoreus*) *rufus* Lamarck. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 140.

Type locality not known.

Shell heavy, fusiform, the greatest diameter not far from the median line. Whorls convex, 6 or 7 exclusive of the 2 smooth protoconchal turns. Spire moderately elevated, tapering rather gradually to an acute apex.

Early whorls sculptured with 9 strong, rounded, subequal axials; every third rib on adolescent shell becomes stronger than the intermediate ribs and develops into the foliaceous varices of the adult; intermediate rib to right of varix becomes obsolete, the rib to the left of the varix develops into a peripheral node. Varices persistent from the middle whorls to the anterior extremity, the primary spirals forming the midribs of the leaflike or linguiform processes which characterize the species and the subgenus. Primary spirals rather narrow, rounded cords, 3 on the whorls of the spire and 10 or 11 on the body and canal, separated by wider interspaces in which are crowded 6 to 8 lirate secondaries. Whorls appressed, the suture not very distinct. Aperture slightly oblique, lobate, with a raised rim, slit at the commissure and at the anterior canal. Canal usually closed, at least posteriorly, often gaping slightly anteriorly.

Dimensions of figured specimen: Height, 57 mm.; diameter including varices, 30 mm.

Figured specimen: U.S.N.M. 168848. Recent, off Sanibel Island, west Florida.

Murex rufus Lamarck is the only Tertiary representative of the trivaricate subgenus recorded from the North Carolina-Virginia area. It has not been reported by later collectors.

Distribution: North Carolina (Emmons).

Outside distribution: Pliocene, Caloosahatchee marl, Caloosahatchee River and Alligator Creek; Delray, 118-foot well, Palm Beach County, Fla. Pleistocene, Antilles (Dall). Recent, Cape Fear to the West Indies in 1 to 30 fathoms.

Subgenus PHYLLONOTUS Swainson

1833. *Phyllonotus* Swainson, Zoological illustrations, ser. 2, vol. 3, pl. 109.

Type by monotypy: *Murex* (*Phyllonotus*) *imperialis* Swainson var. *a.*=*M. pomum* Gmelin. Recent, off the southeast coast of the United States and the West Indies.

Phyllonotus is separated from *Chicoreus* by the more numerous varices, 3 to 8 in number, by the shorter, more open and recurved canal; and by the occasional presence of an umbilical chink.

Murex (Phyllonotus) pomum Gmelin

Plate 29, figures 22, 24

1792. *Murex pomum* Gmelin, in Systema naturae, 13th ed., p. 3527.
1845. *Murex pomum* Gmelin. Reeve, Conchologia iconica, *Murex* species 35, fig. 35.
1852. *Murex mexicanus* Petit de la Saussaye, Jour. conchyliologie, vol. 3, p. 51, pl. 2, fig. 9.
1858. *Murex globosa* Emmons, North Carolina Geol. Survey Rept., p. 247, fig. 105a.
1863. *Murex globosus* Emmons. Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 560.
1890. *Murex (Phyllonotus) pomum* Gmelin. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 142.
1908. *Murex pomum* Gmelin. Rogers, Shell book, p. 31, pl. 6, opposite p. 26, figs. 1, 2.
1928. *Murex (Phyllonotus) pomum* Gmelin. Woodring, Carnegie Inst. Washington Pub. 385, p. 290, pl. 17, fig. 9.
1930. *Murex pomum* Gmelin. Mansfield, Florida Geol. Survey, Bull. 3, p. 83, pl. 11, fig. 9.

Shell moderately large and heavy for the genus, globose. Aperture and canal two-thirds or more of the total height. Whorls of conch 6 or 7, rapidly increasing in size, the body whorl strongly inflated. Ornamentation elaborate; first 3 or 4 conchal turns sculptured with 10 to 12 subequal, undulatory axial riblets overridden by 3 or 4 sharply elevated primary spirals with intercalated secondaries and tertiaries. Varices developed on the fourth or fifth volution and becoming increasingly prominent toward the aperture; axial body sculpture of 4 major varices, formed of 2 or 3 overlapping laminae, the edges free and fluted along the axes of the primary spirals; 1 or 2 varicose costals intercalated between them. Spiral sculpture on the body whorl, exclusive of the canal, of 6 primary spirals, the intermediate areas crowded with secondaries, tertiaries and even higher orders, the total number of lirae 20 to 25 to each interprimary. Incrementals strong enough to shagreen the spirals. Suture line impressed. Aperture, exclusive of the canal, broadly lenticular. Outer lip arcuate, varicose, fluted in harmony with the spiral sculpture, projected backward at the varices upon the preceding volution. Columella broadly concave; entire aperture lined with a continuous coating of enamel which is guttered at the commissure and widely reflected upon the body whorl. Anterior canal short, recurved, sharply differentiated; varices continued across it, the varical edges at the intersection of the 2 or 3 primary spirals produced into linguiform processes longer than those upon the body. Margins of canal parallel and proximate but not united.

Dimensions of figured specimen: Height, 91.5 mm.; diameter including varices, 64.0 mm.

Figured specimen: U.S.N.M. 325426.

Locality of figured specimen: Neills Eddy Landing, Cape Fear River, 3 miles north of Cronly, Columbus County, N. C. Waccamaw formation.

In the Recent faunas, *Murex pomum* is restricted by temperature to the region south of Hatteras and by depth to waters of less than 50 fathoms.

Distribution: North Carolina: Waccamaw formation, Neills Eddy Landing, Columbus County.

Mansfield, 1930, reported *M. pomum* from the *Cancellaria* zone of the Choctawhatchee formation of Florida. Pilsbry and Brown, 1917, listed the species from the Miocene of Cartagena, Colombia, and Woodring, 1928, figured an adult from the Bowden beds of Jamaica. Reports of the species from the Miocene of North Carolina have not been verified.

Outside distribution: Miocene, *Cancellaria* zone of Choctawhatchee formation at Harveys Creek, Leon County, Fla. Pliocene, Caloosahatchee marl, Nashua, Putnam County, Fla.; Caloosahatchee River and Alligator Creek, Fla. Pleistocene, Antilles (Dall). Recent, Beaufort, N. C., to Venezuela. Living shells dredged by Blake in Flannegan Passage in 27 fathoms on sandy bottom, temperature 78° F.

Genus TRITONALIA Fleming

1828. *Tritonalia* Fleming substituted for *Triton*, History British animals, Corrigenda, p. 346, line 17; genus described and the single species *T. erinaceus* discussed, p. 356.
1847. *Ocenebra*, Leach manuscript, Gray, Annals and Mag. Nat. History, vol. 20, p. 269. Type, *Murex erinaceus* Linnaeus.

Type by subsequent designation (Jousseaume, Revue et Magasin de zoologie, ser. 3, vol. 7, p. 331, 1881); *Murex erinaceus* Linnaeus. Recent, on the shores of northern Europe.

Ovate oblong; canal produced, subascending or bent to the left; ribs alternate or remote, not continuous on the whorls.—Fleming, 1828.

Tritonalia is smaller than *Murex* but resembles the shorter, twisted members of that genus in outline. The sculpture also is muricoid. The varices are more numerous than in *Murex* s. s. and are usually foliated but not spinose. The anterior canal is recurved, rather broad as a rule, and closed in the typical species. The characters of the radula are, however, quite distinct, and the operculum has a lateral nucleus instead of the apical nucleus that characterizes *Murex*.

Tritonalia has a rather meager representation in the Tertiary, and the Recent species are few in number and confined for the most part to the Mediterranean and the eastern shores of the lower latitudes of America.

Tritonalia cellulosa (Conrad)

Plate 29, figure 16

1846. *Murex cellulosa* Conrad, Acad. Nat. Sci. Philadelphia Proc., vol. 3, p. 25.
1889. *Ocinebra (Favartia) cellulosa* (Conrad). Dall, Harvard Coll. Mus. Comp. Zoology Bull., vol. 18, p. 210, pl. 16, fig. 1.
1890. *Ocinebra cellulosa* (Conrad). Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 150.

Short-fusiform, with large, prominent revolving lines or costae, the interstices with transverse wrinkled lines, largest on the varices, and giving the shell a cellular aspect; beak much curved; color cinereous; aperture small, obovate, purplish within.

Locality. Tampa Bay. Inhabits oyster beds.—Conrad, 1846.

Shell small, muricoid, the maximum diameter at approximately the median horizontal. Spire scalariform, the whorls broadly tabulated, and of moderate elevation. Body whorl strongly contracted at the base. Nucleus small, acute, probably of about 2 volutions, the first erect, immersed only at the very tip, the second a little larger, and more flattened laterally. Conch including as many as 5 volutions. Surface highly ornamented. Axial sculpture of 8 strongly laminated varices, opposite in arrangement, and persistent to the terminus of the anterior canal; incrementals raised into free lamellae, scabrous when overriding the spirals; intervarical areas concave. Spiral sculpture of broad, elevated bands, semicylindrical in section; 2 on each of the whorls of the spire, 5 on the body, continuous across the intervarical areas, cross-sectioned at the varices, the edges free and oblique to the surface, those of the posterior spiral of the body produced into sublinguliform processes; secondaries not developed. Suture line distinct, feebly impressed. Aperture broadly ovate posteriorly, strongly and abruptly contracted anteriorly. Outer lip broadly arcuate, varicose; the interspiral areas indicated by rather feeble interior denticles elongated normal to the margin. Posterior commissure well rounded. Columellar lip broadly concave, nonplicate. Parietal wall heavily glazed; lining of peristome continuous posteriorly and well rounded. Anterior canal short, recurved, the margins parallel and proximate. Umbilical chink feebly indicated.

Dimensions of figured specimen: Height, 13.5 mm.; diameter, 7.8 mm.

Figured specimen: U.S.N.M. 61013.

Locality of figured specimen: Tampa Bay, Fla. Recent.

The species is well characterized by the miniature muricoid outline, the 8 varices, and the restriction of the spiral sculpture to the few, broad, and prominent, semitubular elevations, which present, at the intersection with the varices a series of closely overlapping crinkled laminae.

Distribution: Duplin marl. Natural Well, 2 miles southwest of Magnolia, Duplin County, N. C.

Outside distribution: Pliocene, Caloosahatchee marl, Caloosahatchee River, Fla. Recent. Cape Lookout to St. Thomas and Sombrero, West Indies, and east to Bermuda, in 0 to 54 fathoms.

Tritonalia? barbitoides Gardner, n. sp.

Plate 29, figures 14, 15

Shell small but rather heavy; lute-shaped. Aperture more than half as high as the entire shell. Spire acutely tapering, slender in proportion to the body. Apex broken away. Remaining volutions 5; whorls of spire closely appressed, angular, with a broad shoulder, sloping gently from the posterior suture to the periphery of the whorl. Axial sculpture of laminar varices, 9 on all except the earliest turns; on the spire, varices usually placed one in front of the other and persistent without change of direction from suture to suture; all of earlier whorls of type much decorticated so that many of the characters of the sculpture have been lost; varices on body exceptionally well preserved, the edges expanded and so strongly recurved that the outer lamina is set almost at right angles to the surface; though placed on a line with the corresponding varices of the spire, the axial laminae on the body are strongly bent sinistrally just in front of the suture at approximately a right angle, so that the posterior end of one varix is brought into contact with the extremity of the next varix to the left (the shell oriented with the apex upward); edges of varices on the pillar and fasciole overlapping by reason of the constriction of the body whorl. Spirals on whorls of spire 2, the posterior a well-rounded, moderately elevated liration outlining the periphery of the whorl, the anterior similar to it and placed about midway between the periphery and the anterior suture; apparent convexity of the intervarical areas increased by the tendency toward the strengthening of the spirals as they mount the varices; outer laminae of body varices sculptured with 6 low, rounded, primary spirals and 2 feeble secondaries, the one just behind the posterior primary, the other in the interspace between the posterior primary and that next in front of it; spirals tending to spread fanlike toward the edges of the laminae, though they persist with undiminished strength to the margins, which they crenulate. Sutures distinct but not prominent. Aperture pyriform. Outer lip arcuate, expanded, the medial portion with 6 feeble tubercles on the inner varical surface. Enameled lining forming inner lamina of terminal varix continuous at the posterior commissure with the glaze of the labium. Columella excavated near the base of the body whorl. Parietal wall heavily enameled. Pillar rounded and feebly flexed. Anterior canal short, with subparallel margins. Anterior fasciole narnow, arched, emarginate. Umbilical chink not entirely concealed by the body callus.

Dimensions of holotype: Height, 18.7 mm.; diameter, including varices, 9.5 mm.

Holotype: U.S.N.M. 325429.

Type and only locality: Yorktown, York County, Va. Yorktown formation.

The single individual on which the species is founded is badly decorticated, but the characters of the sculpture are so unusual and so well marked that it can be confused with no other described species. It does not conform to any recognized group. From *Tritonalia*, which it seems most closely to resemble, it differs in several important characters: the aperture is less

circular than in typical *Tritonalia;* the pillar is angulated at the entrance to the anterior canal in *T.? barbitoides;* in *Tritonalia*, as a rule, it is merely warped; the canal is short and open; in typical *Tritonalia*, it is almost or entirely closed. The axial sculpture consisting of thin sharp laminae, recalls that of *Trophon.* However, *Trophon* is a larger shell with little or no spiral sculpture and a relatively larger body, which is more sharply constricted at the base into a rather long canal.

Genus TRAJANA [17] Gardner, n. gen.

Type by original designation: *Trajana pyta* Gardner, new species. Miocene, Duplin marl of North Carolina.

Shell more or less scalariform in outline. Spire elevated. Protoconch small, unsculptured. Axial costae prominent and somewhat varicose but not foliated or spinose. Spiral sculpture dense. Anal fasciole strongly arched. Aperture regularly elliptical in outline; inner lining continuous. Outer lip varicose, nonlirate within. Inner lip evenly concave, nonplicate. Anterior canal closed, short, and rather feebly recurved. Umbilical chink closed.

Trajana is separated from *Murex*, *Tritonalia*, and *Muricopsis* by the nonmuricated varices, from *Urosalpinx* by the closed canal, and from *Hadriana*, its nearest relative, by the greater relative elevation of the spire, the elliptical rather than pyriform outline of the aperture, the nonlirate outer lip, the nonplicate inner lip, and the absence of an umbilical chink.

Trajana pyta Gardner, n. sp.

Plate 29, figures 10, 11

Shell scalariform, spire elevated, apex acute, body broad and relatively low, abruptly constricted at the base. Whorls strongly convex, tabulated posteriorly, rapidly increasing in size, approximately 7. Protoconch of 1½ to 2 small, unsculptured coils, the earlier largely immersed. Axial sculpture initiated at the beginning of first turn of conch with obtuse vertical riblets that rapidly develop into broad, rounded, strongly elevated, undulatory costals; 7 or 8 on the whorls of the spire, equal in size and spacing except on the final half turn, most prominent on the periphery of the whorl and tending to alternate in arrangement. Spiral sculpture of sharply elevated lirations that override the costals and are equally prominent on the costal and intercostal areas; spirals initiated simultaneously with the axial sculpture by the appearance of the 2 lirae that crown the periphery of the whorl; first one, and then a second finer threadlet introduced behind the periphery and later either 1 or 2 lirae in front of the periphery, those nearest the sutures the least conspicuous; primaries on the body whorl 8 or 9 including the 2 on the shoulder; finer secondaries commonly introduced midway between the primaries, that at the base of the body approximating in strength the primary behind it. Anterior siphonal canal closely sculptured with 9 or 10 sharply elevated lirae, the 1 or 2 posterior spirals set a little apart from those in front of them. Siphonal canal cut off from the base of the body whorl by a convex area that is strongly rippled by the axial costae but not spirally threaded; delicate filamentary incrementals visible under magnification in the interspiral areas. Suture line distinct, impressed, crenulated by the axials of the preceding whorl. A narrow shoulder in front of the suture strongly defined, persistent almost to the apex; concave near the aperture, sloping and feebly undulated by the axials on the earlier volutions and occasionally threaded with a single fortuitous spiral near the anterior margin. Aperture elliptical, smoothly and evenly glazed within, with no trace of any angularity either anteriorly or posteriorly nor of any denticulation or rugosity on either the outer or the inner lip. Labrum strongly varicose, the varix obtuse and prominent, encroaching posteriorly on the preceding whorl. Anterior canal closed, short, and rather feebly recurved. Umbilical chink not visible.

Dimensions of imperfect holotype: Height, 17.3 mm.; diameter, including varices, 10.8 mm.; diameter at right angles to maximum diameter, 8.8 mm.

Holotype and juvenile paratype: U.S.N.M. 497151.

Type and sole locality: Natural Well, 2 miles southwest of Magnolia, Duplin County, N. C. Duplin marl.

Genus EUPLEURA H. and A. Adams

1853. *Eupleura* H. and A. Adams, Genera Recent Mollusca, vol. 1, p. 107.

Type by subsequent designation (Baker, F. C., Chicago Acad. Sci. Bull., vol. 2, p. 176, 1895): *Ranella* (*Eupleura*) *caudata* Say. Recent, along the Atlantic seaboard from Massachusetts to Florida.

Shell solid, ranelliform, carrying 2 continuous primary and several intermediate secondary varices. Aperture oval. Labrum dentate within. Labium smooth. Anterior canal long, narrow, partially closed.

Eupleura was considered by Tryon [18] to be intermediate between *Murex* and *Ranella.* It may be separated from the former by the presence of the two ranelliform varices; from the latter, by the smooth columella, and the muricoid ornamentation.

The genus was not initiated, apparently, until the Tertiary. The Recent representatives are confined to the East Coast of the United States, ranging from New England south to Panama and to the West Indies.

[17] Etymology: Trajana from Trajan, the Roman emperor immediately preceding Hadrian.

[18] Tryon, G. W., Jr., Structural and systematic conchology, vol. 2, p. 157, Philadelphia, 1880.

Eupleura caudata (Say)

Plate 29, figures 12, 13, 18, 19

1822. *Ranella caudata* Say, Acad. Nat. Sci. Philadelphia Jour., 1st ser., vol. 2, p. 236.
1832. *Ranella caudata* Say, Am. Conchology, pl. 48, 2 views; expl. text.
1856. *Apollon caudata* (Say). Tuomey and Holmes, Pleiocene fossils of South Carolina, p. 142, pl. 28, fig. 15.
1858. *Eupleura caudata* Say. Holmes, Post-Pleiocene fossils of South Carolina, p. 62, pl. 10, fig. 3.
1865. *Eupleura caudata* Say. Stimpson, Am. Jour. Conchology, vol. 1, p. 58, pl. 8, fig. 5 (radula).
1889. *Eupleura caudata* Say. Dall, Harvard Coll. Mus. Comp. Zoology Bull., vol. 18, p. 202.
1889. *Eupleura caudata* Say. Dall, U. S. Nat. Mus. Bull. 37, p. 120, pl. 50, fig. 11.
1890. *Eupleura caudata* Say. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 144.
1908. *Eupleura caudata* Say. Rogers, Shell book, p. 39, pl. 10, opp. p. 42, fig. 6.

Shell pale reddish-brown, cancellate with eleven robust costa to the body whirl, and several revolving filiform lines passing over them, which are more prominent upon the varice of the aperture, terminate at its inner edge, and there alternate with the raised lines of the fauces; *volutions* flattened at their summits, abruptly declining to the suture; canal coarctate, rather longer than the spire; *beak* rectilinear, reflected at the tip.

Length one inch.

Inhabits the coast of the United States.—Say, 1822.

Shell rather small; outline fusiform, the maximum diameter at or a little behind the median line. Spire conspicuously scalariform. Varices 11, persistent to the base of the anterior canal, continuous; the series performing half of a complete revolution around the axis of the shell, the edges usually free and produced into short, linguiform processes at the shoulder of the whorl. Spiral sculpture varying rather widely in the degree of prominence; lirae well rounded, moderately elevated, 2 or 3 upon the whorls of the spire, the posterior outlining the shoulder, a second midway between the shoulder and the anterior suture and sometimes a third directly behind the suture; 5 or 6 primaries present on the body whorl with an occasional fortuitous secondary on the shoulder. Pillar sculptured with 3 to 5 lirations that tend to weaken and evanesce anteriorly. Whorls closely appressed, the suture inconspicuous. Aperture obliquely ovate. Columellar margin very feebly concave. Parietal wall heavily enameled, the callus continous with the inner lining of the labrum. Labrum varicose, denticulate within, the denticles corresponding to the interspirals; feebly channelled at the commissure and at the shoulder. Anterior canal long, the margins parallel and proximate, but not coalescent, very slightly recurved at the base.

Dimensions of figured adult: Height, 25 mm.; maximum diameter, 12 mm. Dimensions of figured juvenile: Height, 14.3 mm.; maximum diameter, 6.5 mm.

Figured adult: U. S. N. M. 325421, from Neills Eddy Landing, Cape Fear River, 3 miles north of Cronly, N. C. Waccamaw formation. Figured juvenile: U. S. N. M. 325420, from 1 mile northeast of Suffolk, Nansemond County, Va. Yorktown formation.

Eupleura caudata Say is the only representative of the genus within the Tertiary of Virginia and North Carolina and is readily recognizable by its angular outline, numerous varices, and coarse but not very vigorous spiral sculpture. The species when adult shows the characteristic *Ranella*-like tendency in the exaggeration of the varix opposite the labrum.

Mansfield, 1930, figured two subspecific forms of *Eupleura caudata* from the *Cancellaria* zone of the Choctawhatchee formation. His subspecies *leonensis* is larger and coarser than any of the Duplin and Waccamaw individuals, and his *brevispira* is well-named, for the spire is lower even than in Dall's subspecies *sulcidentata.*

Distribution: Virginia: Yorktown formation, Maddelys Bluff on the Meherrin River, Southampton County; 1 mile northeast of Suffolk, and half a mile below the Suffolk waterworks dam, Nansemond County.

North Carolina: Croatan sand, Slocum's Creek, 15 miles below New Bern, Neuse River, Craven County. Waccamaw formation, Walkers Bluff on the Cape Fear River, Bladen County; Neills Eddy Landing on the Cape Fear River, Columbus County.

Outside distribution: Pliocene, Waccamaw formation, Tilly Lake, Horry County, S. C. Caloosahatchee marl, Caloosahatchee River, Fla. Pleistocene, Sankaty Head, Mass.; Heislerville, N. J.; Wailes Bluff and Federalsburg, Md.; Dismal Swamp Canal between posts 15 and 16, Va.; Simmons Bluff, S. C.; Labelle, Hendry County, Fla. Recent, Cape Cod to the West Indies and east to Bermuda; dredged by Woods Hole Survey in 3 to 13 fathoms, chiefly on muddy bottoms.

Eupleura caudata sulcidentata Dall

Plate 29, figure 17

1890. *Eupleura caudata* var. *sulcidentata* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 144.

This variety is characterized by its thinner, more expanded and recurved varices, its generally whiter color, larger size, and has, in the adult, on the back, three intervarical, flattish, transverse ribs and two or three in front. The spire is rather more elevated than in the typical *caudata,* and except on the varices, the spiral threads are often absent or obsolete. Young shells have more intervarical ribs than adults.—Dall, 1890.

Type locality: Florida Keys.

Dimensions of figured specimen: Height, 23.9 mm.; maximum diameter, 13.5 mm.

Figured specimen: U.S.N.M. 54393.

Locality of figured specimen: Recent, from Egmont Key, Fla.

Distribution: North Carolina: Yorktown formation, Rock Landing on the Neuse River, Craven County. A single young individual is tentatively referred to this subspecies because of the widely flaring varices and the obsolete spiral sculpture. It does not, however, exhibit the intervarical ribs which presumably characterize the subspecies.

Outside distribution: Pleistocene, Florida (Dall). Recent, west coast of Florida to Cuba.

Genus UROSALPINX Stimpson

1865. *Urosalpinx* Stimpson, Am. Jour. Conchology, vol. 1, p. 58.

Type by original designation: *Fusus cinereus* Say. Prince Edward Island, Canada, to San Augustine, Florida.

Shell elongated oval, or short fusiform, longitudinally ribbed or undulated and spirally striated; aperture with a short canal. Operculum somewhat like that of *Purpura*, semicordate, with the nucleus at the outer edge a little below the middle. Lingual dentition nearly like that of *Trophon* * * *.

It differs from *Trophon* in its operculum, and from *Ocinebra* in its smoother shell, want of varices, and open canal."—Stimpson, 1865.

Dall,[19] 1890, has compared *Urosalpinx* to a *Eupleura* "in which the varices have become obscure or absent." *Urosalpinx* is essentially a muricid in which the varices have been subdued into costals of varying degrees of prominence. Evidence of the family relationship, however, is still retained even in the ornamentation, for the surface is rasped, as a rule, by fine, sharp incremental laminae.

The genus was probably initiated as early as the Eocene. Both the fossil and the Recent species are best represented along the east coast of North America and the Gulf. The most prolific of the Recent species is the type, *Urosalpinx cinerea* (Say), the common oyster drill which has caused such havoc among the oyster beds of the Middle Atlantic slope.

Urosalpinx trossula (Conrad)

Plate 31, figures 19, 20

1832. *Fusus trossulus* Conrad, Fossils of the Tertiary formation of North America, p. 18, pl. 3, fig. 5.

1861. *Fusus trossulus* Conrad, Fossils of the medial Tertiary of the United States, 1st ed., p. 84, pl. 48, fig. 6; 2d ed., p. 89.

1863. *Neptunea trossula* Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 560.

1869. *Siphonalia trossula* Conrad, Am. Jour. Conch., vol. 4, p. 249.

1890. *Urosalpinx trossulus* Conrad. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 148, pl. 7, fig. 12.

1903. *Urosalpinx trossula* (Conrad). Cossmann, Essais paléoconchologie comp., vol. 5, p. 49, pl. 2, figs. 11, 12.

Fusiform; cancellated, with longitudinal ribs and revolving striae, alternated in size; whorls rounded and regular; beak short, slightly recurved; right lip thick, striated within.

Locality. James River, near Smithfield, Va.—Conrad, 1832.

This species is very variable; the typical form is rather more elongated than the specimen figured, which is an especially blunt and short variety. In the type-specimens of Conrad, which are still preserved, the sculpture is of rather broad primary spirals with a single, much narrower, secondary thread between each pair and two extremely fine tertiary spiral lines, one on each side of the secondary. The faint transverse riblets are subequal, regular and separated by about equally wide interspaces; the suture, though distinct, is not deep and the whorls are rather compact. The primary spirals are undulated, but not granular, and the granulations on the others are inconspicuous. In one of the Pliocene forms (which may be called variety *subsidus*) the spirals have become subequal, narrow and granulous, with more distinct interspaces, the whorls are less compact, and the transverse ribs on the last whorl or two are sparse, irregular, and obsolete or nearly so. The sculpture of this variety is very elegant; it appears to be confined to the Pliocene, and has been found both on the Caloosahatchee and Shell Creek. It is connected by intermediate varieties with the typical form.—Dall, 1890.

Dimensions of figured specimen: Height, 28.7 mm.; maximum diameter, 14.0 mm.

Figured specimen: U. S. N. M. 325422, from 8 to 9 miles southeast of Greenville, Pitt County, N. C. Yorktown formation.

Urosalpinx trossula (Conrad) ranges widely in relative proportions and in the degree of development of the axial sculpture. In the type the costals are inconspicuous, undulatory, irregular in spacing, and 19 on the final volution. In many individuals, they become obsolete toward the aperture and even on the entire body whorl. This species is the most abundant representative of the genus in the Tertiary.

Distribution: Virginia: Yorktown formation, Yorktown, York County; 5 miles northeast of Smithfield and 1½ miles northeast of Smithfield, James River, Isle of Wight County; a half to three-fourths of a mile above the lower Seaboard Air Line Railroad bridge, Southampton County; Exit, 1 mile west of Suffolk, 1½ miles north of Suffolk, 1½ miles northeast of Suffolk, and half a mile below Suffolk waterworks dam, Nansemond County.

North Carolina: Yorktown formation, 1½ to 2 miles above Branchs Bridge over the Meherrin River, Northampton County; 1½ miles above Murfreesboro, and 1 mile above Murfreesboro, Meherrin River; 3 to 4 miles below Tar Ferry, Hertford County; Colerain Landing on the Chowan River, Bertie County; Swift Creek and 1 mile below Old Sparta Bridge, Edgecombe County; 2 miles below Toddy Station, 2 miles southeast of Tugwell, 2⅓ miles north of Standard, 3 miles southwest of Frog Level on Mr. J. A. Noble's Branch, 6 miles below Greenville, 6¾ miles below Greenville, 8 to 9 miles southeast of Greenville, and 1 mile northwest of Galloway Crossroads, Pitt County; 1 mile northeast of Chocowinity, Beaufort County; 1 mile north of Castoria, Greene County. Duplin marl, 4 miles north of Lumberton, 2 miles below Lumberton, 4 to 5 miles below Lumberton, 1½ miles northeast of Fairmont on the farm of Mr. Andrew Jones, and at Fairmont, Robeson County. Waccamaw formation, Lake Waccamaw, Columbus County; Wilmington, New Hanover County.

Outside distribution: Miocene, *Cancellaria* zone of the Choctawhatchee formation(?), Fla., Pliocene, Caloosachatchee marl, Caloosahatchee River and Shell Creek, Fla.

Urosalpinx phrikna Gardner and Aldrich

Plate 28, figures 4, 5, 11

1919. *Urosalpinx phriknos* Gardner and Aldrich, Acad. Nat. Sci. Philadelphia, Proc., p. 35, pl. 4, figs. 2, 4, 6, 7.

Shell of medium size, moderately stout, the greatest diameter falling close to the median line. Aperture approximately half the total height. Whorls of spire convex, obscurely shouldered, decreasing rapidly in size toward the subacute apex. Protoconch of 1½

[19] Dall, W. H., Contributions to the Tertiary fauna of Florida: Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 147, 1890.

small, smooth, somewhat flattened whorls, the first half turn partially submerged in the succeeding volution. Differentiation between conch and protoconch sharp. Both axial and spiral sculpture initiated at the beginning of the first whorl of the conch. Adult axial sculpture of 9 or 10 broad, rounded, prominent ribs which tend to evanesce upon the anal fasciole and canal. Intercostal areas broadly convex and approximately equal in width to the costals. Incremental sculpture of minute, overlapping lamellae most conspicuous on the anal fasciole, and at the intersection with the spirals. Primary spirals rather low, uniform, broadly arched lirations, 3 or 4 on the spire and 14 to 16 on the body and canal; secondaries regularly intercalated; tertiaries rarely. Shoulder closely appressed against the preceding volution. Suture line slightly impressed, undulated. Aperture rather narrow, pyriform. Labrum subvaricose; outer edge minutely crenulated; inner transverse lirations analogous in position to the secondaries. Labium gently excavated at the base of the body whorl, somewhat thickened but not plicate at the entrance to the canal. Anterior canal rather long, slightly twisted, with proximate margins and a shallow terminal notch. Umbilical chink almost or entirely concealed by the parietal callus.

Dimensions of holotype: Height, 20.0 mm.; maximum diameter, 10.4 mm.; diameter at right angles to maximum diameter, 9.5 mm. Paratype: Height, 23.4 mm.; maximum diameter, 13.0 mm.; diameter at right angles to maximum diameter, 12.1 mm.

Holotype and paratype: U.S.N.M. 325423.

Type locality: Natural Well, 2 miles southwest of Magnolia, Duplin County, N. C.

Urosalpinx phrikna is remarkable for the relatively few but uniform and vigorous costals.

Distribution: North Carolina: Yorktown formation, 3 miles southwest of Frog Level, Pitt County; Wilson, Wilson County. Duplin marl, Natural Well, 2 miles southwest of Magnolia, Duplin County; 4 to 5 miles below Lumberton and 1½ miles northeast of Fairmont, Robeson County.

Outside distribution: Miocene, Duplin marl, at the Muldrow Place, 5 miles southeast of Mayesville, Sumter County, S. C.

Urosalpinx stimpsoni Gardner, n. sp.

Plate 31, figures 13, 23

Shell large for the genus, stout-fusiform; aperture more than half the total height. Whorls convex, obtusely carinated posteriorly, probably 6 or 7. Spire moderately elevated, tapering rather rapidly. Apex decorticated in all available material. Sculpture heavy. Axial costals about a dozen upon the later volutions, evenly rounded and rather prominent on the spire, evanescent on the shoulder of the whorls and toward the aperture; intercostal areas narrower, as a rule, and more angular than the costals. Spiral sculpture of rather broad, flattened fillets, most conspicuous on the periphery of the whorl and overridding the costals without increase or diminution of strength; primary spirals usually 4 on the later whorls of the spire and about 15 on the body; secondaries intercalated with a fair degree of regularity; both primaries and secondaries disappearing abruptly a short distance in front of the suture. Incrementals strong enough to crenulate the spirals minutely and corrugate the siphonal fasciole. Suture line appressed, undulated by the costals of the preceding whorl. Aperture pyriform. Inner lip sinuous, somewhat thickened at the entrance to the canal, but not plicate. Parietal wall heavily washed with a callus which is produced backward at the posterior angle of the aperture and which usually completely conceals the umbilical chink. Outer lip gently arcuate, lirate a short distance from the edge in harmony with the secondary spirals. Canal short, narrow, slightly flexed, and emarginate.

Dimensions of holotype: Height, 42.0 mm.; maximum diameter, 23.5 mm. Dimensions of paratype: Height, 33.6 mm.; maximum diameter, 18.5 mm.

Holotype and paratype: U.S.N.M. 325424.

Type locality: Neills Eddy Landing, Cape Fear River, 3 miles north of Cronly, Columbus County, N. C. Waccamaw formation.

Traces of a brownish epidermis are preserved, apparently, in most of the individuals. This darker background is sharply contrasted with the slightly worn whitish spirals and the chalky white of the aperture.

Urosalpinx stimpsoni is larger than the other Tertiary representatives of the genus. The young are separated from *U. perrugata* (Conrad) and *U. phrikna* by the more numerous and usually less regular axial costals..

The species is named in honor of the author of the genus.

Distribution: North Carolina: Yorktown formation, Tar Ferry on Wiccacon Creek opposite Harrelsville, and Mount Pleasant Landing on the Chowan River, Hertford County. Duplin marl, 2 miles below Lumberton, Robeson County. Waccamaw formation, Walkers Bluff, Cape Fear River, Bladen County; Neills Eddy Landing, Cape Fear River, 3 miles north of Cronly, Columbus County.

Urosalpinx perrugata (Conrad)

Plate 31, figure 24

1846. *Fusus perrugatus* Conrad, Am. Jour. Sci., 2d ser., vol. 2, p. 397.

1889. *Urosalpinx perrugatus* Conrad. Dall, Harvard Coll. Mus. Comp. Zoology Bull., vol. 18, pp. 212, 214.

1890. *Urosalpinx perrugatus* Conrad. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 148.

1937. *Urosalpinx perrugatus* Conrad. Maxwell Smith, East coast marine shells, p. 116, pl. 45, fig. 15.

Fusiform, with remote longitudinal ribs, and large prominent revolving lines alternated with a fine line; whorls longitudinally rugose, upper half flat and oblique; aperture rather more than half the length of the shell, purple within; labrum striate; color of the exterior cinerous.

Proportionally wider than *F. cinereus* with fewer and larger ribs and lines.—Conrad, 1846. Manatee River.

Dimensions of figured specimen: Height, 20.7 mm.; maximum diameter, 12.0 mm.

Figured specimen: U.S.N.M. 94298, living in Tampa Bay, Fla.

Immature forms similar to the young of the Recent *U. perrugata* from Sarasota Bay, Fla., have been tentatively referred to Conrad's species, although the presence of the West Florida Recent species in the Duplin and Waccamaw of North Carolina is by no means established.

Distribution: North Carolina: Duplin marl (?) Fairmont, Robeson County. Waccamaw formation, (?) Walkers Bluff on the Cape Fear River, Bladen County; (?) Neills Eddy Landing, 3 miles north of Cronly, Columbus County.

Outside distribution: Pliocene, Caloosahatchee marl, Nashua, Putnam County, Fla.; Caloosahatchee and Myakka Rivers, Fla. Pleistocene, Orient, Hillsboro Bay, Hillsboro County; North Creek, Manatee County, Fla. Recent, Cedar Keys to Key West in less than 50 fathoms.

Urosalpinx suffolkensis Gardner, n. sp.

Plate 28, figure 9

Shell rather heavy, fusiform, ranging rather widely in relative proportions. Aperture approximately half the total height, in some shells a little more, in others a little less. Whorls convex, obscurely tabulated, probably about 6. Spire moderately elevated, tapering rather abruptly to an acute apex. Surface heavily sculptured. Axial costals approximately 10 on the later volutions, evenly rounded, elevated, separated by narrower intercostals; costals usually evanescent on the anal fasciole and often toward the aperture. Spiral sculpture of broadly rounded lirations minutely crenulated by the incrementals, prominent alike upon the costal and intercostal areas. Primaries about 16 on the body and canal and 4 or 5 on the later whorls of the spire. Secondaries intercalated with a fair degree of regularity. Aperture pyriform. Labrum evenly arcuate, its edge minutely crenulate and transversely striated within in harmony with the external secondaries. Labium gently excavated at the base of the body whorl, thickened but not plicate at the entrance to the anterior canal. Parietal wall heavily washed with a callus that may almost completely conceal the umbilical chink. Anterior canal with proximate margins, short, recurved, and slightly emarginate.

Dimensions of holotype: Height of imperfect specimen, 31.0 mm.; maximum diameter 15.8 mm.

Holotype: U. S. N. M. 325425.

Type locality: One mile northeast of Suffolk, Nansemond County, Va. Yorktown formation.

All of the individuals in the material at hand exhibit a grayish or brownish background that contrasts rather strongly, especially in slightly weathered forms, with the whiter spirals and the lining of the aperture.

Urosalpinx suffolkensis is separated from *Muricopsis floridana* (Conrad) by the absence of a conspicuous shoulder; the persistence of the costals, almost, if not quite, to the posterior suture; and the lesser prominence of both the axial and spiral sculpture. *Urosalpinx stimpsoni* is larger and relatively lower, and is ornamented with somewhat more numerous but usually less elevated axial ribs.

Distribution: Virginia: Yorktown formation, Three-fourths of a mile above Yorktown and at Yorktown, York County; 1¼ miles north of Suffolk, 1 mile west of Suffolk and 1 mile northeast of Suffolk, Nansemond County.

North Carolina: Yorktown formation 2½ miles northwest of Murfreesboro and 1½ miles above Murfreesboro on the Meherrin River, Hertford County; 1 mile northwest of Galloway crossroads, on the Tar River, Pitt County. Duplin marl, Natural Well, 2 miles southwest of Magnolia, Duplin County.

Superfamily BUCCINACEA

Family PYRENIDAE

Genus MITRELLA Risso

1826. *Mitrella* Risso, Histoire naturelle des principales productions de l'Europe méridionale, vol. 4, p. 247.

Type by subsequent designation (Cox, Rept. Paleontology Zanzibar, Moll., p. 28, 1927): *Mitrella flaminea* Risso=*Murex scriptus* Linnaeus. Recent, in the Mediterranean.

Shell dense, rather small, fusiform. Spire elevated, the whorls evenly tapering. Protoconch small, smooth, blunt, paucispiral. Sculpture restricted to the feeble striae which gird the pillar and the anterior fasciole. Aperture rather narrow. Outer lip thickened a little, feebly emarginate posteriorly; denticulate within. Parietal wash moderately heavy. Pillar feebly rugose. Anterior canal not defined, the fasciole little or not at all expanded. Terminal notch U-shaped, oblique.

The type of *Astyris*, a group with which *Mitrella* has been commonly confused is *Astyris rosacea* Gould, a thin shelled Arctic species; it differs from the dense shells of *Mitrella* in the feebly convex whorls, the thin outer lip, nonplicate within, the absence or obscure development of the siphonal notch directly in front of the suture on the outer lip, and in the compressed margin of the pillar.

The Recent representatives in the warm and shallow waters are of world-wide distribution.

Mitrella lunata (Say)

Plate 30, figures 17, 18

1826. *Nassa lunata* Say, Acad. Nat. Sci. Philadelphia Jour., 1st ser., vol. 5, p. 213.

1870. *Astyris lunata* (Say). Dall, Boston Soc. Nat. History Proc., vol. 13, p. 242.

1890. *Astyris lunata* Say. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 137.

Shell reddish-brown, with about six volutions; whorls with two revolving lines of dilated, sublunate, whitish spots, and sometimes a third one at base; suture not deeply impressed;

labrum dentate on the inner submargin, the superior teeth more prominent; labium with the plate not thickened * * *.

Length 3/20 inch.

Inhabits the Coast of the Southern States.—Say, 1826.

Shell small, compact, irregularly biconic. Whorls approximately 6, the body well rounded, the whorls of the spire trapezoidal, very closely appressed. Surface smooth excepting for 5 to 12 sulci on the pillar. Suture distinct, slightly impressed. Aperture obliquely lenticular, angulated posteriorly. Outer lip straight or slightly patulous in front, the margin sharp, somewhat thickened and dentate within. Parietal wall glazed. Columella simple, broadly and rather strongly concave. Anterior extremity rather deeply emarginate.

Dimensions of figured specimen: Height, 3.6 mm.; maximum diameter, 1.8 mm.

Figured specimen: U.S.N.M. 325419, from Neills Eddy Landing, Cape Fear River, 3 miles north of Cronly, Columbus County, N. C. This individual from the Waccamaw formation is figured to show the remarkable retention of the color pattern.

Mitrella lunata (Say) varies considerably in relative proportions within its narrow confines. In general aspect, it strongly resembles a miniature *M. communis* (Conrad), although it never attains more than half the normal height of the latter. The young of Conrad's species may be separated from *M. lunata* by the juvenile characters, such as the obtusely angulated body whorl, the thin nondentate outer lip, and the unglazed parietal wall.

Mitrella debooyi (Maury), from the Cercado beds of the Dominican Republic, is more slender but similar to *M. lunata* in general aspect.

Distribution: Virginia: Yorktown formation, Suffolk, Nansemond County.

North Carolina: Yorktown formation, one-half to three-fourths of a mile above Edenhouse Point on Chowan River, Bertie County; Rock Landing on the Neuse River, Craven County. Duplin marl, Natural Well, 2 miles southwest of Magnolia, Duplin County; 1½ miles northeast of Fairmont, Robeson County. Croatan sand, 13 to 15 miles below New Bern, Neuse River, Craven County. Waccamaw formation, Walkers Bluff on the Cape Fear River, Bladen County; Lake Waccamaw and Neills Eddy Landing, 3 miles north of Cronly, Columbus County. Pleistocene, Quarantine Station well.

Outside distribution: Miocene, Duplin marl of Sumter County, S. C. Pliocene, Waccamaw formation, Tilly Lake, Horry County; Smiths and Goose Creek (Tuomey and Holmes), Berkeley County, S. C. Caloosahatchee marl, Nashua, Putnam County, Fla., Caloosahatchee and Myakka Rivers, Fla. Pleistocene, Sankaty Head, Mass.; Gardiners Island, N. Y.; Heislerville, N. J.; Wailes Bluff and Federalsburg, Md.; Dismal Swamp Canal, posts 15 to 16, Va.; Simmons Bluff, S. C.; North Creek, Manatee, Labelle, and Eau Gallie, Fla. Recent, Cape Ann to Brazil, in 0 to 1 fathom. "Abundant and generally distributed throughout Vineyard Sound; in Buzzards Bay, chiefly restricted to inshore stations; dredged in 0 to 19 fathoms on every sort of bottom; abundant among algae growing upon piles or rocks near shore." —Woods Hole Survey.

Mitrella waccamawensis Gardner, n. sp.

Plate 30, figure 16

Shell very small, slender, volutions 6 to 7, body whorl evenly rounded, aperture less than one-half the total height; whorls of spire feebly convex, closely appressed, tapering gradually to a rather obtuse apex. Protoconchal characters obliterated by the decortication of the tip. Surface of conch smooth, except for a few coarse threads on the anterior canal. Suture distinct, feebly impressed. Aperture rudely lenticular. Outer lip imperfect but probably thin and nondentate within. Columella simple, broadly concave. Parietal wall thinly glazed. Anterior extremity broadly emarginate.

Dimensions of holotype: Height, 3.8 mm.; maximum diameter, 1.55 mm.

Holotype: U. S. N. Mus. 325417.

Type locality: Neills Eddy Landing on the Cape Fear River, 3 miles north of Cronly, Columbus County, N. C. Waccamaw formation.

The Waccamaw form is smaller and more slender than either *M. lunata* or *M. multilineata* Dall from the Recent faunas on the east coast.

The constriction at the base of the body is too marked for typical *Mitrella;* the inner lip is apparently thin and nondentate on the inner surface so that, if the type is an adult, the species can scarcely be included in the section *Columbellopsis.*

Genus ANACHIS H. and A. Adams

1853. *Anachis* H. and A. Adams, Genera Recent Mollusca, vol. 1, p. 184.

Type by subsequent designation (Tate, in Woodward's Manual of the Mollusca, ed. 3, app., p. 13, 1875): *Columbella scalarina* Sowerby. Recent, off Panama.

The type of the genus is rather squat for the group, the whorls are shouldered and axially costate. *Anachis* s. s. has not been recognized in the Tertiary of Virginia and the Carolinas.

Subgenus THIARINELLA Sacco

1890. *Thiarinella* Sacco, in Bellardi, I Molluschi dei Terreni Terziarii del Piemonte e della Liguria, pt. 6, p. 56.

Type by monotypy: *Fusus comptus* Bronn. Miocene and Pliocene, of northern Italy.

Woodring (Miocene mollusks from Bowden, Jamaica, pt. 2, p. 278, 1928) has considered *Thiarinella* a subgenus of *Metulella* and *Costoanachis* a subgenus of *Anachis.* The Tertiary species from the eastern seaboard faunas which seem to be referable to *Thiarinella* are so like those included under *Costoanachis* that the differences should not be of more than subgeneric value. The differences which separate *Thiarinella* from *Metulella* s. s. which is characterized by rounded whorls, an almost imperceptible notch directly in front of the suture, and a relatively long unemarginate canal seem

differences more important than those which separate it from *Anachis* s. s., a group of relatively short and moderately stout species strongly ribbed axially. *Thiarinella* is of moderate dimensions and moderately slender; axial costae are well developed and although spiral lirae are apparently absent in the type, they are present on closely related forms. The anterior canal, judging from an illustration of the type species, is of only moderate length and emarginate at its extremity. The outer lip curves directly into the anterior fasciole and is not constricted to form the outer wall of the canal as in *Thiarella.* The labral notch directly in front of the suture is more pronounced than in *Metulella.*

Anachis (Thiarinella) camax Dall

Plate 30, figure 15

1890. *Anachis camax* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 136, pl. 12, fig. 3.

Shell slender, elevated, with two small, smooth (usually caducous) nuclear whorls and eight subsequent reticulated whorls; spire acute, with flattish sides; transverse sculpture of (on the last whorl 15) narrow, rounded ribs extending from suture to suture and (on the last whorl) over the periphery, becoming obsolete on the base, and, especially on the later whorls, with much wider interspaces; spiral sculpture of (between the sutures about 5) strong, flattish threads, most marked on the base and interspaces, feeble on the ribs and with subequal interspaces, except the first one in front of the suture, which is wider; whorls flattish, suture distinct; aperture rather narrow and long; canal short, pillar twisted; inner lip with a thin callus; outer lip not much thickened and with a few feeble lirae; lines of growth distinct. Max. lon. of shell 14.5 [14.9]; of aperture 5.0; max. diam. of shell 4.5 [4.7] mm.

Pliocene marls of the Caloosahatchie and Shell Creek. [Fla.]—Dall, 1890.

Holotype: U.S.N.M. 112146.

Anachis (*Thiarinella*) *camax* Dall has been recorded in a number of the checklists from the Duplin marl and Waccamaw formation of North Carolina, but none of the forms examined attain so elevated an outline, nor do they present the same character of spiral sculpture as the Caloosahatchee species; they seem to be referable rather to *Anachis* (*Costoanachis*) *avara* Ravenel, the species most elevated and most strongly sculptured spirally of the *A. avara* group.

Outside distribution: Caloosahatchee marl, Shell Creek and Caloosahatchee River, Fla.

Anachis (Thiarinella) styliola (Dall)

Plate 30, figure 28

1892. *Columbella* (*Anachis*) *styliola* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 242, pl. 13, fig. 11.

Shell slender, acute, of eight or ten whorls; nucleus large, bulbous, smooth, of two whorls; subsequent whorls flattened, sloping, with a strong peripheral keel with a wide groove below it, on the anterior edge of which the suture runs, and a narrower groove above it; transverse sculpture of straight, strong, equal riblets with equal interspaces which extend from the suture to the keel, which is made wavy by their ends; these become more and more numerous as the whorls advance, but near the aperture become obsolete on the middle of the whorl; spiral sculpture of sharp grooves, more evident on the later whorls, one or two near the suture stronger than the others; on the middle of the whorl the spirals are more or less obsolete, but on the base and pillar of the last whorl they are broad and clear-cut, separating narrower, rounded threads; aperture narrow, with an obscure varix behind the outer lip at maturity; canal short, narrow, recurved; inner lip callous, reflected, its edge prominent, with a row of short lirae running across its inner surface; body with a thin wash of callous; outer lip sharp-edged, with a few (5–6) short lirae within, a smooth interval next the suture. Max. lon. of shell 16.5; max. diam. 5.0 [4.9] millimeters.

This shell most nearly resembles *A. camax* Dall, which has coarser and stronger spiral sculpture, flatter whorls with a less conspicuous, more closely appressed suture and a much smaller nucleus. In *A. camax* the earlier whorls are slightly turriculate, being somewhat smaller than the sutural margin in front of them. In *A. styliola* the peripheral keel is expanded in a roof-like manner over the whorl in front of it in the earlier whorls; the pillar also is stouter and more swollen than in *A. camax*, which also has less conspicuous liration in the aperture.—Dall, 1892.

Holotype: U.S.N.M. 113259.

Type locality: Mrs. Guion's marl pit on the Cape Fear River, probably in Columbus County, N. C.

Distribution: North Carolina: Duplin marl, Natural Well, 2 miles southwest of Magnolia, and at Mr. Frank Wilson's marl pit 1 mile east of Magnolia, Duplin County; 4 to 5 miles below Lumberton, Robeson County. Waccamaw (?) formation, Mrs. Guion's marl pit on the Cape Fear River, Columbus (?) County (U. S. National Museum).

Anachis (Thiarinella) styliola obsoleta Gardner and Aldrich

Plate 30, figures 27, 29

1919. *Anachis styliola obsoleta* Gardner and Aldrich, Acad. Nat. Sci. Philadelphia, Proc., p. 30, pl. 2, figs. 7, 9, 12.

Shell moderately tall, varying widely in degrees of slenderness. Spire acute, attenuated. Aperture in some specimens less than one third the total height. Whorls 8 to 10, regularly increasing in size, narrowly tabulated posteriorly, the preceding volution correspondingly undercut anteriorly. Protoconch of 1½ to 2 whorls, the first half turn largely immersed, the second globose posteriorly, becoming decreasingly convex anteriorly. Early whorls of conch strongly carinated, the keel moving forward from its initial position at approximately the median horizontal to directly overhang the suture and conspicuously coronate the succeeding turn; gradually, however, becoming lower and less prominent and usually reduced to the normal plane of the spire by the end of the third whorl. Axial sculpture appearing, as a rule, on the first coil of the conch as faint incremental striae which rapidly strengthen and recur at more and more regular intervals until, at the beginning of the second conchal whorl, there is, in the majority of individuals, a well established axial sculpture of 16 to 18 narrow, obtuse, slightly arcuate riblets uniform in strength from the posterior shoulder to the anterior

keel, which they delicately crenulate; axial sculpture ranging in degree of development and persistence from that of *A. styliola* s. s. to an almost smooth type in which the costals are reduced to feeble undulations faintly visible just posterior to the suture line and even feebler wavelets anterior to the suture. Spiral sculpture confined, as a rule, to the base of the body whorl, and the pillar; periphery of final whorl usually outlined by a shallow linear sulcus; base sculptured with 6 to 8 low, half-obsolete threads separated by linear interspaces, and in front of them, 2 less feeble, more widely separated spirals; normally 9 or 10, well rounded, rather prominent and close-set lirations on the pillar and anterior fasciole; faint traces of spiral lirae visible under magnification on other parts of the surface but nowhere sufficiently strong to affect the general aspect of the shell. Suture distinct but inconspicuous; anterior sulcus of preceding whorl commonly visible behind it. Aperture narrow, lenticular, angulated posteriorly. Outer lip feebly arcuate, obscurely varicose in the adult forms and transversely lirate within. Inner lip contracted at the base of the body whorl. Parietal wall glazed, roughened in harmony with the spiral sculpture; margin of reflected callus sharp, standing apart from the pillar wall. Anterior canal moderately long for the subgenus, recurved, obliquely emarginate.

Dimensions of holotype: Height, 16.6 mm.; maximum diameter, 4.8 mm.

Holotype: U.S.N.M. 114216.

Type Locality: Natural Well, 2 miles southwest of Magnolia, Duplin County, N. C. Duplin marl.

The diagnostic characters of the subspecies are the relatively shallow sutural channel and the more or less obsolete sculpture, both axial and spiral.

The range of variation in relative dimensions as well as in sculpture is wide. A stout, strongly costate individual (U.S.N.M. 325414) is illustrated in figure 29. The decollated specimen is 11.4 mm. high and 4.2 mm. in diameter. It was collected at the F. M. Wilson marl pit, 1 mile east of Magnolia, Duplin County, N. C.

The subspecies is rather abundant in the marls of Duplin County and also is present in the Duplin of Sumter County, S. C.

Anachis (Thiarinella) virgilina Gardner, n. sp.

Plate 30, figures 33, 40

Shell heavy, relatively high. Spire elevated. Body whorl slender, rather abruptly constricted at the base. Volutions 8 to 9 in all, those of the conch narrowly tabulated posteriorly, flattened laterally, undercut anteriorly. Protoconch of 1½ to 2 smooth coils, the initial half turn somewhat oblique, immersed at the tip; final turn of protoconch erect, moderately convex. Axial sculpture well developed, consisting of 18 to 20 narrow, rounded, often feebly arcuate, rather prominent costals which tend to become obsolete on the last half turn of the body; approximately uniform in strength from the posterior tabulation of the whorl to the anterior undercut, and on the body whorl abruptly evanescent at the shallow sulcus which outlines the periphery. Spiral striations faintly visible over the entire surface in the young forms but confined in the adults, to the peripheral sulcus, the feeble, half-obsolete striations upon the base, and the 9 to 12 vigorous and crowded lirations upon the pillar and anterior canal. Suture line distinct but not conspicuous; channel behind the suture persistent from the protoconch to the aperture, well-defined, feebly undulated by the remnants of the axial costae, its depth corresponding to the width of the posterior shoulder of the succeeding whorl, so that the outline of the spire is uniform except for the recurrent notches at the suture. Aperture narrow, rudely lenticular, angulated posteriorly. Labrum gently arcuate, lirate within. Labium obliquely constricted at the base of the body whorl. Parietal wall heavily glazed, the outer edge of the enamel sharp and standing apart from the pillar. Columella more or less corrugated in harmony with the spiral sculpture. Anterior canal moderately long, approximately straight, obliquely emarginate anteriorly.

Dimensions of holotype: Height, 18.5 mm.; maximum diameter, 6. 3 mm.

Holotype: U.S.N.M. 325412.

Type locality: Eight to 9 miles southeast of Greenville, Pitt County, N. C.

Anachis virgilina is separated from the closely allied and possibly descendant form, *A. styliola* Dall, by the heavier, stouter shell; the more conspicuous axial sculpture; the spiral sculpture, almost or altogether obsolete except on the area in front of the periphery of the body whorl; and by the deeper channel behind the suture and the slightly wider tabulation in front of it. The former is limited in its distribution to the Miocene Chesapeake group of Virginia and North Carolina, the latter to the Miocene Duplin marl and the Pliocene Waccamaw formation of the Carolinas.

Distribution: Virginia: St. Marys formation, 1 to 2 miles below Bowlers Wharf, Essex County.

North Carolina: Yorktown formation, 8 to 9 miles southeast of Greenville, Pitt County, 2½ miles northwest of Chocowinity and 1 mile northeast of Chocowinity, Beaufort County.

Subgenus COSTOANACHIS Sacco

1890. *Costoanachis* Sacco, I Molluschi dei Terreni Terziarii del Piemonte e della Liguria, pt. 6, p. 57.

Type by subsequent designation (Pace, Malacol. Soc. London Proc., vol. 5, p. 43, 1902): *Columbella (Anachis) turrita* Sacco. Miocene, of northern Italy.

Costoanachis includes the less slender, axially costate and spirally striate forms. The anterior canal is very short or rudimentary and the anterior extremity emarginate. In some species, the outer lip is definitely vari-

cose and the posterior siphonal notch fairly deep and sharply defined.

Anachis (Costoanachis) obesa (C. B. Adams)

Plate 30, figure 26

1845. *Buccinum obesum* C. B. Adams, Boston Soc. Nat. History Proc., vol. 2, p. 2.
1850. *Columbella obesa* C. B. Adams, Contributions to conchology, p. 55.
1889. *Columbella (Anachis) obesa* C. B. Adams. Dall, U. S. Nat. Mus. Bull. 37, p. 118.
1895. *Columbella (Anachis) obesa* C. B. Adams. Harris, Bull. Am. Paleontology, vol. 1, No. 3, p. 20.

Shell small, squat, inversely ovate; aperture a little less than half the total height. Whorls approximately 7, closely appressed, trapezoidal. Protoconch apparently twice-coiled, the initial turn largely immersed. Sculpture dominantly axial; costae develop gradually, the first half turn of the conch faintly undulated, the wavelets becoming less feeble and more sharply defined anteriorly. Axials, when typically developed, 15 to 30 on the whorls of the spire, very narrow, obtuse, approximately vertical, uniform in strength from suture to suture, relatively fewer in number on the body whorl and consequently more distant, stronger on the earlier half and persistent to the base but tending to evanesce toward the aperture, and in the adult reduced to a few distant, irregular undulations near the suture. Spiral sculpture inconstant in the degree of development and consists of 6 to 10 crowded lirations upon the pillar and siphonal canal in many of the adults. In the young and occasionally in the adults the entire intercostal surface is sulcated with linear or sublinear grooves, uniform in depth and spacing, except for the sulcus directly in front of the suture which is usually strong enough to dissect the costae; suture line distinct, impressed. Aperture rather narrow. Outer lip feebly arcuate, constricted in the adults at the posterior siphonal fasciole, and at the anterior canal; subvaricose at the resting stages, the inner surface with about 6 denticles elongated normal to the margin, the posterior strongest. Inner lip contracted at the base of the body. Parietal and pillar glaze heavy, filling the posterior angle of the aperture of the adults, and rounding it evenly. Pillar wash denticulated in harmony with the external spirals; anterior canal short, obliquely emarginate.

Dimensions of figured specimen; height, 5.55 mm.; maximum diameter, 2.7 mm.

Figured specimen: U.S.N.M. 54283, from Samana Bay, Dominica.

The fossil representatives of the species are similar to individuals collected in Jamaica, Adams' type locality. The Recent forms from Carolina and Florida are, as a rule, characterized by a relatively stronger spiral sculpture than the fossils.

Distribution: Virginia: Yorktown formation, 1½ miles northeast of Suffolk, Nansemond County.

North Carolina: Duplin marl, Natural Well, 2 miles southwest of Magnolia, Duplin County. Croatan sand, 13 and 15 miles below New Bern, Neuse River, Craven County. Waccamaw formation, Walkers Bluff on the Cape Fear River, Bladen County.

Outside distribution: Pliocene, Waccamaw formation, Tilly Lake, Horry County, S. C. Recent, Hatteras to St. Thomas and Brazil, in less than 50 fathoms.

Anachis (Costoanachis) avara (Say) Dall

1822. *Columbella avara* Say, Acad. Nat. Sci. Philadelphia Jour., 1st ser., vol. 2, p. 230.
1839. *Columbella avara* Say. C. B. Adams, Boston Jour., Nat. History, vol. 2, p. 263.
1841. *Columbella avara* Say. Gould, Rept. Invertebrata Massachusetts, p. 313, fig. 197.
1856. *Columbella avara* Say. Tuomey and Holmes, Pleiocene fossils of South Carolina, p. 139, pl. 28, fig. 12.
1859. *Columbella avara* Say. Holmes, Post-Pleiocene fossils of South Carolina, p. 73, pl. 12, fig. 4.
1889. *Columbella (Anachis) avara* Say. Dall, U. S. Nat. Mus. Bull. 37, p. 116, pl. 50, fig. 12.
1890. *Columbella (Anachis) avara* Say. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 135.

Shell small, covered with a dirty-brownish pigment beneath which it is whitish reticulated or maculated with rufous; spire elevated, acute; volutions eight, with spiral impressed lines, and transverse elevated obtuse costa; the costa upon the body whirl are terminated at the middle, and are about eleven in number; labium with a distinct plate crenated on the submargin; labrum denticulated within, but not very perceptibly thickened on the inner middle.

Length less than half an inch.

Inhabits the coast of the southern states.—Say, 1822.

Although well represented by subspecific variations, *Anachis avara* s.s. is unknown in the Neocene of Virginia and North Carolina.

Anachis (Costoanachis) avara translirata (Ravenel)

Plate 30, figures 36, 37

1861. *Columbella translirata* Ravenel, Acad. Nat. Sci. Philadelphia Proc., vol. 13, p. 42.

Shell elevated, conical, sharp at the apex; whorls nine, nearly flat, rather closely ribbed, ribs and interspaces about equal, with five equidistant revolving striae, from the anterior canal to the apex. Upon the upper whorls, one line is lost at the suture, where the whorls seem to overlap as they ascend; the body whorl is much the largest, and is angulated from opposite the posterior end of the aperture, revolving to near the center of the outer lip; to this angle the ribs are half the number that are upon the whorl immediately above, and at the suture are nodulous; the nodules being generally white, give a decided character to the shell. Below this angle the ribs are much less decided, and again resume their original number, and by holding the canal toward the eye, the intermediate rib can be traced, running up between the larger ones, gradually becoming obsolete; and below this angle the revolving striae become more numerous and more decided, crossing the ribs so as to produce a reticulated appearance, except as they approach the end of the anterior canal, where the ribs cease and the revolving striae alone are to be seen.

Aperture moderate, oblong, rather narrow, very little hollowed on the pillar lip; pillar callus with obsolete denticula-

tions; outer lip not decidedly thickened, denticulate slightly within.

Color varying from a light straw to a dark brown, with the ends of the ribs at the suture of the body whorl and at the angle on this whorl, white. Some of the specimens have blotches of white, which give the whole shell a mottled appearance. It is larger than *C. avara* Say, being nearly an inch in length. This shell and "*C. similis*" are allied to "*C. avara*," but are very distinct. They belong to the group of which *C. avara* is the type.

From the stomachs of fish off Charleston bar, and is more abundant than any species obtained from this source as yet. Dr. Stimpson found it at Beaufort, N. C.—Ravenel, 1861.

Dimensions of figured specimen: Height, 12.5 mm.; maximum diameter, 5.0 mm.

Figured specimen: U.S.N.M. 325415, from Neills Eddy Landing, Cape Fear River, 3 miles north of Cronly, Columbus County, N. C. Waccamaw formation.

The subspecies is characterized by the elevated spire and the relatively strong development of the spiral sculpture; to it have been referred the majority of those forms from the Miocene and Pliocene of North Carolina which have been noted in the checklists under *Anachis camax* Dall, of the Caloosahatchee marl. The Florida species is closely related to the protean *A. avara*, which it resembles in the increase in the prominence and spacing of the axials on the first half turn of the body and their subsequent tendency to become obsolete near the aperture. However, it is more slender and the spiral sculpture more uniform than in any of the individuals from the Miocene or Pliocene (Waccamaw).

Distribution: North Carolina: Yorktown formation, Mount Pleasant Landing on the Chowan River, Hertford County. Waccamaw formation, Walkers Bluff on the Cape Fear River, Bladen County; Lake Waccamaw and Neills Eddy Landing, 3 miles north of Cronly, Columbus County; Wilmington, New Hanover County.

Outside distribution: Pliocene, Waccamaw formation, Nixon's and Tilly Lake, Horry County, S. C. (Dall). Recent, New York to Yucatan in less than 50 fathoms.

Anachis (Costoanachis) avara similis (Ravenel)

Plate 30, figures 35, 38

1861. *Columbella similis* Ravenel, Acad. Nat. Sci. Philadelphia Proc., vol. 13, p. 41.

This has generally been considered the young or immature shell of "*C. avara*." The *avara* is a larger shell, and has fewer and much larger ribs at the upper portion of the body whorl. It has about 11 ribs; whereas this shell has often as many as 20 ribs, but the number varies. The *avara* never has all of the whorls decidedly ribbed; the larger ribs are usually confined to the body whorl, sometimes extending to the second; but above this, there is a space embracing one or two whorls, which is smooth or slightly wrinkled, and the two or three upper whorls are regularly ribbed to the apex. With the "*similis*", the ribs on the body whorl are more numerous, smaller and more regular generally, and occupy more of the whorl, and generally all of the whorls are regularly ribbed to the apex. The general appearance of the two shells differs, one being always smaller than the other. The revolving striae are very similar in the two shells; the same may be said of the coloring, the "*similis*" being the most prettily mottled. It must, however, be acknowledged, that the two run into each other so nearly, that occasionally, it is not easy to determine a specimen. The uncertainty is increased by the difficulty in following up a series from the very young to the mature state of either. I have not been able to compare the animals; common on the coasts of North and South Carolina.—Ravenel, 1861.

Dimensions of figured specimen: Height, 13.3 mm.; maximum diameter, 5.5 mm.

Figured specimen: U.S.N.M. 325416, from 1 mile northeast of Suffolk, Nansemond County, Va. Yorktown formation.

Anachis (*Costoanachis*) *avara similis* (Ravenel) is represented in the east coast Neocene by rather heavy, moderately elevated shells, sculptured with narrow, obtuse axial costae numbering 18 or 20 on the final whorl of the spire, fewer and more distant on the first half turn of the body, and tending to become obsolete toward the aperture; the spiral sculpture as in the species sensu stricto varies widely in the degree of development. *A. avara similis* is separated from *A. avara translirata* (Ravenel) by the less elevated spire, the less regular axials and the less constant and uniformly developed spirals.

Distribution: Virginia: Yorktown formation, 1 mile northeast of Suffolk, Nansemond County.

North Carolina: Yorktown formation, Rock Landing, Craven County. Waccamaw formation, Lake Waccamaw and Neills Eddy Landing, 3 miles north of Cronly, Columbus County.

Outside distribution: Recent, Vineyard Sound, Massachusetts, to Florida Keys and Yucatan, in less than 50 fathoms.

Anachis (Costoanachis) avara amydra (Dall)

Plate 30, figure 34

1890. *Columbella* (*Anachis*) *avara* var. *amydra* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 136.

In this variety, which is less common, the ribs are obsolete or absent and represented only by a band of little knobs which coronate the whorl at the suture, which is not appressed; the spiral sculpture, always present, is in this variety more prominent owing to the absence of the ribs; the aperture is strongly lirate. This form is found with the preceding [*Columbella* (*Anachis*) *avara caloosaensis* Dall] and is nearest some of the mutations of *A. avara* var. *semiplicata* Stearns of the recent fauna.—Dall, 1890.

Dimensions of holotype: Height, 14.6 mm.; maximum diameter, 6.4 mm.

Holotype: U.S.N.M. 112145.

Type locality: Pliocene of the Caloosahatchee River, Fla.

Distribution: North Carolina: Miocene, Duplin marl, Natural Well, and Mr. Frank Wilson's marl pit, 1 mile east of Magnolia, Duplin County.

Outside distribution: Pliocene, Caloosahatchee marl, Shell Creek and Caloosahatchee River, Fla.

Anachis (Costoanachis) avara caloosaensis Dall

Plate 30, figure 39

1890. *Columbella (Anachis) avara caloosaensis* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 135.

This form differs from the recent var. *avara* s. s. in having the suture appressed above the ends of the ribs so as to give it a somewhat marginated appearance and to angulate the aperture a little in front of the suture on the outer lip; the varix of the adult is more pronounced than in any specimen of the recent form I have seen, the lirae on the pillar and outer lip are stronger, the aperture narrower, the periphery of the last whorl distinctly flattened, and owing to the margination of the suture the spire has a slightly turrited appearance.

This varies in size and in the strength of the (usually 13–14) ribs, as the recent shells do, but I have not been able to find a single specimen which exactly reproduces the recent type in any of its numerous variations.—Dall, 1890.

Dimensions of holotype: Height, 15.6 mm.; maximum diameter 6.4 mm.

Holotype: U.S.N.M. 112144.

Type locality: Caloosahatchee River, Fla. Caloosahatchee marl.

Distribution: North Carolina: Waccamaw formation, Walkers Bluff on the Cape Fear River, Bladen County; Neills Eddy Landing, 3 miles north of Cronly, Columbus County.

Outside distribution: Pliocene, Caloosahatchee marl, Nashua, Putnam County, Fla.; Caloosahatchee River and Shell Creek, Fla.

Anachis (Costoanachis) milleri Gardner, n. sp.

Plate 28, figure 2

Shell of moderate size and weight, and moderately slender. Spire elevated. Whorls 8½ or 9, flattened laterally, the body whorl angulated at the periphery in the juveniles, well rounded in the adults. Protoconch small, smooth, thrice-coiled apparently; the initial turn slightly globose, depressed and largely immersed; succeeding turns feebly convex. Both axial and spiral sculpture developed, the former dominant. Axials appearing abruptly at the initiation of the conch, between 20 and 30 (28 in the type) on the final whorl of the spire, very narrow, rounded or obtusely pinched, fairly equal and regular in size and spacing upon the spire, uniform in strength from suture to suture, becoming irregular and more or less obsolete upon the periphery of the body and on the final half turn. Spiral sculpture of very low, rather broad, flat fillets, least feeble on the intercostal areas, separated by sublinear, squarely channeled sulci, usually 6 to 8 on the penultima (7 in the type) and 14 to 16 (15 in the type) on the body, becoming a little more distant upon the base of the body; on the pillar and fasciole about 9, rounded, moderately prominent, closely crowded lirations; fillet in front of the suture relatively elevated and the sulcus relatively wide and deep, dissecting the costals and nodulating the posterior margin of the whorl. Suture line distinct, impressed, often minutely crenulated by the costals of the preceding whorl.

Aperture moderately narrow, lenticular, angulated posteriorly. Outer lip broadly emarginate at the anal fasciole, slightly flaring anteriorly, abruptly contracted at the anterior canal, rarely varicose, transversely lirate within. Inner lip contracted at the base of the body whorl, nonplicate. Parietal wall heavily glazed, in some individuals, feebly corrugated by the spiral sculpture. Anterior canal moderately long for the genus, slightly recurved, obliquely emarginate.

Dimensions of holotype: Height, 13.5 mm.; maximum diameter, 5.6 mm.

Holotype: U.S.N.M. 325413.

Type locality: Wilson, Wilson County, N. C. Yorktown formation.

Anachis milleri suggests on the one hand *A. avara* Say, on the other *A. harrisii* Dall. From the former it differs in the finer and more numerous costals, which show no tendency to evanesce on any of the whorls of the spire, nor to become more prominent and more distant on the first half of the body turn. From the latter it is separated by the more numerous costals (20 to 30 in *A. milleri*, 16 in *A. harrisii*), and by the more numerous and more elevated spirals (6 to 8 on the whorls of the spire in *A. milleri*, 4 in *A. harrisii*).

The confines of the species are moderately narrow. The range in relative dimensions is slight; the range in the number of axial riblets is fairly wide. The representatives from the vicinity of the mouth of the Chowan River, Bertie County, N. C., develop only 6 spirals on the final whorl of the spire. The juveniles from the Waccamaw formation of Neills Eddy Landing, N. C., present no characters by which they can be separated from the Yorktown forms. The type is rather worn, unfortunately, so that the spiral sculpture is enfeebled by erosion.

I have the pleasure of naming this interesting species, which is well represented both in Virginia and North Carolina, in honor of the late Dr. Benjamin L. Miller, formerly of Lehigh University, who made extensive and siginficant collections in the east coast Tertiary during his association with the U. S. Geological Survey.

Distribution: Virginia: St. Marys formation, 1 to 2 miles below Bowlers Wharf, Essex County. Yorktown formation, 1½ miles north of Suffolk, Nansemond County.

North Carolina: Yorktown formation, Wilson, Wilson County; Tar Ferry on Wiccacon Creek opposite Harrelsville and at Mount Pleasant Landing on the Chowan River, Hertford County; Colerain Landing, Mount Gould Landing, and a half to three-fourths of a mile above Edenhouse Point on the Chowan River, Bertie County. Waccamaw formation, (?) Neills Eddy Landing, 3 miles north of Cronly, Columbus County.

Genus STROMBINA Mörch

1852. *Strombina* Mörch, Catalogus conchyliorum quae reliquit D. Alphonso d'Aguirra et Gadea, Comes de Yoldi, p. 85.
1901. *Strombocolumbus* Cossmann, Essais de Paléoconchologie Comparée, vol. 4, p. 241.

Type by subsequent designation (Cossmann, Essais Paléoconchologie Comparée, vol. 4, p. 241): *Columbella lanceolata* Sowerby=*Columbella recurva* Sowerby. Recent, on the Pacific side of Panama.

Strombina anomala (Gardner and Aldrich)

Plate 30, figure 32

1919. *Anachis anomala* Gardner and Aldrich, Acad. Nat. Sci. Philadelphia Proc., p. 33, pl. 2, fig. 3.

Shell small, heavy, rather stout, fusiform. Volutions approximately 6, flattenend laterally, narrowly tabulated, rapidly increasing in size. Aperture about one-half the total height. Apex somewhat decorticated, so that it is impossible to determine all of the characters on the earlier whorls; protoconch probably small, smooth, papillate and paucispiral. First whorl of conch eroded; second whorl sculptured with about 16 narrow, rounded, axial riblets which disappear abruptly on the final whorl of the spire. Spiral sculpture for the most part wanting, though faintly impressed lines occasionally may be caught on the second whorl under high magnification, and a faint but distinct linear sulcus follows directly behind the suture from the second turn to the last; 2 strongly impressed spirals directly in front of the periphery of the body. Pillar and canal sculptured with 9 straight-sided, proximate grooves sufficiently deep to be visible with the unaided eye. Suture line impressed. Aperture irregularly elongate. Outer lip broadly and feebly emarginate posteriorly, somewhat flaring medially, varicose, thickened and denticulate within, the 5 denticles decreasing in prominence anteriorly; posterior commissure filled with callus. Labium broadly constricted at base of body. Pillar straight, simple, heavily calloused, slightly rugose near the outer margin of the wash, the rugae corresponding in position to the spirals; canal short, open, slightly recurved, truncate and broadly emarginate anteriorly.

Dimensions of holotype: Height, 5.2 mm.; maximum diameter, 2.5 mm.

Holotype: U.S.N.M. 499112.

Type locality: One and a half miles northwest of Magnolia, Duplin County, N. C. Duplin marl.

Strombina anomala is similar in general aspect to *Strombina pseudohaitensis guraboensis* Maury, from the Gurabo formation of the Dominican Republic, but it is larger and the spire is more elevated.

Distribution: North Carolina: Duplin marl, 1½ miles northwest of Magnolia, Duplin County.

Outside distribution: Miocene, Duplin marl, the Muldrow Place, 5 miles southeast of Mayesville, Sumter County, S. C.

Genus AESOPUS Gould

1860. *Aesopus* Gould, Boston Soc. Nat. History Proc., vol. 7, p. 383.

Type by monotypy: *Aesopus japonicus* Gould. Recent, in Kagosima Bay, Japan, at 5 fathoms, sandy bottom.

Shell small, slender, cylindrical, pupoid. Protoconch paucispiral, bulbous, the initial turn immersed at the tip. Whorls of conch relatively few, high, compressed, and wound like a bandage, the suture drooping slightly at the aperture. Surface of type shining and smooth except for microscopically fine spiral striae; other species less finely striate and grated by the incrementals. Aperture narrow, the outer lip broadly emarginate; little or no labral and labial thickening. Anterior extremity broad, truncate, obliquely emarginate.

This group of minute forms has a few scattered representatives in the warm waters of both the Pacific and the Atlantic.

Aesopus stearnsii (Tryon)

Plate 30, figure 19

1873. *Nitidella filosa* Stearns, Acad. Nat. Sci. Philadelphia Proc., p. 345, text figure.
Not *Aesopus filosus* Angas, 1867.
1883. *Columbella (Seminella) stearnsii* Tryon, Manual of Conchology, vol. 5, p. 179, pl. 58, fig. 48.
1889. *Aesopus stearnsii* (Tryon). Dall, Harvard Coll. Mus. Comp. Zoology Bull., vol. 18, p. 194, pl. 29, fig. 5.
1890. *Columbella (Aesopus) stearnsii* Tryon. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 138.

Shell small, acutely conic, spire elevated, apex rounded; whorls five, convex; suture distinct; surface white, traversed by numerous equidistant fine revolving grooves; body-whorl one-half to three-fifths, and the aperture about one-fourth the length of the shell; mouth ovate, outer lip simple, internally ribbed, thickened at its upper part, turned and reflected upon the body whorl, forming a callus on the upper portion of the columella which latter is rather abruptly shortened and slightly twisted anteriorly.

Length 0.16. Length of aperture 0.06. Breadth 0.06.

Habitat.—West Coast of Florida, on the shores of Tampa Bay, collected by Col. E. Jewett.—Stearns, 1873.

Whorls five, convex; surface white, with fine revolving grooves and no ribs; lip simple, ribbed within. Length, 0.16 inch.

Described by Mr. Stearns under the specific name of *filosa*, preoccupied by Angas for an Australian species.—Tryon, 1883.

This minute univalve is well characterized by the low convexity of the slender whorls and the incipient depression in front of the suture, the absence of axial sculpture, the uniform spiral sculpture of angular linear sulci, usually 11 to 13 on the final whorl of the spire and 20 to 25 on the body and pillar, the delicate filament tracery of the incrementals, and the peculiar diagnostic forward droop of the suture line at the aperture.

A Recent species, U.S.N.M. 93309, is figured. It was taken at 15 fathoms on a sandy bottom, 25 miles southeast of Cape Fear, N. C. Dimensions of figured specimen: Height, 4.9 mm.; diameter, 1.7 mm.

Aesopus stearnsii (Tryon) is one of the relatively few species that has persisted from the Tertiary times to the Recent in approximately the same habitat.

Distribution: North Carolina: Duplin marl, Natural Well, 2 miles southwest of Magnolia. Waccamaw formation Cronly, and at Neills Eddy Landing, 3 miles north of Cronly, Columbus County.

Outside distribution: Pliocene, Waccamaw formation, Tilly Lake, Horry County, S. C. Caloosahatchee marl, Caloosahatchee River, Fla. Recent, Cape Fear to Tampa Bay in less than 50 fathoms; dredged off the North Carolina coast in 12 fathoms; dredged off west Florida in 15 to 17 fathoms, sandy bottom.

Aesopus? smithfieldensis (Mansfield)

Plate 28, figures 23–25

1929. *Columbella (Seminella) smithfieldensis* Mansfield, U. S. Nat. Mus. Proc., vol. 74, p. 4, pl. 1, figs. 6, 7.

Shell small, stout, rather fragile, spirally sculptured, having body whorl longer than spire, consisting of 1½ nuclear and three postnuclear whorls. Nuclear whorls large, smooth, moderately inflated, constricted at the suture, apical one bluntly rounded. Postnuclear whorls rather rapidly enlarging and broadly rounded in outline. Suture grooved, not appressed. Sculpture of (on the penultimate whorl, five) slightly raised, paired, spiral lines, the individual lines composing each pair being separated from each other by a narrow groove and the pairs from each other by an interspace about equal to their width. The spirals extend forward to the end of the canal. Very fine axial growth lines connect the paired spirals. Aperture elongate-subovate, outer lip thin, margin crenulate. Pillar at its lower margin provided with a fold, forming the inner and upper edge of the short and curved siphonal canal. The new species may not be mature.

Dimensions.—Type (Cat. No. 352438, U.S.N.M.), altitude, 3.8 mm.; diameter, 1.6 mm.; length of aperture, 1.5 mm.; width, 0.7 mm.

Type locality.—U. S. G. S. Sta. 1/205, uppermost bed in section along a small stream flowing into Tormentor Creek, about 2 miles north of Smithfield, Va. (W. C. Mansfield, collector.)

Occurrence.—Yorktown formation, zone 2, middle part; only known from type locality.—Mansfield, 1929.

Mansfield's type suggests a young *Aesopus* rather than *Columbella (Seminella)*.

The same species is probably represented by another juvenile (U.S.N.M. 325409), from the Yorktown formation of Colerain Landing, Bertie County, N. C.

Slight differences in outline and sculptural detail characterize 2 closely related species represented by juveniles from the Yorktown formation at Colerain Landing, Chowan River, Bertie County, N. C. (U. S. N. M. 325411, pl. 28, fig. 33); and from the Waccamaw formation at Neills Eddy Landing on the Cape Fear River (U.S.N.M. 325408, pl. 28, figs. 8, 13).

Family BUCCINIDAE

Genus PTYCHOSALPINX Gill

1867. *Ptychosalpinx* Gill, Am. Jour. Conchology, vol. 3, p. 153.

Type by original designation: *Buccinum altile* Conrad. Miocene, of Virginia and North Carolina.

Shell ovate, buccinoid, with the whorls regularly rounded and ventricose; the spire moderate (about as long as aperture;) furnished with equal revolving linear ridges, siphonal canal very short, very obliquely twisted, and concurrent with the siphonal fasciole; *aperture* rhombo-ovate, oblong; labrum entire, not sinuous, smooth within; columella inversely sigmoidal, concave near the middle, with a very thin callous deposit, and with a revolving marginal linear plait in front.

This genus is related to *Buccinum*, with which its species have been confounded, but differs in too many respects to be properly associated with *B. undatum* and its allies in a natural genus; it is distinguished from *Buccinum* as represented by the type named, by the more oblique canal and its concurrence with the siphonal fasciole, the linear fold in front of the columella, the esinuate labrum as well as by the sculpture. The American species have recently been referred to *Tritia*, a subdivision of *Nassa*, but probably through inadvertence. The known representatives of the genus are extinct and characteristic of the later Tertiary formation, one being found in the Miocene beds of Yorktown, Virginia, and a second in the Upper Tertiary beds at Monthelan in Touraine, (France).—Gill, 1867.

Ptychosalpinx is readily differentiated from *Ilyanassa*, which it somewhat resembles in general outline, by the uniform absence of transverse striations on the inner surface of the labrum and the more pronounced basal constriction of the body whorl.

The genus seems particularly characteristic of the middle Miocene of the middle Atlantic Coastal Plain and the waters in which it flourished were doubtless very shallow. It has been suggested by Dall that his *Sipho? globulus*, collected by the Blake expedition, may be referable to this genus, hitherto supposed to be confined to the Tertiary. Cossmann (1901) refers "*Buccinum escheri* Mayer-Eymar" from the Helvetian of the Touraine, France to *Ptychosalpinx*, but this single record of the genus in extra-East American seas has not been verified.

Ptychosalpinx altilis (Conrad) Gill

Plate 31, figures 14, 17

1832. *Buccinum altile* Conrad, Fossil shells of the Tertiary formation of North America, p. 19, pl. 4, fig. 6.

1867. *Ptychosalpinx altilis* (Conrad). Gill, Am. Jour. Conchology, vol. 3, p. 154.

1868. *Ptychosalpinx altilis* Conrad, Am. Jour. Conchology, vol. 3, p. 262.

1892. *Ptychosalpinx altilis* Conrad. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 237.

1901. *Cominella (Ptychosalpinx) altilis* (Conrad), Cossmann, Essais paléoconchologie comp., vol. 4, p. 150, pl. 6, fig. 19.

Subovate, with numerous longitudinal undulations and obtuse spiral striae; body whorl rather ventricose; spire conical; apex obtuse.

Locality: James River near Smithfield, Virginia.—Conrad, 1832.

It is exceedingly unfortunate that the character of the type species of the genus should not be susceptible of clear definition. There are apparently two races involved; a representative of one has been figured by Conrad, the other by Gill. I have been unable, however, to find either Conrad's type in the collections of the Philadelphia Academy of Natural Sciences, or Gill's in the U. S. National Museum. Conrad's description

and figure imply a species characterized by a rather stout, scalariform spire, an irregular axial sculpture, and a rather low, uniform spiral ornamentation; Gill's species is a regularly ovate shell, destitute of axial sculpture, but it has a coarse, uniform spiral ornamentation. Conrad's type locality is Smithfield, Va., but, unhappily, the available material from that locality contains only young or imperfect individuals. The dominant form throughout the Yorktown is the smaller, rudely scalariform, axially sculptured race, although those occurring along the Tar River in Pitt and Edgecombe Counties, N. C., are larger, ovate in outline, not axially sculptured, and threaded with broader spirals than those which adorn the forms occurring in Virginia. To increase the confusion, this race grades without a well defined hiatus into the ovate *Ptychosalpinx multirugata* (Conrad), which is also characterized by the absence of axial sculpture, but is spirally sculptured by low, broad, more or less irregular bands, which may be linearly sulcate. As a matter of fact the available evidence favors the assignment of these forms to subspecific rank under *P. multirugata*. However, because of the obscure delineation of Conrad's type and the importance of the species, owing to its selection as the type of the genus, by Gill, it seems better to wait until the type of the species can be found before specifically separating the forms figured by Conrad and Gill under the one name.

Dimensions of figured specimen: Height, 30.0 mm.; maximum diameter, 18.5 mm.

Figured specimen: U.S.N.M. 325399, from 1 mile northeast of Suffolk, Va. Yorktown formation.

Distribution: Virginia: Yorktown formation, at Yorktown and three-fourths of a mile east of Yorktown, York County; 5 miles northeast of Smithfield, Isle of Wight County; a quarter of a mile north of Chuckatuck, 1¼ miles north of Suffolk, and 1 mile northeast of Suffolk, Nansemond County.

North Carolina: Yorktown formation, Mount Pleasant Landing on the Chowan River, Hertford County.

Ptychosalpinx laqueata (Conrad) Conrad

Plate 31, figure 16

1832. *Buccinum laqueatum* Conrad, Fossil shells of the Tertiary formations of North America, p. 19, pl. 4, fig. 5.
1863. *Tritia laqueata* Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 562.
1868. *Ptychosalpinx laqueata* Conrad, Am. Jour. Conchology, vol. 3, p. 262.
1892. *Ptychosalpinx laqueata* Conrad. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 237.
1901. *Cominella* (*Ptychosalpinx*) *laqueata* Conrad. Cossmann, Essais paléoconchologie comp., vol. 4, p. 151, pl. 6, fig. 8.
1930. *Ptychosalpinx laqueata* (Conrad). Mansfield, Florida Geol. Survey Bull. 3, p. 72, pl. 17, fig. 1.

Ovate conical, with spiral striae, and minute spiral lines between; ribs or folds elevated, subacute, obsolete on the inferior half of the body whorl.

Locality: James River, near Smithfield, Va.—Conrad, 1832.

Shell rather heavy, obliquely ovate; spire elevated for the genus. Height of aperture more than half the total height. Protoconch so badly eroded in all available material that characters are not determinable. Whorls of conch 5 to 6, rapidly increasing in size, very gently convex, obscurely carinate, the greatest diameter slightly behind the median line. Axial sculpture rather irregular in character; costals 12 to 14, subacute on the earlier whorls and continuous from suture to suture, broadening and becoming more undulatory on the later whorls, and evanescing altogether on the anterior half of the body. Spiral lirae somewhat irregular in size and spacing; spirals approximately 7 on each of the whorls of the spire, those on the anterior half or two-thirds of the whorl low, usually broad, and separated by linear or sublinear grooves; the 2 to 4 spirals on the shoulder sharper, narrower, more elevated, and more distant than those in front; analogous spirals developed on shoulder of body whorl; medial portion and base of body closely corded. Suture line impressed, undulated by the costals of the preceding whorl. Aperture broadly and obliquely lenticular. Labrum gently arcuate, not thickened without nor striate within. Columellar lip excavated at the base of the ultima, and bearing a rather sharp marginal fold. Parietal wall washed with enamel but so thinly that the spirals are not entirely concealed. Anterior fasciole very short, oblique, delimited posteriorly by a sharp, exaggerated spiral, subangulated medially so that the incrementals that corrugate it have the outline of a reversed **S**. Terminal notch deep.

Ptychosalpinx laqueata (Conrad) is unique among its associates in the degree of elevation of the spire and in the prominence of its costal sculpture.

Dimensions of figured specimen: Height, 37 mm.; diameter, 20.5 mm.

Figured specimen: U.S.N.M. 124937, from Petersburg, Va.

Mansfield observed that the Florida shells were "more delicately ornamented with finer and more numerous threads intercalating the coarser lines." In Florida, *Ptychosalpinx laqueata* has been found only in the *Ecphora* zone.

Distribution: Virginia: Yorktown formation, Yorktown and on the York River 2 miles below Yorktown, York County; Petersburg, Dinwiddie County; on the James River at Fergusons Wharf, Isle of Wight County, and at Willis Lees Wharf, 18 miles below Suffolk, Nansemond County.

North Carolina: Yorktown formation, (?) 1½ miles west of Murfreesboro, Hertford County. The individual referred tentatively to this species is young and its determination by no means beyond question.

Outside distribution: Miocene, of Sumter County, S. C. and at Alum Bluff (upper bed), Fla. The specimen figured by Mansfield was collected from the *Ecphora* zone of the Choctawhatchee formation. There is no record of it from any other horizon.

Ptychosalpinx multirugata (Conrad) Conrad

Plate 32, figures 2, 3

1841. *Buccinum multirugatum* Conrad, Am. Jour. Sci., 1st ser., vol. 41, p. 345.
1863. *Tritia multirugata* Conrad. Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 562.
1867. *Ptylchosalpinx multirugata* (Conrad). Gill, Am. Jour. Conchology, vol. 3, p. 154.
1868. *Ptychosalpinx multirugata* Conrad, idem, p. 262.
1892. *Ptychosalpinx multirugata* Conrad. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 237.
1901. *Cominella* (*Ptychosalpinx*) *multirugata* Conrad. Cossmann, Essais paléoconchologie comp., vol. 4, p. 151.
1904. *Ptychosalpinx multirugata* Conrad. Martin, Maryland Geol. Survey, Miocene, p. 189 (part; figure excluded).

Ovate-conical, with numerous wrinkled spiral lines, coarser and more distant near the suture and at base of the body whorl; base bicarinated and subumbi[li]cated; columella with a thick fold at base. Length, 2 inches; width, 1⅛ inches: from the collection of D. B. Smith. Locality, Natural Well, Duplin Co., N. C.—Conrad, 1841.

Dimensions of holotype: Height, 24.9 mm.; diameter, 14.2 mm.

Holotype: Acad. Nat. Sci. Philadelphia 1615.

Type locality: Natural Well, 2 miles southwest of Magnolia, Duplin County, N. C.

The Maryland Geological Survey has figured a form which is apparently an end member of the *P. lienosa* group.

Shell roughly obovate, moderately heavy. Length of aperture more than half the total height. Whorls 6 in the holotype, increasing regularly in size, slightly ventricose, obscurely tabulated posteriorly. Axial sculpture absent except for fortuitous and irregular incrementals and occasional exaggerated growth lines. Spiral sculpture developed over the entire shell but not very prominently; spirals on earlier volutions 6 to 8, flattened on the summits, equisized and separated by linear interspaces. Body sculpture more or less irregular, the spirals directly in front of the suture more distant, those on the medial portion very low, irregular, subdivided by 1 to 3 linear sulci; spirals directly behind the anterior fasciole simple, relatively coarse, and distant; incrementals frequently manifested in the minute crenulations of the spirals. Aperture broadly lenticular. Outer lip sharp, simple, not crenulated within. Columellar margin inversely sigmoidal, strongly excavated at the base of the body whorl, simple except for the rather prominent marginal fold. Parietal wall broadly and heavily glazed. Anterior fasciole broad, corrugated by sigmoidal growth lines, margined posteriorly by an elevated ridge. Anterior canal short, deeply emarginate.

Ptychosalpinx multirugata Conrad is characterized by the relatively large size, the regularly ovate outline, the absence of axial sculpture and the irregularity and linear sulcation of the spirals on the body whorl. There is considerable variation in the degree of irregularity in the spiral sculpture, and those individuals in which this character is not pronounced, closely approach the variants of Conrad's *P. altilis*.

Distribution: Virginia: Yorktown formation, 1½ miles northeast of Smithfield, Isle of Wight County; Maddelys Bluff, and half to three-fourths of a mile above the lower Seaboard Air Line Railroad bridge, Meherrin River, Southampton County; 1 mile west of Suffolk, (?) 1½ miles north of Suffolk, 1½ miles northeast of Suffolk, and 1 mile northeast of Suffolk, Nansemond County.

North Carolina: Yorktown formation, Branchs Bridge, Northampton County; Palmyra Bluff, Halifax County; 2⅓ miles north of Standard, 1¼ miles northeast of Farmville, 1½ miles west of Greenville, and 8 to 9 miles southeast of Greenville on the Tar River, Pitt County. Duplin marl, Natural Well, 2 miles southwest of Magnolia, Duplin County.

Ptychosalpinx fossulata (Conrad) Conrad

Plate 32, figures 1, 4, 8, 9

1843. *Buccinum fossulatum* Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1843, vol. 1, p. 308.
1863. *Tritia fossulata* Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 562.
1868. *Ptychosalpinx fossulata* Conrad, Am. Jour. Conchology, vol. 3, p. 262.
1892. *Ptychosalpinx fossulata* Conrad. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 237.

Subovate with numerous impressed alternated revolving lines; body whorl ventricose; whorls 4 or 5; sides convex; spire somewhat conical, with a channel at summit of the volutions, which has a rectilinear slope to the suture; columella short; fold at base of the shell acutely carinated. Length one inch and a third.—Conrad, 1843.

Dimensions of holotype: Height, 30.9 mm.; diameter, 21.6 mm.

Holotype and paratype: Acad. Nat. Sci. Philadelphia 1616.

Type locality: Not given.

Shell rather thin for the genus, roughly obovate. Apical whorls broken away; spire relatively low. Whorls with gently sloping sides, little or not at all convex; body large, inflated; both spire and body whorls tabulated posteriorly. Transverse sculpture limited to a few feeble undulations near the posterior suture. Spiral sculpture of very low, flat cinguli, equisized, and equispaced on the spire, 12 on the final whorl of the spire, but becoming irregular in size and spacing and commonly medially incised on the body; interspaces linear or sublinear. Incremental sculpture faint but distinct, particularly on the body whorl and fasciole. Suture impressed. Sutural channel continuous almost from the apex, broad on the later whorls, unsculptured except for the incrementals. Body whorl contracted rather abruptly at anterior canal. Canal short, wide, recurved, emarginate. Siphonal fasciole short, heavy, corrugated by the growth lamellae, keeled posteriorly. Labrum broadly and evenly arched, smooth within. Columella callused, abruptly contracted at the base of the body, bearing a single marginal fold.

Conrad's type was used in making the description just given. It seems to differ from *Ptychosalpinx multirugata* (Conrad) chiefly in the feeble axial sculpture and more numerous spiral lirations, both of them dubious specific diagnostics in this genus. *Ptychosalpinx fossulata* (Conrad) is not represented in the later collections.

Distribution: Yorktown formation, Yorktown, York County, Va. (Harris).

Ptychosalpinx tuomeyi (H. C. Lea)

Plate 31, figure 18

1846. *Buccinum tuomeyi* H. C. Lea, Am. Philos. Soc. Trans., 1st ser., vol. 9, p. 271, pl. 37, fig. 97.
1863. *Tritia tuomeyi* H. C. Lea. Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 562.
1892. *Ptychosalpinx tuomeyi* H. C. Lea. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 237.

Shell ovately fusiform, thick, imporforate, striate; spire elevated, scalariform; sutures impressed, deep; whorls somewhat convex, angulate at the upper suture; striae transverse, double, numerous, small; last whorl rounded, with large and small alternating striae below; base longitudinally sulcate; mouth quadrangular; canal long, retorted; columella flexuose, with one large fold below.

Length.—Breadth, 1.40 inches.

Remarks.—On the upper part of the last whorl the striae are in pairs with a minute impressed line between them having the appearance of double striae. These, as they approach the base, pass gradually into alternating ones. The base, immediately behind the lower part of the columella, is marked with deep, somewhat semicircular, sulcations pointing the successive growth of the canal. The upper part of the columella is marked by faint continuations of the striae, not entirely obliterated by a thin deposit of callus. The canal is longer than is usual with the Buccina, and is bent somewhat backwards. The columella is much twisted. Close to the upper suture the whorls are bent, first at a right angle, and then downwards, descending gradually to the suture. Near the middle of the whorl, the striae are faintest. As my only specimen is quite imperfect, I am unable to give the length or number of whorls; of these latter, portions of three remain, and there have probably been three or four more.

This fine shell is the largest of our fossil Buccina. Judging from description, it may bear a distant resemblance to the *B. multirugatum*, Conrad, but it differs in its straight striae, size, want of an umbilicus, etc. It is quite rare. Mr. Tuomey whose name I have great pleasure in affixing to it, tells me that he has met with but two specimens of it, both imperfect.—H. C. Lea, 1846.

Type locality: Petersburg, Va.

The shell is not heavy, but on the contrary, is very thin for the genus. Lea has applied the term "transverse" to the spiral sculpture. Axial sculpture is entirely wanting excepting for the incrementals, which are usually strong enough to minutely corrugate the spirals. The shell seems to have been peculiarly susceptible to injury and scars are visible at frequent intervals on the later whorls. The spiral sculpture covers the entire surface from the protoconch to the canal; on the final whorl of the spire of a large adult there are 12 very low, rather broad, medially sulcated, flattened fillets separated by linear interspaces, with an occasional intercalated secondary; a similar sculpture prevails on the posterior half of the body whorl, but on the anterior half the spirals become more elevated and the primaries alternate with either one or two secondaries.

Ptychosalpinx tuomeyi (H. C. Lea) attains a larger size than any other member of the genus. The tabulation of the whorls is more strongly defined than in any other species, and the spirals are more numerous, less elevated, and more irregular.

Distribution: Virginia: Yorktown formation, Yorktown, York County; 5 miles northeast of Smithfield, Isle of Wight County; Petersburg, Dinwiddie County; Sycamore on the Nottoway River one-half to three-fourths of a mile above the lower Seaboard Air Line Railroad bridge over the Meherrin River, Southampton County.

North Carolina: Yorktown formation, Branchs Bridge and 1 mile above Branchs Bridge, Northampton County; 1½ miles above Murfreesboro, Hertford County; half a mile above Bells Bridge over the Tar River, Edgecombe County; (?) 1¼ miles northeast of Chocowinity, Beaufort County, half a mile east of Lizzie, Greene County. Duplin marl, (?) 4 to 5 miles below Lumberton, and at (?) Fairmont, Robeson County.

"Ptychosalpinx" bilix (Conrad) Conrad

Plate 31, figures 21, 25

1843. *Buccinum bilix* Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1843, vol. 1, p. 308.
1863. *Tritia bilix* Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 562.
1868. *Ptychosalpinx bilix* Conrad, Am. Jour. Conchology, vol. 3, p. 262.
1892. *Ptychosalpinx bilix* Conrad. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 237.
1892. *Rapana tampaensis* Dall var.?, idem, p. 244 (part, figure excluded).
1904. *Ptychosalpinx lienosa* "Conrad" (part). Martin, Maryland Geol. Survey, Miocene, p. 189.

Elliptical, thick, with alternated revolving lines crossed by rugose lines of growth; spiral conical, volutions convex; one or two towards the apex longitudinally ribbed; suture profound; aperture about two-thirds the length of the shell; labrum ribbed within. Length one inch.

Locality: James River, Virginia.—Conrad, 1843.

Dimensions of holotype: Height, 28 mm.; maximum diameter, 19 mm.

Holotype: Acad. Nat. Sci. Philadelphia 1614.

Shell stout, fusoid; earlier whorls broken away. Spire apparently rather elevated. Volutions rather strongly convex, decreasing rapidly in size toward the apex. Axial sculpture absent except for the remnants of axial ripples on the posterior portion of the spire. Spiral sculpture prominent; two series strongly differentiated on the body and the final whorl of the spire; primaries 6 on the final whorl, 25 on the body; secondaries regularly intercalated except on the anterior canal; both primaries and secondaries rather low, broadly rounded, separated from one another by linear interspaces. Anterior canal moderately long, broad, open, feebly recurved, obliquely emarginate anteriorly.

Anterior fasciole incrementally sculptured not keeled posteriorly. Umbilicus a mere chink.

The generic affinites of this species are rather puzzling. It has much in common with forms which have been referred to *Rapana* Schumacher, 1817, but the genotype of *Rapana* is the large Indo-Pacific shell, *R. bezoar* Linnaeus, with a widely flaring outer lip and wide umbilicus. Conrad's species seems rather to be allied with *Buccinum.*

Distribution: James River, Virginia (Conrad).

Genus PISANIA Bivona

1832. *Pisania* Bivona, Effemeridi Scientifiche e Letteraire per la Sicilia, vol. 2, p. 8, pl. 2, figs. 6a–d.

Type by subsequent designation (Herrmannsen, Indicis generum malacozoorum, primordia, vol. 2, p. 274, 1847): *Voluta syracusana* Gmelin=*Murex pusio* Linnaeus. Recent, off the Florida Keys and the West Indies.

Shell spindle-shaped to elongate ovoid. Whorls smoothly rounded, tightly wound. A rather feeble spiral sculpture usually developed, the spiral pattern in some species manifested in the color-pattern only. Anterior canal rather wide. Outer lip expanded, thickened in the fully adult and lirate within. Columellar lip concave at the base of the body, bearing opposite the posterior labral denticle a strong parietal fold which is normal to the axis of the shell. Columellar bent slightly at the entrance to the canal and plicate along the margin. Basal notch oblique, moderately deep.

The genus is an inconsipcuous element in the Tertiary faunas. The Recent species like the fossil are relatively few in number and are confined for the most part to the warmer waters.

Subgenus CELATOCONUS Conrad

1863. *Celatoconus* Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 566.

1892. *Celatoconus* Conrad. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 235.

Type by monotypy: *Buccinum protractum* Conrad. Calvert formation of Maryland.

The genus *Celatoconus* was never described by Conrad, who listed it as a genus in the family Conidae. * * * *Celatoconus*, like *Metula*, differs from all the Pisanias in wanting the subsutural callus and contracted notch of the posterior commissure of the aperture; in its thinner shell, larger nucleus, and thin and smooth callus on the body and pillar. All the other characters of the shell may be observed in *Pisania* or *Tritonidea*. The type belongs to the Chesapeake Miocene of Maryland.—Dall, 1892.

Pisania (Celatoconus) nux Dall

Plate 31, figure 22

1892. *Pisania* (*Celatoconus*) *nux* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 235, pl. 13, fig. 6.

Shell small, not heavy, subfusiform, with a rather short, pointed spire and about seven whorls; nucleus of two and a quarter smooth whorls, apex moderately pointed, whorls rapidly enlarging beyond it; spiral sculpture of about five revolving, strap-like elevated bands on the earlier whorls, with wider interspaces, especially that next the suture; later whorls show an intercalary fine thread in each interspace; the spirals pass over more obscure transverse riblets, of about their own width, which ripple them, and on the last whorl and a half give rise to squarish little-elevated nodules at the intersections; the incremental lines are distinct, and the sculpture is practically uniform over the whole shell; most of the shell is comprised in the last whorl, and the aperture is longer than half the shell; outer lip gently arched, and in the adult somewhat varicose behind the margin; suture very distinct, not channelled; aperture rather narrow, canal short and wide; outer lip simple, with a row of denticles within behind the edge, but no lirae in the throat; body with a thin smooth callus; pillar short, obliquely truncate, with an obscure anterior plait and siphonal fasciole. Lon. of shell 18; of aperture 11; max. lat. of shell 9 mm.—Dall, 1892.

The proportions given by Dall, both in the plate description and the text, hold good for a smaller, less perfect shell than the one figured. The smaller shell is from the Waccamaw formation of the Cape Fear River, N. C.

Dimensions of lectotype: Height, 26.2 mm.; maximum diameter, 12.5 mm.

Lectotype: U.S.N.M. 114188.

Lectotype locality: Miocene, Duplin marl, Natural Well, 2 miles southwest of Magnolia, Duplin County, N. C.

Two individuals from the Yorktown formation of Pitt County, N. C., differ slightly from the more southern and later representatives in that the body whorl is somewhat more globose than in the latter, the axial rippling less perceptible, the spiral liration a little wider and separated by much narrower interspaces, for the most part unadorned with secondaries. The differences are, however, so essentially of degree rather than kind that it has seemed unwise to recognize them even subspecifically.

The Maryland subgenotype, *Pisania* (*Celatoconus*) *protracta*, is a less smoothly rounded shell than the younger and more southern *P.* (*C.*) *nux*, and the aperture is shorter and wider. Mansfield, 1928, described from the St. Marys formation at Urbanna, Va., a heavier and more coarsely sculptured member of this small group which he called *Pisania* (*Celatoconus*) *burnsi.*

Distribution: Virginia: Yorktown formation, Yorktown, York County; drainage ditch, 1 mile northeast of Suffolk, Nansemond County.

North Carolina: Yorktown formation, 8 to 9 miles southeast of Greenville, Pitt County. Duplin marl, Natural Well, 2 miles southwest of Magnolia, Duplin County. Waccamaw formation, Neills Eddy Landing, Cape Fear River, 3 miles north of Cronly, Columbus County.

Outside distribution: Miocene, Duplin marl of the Muldrow Place, 5 miles southeast of Mayesville, Sumter County, S. C.

Family BUSYCONIDAE

Genus BUSYCON "Bolten" Roeding

1798. *Busycon* "Bolten" Roeding, Museum Boltenianum, pt. 2, p. 149.

Type by subsequent designation (Herrmannsen, Indicis generum malacozoorum, primordia, vol. 1, p. 149, 1846): *Busycon muricatum* Roeding=*Murex aruanus* Linnaeus=*Murex carica* Gmelin. Living in the west Atlantic from Cape Cod to Saint Thomas.

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

The genus was initiated in the Cretaceous and represented in the Eocene by small and rather thin-shelled species. These rapidly evolved into the large and ponderous conchs which constitute one of the most conspicuous elements in the Tertiary faunas in the east coast, 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 coats. Their limited distribution is to be correlated with the loss of the velum before the animal emerges from the egg capsule.

Busycon amoenum Conrad

Plate 34, figures 2, 4–6; plate 35, figure 5

1875. *Busycon* (*Sycotypus*) *amoenum* in Conrad, Kerr, Geol. Survey North Carolina Rept., vol. 1, app. A, p. 23.

Shell pyriform, spire scalariform; sides of volutions straight, direct, angle acute, with longitudinal tubercles, top of large volution flat, canal slightly impressed, obsolete on the spire which is acutely pointed, the two first volutions smooth; spiral lines rather fine, unequal, columellar fold prominent and the furrow above it rather deeply impressed.

Locality. Walker's Bluff, Cape Fear river [N. C.]. Allied to *canaliculatum*, but distinguished by its slight canal and absence of a carinated line bordering the suture and angle of last volution.—Conrad, 1875.

Conrad's description is somewhat general, no figure has ever been published, and the type is unavailable so that it is impossible to discuss the form with complete assurance. However, the common *Busycon* from the Waccamaw formation of the Pliocene series has been referred to this species.

Shell moderately large, broadly pyriform to fusiform; the 7 or 8 whorls rapidly decreasing in diameter toward the acute apex. Protoconch small, smooth, twice-coiled; initial turn inflated, tilted sharply to the normal axis of coiling; second turn convex initially but showing an increasing tendency toward angularity. Sculpture introduced on the first whorl of the conch in the form of minute peripheral crenulations; spirals initiated within the first half turn; sculpture, when once established, rather coarse and vigorous. Axial ornamentation consisting chiefly of 22 or 23 nodules crowning the periphery of the whorl, crowded on the earlier volutions, more distant on the later, and persisting, though with diminished strength to the outer margin of the aperture; incrementals and resting stages usually visible, but taking no part in the sculptural pattern of the shell. Spirals coarse, unequal in size and spacing; on all but the earliest whorls of the spire, 7 to 9 primaries usually present behind the peripheral angle and 4 to 7 in front of it; secondaries rather regularly intercalated on the later whorls; interspaces linear. Spiral sculpture on body not uniform; upper half to two-thirds of that portion of the body in front of the periphery sculptured with 7 to 11 primaries, rather less coarse than those on the shoulder and more irregular in size and spacing; secondaries usually occurring between each pair of primaries. Spirals on antero-medial portion of body taking the form of very fine, crowded, minutely crenulated lirae; differentiation between the two phases of sculpture obscure or obsolete in older individuals; anterior portion of body whorl and pillar striated with some 16 primaries with intercalated secondaries; both primaries and secondaries minutely waved by the incrementals. Canal of younger forms ornamented with 8 to 10, crowded primaries which, in the adults, become more or less obscured by the concentric resting stages. Posterior sutural channel nothing more than a narrow unsculptured presutural band depressed on the later whorls, increasingly narrower posteriorly and entirely undeveloped near the apex and in the young forms. Aperture pyriform; shell rather abruptly contracted at the base of the body. Outer lip broadly arcuate, obtusely angulated at the shoulder. Inner lip loosely sigmoidal, thickened in the adults just in front of the posterior commissure; a single columellar fold developed, but rarely visible at the outer margin. Parietal wall so thinly glazed that the spiral sculpture is only partially obscured. Anterior canal long, open, more sinuous in the adult forms than in the young.

Dimensions of largest figured specimen: Height, 143 mm.; maximum diameter, 82 mm. Dimensions of adolescent: Height, 79.0 mm.; diameter, 39.5 mm. Dimensions of intermediate individual: Height, 113.0 mm.; diameter (aperture broken), 52.5 mm. Largest figured individual, adolescent and juvenile: U.S.N.M. 325392. Intermediate individual, U.S.N.M. 325395.

Locality of figured specimens: Neills Eddy Landing, Cape Fear River, 3 miles north of Cronly, Columbus County, N. C. Waccamaw formation.

Busycon amoenum Conrad is the most abundant *Busycon* in the Waccamaw formation of Columbus

County; it is associated with the ornately sculptured variant of *B. maximum*, *B. tritone* Conrad, which is larger than *B. amoenum* and has a greater relative diameter. The spire is rudely conical, rather than scalariform, the peripheral angle very near the anterior suture, and the shoulder more oblique than in *B. maximum*. The peripheral sculpture of *B. tritone* is spinose rather than nodose, the resting stages very much more conspicuous, and the spirals finer, more numerous, and more affected by the growth lines and incrementals than in *B. amoenum*.

Distribution: North Carolina: Duplin marl, (?) 4 to 5 miles below Lumberton, Robeson County. These Duplin forms are young and cannot be determined with assurance. Waccamaw formation, Walkers Bluff, Cape Fear River, Bladen County; Neills Eddy Landing, Cape Fear River, 3 miles north of Cronly, Columbus County.

Busycon perversum (Linnaeus)

1758. *Murex perversus* Linné, Systema Naturae, ed. 10, p. 753.
1856. *Busycon perversum* Conrad. Tuomey and Holmes, Pleiocene fossils of South Carolina, p. 145, pl. 29, fig. 3.

Busycon perversum robesonense Gardner, n. subsp.

Plate 35, figures 1, 3

Shell sinistral. Type immature but probably small for the genus. Whorls of adult may be 6 or 7. Shoulder broad, gently sloping, the angle of the whorl only a little behind the anterior suture. Axial sculpture confined to a row of obtuse, peripheral tubercles, ranging from 20 to 25 on the final whorl of the spire, evanescent on the body. Spiral sculpture well developed; behind the shoulder 6 or 7 elevated obtuse lirations, the two posterior of little prominence, and separated by a wide interspace from those in front of them; between the periphery and the anterior suture, only 1 or 2 spirals developed, but these are broad and somewhat flattened on their summits. Sculpture on the body typically fulgurian, an area directly in front of the periphery threaded with 10 to 12 prominent, rather distant lirations alternating in size; in front of this, and a little more than halfway between the shoulder and the base of the body, an area sharply differentiated by some 8 or 10 fine, crowded lirae; basal portion of whorl and pillar threaded with 20 to 25 rather sharp, narrow, lirae which become increasingly finer and more proximate anteriorly. Aperture lenticular posteriorly, contracted at the base of the whorl. Outer lip obtusely angulated at the shoulder, internally lirate, the lirae extending far within the aperture. Columella bearing a single fold evanescent at the aperture, and delimited posteriorly by a shallow sulcus. Anterior canal long, slightly bent, open, with rather proximate, parallel margins.

Dimensions of holotype: Height, 61 mm.; diameter, 29 mm.

Holotype: U.S.N.M. 325394.

Type locality: Four miles north of Lumberton, Robeson County, N. C. Duplin marl.

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In the subspecies the anterior canal is shorter than in *B. perversum* s. s., the spiral sculpture is stronger, and the axials more numerous and nodose rather than spiney. A number of other names have been used for the sinistral Busycons. The adult whorls of *Busycon contrarium* Conrad are rounded at the periphery and devoid of axial sculpture. The shoulder of *Busycon obrapum* (Grabau) is also rounded. *Busycon adversarium* Conrad, 1862, was not described, but reference was made to the illustration of *B. perversum* by Tuomey and Holmes, Pliocene Fossils of South Carolina, plate 29, figure 2, 1856; the individual figured is decorated with a series of short, distantly spaced spines. *Busycon obfilosum* (Grabau), 1903, is not figured but is described as the reverse of *B. filosum*, another species spinose at the periphery. None of the variants cited present the strong spiral sculpture and the noded but not spinose axial sculpture of the Robeson County individuals. The individual figured by Mansfield, 1930, as *B. perversum*, from the *Cancellaria* zone of the Choctawhatchee formation, is similar, but the shoulder nodes are less persistent. In Virginia and the Carolinas the species has been reported only from the neighborhood of Lumberton and Fairmont in Robeson County.

Distribution: North Carolina: Duplin marl, 4 miles north of Lumberton, 2 miles below Lumberton, at Fairmont (Ashpole), and 1½ miles northeast of Fairmont, Robeson County.

Busycon bladenense Gardner, n. sp.

Plate 35, figures 2, 4

Shell pyriform, apparently rather small for the genus. Spire short; volutions 5 or 6, scalar, broadly tabulated, the peripheral angle a right angle. Body whorl inflated, strongly contracted at the base. Aperture about four-fifths the total length of the shell. Nucleus small, tilted, consisting of 1½ turns. Axial sculpture confined to a row of close-set tubercles placed upon the peripheral angle of the whorl, and numbering 22 to 28 on the later volutions of the spire; body tubercles may be altogether obsolete or replaced by irregular wrinkles; incrementals faintly perceptible without the aid of a hand lens. Spiral lirations widely variable in number and strength; 4 to 6 inconspicuous primaries usually present on the shoulder of the whorls of the adult; secondaries irregularly intercalated; lirations in front of the keel about 7, more prominent than those on the shoulder; primaries 40 to 50 on the body and pillar; secondaries intercalated, especially near the carina and toward the base of the body. Anal fasciole not defined but suggested by a smooth revolving band directly in front of the suture. Suture line distinct but not conspicuous. Aperture wide, angulated posteriorly by the carina, contracted anteriorly into a narrow, slightly twisted canal. Outer lip thin, sharp. Columella concave, bearing at the angle of the body whorl an oblique fold which is rather prominent for

the genus. Anterior fasciole obscurely lirate, incrementally wrinkled.

Dimensions of holotype: Height (specimen imperfect), 83.5 mm.; maximum diameter, 45.0 mm. Dimensions of paratype: Height, 73.0 mm.; maximum diameter, 37.5 mm.

Holotype and paratype: U.S.N.M. 325390.

Type locality: Walkers Bluff, Cape Fear River, Bladen County, N. C. Waccamaw formation.

Busycon bladenense strongly suggests *Busycon kerrii* Conrad. It does not, however, attain the size attributed to the latter, nor does it develop the concave depression in front of the suture that apparently characterizes Conrad's species. The type of *B. kerrii* is not available, and there is too great a dissimilarity between *B. bladenense* and the species indicated by Conrad's figure to permit of their union. *B. bladenense* is closely related to *B. amoenum* Conrad, but may be separated from it, as from all other coexistent members of the genus, by the broad, horizontal shoulder on which the spiral sculpture is limited to a few feeble lirations.

Distribution: North Carolina: Duplin marl, 2 miles below Lumberton on the Lumber River, Robeson County. Waccamaw formation, Walkers Bluff, Cape Fear River, Bladen County; Neills Eddy Landing, 3 miles north of Cronly, Columbus County.

Busycon carinatum Conrad

Plate 35, figure 6

1862. *Busycon carinatum* Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 286.

1863. *Busycon carinatum* Conrad, idem, p. 560.

1890. *Fulgur carinatum* Conrad. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 117.

Fusiform; whorls 6; spire elevated; whorls angular, angle situated below the middle of the whorls, carinated, carina tuberculated, sides of volutions above the angle straight and very oblique, surface transversely striated; lines rugose, unequal, obsolete on the middle of last whorl; columella and canal sinuous.

Locality. Virginia.—Conrad 1862.

The species has not been recognized in the later collections.

The holotype from the Academy of Natural Sciences, Philadelphia, 1680, has been figured.

Busycon willcoxi, from the Cape Fear River in North Carolina, is closely related, and the differences may be less than specific. The most obvious difference is in the wider, more sloping shoulder of *B. carinatum*, and the more feeble and less crowded nodulation on the early whorls.

Busycon willcoxi Gardner, n. sp.

Plate 34, figures 1, 3

Shell heavy, thick, rudely fusiform. Spire moderately elevated, terraced; whorls approximately 7, their maximum diameter in front of the median horizontal except on the later volutions. Body whorl medially flattened, broadly concave at the base. Periphery prominent on the earlier whorls, overhanging the anterior suture; area between the periphery and posterior suture slightly concave; peripheral cornice evanescent with advancing age, reduced first to an elevated ridge that becomes almost obsolete near the aperture; with the decrease in the prominence of the peripheral carina is a gradual change in the outline of the shoulder, from concave to horizontal, and later, on the body whorl, from horizontal to gently sloping. Axial sculpture appearing only in the crenulated margin of the periphery of the earlier whorls and in the incrementals and resting stages. Spiral sculpture least feeble on the later volutions, absent on all but the last whorls of the spire, except for microscopic striations on the shoulder, and 3 or 4 faint lirae in front of the periphery; last whorl of spire marked by 12 or more flattened linear lirations, subequal in size and spacing, feeble but macroscopic; lirae in front of the periphery and on the body whorl crowded and minutely crenulated by the incrementals, less feeble at the base of the body than on any other part of the shell; peculiar shagreen aspect of surface suggestive of former presence of a bristle-bearing epidermis. Suture line distinct, falling in front of the normal plane of coiling on the last half-turn of the body. Aperture pyriform. Outer lip obtusely angulated at the shoulder, feebly dilated in front of it. Columella loosely sigmoidal, bearing a single oblique plait that evanesces near the margin of the aperture. Parietal wall glazed, the callus heavy directly in front of the posterior commissure. Anterior canal broken; probably rather long, moderately broad and recurved.

Dimensions of incomplete holotype: Height, 97.5 mm.; maximum diameter, 56.0 mm.

Holotype: U.S.N.M. 325391.

Type locality: "Cape Fear" River, N. C. (?)Waccamaw formation.

The only form with which *Busycon willcoxi* is comparable is the Miocene *B. carinatum* Conrad, possibly an ancestral type. The spire of *B. willcoxi* is lower relatively, the whorls more compressed vertically, the periphery more conspicuous, the shoulder concave or horizontal except near the aperture where it slopes at a gentle angle similar to that exhibited by the third or fourth volution of *B. carinatum*. The shoulder angle is less uniform than in the Virginia species, more conspicuously defined on the earlier whorls, and is less prominent on the later turns than that of *B. carinatum*. The spiral sculpture is more feeble, the constriction at the base of the body whorl is less pronounced, and the anterior canal is broader in *B. willcoxi*. The general outline of the spire and the character of the axial ornamentation suggest *Busycon canaliculatum* (Linnaeus) and its allied species, but there is no indication in *B. willcoxi* of any tendency toward a channelling in front of the suture. The irregularity of the coiling toward the aperture suggests a gerontic individual.

The type was collected by Mr. Joseph Willcox from the Cape Fear River, N. C. I have the pleasure of naming the species in honor of Mr. Willcox, not only because he is the collector of this unusually interesting *Busycon*, but more especially because of his inspiring interest in the Waccamaw fauna and his notable contributions to the knowledge of the southern Tertiary.

Distribution: North Carolina: Waccamaw formation, Walkers Bluff, Cape Fear River, Bladen County; Neills Eddy Landing, Cape Fear River, Columbus County. (?)Waccamaw formation, "Cape Fear" River.

Busycon chowanense Gardner, n. sp.

Plate 36, figure 4

Whorls of incomplete specimen 4; apex of spire and half of body lost; remaining volutions indicating a conch with a short spire of convex, regularly rounded whorls tapering to an acute apex. Axial sculpture limited to a few incrementals. Spirals 5 on whorls of spire, 14 on the body; low rounded fillets almost 1 millimeter wide, separated by angular interspaces wider than the spirals; pillar threaded with 9 primary lirations and 2 or 3 vaguely defined, probably fortuitous secondaries. Whorl narrowly flattened; suture line impressed but no sutural channel developed. Aperture probably wide. Curvature of both outer and inner lips strong. Parietal wash thin. Columella concave, twisted. Anterior canal long, bent slightly to the left.

Height of incomplete holotype, 79 mm.

Holotype: U.S.N.M. 325393.

Type locality: One-half to three-fourths of a mile above Edenhouse Point, Chowan River, Bertie County, N. C. Yorktown formation.

Busycon chowanense, though described from a very imperfect specimen, is so well characterized by its regularly convex whorls, the absence of axial sculpture, and the broad, approximately equisized and equispaced spiral fillets that make up the uniform ornamentation of the species, that there should be no difficulty in recognizing the species in future collections.

Distribution: Virginia: Yorktown formation, (?)Yorktown, York County. The single form which has been doubtfully referred to this species is young and can not be determined with assurance.

North Carolina: Yorktown formation, one-half to three-fourths of a mile above Edenhouse Point, on the Chowan River, Bertie County.

Subgenus SYCOTYPUS Gill

1867. *Sycotypus* Gill, Am. Jour. Conchology, vol. 3, p. 147.

Type by original designation: *Murex canaliculatus* Linnaeus. Recent, east coast from Cape Cod to Florida.

This name has been commonly credited to Browne, who applied it to "the smaller, hairy fig-shell" (Civil and natural history of Jamaica, p. 406, 1756). 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 Gray maintained (Zool. Soc. London, Proc., p. 135, 1847), to *Pyrula*, which is not hairy. However, that question is purely academic since Browne's name 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*, *Sycotypus* 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 *Sycotypus 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 *S. pyrum* group, but in the relatively cool water of the upper Miocene, Choctawhatchee time, there is a precursor, *S. aepynotus* Dall, of the genotype.

Busycon (Sycotypus) incile (Conrad)

1833. *Fulgur incile* Conrad, Am. Jour. Sci. and Arts, 1st ser., vol. 23, p. 343.

1867. *Sycotypus incilis* (Conrad). Gill, Am. Jour Conchology, vol. 3, p. 149.

1890. *Fulgur pyrum* var. *incile* Conrad (part). Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 112.

1903. *Sycotypus incilis* (Conrad). Grabau, Am. Naturalist, vol. 37, No. 440, pp. 523, 524, text fig. 7.

1914. *Fulgur incile* Conrad. Burnett Smith, Acad. Nat. Sci. Philadelphia, pp. 570, 574–578, pl. 24, figs. 4, 4a.

Shell fusiform, with coarse alternated with finer spiral striae; spire elevated; whorls five, rounded, flattened a little above, but crowned with a carinated line; suture broadly and profoundly channeled; body whorl ventricose. *Locality.* Yorktown, Va. Upper marine.—Conrad, 1833.

Shell large, stout, fusiform. Aperture between two-thirds and three-fourths the total height. Whorls approximately 6, tapering rather rapidly to a subacute apex, those of the spire scalariform, the body broadly rounded. Protoconch small, coiled 1½ times, the first half turn tilted and somewhat inflated, the succeeding volution showing an increasing tendency toward angulation. First whorl of conch broadly tabulated posteriorly but not canaliculate, the periphery outlined by a strong spiral; presutural channel and marginal spiral initiated about the beginning of the third whorl, the former deepening and the latter becoming more elevated toward the aperture and, in the adult, producing a sharp flexure in the outer margin. Shoulder strongly angulated on the early whorls, more rounded and much less prominent on the later whorls. Axial sculpture absent except for the incrementals and a crude peripheral noding on the early whorls. Spirals low and irregular in size and spacing, absent on the posterior canal and increasingly feeble on the shoulder. Aper-

ture pyriform. Labrum flexed at the posterior canal, expanded medially, commonly striate within, inner margin of aperture loosely sigmoidal. Anterior canal a long slender, sinuous stalk, roughened by the growth lines.

Busycon conradii Tuomey and Holmes (pl. 33, fig. 2) of the Duplin marl of Sumter County, S. C., was considered synonymous with *B. incile* by many of the earlier writers, but Grabau and Burnett Smith were probably correct in considering it a parallel development. Authentic records of *B. incile* are restricted to Virginia.

Busycon incile Conrad diverges from the closely related *B. pyrum* in the greater size and weight of the shell; the elevation of the spire; the much stronger contraction at the base of the body whorl; the tendency toward a feeble or even obsolete sculpture except for resting stages; the broader and relatively shallow posterior canal, delimited by a ridge so elevated that the outer lip is in many individuals conspicuously notched; an aperture relatively and absolutely wider posteriorly; and a shorter, more narrow, and more strongly recurved anterior canal.

An allied species, *Busycon pyrum propeincile* Mansfield, 1930, was described from the *Ecphora* zone of the Choctawhatchee formation. The Florida species does not exhibit the scalar spire characteristic of *B. incile* and is more finely and elaborately sculptured spirally.

Busycon incile is conspicuously large among the species of gastropods, so well characterized that even imperfect material can be confidently determined, and as sure a witness for the Miocene age as is *Ostrea sellaeformis* for the Eocene below or *Arca rustica* for the Pliocene above. It is most commonly found in the upper part of the Yorktown formation.

Distribution: Virginia: Yorktown formation, Yorktown, York County; Fergusons Wharf, Isle of Wight County; a quarter to half a mile below Sycamore, Southampton County; 1½ miles north of Suffolk, and half a mile below Suffolk waterworks dam, Nansemond County.

North Carolina: Yorktown formation, 6 miles below Greenville at Cherry Landing on the Tar River, Pitt County.

Busycon (Sycotypus) canaliculatum canaliferum Conrad

Plate 33, figure 5

1856. *Busycon canaliculatum*, Tuomey and Holmes, Pleiocene fossils of South Carolina, p. 146, pl. 29, fig. 2.
Not *Murex canaliculatum* Linné, 1758, s. s.
1858. *Pyrula carolinensis* Emmons, North Carolina Geol. Survey Rept., p. 249.
1863. *Busycon canaliferum* Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 560.
1867. *Sycotypus canaliferus* (Conrad). Gill, Am. Jour. Conchology, vol. 3, p. 149.
1890. *Fulgur canaliferum* Conrad. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 113.
1903. *Sycotypus canaliferus* (Conrad). Grabau, Am. Naturalist, vol. 37, pp. 525, 539.

Conrad did not describe his species but merely isolated under a new name the forms previously referred to *Busycon canaliculatum* (Linnaeus) s. s. Only young individuals are available and descriptions from immature shells are unsatisfactory. The diagnostic character of the subspecies is, apparently, the persistence of the tubercles and the more acute shoulder angle on the final whorl.

Grabau considered *B.* (*Sycotypus*) *canaliculatum* (Linnaeus) (pl. 33, figs. 4, 6) merely a more accelerated type and the direct descendent of the subspecies *canaliferum*.

Type locality: Waccamaw, S. C.

Distribution: Virginia: Yorktown formation, 1½ miles north of Suffolk, Nansemond County.

Outside distribution: Pliocene, Waccamaw formation, Waccamaw, S. C.

Busycon (Sycotypus) concinnum Conrad

Plate 33, figures 1, 3

1875. *Busycon* (*Sycotypus*) *concinnum* Conrad in Kerr, North Carolina Geol. Survey Rept., vol. 1, app. A., p. 23.

Shell pyriform, with unequal very distinct prominent spiral lines; volutions prominently carinated, those of the spire tuberculated; tubercles obsolete on the angle of last volution; beneath this angle and on the slight contraction of the 3 inferior volutions are very fine equal spiral lines; summit of volutions oblique and concave; canal wide, moderately impressed.

Locality. Mr. King's marl. [Sampson County, N. C.]

This species is the most nearly allied to *B. canaliculatum* of any Miocene species. Compared with a specimen of the latter nearly of the same size it has smaller and more numerous tubercles, a wider and less deeply impressed canal, narrower body volution, a shorter siphonal canal and larger revolving lines. The fine lines beneath the carina are wanting in *B. canaliculatum*.—Conrad, 1875.

Dimensions of figured specimen: Height (tip decorticated), 76.0 mm.; maximum diameter, 37.5 mm.

Figured specimen: U.S.N.M. 325396, from Walkers Bluff, Cape Fear River, Bladen County, N. C.

The forms identified as *B. concinnum* are characterized by the scalariform outline, the evanescence of the peripheral tubercles toward the aperture, the relatively prominent spiral sculpture, the coronated periphery of the earlier whorls, and the elevated outer margin of the sutural canal.

Busycon concinnum Conrad recalls *Busycon canaliculatum canaliferum* in the scalariform outline and the persistence of the tubercles to the final whorl. It differs in the heavier shell, less inflated and less angular body whorl, the coarser and more prominent spiral sculpture, and the heavier and less elegantly defined coronal tubercles.

Busycon aff. *B. canaliculatum* (Linnaeus) Mansfield from the *Cancellaria* zone of the Choctawhatchee for-

mation is very close to the Waccamaw form. In the specimen shown on plate 7, figure 1, of Bulletin 3 of the Florida Geological Survey, 1930, the whorls of the Florida shell are more angular, and the peripheral keel more persistent than in *B.* (*S.*) *concinnum.*

Distribution: North Carolina: Waccamaw formation(?), "Mr. King's marl," Sampson County. Waccamaw formation, Walkers Bluff, Cape Fear River, Bladen County; Neills Eddy Landing, Cape Fear River, Columbus County, N. C.

Family NASSARIIDAE

Genus ILYANASSA Stimpson

1865. *Ilyanassa* Stimpson, Am. Jour. Conchology, vol. 1, p. 61.

Type by original designation: *Buccinum obsoletum* Gould. Living from the south shore of the Gulf of Saint Lawrence to Florida.

Shell reticulated or decussated, rather thick and strong; spire elevated; inner lip smooth; callus moderate. Foot broad without caudal bifurcation or cirri. Operculum resembling somewhat that of *Buccinum*, obovate, broadest below; nucleus a little within the margin at the outer side near the base; margin entire, not serrated; lingual teeth like those of Nassa. * * * The typical species is littoral in station, living on mud-flats in bays and harbors, and is found more abundantly than any other gastroped on the eastern coasts of the United States of North America.—Stimpson, 1865.

The lirate or nonlirate character of the inner surface of the outer lip is a character of individual or of age variation. In the majority of the adult *I. obsoleta*, the inner surface of the outer lip is to a greater or less degree lirate. The differences which presumably separate the section *Paranassa* Conrad, 1868, from *Ilyanassa* s. s., the character of the outer lip and of the anterior extremity of the shell, seem too slight and too inconstant to be recognized systematically.

Ilyanassa is used in this report to include nassoid shells of medium size, rather crudely fashioned, many of them squat and stout, most of them with a sculpture that is more or less worn. The body is constricted directly into the fasciole with no intermediate sulcus. The aperture is obliquely lenticular; the outer lip is commonly more or less thickened and lirate within, and the variation in these characters is related to the age and stage of growth. The inner wall of the aperture is abruptly constricted at the base of the body, the parietal callus commonly heavy and widely displayed over the body wall and the margin of the pillar pinched into a sharp and rather prominent fold. The anterior fasciole is corrugated by the growth laminae, and the terminal notch is shallow to fairly deep and oblique.

The genotype is intertidal and the name *Ilyanassa*, the queen of the mud, indicates its habitat and its successful possession of the Coastal Plain mud flats. Some of the species included within *Ilyanassa* are doubtless marine and in no degree brackish water forms. They seem, however, to be more closely allied to *I. obsoleta* and *I. porcina* than to the nassoid genera such as *Nassa*, *Nassarius*, *Uzita*, and *Alectrion*, to which they have have been commonly referred.

Ilyanassa has inhabited the mud flats of the eastern Atlantic coast since the middle Tertiary. The peculiar susceptibility of the spire to corrosion is indicative of the more or less brackish water conditions under which it lives.

Ilyanassa arata (Say)

Plate 31, figure 1

1824. *Buccinum aratum* Say, Acad. Nat. Sci. Philadelphia Jour., 1st ser., vol. 4, p. 127, pl. 7, fig. 4.

1863. *Tritia arata* Say. Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 562.

1868. *Ptychosalpinx* (*Paranassa*) *arata* (Say). Conrad, Am. Jour. Conchology, vol. 3, p. 262.

1892. *Ilyanassa* (*Paranassa*) *arata* Say. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 238, pl. 20, fig. 15.

1892. *Tritia idonea* Conrad, Mss. label in collection Acad. Nat. Sci. Philadelphia, fide Dall, idem.

1901. *Paranassa arata* Say. Cossmann, Essais paléoconchologie comp., vol. 4, p. 225, text fig. 52.

Oblong subovate, spirally striated; labrum thickened and toothed within.

Shell with more than twenty revolving, slightly elevated lines; Whorls but little convex: suture very narrow, consisting of a mere indented line: aperture moderate: labium covering the columella, which is concave: labrum thickened on the exterior, and with striaeform teeth on the interior submargin.

Breadth half an inch, length of the aperture rather less.

Smaller and of a much more slender form than the preceding [*Buccinum porcinum* Say] and altogether destitute of undulations. The summit of the spire being deficient in the specimen, its length cannot be ascertained.—Say, 1824.

Habitat: Maryland?

Dimensions of figured specimen: Height 21.0 mm., maximum diameter 13.8 mm.

Figured specimen: U.S.N.M. 112377.

Locality of figured specimen: Waccamaw River, S. C. Waccamaw formation.

Possibly with sufficient material, a series may be established connecting *Ilyanassa arata* (Say) and *I. porcina* (Say). The latter is, apparently, the larger, more irregular type, with usually more convex whorls; the former, the immature, more freshly sculptured representative of the race. The brackish-water Mollusca are notoriously variable in outline and peculiarly susceptible to corrosion, and the separating characters of these two allied and coexistent forms suggest an age variation as strongly as a specific difference.

Distribution: Duplin marl, Natural Well, 2 miles southwest of Magnolia, Duplin County, N. C.

Outside distribution: Miocene, "Maryland" (Say). The species is not recorded from later collections from Maryland. Pliocene, Waccamaw formation, Waccamaw River, S. C.

Ilyanassa irrorata (Conrad) Conrad

Plate 31, figure 2

1856. *Buccinum obsoletum* Tuomey and Holmes, Pleiocene fossils of South Carolina, p. 135, pl. 28, fig. 5.
Not *Buccinum obsoletum* Say, 1822.
1863. *Tritia irrorata* Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 562.
1868. *Ilyanassa irrorata* Conrad, Am. Jour. Conchology, vol. 3, p. 263, pl. 19, fig. 10.
1892. *Ilyanassa irrorata* Conrad. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 239.

Distinguished by the sculpture being more prominently granulose than in that of the recent species; it is also a thicker shell with a much thicker labrum. The minute granulations on the polished inner lip of the *I. obsoleta*, are obscurely traced on the weathered lip of the fossil.—Conrad, 1868.

No locality given.

Outline elevated-conic. Aperture in adult forms less than half the total height. Whorls tapering gradually to an acute apex, 7 or 8, including the nucleus. Protoconch small, of 1½ to 2 smooth coils, the first half turn or three-quarter turn largely submerged, the succeeding volution broadly convex. Sculpture approximately uniform over the entire external surface from the protoconch to the canal. Axial sculpture of 20 to 35 narrow, rounded, nearly vertical riblets, persistent with undiminished vigor from suture to suture and separated by interspaces of equal or slightly lesser width. Primary spirals 4 to 6 on the later whorls of the spire, 10 to 12 on the body, prominent only at the intersection with the axials, which they nodulate; areas included between costals and spirals small squarish pits; secondaries irregularly intercalated between the primaries on the body. Suture line distinct, impressed. Aperture rudely lenticular. Outer lip not thickened, slightly flaring anteriorly, irregularly striated within by some 4 to 10 subequal lirae that evanesce a short distance within the aperture. Columellar lip rather strongly excavated at the base of the final whorl, bearing an oblique, inconspicuous, marginal fold. Parietal wall washed with a callus commonly too thin to entirely conceal the sculpture. Anterior canal very short, broadly oblique, corrugated by the incrementals, rather deeply emarginate.

Ilyanassa irrorata (Conrad) is undoubtedly the ancestor of *I. obsoleta* Say, a smaller, thinner, very much more feebly and irregularly sculptured species.

Ilyanassa sexdentata and its subspecies *granifera* (Conrad) are decidedly smaller than *I. irrorata*, are both relatively and absolutely lower, and exhibit a spiral sculpture that, unlike that of the latter, is prominent alike on the costal and intercostal areas.

Distribution: North Carolina: Duplin marl, 2 miles north of Lumberton, and 4 to 5 miles below Lumberton, Robeson County. Waccamaw formation, County Line Bluff and at Walkers Bluff on the Cape Fear River, Bladen County; Lake Waccamaw and Neills Eddy Landing, Columbus County; Wilmington at the City Rock Quarry, New Hanover County.

Outside distribution: Waccamaw formation (?), Smith's Goose Creek, Berkeley County; and Waccamaw formation, Waccamaw River, Horry County, S. C. (Tuomey and Holmes).

Ilyanassa wilmingtonensis Gardner, n. sp.

Plate 30, figures 30, 31

Shell ovate, the greatest diameter near the median line. Spire moderately high; whorls trapezoidal, very slightly convex. Body flattened, with a feeble peripheral bulge; not constricted posteriorly. Nucleus rather small, obtuse, papillate, but apex so badly decorticated that it is impossible to differentiate conch and protoconch. Volutions 6½ in all. Axial sculpture limited to incrementals, which are, however, strong enough to granulate the spirals; a number of irregular longitudinal breaks indicating unstable conditions of growth and doubtless due to injuries suffered by the animal in the course of its existence. Spiral sculpture on the next to the last whorl of the spire of 4 very low, close-set, minutely nodose fillets; on the final whorl of the spire 5 nodose primaries with 1 or 2 simple secondaries intercalated in the grooved interspaces; on the body 14 low, nodular, or subnodular spirals; secondaries introduced with a fair degree of regularity on the posterior half, midway between the nodular primaries; anterior to the greatest diameter, both primaries and secondaries become subnodular and irregular in size and spacing. Suture impressed but not conspicuous. Outer lip badly broken. Columella strongly concave and bearing a sharp, prominent fold on the anterior margin. Parietal callus very heavy, extending well over the body whorl. Siphonal fasciole keeled, strongly corrugated, the anterior notch very shallow.

Dimensions of holotype: Height, 25.5 mm.; maximum diameter, 12.4 mm.

Holotype: U.S.N.M. 325400.

Type locality: City Rock Quarry, Wilmington, N. C. Waccamaw formation.

This species is described from a unique type. The diagnostic features are the relatively slender, regularly ovate outline, and the low, crowded, nodular, or subnodular spirals which cover the surface from apex to anterior fasciole.

Ilyanassa wilmingtonensis is, judging from the figure, close to *I.* (*Paranassa*) *aratum deleonensis* Tucker,[20] 1931, from the Caloosahatchee marl of De Leon Springs, Fla. The latter is less slender than the former, and the cancellation of the spirals by the incrementals is not indicated by the drawing. If the anterior extremity of this shell had been missing, it would have been placed close to *Pisania* (*Celatoconus*) *burnsi* Mansfield, from the St. Marys formation of Urbanna, Va.

[20] Tucker, H. I., A new *Ilyanassa:* Indiana Acad. Sci. Proc., vol. 40, p 375, text fig. 1, 1931.

Ilyanassa isogramma Dall

Plate 31, figure 9

1892. *Ilyanassa (Paranassa) isogramma* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 239, pl. 20, fig. 16.

Shell elevated, moderately heavy, with about seven moderately rounded whorls, a distinct suture and even, uniform spiral threading, crossed only by fine lines of growth; the interspaces are usually narrower than the threads and are sometimes mere grooves, the threads are occasionally feeble; body whorl not greatly inflated, the base not constricted, the fasciole obscure and the canal extremely short; the outer lip slightly thickened, internally lirate, with about eight short lirae; lon. of shell 24; max. diam. 14 mm.

This form apears to be distinguished from *I. arata* by its closer and finer spiral sculpture, more elevated spire, less inflated last whorl, and generally by a somewhat pupiform outline.—Dall, 1892.

Holotype: U.S.N.M. 124948.

Type locality: Bellefield, on the York River, Va. Yorktown formation.

Distribution: Yorktown formation, Bellefield, just below Yorktown on the York River, York County; Petersburg, Dinwiddie County, Va.

North Carolina: Duplin Marl, 4 to 5 miles below Lumberton, Robeson County; Waccamaw formation, Walkers Bluff, Bladen County; Neills Eddy Landing, Columbus County; Wilmington at the City Rock Quarry, New Hanover County.

Ilyanassa obsoleta (Say)

Plate 31, figure 5

1822. *Nassa obsoleta* Say, Acad. Nat. Sci. Philadelphia Jour., vol. 2, p. 232.

1838. *Buccinum obsoletum* Say. C. B. Adams, Boston Jour. Nat. History, vol. 2, p. 267.

1841. *Buccinum obsoletum* Say. Gould, Invertebrata Massachusetts, p. 308, fig. 210.

1859. *Buccinum obsoletum* Adams. Holmes, Post-Pleiocene fossils of South Carolina, p. 71, pl. 12, fig. 1.

1870. *Nassa obsoleta* Say. Gould, Invertebrata Massachusetts (Binney ed.), p. 362, fig. 631.

1889. *Nassa obsoleta* Say. Dall, U. S. Nat. Mus. Bull. 37, p. 116, pl. 50, fig. 9.

1892. *Ilyanassa obsoleta* (Say). Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 239.

1906. *Ilyanassa obsoleta* (Say). Clark, Maryland Geol. Survey, Pliocene and Pleistocene, p. 181, pl. 49, figs. 3, 4.

1908. *Nassa obsoleta* Say. Rogers, Shell book, p. 72, pl. opp. p. 74, fig. 6.

Shell ovate-conic, subacute, cancellate, exhibiting a granulated appearance, dark reddish-brown, or blackish, sometimes tinged with olivaceous; spire shorter than the body; suture not deeply impressed; beak not distinguished from the whirl by any profound depression, and not prominent; labrum within lineated with elevated, abbreviated, or interrupted lines, not incrassated, purple-black; columella at base with a prominence or fold.

Length three-fifths of an inch.

Inhabits the coast of the United States * * *.

Inhabits the shores of our estuaries in great numbers. When left by the recess of the tide, they collect together in small pools, or crawl in pursuit of the retiring water; but when left quite dry, they burrow in the sand so as to conceal themselves from the action of the sun, and patiently await the returning tide. They assemble about dead crabs and other animals, and appear to feed upon them.—Say, 1822.

Ilyanassa obsoleta (Say) is smaller and less robust than its Tertiary ancestor *I. irrorata* (Conrad) Conrad. The axial sculpture is feeble and irregular and consequently the granular aspect, so characteristic of the latter is wanting.

The spiral sculpture presents the ill-defined, obsolete appearance that has inspired the name.

There is some doubt about the authenticity of the forms occurring in the environs of Suffolk, Va.

Distribution: Virginia: Yorktown formation, 1½ miles north of Suffolk, 1¼ miles north of Suffolk, half a mile below Suffolk waterworks dam, Nansemond County.

Outside distribution: Pliocene, Waccamaw formation, Nixons, Tilly Lake, and Todds Ferry, Horry County, S. C. Pleistocene, Point Shirley, and Sankaty Head, Mass.; Gardiners Island, N. Y.; Heislerville, N. J.; Wailes Bluff, Langleys Bluff, and Federalsburg, Md.; Dismal Swamp Canal between posts 15 and 16, Va.; Simmons Bluff, S. C. Recent, Muddy beaches from Nova Scotia to Florida.

Ilyanassa sexdentata (Conrad)

Plate 31, figure 3

1843. *Buccinum sexdentatum* Conrad, Acad. Nat. Sci. Philadelphia Proc., vol. 1, p. 308.

1863. *Tritia sexdentata* Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 562.

1868. *Ptychosalpinx (Paranassa) sexdentata* (Conrad), Am. Jour. Conchology, vol. 3, p. 262.

1892. *Ilyanassa granifera* var. *sexdentata* (Conrad). Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 239.

Acutely oblong-ovate, with regular prominent compressed longitudinal ribs, and fine revolving lines, one or two of which, near the suture are larger and more distinct; towards the base the lines are more profound; spire elevated; volutions 9, with straight sides; suture impressed; aperture about one-third the length of the shell; labrum with 6 dentiform tubercles within. Length half an inch.—Conrad, 1843.

Locality not given.

Shell small, stout, obliquely ovate. Whorls 7½, including the small, smooth, protoconchal volutions; trapezoidal, tapering gradually to an acute apex; the first protoconchal volution largely submerged, the succeeding turn convex initially, gradually flattening toward the conch. Line between protoconch and conch lost by the abrasion of the spire. Axial sculpture of 20 to 25 narrow, rounded, slightly retractive riblets, separated by intercostals of approximately equal or slightly lesser width. Spiral sculpture dominant; fillets 5 to 6 on whorls of spire, 10 to 12 on body, overriding the costals but not nodulating them, conspicuous alike on the costal and intercostal areas; fortuitous secondaries occasionally intercalated. Suture line feebly impressed, not prominent. Aperture broadly lenticular. Outer lip arcuate. Inner striations 5 to 8, evanescing a short distance within the aperture. Parietal wall heavily callused. Columellar lip loosely sigmoidal, bearing at the anterior margin a single oblique fold. Base of body whorl constricted into the short, oblique, broadly emarginate anterior fasciole, corrugated by the incrementals.

No individual has been noted that presents the number of whorls mentioned in Conrad's description, nor is the number of the striations on the inner surface of the labrum a constant character.

Ilyanassa sexdentata (Conrad) s. l. is most readily separated from the closely allied and coexistent *I. irrorata* (Conrad) by the uniform strength of the spirals on the costal and intercostal areas. In *I. irrorata*, the costals are nodulated and the intercostals, obscurely lirate.

Dimensions of figured specimen: Height, 20.8 mm.; maximum diameter, 10.7 mm.

Figured specimen: U. S. N. M. 124953.

Locality of figured specimen: One and a half miles northwest of Magnolia, in an air line about 2 miles north of Natural Well, Duplin County, N. C. Duplin marl.

Distribution: North Carolina: Yorktown formation, 8 to 9 miles southeast of Greenville on the Tar River, Pitt County; 1 mile east of Lizzie, Greene County. Duplin marl, Natural Well and 1½ miles northwest of Magnolia, Duplin County; 2 miles below Lumberton and 4 to 5 miles below Lumberton, Robeson County. Waccamaw formation, Walkers Bluff on the Cape Fear River, Bladen County; Neills Eddy Landing, 3 miles north of Cronly, Columbus County; Wilmington at the City Rock Quarry, New Hanover County.

Ilyanassa granifera (Conrad)

Plate 31, figure 10

1868. *Ptychosalpinx* (*Paranassa*) *granifera* Conrad, Am. Jour. Conchology, vol. 3, p. 263, pl. 19, fig. 6.

1892. *Ilyanassa granifera* Conrad. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 239.

Ovate, thick, with numerous oblique granulated ribs and distinct impressed lines, about 9 on the body whorl; one or two filiform lines between the larger lines near the suture; spire short, whorls slightly turrited; aperture with 6 prominent lines within; beak carinated on the back.

Locality. Virginia.—Conrad, 1868.

Dimensions of figured specimen: Height, 23.5 mm.; maximum diameter, 13.5 mm.

Figured specimen: U.S.N.M. 124951, from Yorktown formation, half to three-fourths of a mile below Yorktown, Va.

Ilyanassa sexdentata is characterized by the coarser, and usually less numerous, spiral lirations that seem to average about 4 to the final whorl of the spire and 10 to the body.

Distribution: Virginia: Yorktown formation, Yorktown and half to three-fourths of a mile below Yorktown, York County.

North Carolina: Yorktown formation, 3½ miles northwest of Rocky Mount, Edgecombe County; half to three-fourths of a mile above Edenhouse Point, on the Chowan River, Bertie County; Rock Landing on the Neuse River, Craven County. Duplin marl, 4 miles south of Clinton, Sampson County; Natural Well, 2 miles southwest of Magnolia, Duplin County; 2 miles below Lumberton, Robeson County.

Outside distribution: Miocene, Duplin marl, 5 miles southeast of Mayesville, Sumter County, S. C. Pliocene, Caloosahatchee marl, Nashua, Putnam County, Fla.

Ilyanassa schizopyga Dall

Plate 31, figure 4

1892. *Ilyanassa* (*porcina* var.?) *schizopyga* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 238.

Shell differing from typical *porcina* by its more elevated and conical spire, its less inflated last whorl, square or rounded but not appressed suture, constricted base, strong, flaring, subumbilicate siphonal fasciole, and more uniform and sharply reticulate sculpture. The aperture is thickened on both sides, there is no subsutural lamina and the lirae of the outer lip run deeply into the aperture instead of being confined to the vicinity of the margin. Alt. of shell, 32; max. diam., 18 mm.

This apparently distinct form was found in Mrs. Purdy's marl-bed on the Cape Fear River by Mr. C. W. Johnson. It is probably later Miocene. I hesitate to assign it an absolute specific rank, notwithstanding the characters mentioned, in the absence of more profuse material; that available being only two rather worn specimens.—Dall, 1892.

Holotype: U. S. N. M. 124945.

Shell rude, heavy, roughly ovate, the aperture approximately half the total height; the spire rather elevated for the genus, tapering to an acute apex. Whorls feebly convex, commonly obscurely tabulated, 8 or 9, including the very small, smooth nucleus. Spire badly decorticated and differentiation of conch and protoconch impossible. Axial sculpture confined, for the most part, to the earlier whorls; consisting of 20 to 30 slightly oblique, narrow, rounded, retractive riblets, separated by interspaces of approximately the same width; extending from suture to suture though becoming irregular or altogether obsolete on the final whorl. Spiral sculpture, like the axial, more prominent on the earlier volutions than on the later; about 6 low, flattened fillets on the later whorls of the spire, commonly subnodose at the intersection with the axials; body spirals 15 to 20, unequal in size and spacing, less feeble on the base of the whorl, commonly obscure on the periphery. Suture line distinct, impressed. Aperture broadly lenticular. Labrum heavy but not conspicuously thickened; striate within, the striae corresponding to the interspirals. Labrum strongly concave, bearing at its anterior margin a single, sinuous fold. Parietal wall heavily calloused. Fasciole corrugated by the growth lamellae, broadly emarginate. Umbilical chink commonly concealed by the parietal callus.

Ilyanassa schizopyga Dall is the analogue in the Duplin and Waccamaw faunas of *I. porcina* (Say) in the Chesapeake and Yorktown faunas. It is a heavier, more angular shell than the latter, with a more elevated spire, obscurely shouldered whorls, and, as a rule, a distinctly reticulated spire.

Distribution: North Carolina: Duplin marl, 4 miles north of Lumberton, 2 miles below Lumberton, 4 to 5 miles below Lumberton, 1½ miles northeast of Fairmont, and at Fairmont (Ashpole), Robeson County. Waccamaw formation, Walkers Bluff, Bladen County; Mrs. Purdy's marl bed on the Cape Fear River, Bladen (?) County; Neills Eddy Landing, 3 miles north of Cronly, Columbus County.

Ilyanassa johnsoni (Dall)

Plate 31, figure 6

1892. *Nassa johnsoni* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 241, pl. 13, fig. 12.

Shell short, inflated, with a pointed but little-elevated spire and about seven whorls; nucleus lost in the types; early whorls with six or seven narrow, strap-like, revolving elevated lines, of which two are more prominent; later the prominent lines take on a more carinated appearance, and are reinforced by numerous smaller ones; on the last whorl this pre-eminence is obsolete and the spiral sculpture recalls that of *N. consensa*, consisting of very numerous continuous, even, narrow threads alternating in the proportion of one slightly more prominent followed by three to five finer and then another slightly larger one, the interspaces being equal to or slightly wider than the threads; transverse sculpture of numerous (on the last whorl 18 to 20) rounded ribs extending from the suture to the siphonal carina, with the interspaces equal or wider on the last and narrower on the early whorls; suture distinct, not channelled, toward the last laid over an edge of body callus; whorls rounded, aperture longer than the rest of the shell, wide, semi-lunar, narrow and pointed behind, with an obtuse subsutural callus; whorls rounded, aperture longer than the rest of the shell, wide, semi-lunar, narrow and pointed behind, with an obtuse subsutural callus; body with a broad, thick, smooth callus; pillar concave, with a prominent anterior keel, shorter than the outer lip; siphonal notch deep, with the usual nassoid keel; outer lip little reflected, moderately thickened, simple, with about fifteen short denticular lirae just within; throat without lirae. Lon. of shell 22 [19.5]; of aperture 13.5; max. lat. of shell 15.5 [13.5] mm.

This fine species is related to *"Ptychosalpinx" scalaspira* and *"Paranassa" harpuloides* Conrad.

N. scalaspira was described from a broken specimen, but is destitute of the fine sharp spiral sculpture and has fewer ribs and a higher, more scalar spire than *N. Johnsoni*. The proportions of *N. harpuloides* are quite different, especially about the aperture, while the pillar is quite unlike that of *N. Johnsoni*.

The species is named in honor of Mr. Chas. W. Johnson, to whose successful researches we owe much valuable information as to the Tertiaries of the Carolinas.—Dall, 1892.

Holotype: U.S.N.M. 124961.

Type locality: Mrs. Purdy's marl bed on the Cape Fear River, Bladen (?) County, N. C. Waccamaw formation.

The apparent strength of the marginal fold is increased by a slight breakage of the shell directly behind it.

Ilyanassa johnsoni (Dall) together with *I. scalaspira* (Conrad) and *I. harpuloides* (Conrad) develop the so-called "nassoid keel" and behind it the body is constricted. A similar keel and body constriction are exhibited, however, by *I. granifera* Conrad and closely allied species. The representatives of this group are larger than *Uzita*, and more squat. The anal fasciole is not guttered by opposing lirae, as it is commonly in *Uzita*, and no denticles are developed on the callus of the pillar. No restricted superspecific name has been found to cover the group and the differences are so largely of degree rather than kind that none is introduced. The alliance of the group to *Ilyanassa* seems definitely closer than to *Uzita*, *Nassarius*, or any of the divisions of "*Phos*."

Distribution: Yorktown formation, 1½ miles northeast of Suffolk on the Nansemond River, Nansemond County, Va.

North Carolina: Yorktown formation, Tafts Landing, 6¾ miles below Greenville and 8 to 9 miles southeast of Greenville, on the Tar River, Pitt County. Duplin marl, Natural Well, 2 miles southwest of Magnolia, Duplin County; 2 miles below Lumberton, 4 to 5 miles below Lumberton, 1½ miles northeast of Fairmont and at Fairmont, Robeson County. Waccamaw formation, Walkers Bluff, Bladen County, and Mrs. Purdy's marl bed on the Cape Fear River, Bladen (?) County; Neills Eddy Landing, 3 miles north of Cronly, Columbus County.

Outside distribution: Miocene, Duplin marl, Sumter County, S. C.

Ilyanassa scalaspira (Conrad)

Plate 31, figures 7, 8

1868. *Ptychosalpinx scalaspira* Conrad, Am. Jour. Conchology, vol. 3, p. 263, pl. 19, fig. 4.

1892. *Nassa scalaspira* Conrad. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 240.

Ovate; body whorl profoundly ventricose, spire scalariform, acute; ribs small, numerous, oblique, not very prominent, revolving lines obsolete on the penultimate and upper part of the body whorl; columellar fold very prominent.

Locality. Virginia.—Conrad, 1868.

Shell of medium size, heavy, depressed, scalariform. Whorls 6 or 7, rapidly increasing in diameter; strongly tabulated posteriorly. Aperture fully half the total height. Apex acute but so badly eroded that the nuclear characters are obscured. Axial sculpture prominent, affecting the outline of the whorl; costals usually 12 on the later turns, feebly arcuate, narrow with evenly rounded and conspicuously elevated summits; opposite, as a rule, and ceasing abruptly just in front of the suture line, thus forming a very decided shoulder; intercostal areas wider than costals; a fine and very regular incremental sculpture discernible under magnification. Spiral sculpture uniform and continuous from the apex to the anterior fasciole; spirals linear, separated by sublinear interspirals oblique to the posterior suture; secondaries commonly intercalated especially on the anterior half of the body whorl. Aperture broadly and obliquely lenticular. Labrum subvaricose, dilated anteriorly, abruptly contracted basally; inner lirations about 7, equispaced and subequisized. Inner lip strongly excavated at the base of the body, bearing a sharp marginal keel. Parietal wall washed with a heavy enamel reflected backward nearly to the suture line and almost or entirely closing the umbilical chink. Anterior fasciole short and wide; strongly corrugated by the incrementals. Terminal notch deep.

Dimensions of figured specimen: Height, 21.4 mm.; maximum diameter, 12.6 mm.

Figured specimen: U. S. N. M. 325407, from 1½ miles northeast of Fairmont, N. C. Duplin marl.

In general outline and type of sculpture, *Ilyanassa scalaspira* (Conrad) most closely resembles *I. harpuloides* (Conrad). The former is relatively more de-

pressed, however, with a lower, more scalariform spire, and a more conspicuous axial sculpture. It shares with *I. harpuloides* the fine spiral sculpture oblique to the suture line, but lacks the strong primary spiral banding.

Distribution: Yorktown formation, Yorktown on the York River, York County, Va.

North Carolina: Duplin marl, Natural Well, 2 miles southwest of Magnolia, Duplin County; 2 miles below Lumberton, 4 to 5 miles below Lumberton, 1½ miles northeast of Fairmont and at Fairmont, Robeson County, Waccamaw formation, Walkers Bluff on the Cape Fear River, Bladen County; Neills Eddy Landing, 3 miles north of Cronly, Columbus County; Wilmington, New Hanover County.

Outside distribution: Miocene, at the Muldrow Place, 5 miles southeast of Mayesville, Sumter County, S. C.; Pliocene, Caloosahatchee marl, Nashua, Putnam County, Fla.

Ilyanassa harpuloides (Conrad)

Plate 31, figures 11, 12

1844. *Buccinum harpuloides* Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1843, vol. 1, p. 326.
1863. *Tritia harpuloides* Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 562.
1868. *Ptychosalpinx* (*Paranassa*) *harpuloides* Conrad, Am. Jour. Conchology, vol. 3, p. 264, pl. 19, fig. 7.
1892. *Nassa harpuloides* Conrad. Dall, Wagner Free Inst. Sci. Trans., vol. 13, pt. 2, p. 240.

Ovate, ventricose, with alternated revolving raised lines, and longitudinal slightly oblique rather distant narrow elevated ribs: spire scalariform, volutions five; base of the shell with an acute oblique carina; aperture half the length of the shell; columella profoundly concave, with a prominent fold or carina on the angle formed by the obliquely truncated base; a slight protuberance near the superior extremity of the aperture; margin of labrum nearly straight, suddenly rounded inferiority. Length, one inch; width, five-eighths of an inch.—Conrad, 1844.

Type locality. Petersburg, Va.?

This fine species is readily recognized, even when in poor condition, by its square-sided whorls, elevated spire, and the fact that the fine spiral striation above the shoulder of the whorls is laid obliquely to the suture and not parallel to it, without reference to the undulations caused by passing over the ribs. When mature it has a heavy labial callus, subsutural ridge, thickened lirate and somewhat reflected outer lip.—Dall, 1892.

This is an unusually well characterized species and readily recognizable, even from a fragment, if it includes a suture.

Dimensions of figured specimen: Height, 23 mm.; maximum diameter, 13 mm.

Figured specimen: U.S.N.M. 325401, from 2 miles southeast of Tugwell, Pitt County, N. C. Yorktown formation.

Distribution: Yorktown formation, Yorktown on the York River, York County; Petersburg?, Dinwiddie County, Va.

North Carolina: Yorktown formation, 2 miles southeast of Tugwell, on Jacobs Branch, 8 to 9 miles southeast of Greenville, 9 to 10 miles south of Greenville, and 1 mile northwest of Galloway crossroads, Pitt County. Duplin marl, Natural Well, 2 miles southwest of Magnolia, Duplin County.

Genus NASSARIUS Duméril

1806. *Nassarius* Duméril, Zoologie analytique, p. 166.
1928. *Nassarius* Duméril. Woodring, Carnegie Inst. Washington Pub. 385, p. 264.
1931. *Nassarius* Duméril. Grant and Gale, San Diego Soc. Nat. History Mem., vol. 1, p. 670.

Whether the name be considered as a substitute name for *Nassa* Lamarck not Bolten, and the type by monotypy, *Buccinum mutabile* Linnaeus, or whether it be considered a new name and the type by monotypy, *Buccinum arcularia* Linnaeus, *Nassarius* s. s. is not recorded in the Tertiary of the Atlantic Seaboard.

The moderately large rather exotic looking species such as *johnsoni* and *scalaspira* seem more closely allied to *Ilyanassa* than to *B. arcularia* with its *Cassis*-like callus pad, channelled posterior commissure, and lirae which extend far within the throat. Possibly *Ilyanassa* is unduly expanded by the inclusion of true marine forms, such as *johnsoni* and *scalaspira*, but until a comprehensive revision has been made, it seems better to treat them as a part of an East American assemblage.

Genus UZITA H. and A. Adams

1853. *Uzita* H. and A. Adams, General Recent Mollusca, vol. 1, p. 120.

Type by subsequent designation (Cossmann, Essais de paléoconchologie comp., vol. 4, pp. 205, 1901): *Buccinum migum* Bruguière. Recent, off the coast of Senegal.

This is "Le Miga" of Adanson, 1757 (Histoire naturelle du Sénégal, p. 116, pl. 8, fig. 10). Adanson's rather poor figures do not greatly resemble that of Reeve (Conchologia iconica, vol. 8, *Nassa*, pl. 13, fig. 86), and indicate a stouter shell. However, for the want of a better name, *Uzita* is used in this report for the large group of small cancellate nassoids which occur in abundance in the Tertiary and Recent faunas of the Atlantic Coastal Plain and in the mid-Americas.

Uzita smithiana (Olsson)

Plate 30, figures 1, 4, 11

1916. *Nassa smithiana* Olsson, Bull. Am. Paleontology, vol. 5, No. 27, p. 12, pl. 1, fig. 2.

Shell small, solid, elongate, with heavy straight ribs and spiral bands; nuclear whorls 2–3, small, smooth; post-nuclear whorls flattened; ribs heavy and straight, occasionally one is developed which is more prominent than the others and may represent a resting stage; ribs on the body-whorl about 10; spiral sculpture consisting of bands, produced by incised lines cutting both the ribs and the interspaces, these spiral bands, on the body-whorl, number about 11 and are regular and large, except the two uppermost, which are smaller; whorls of the spire with 6 or 7 spiral bands; a deep smooth sulcus cuts into the base of the body-whorl; suture distinct, bordered either by a smooth area or by small spirals; mouth small, rounded or ovate, angulated above; outer lip heavy, denticulate within, columella with a callus, denticulate; siphonal fasciole strong.

Length 14, breadth 6, body whorl 7 mm.

A very distinctive species, characterized by its elongate shape, heavy ribs and even spiral bands. The species is fairly abundant at Natural Well.

Named for Ernest R. Smith, a member of the 1st and 2nd Ecphora trips.

Duplin formation; Natural Well, N. C.—Olsson, 1916.

Dimensions of figured topotype: Height, 12.2 mm.; maximum diameter, 6.1 mm.

Figured topotype: U. S. N. M. 114200.

Locality of figured topotype: Natural Well, 2 miles southwest of Magnolia, Duplin County, N. C.

The young are relatively lower than the adults and are commonly squat little forms. No other Tertiary species on the east coast combines the slender turrited outline of *U. smithiana* with its full, vigorous and elevated costals. The former resting stages are usually traceable well up toward the apex by the succession of subvaricose costals. The spirals vary in relative width; in the young and on the earlier whorls, they may be no wider than the interspirals, whereas on the later whorls of the adult, the interspirals may be no more than linear.

Distribution: Virginia: Yorktown formation, (?) Yorktown, York County; (?) 1 mile northeast of Suffolk, Nansemond County. North Carolina: Duplin marl, southwest of Magnolia at the Natural Well, Duplin County.

Uzita neogenensis (Gardner and Aldrich)

Plate 30, figures 6, 7

1919. *Alectrion neogenensis* Gardner and Aldrich, Acad. Nat. Sci. Philadelphia Proc., p. 29, pl. 1, fig. 5, 6.

Shell rather large for the group, slender, multiwhorled. Protoconch very small and smooth, slightly imperfect, including, apparently, a little more than 2 volutions. Beginning of conch indicated by the faint but abrupt appearance of both the spiral and the axial sculpture. Whorls of conch 6, closely appressed, increasing but slowly in diameter, narrowly and obscurely tabulated, their apparent convexity increased by the slightly decreased elevation of the axials at the suture. Body more than half as high as the entire shell, abruptly constricted at the base. Sculpture pattern strong. Axials narrow, rounded, elevated, persisting from suture to suture and well down to the base of the body, 12 on the second whorl of the conch, 14 on the body, overridden and subnodulated by the spirals; the final rib subvaricose. Primary spirals 5 to the whorl on the spire, 10 on the body, low and flattened in the intercostal areas, more prominent on the crests of the costals; 1 or 2 finer lirae introduced behind the posterior primary and, on the holotype, one behind the basal sulcus. Suture impressed, undulated by the costals of the preceding volution. Aperture broadly lenticular, obtusely angulated posteriorly. Outer lip subvaricose a little behind the thin, sharp margin, feebly lirate within; slightly flaring medially; bent in sharply toward the canal, anteriorly. Inner lip strongly and smoothly concave. Parietal callus thickly spread in a rather narrow sharply defined arc from the commissure to the anterior extremity; a few obscure denticles developed along the pillar near the margin of the wash and a single stronger denticle directly in front of the commissure. Pillar very short, the edge acute. Basal sulcus deep, devoid of sculpture other than incremental. Anterior fasciole short, moderately elevated, cuneate, lirate and incrementally striate. Terminal notch oblique and very deep, the sharply elevated margin of the basal sulcus forming the longer arm of the asymmetric U, the extremity of the fasciole, the shorter inner arm.

Dimensions of holotype: Height, 12.4 mm.; maximum diameter, 6.0 mm.

Holotype: U.S.N.M. 325403.

Type locality: Cronly, Columbus County, N. C. Waccamaw formation.

Uzita neogenensis belongs to the group represented by *U. chowanensis* in the Yorktown formation and by *U. smithiana* in the Duplin. In general form and sculpture pattern, it most closely resembles the Yorktown species, but both the axial and the spiral sculpture are more vigorous, and the shell itself is larger and heavier.

Uzita lapenotierei (Dall) is similar in outline but is smaller, and has fewer, much narrower, and more distant spirals. *Uzita suffolkensis* is a little higher relatively than *U. neogenensis*. The costals are usually more pinched in the former, whereas the interspirals are sublinear instead of approximately equal in width to the spirals, as is the rule in *U. neogenensis*.

Distribution: Virginia: Yorktown formation, Yorktown, York County; 1½ miles north of Suffolk, 1 mile northeast of Suffolk, and Suffolk, half a mile below the Suffolk waterworks dam, Nansemond County.

North Carolina: Yorktown formation, Colerain Landing on the Chowan River, Bertie County; 4 miles northwest of Williamston, Martin County; 1 mile west of Wilson in Hominy Swamp, Wilson County. Duplin marl, 2 miles below Lumberton, and 4 to 5 miles below Lumberton, Robeson County. Waccamaw formation, Neills Eddy Landing, 3 miles north of Cronly, Columbus County.

Outside distribution: Miocene, Duplin marl at the Muldrow Place, 5 miles southeast of Mayesville, Sumter County, S. C.

Uzita chowanensis Gardner, n. sp.

Plate 30, figures 9, 10, 12, 13

Shell rather small, the spire elevated, turrited, somewhat scalar. Whorls of conch between 5 and 6, increasing rather rapidly in diameter and gently convex. Protoconch small, the early whorls smooth, evenly rounded, too much eroded for further determination of detail. Adult costals approximately 12 to the whorl, rather low, narrow, and separated by wider intercostal areas. Spirals 4 to 6 on the later whorls of the spire,

9 on the body; low, rather narrow, angular fillets overriding the costae but not nodulating them; interspirals equal to or exceeding the spirals in width. Aperture a little more than one-third the total height, broadly lenticular. Labrum subvaricose, broadly arcuate, with some half dozen dentate ridges disposed along the inner surface at right angles to the margin. Inner lip sigmoidal, heavily calloused; a denticle just in front of the posterior commissure and two or three smaller denticles on the wall of the canal. Sulcus at base of body moderately deep; incrementally sculptured. Canal showing faint traces of spirals, very short, recurved, strongly emarginate.

Dimensions of holotype: Height, 9.4 mm.; maximum diameter, 5.0 mm.; diameter at right angles to maximum diameter, 4.4 mm. Dimensions of paratype: Height, 9.0 mm.; maximum diameter, 4.8 mm.

Holotype: U.S.N.M. 325405. Paratype, U.S.N.M. 325404.

Holotype locality: Colerain Landing on the Chowan River, Bertie County, N. C. Yorktown formation. Paratype locality, 1½ miles below Tar Ferry, Hertford County, N. C. Yorktown formation.

Uzita chowanensis offers no striking characters, but no other species, unless it is "*Nassa*" *impressa* H. C. Lea (pl. 30, fig. 22), described from a juvenile from the Yorktown formation at Petersburg, Va. offers the ensemble of elevated, multi-whorled spire, and strong rounded axials overridden by sharp and evenly spaced spiral lirae.

The group which includes *Uzita chowanensis*, *U. suffolkensis*, *U. neogenensis*, and *U. smithiana* seems particularly characteristic of the late Miocene of the Middle Atlantic coast. They have in common a slender outline, an elevated multi-whorled spire, and a strong axial ribbing overridden by spiral grooves or lirae. The small conic nassoids, on the other hand, which are so abundant in the Alum Bluff and well developed in the later Tertiary of Florida and mid-America are an inconspicuous group in the late Miocene and Pliocene of Virginia and North Carolina.

Distribution: Yorktown formation, 1½ miles north of Suffolk, (?) 1 mile northeast of Suffolk, and at Suffolk, half a mile below the waterworks dam, Nansemond County, Va.

North Carolina: Yorktown formation, Swift Creek near the confluence with the Tar River, Edgecombe County; 4 miles northwest of Williamston, and 3 miles west of Williamston, Martin County; 1 mile west of Wilson in Hominy Swamp, Wilson County; Tar Ferry, 1½ miles below Tar Ferry, and 3 to 4 miles below Tar Ferry, on Wiccacon Creek, and Mount Pleasant Landing on the Chowan River, Hertford County; Colerain Landing, Mount Gould Landing, and a half to three-fourths of a mile above Edenhouse Point on the Chowan River, Bertie County. Duplin marl, Natural Well, 2 miles southwest of Magnolia, Duplin County; Fairmont, Robeson County.

Uzita bidentata (Emmons)

Plate 30, figure 20

1858. *Buccinum bidentatum* Emmons, North Carolina Geol. Survey Rept., p. 257, fig. 126.

1890. *Nassa bidentata* Emmons. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 133, pl. 9, fig. 9.

1909. *Nassa bidentata* Emmons. Grabau and Shimer, North American index fossils, vol. 1, p. 764, fig. 1113.

Shell quite small, thick, robust; whorls about five, two upper smooth, the others are ornamented with ribs and spiral bands; aperture oval, acute behind, outer lip furnished with two rather prominent teeth, or short ridges; canal wide and very short.—Emmons, 1858.

Habitat: North Carolina.

Shell stout, acute, with two smooth nuclear and five subsequent whorls; transverse sculpture (on the last whorl) of eleven or twelve stout, even, rounded, straight ribs, crossing the whorl, and faint incremental lines; spiral sculpture of (on the upper whorls two) six or seven stout, rounded, continuous threads, very slightly swollen as they cross the ribs; the anterior pair are closer together, the rest equi-distant from each other; beside these there are five or six close-set threads on the canal; on the upper whorls two of these threads are visible, and one is included in the suture; suture distinct, not channelled; terminal varix stout, thick, broader and posteriorly expanded at the suture, overrun by the spirals; aperture subovate; pillar-lip calfous, with a raised border, smooth, with a sulcus at the posterior commissure of the mouth; outer lip with two strong teeth near the middle, and faint indications of one or two more anterior to the first pair; canal nearly closed, short, recurved and twisted; siphonal fasciole strong, the base of the whorl constricted behind it. Max. lon. of shell 6.5 [7.0]; max. lat. 3.75 [3.7] mm. * * *.

Emmons' specimen was not adult, but his figure agrees well with small specimens of the present species. It is not known in the recent state. The specimens vary somewhat in size, and in the closeness of their reticulation, as usual in this genus.—Dall, 1890.

Figured specimen: U.S.N.M. 112140, from the Pliocene of the Caloosahatchee River, Fla.

Distribution: Duplin marl, Natural Well, 2 miles southwest of Magnolia, Duplin County, N. C.

Outside distribution: Pliocene, Caloosahatchee marl, Shell Creek and Caloosahatchee River, Fla. (Dall)

Uzita lapenotierei (Dall)

Plate 32, figure 12

1890. *Nassa lapenotierei* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 133, pl. 9, fig. 8.

Shell small, elevated, slender, with three smooth nuclear and five subsequent whorls; transverse sculpture of (on the last whorl ten) elevated, rounded, even ribs with wider interspaces; more prominent near the suture, but crossing the whorl; there are also faint incremental striae; spiral sculpture of (on the last whorl seven to nine) little-elevated bands with somewhat wider interspaces, subnodulous at their intersection with the ribs; between each pair of spiral bands on the last whorl are one to three finer, faint, secondary spirals; some of the specimens indicate that when alive the reticulation appeared white or pale-colored on a much darker ground; on the upper whorls three or four primary spirals are visible; whorls full and rounded, a little turrited; ribs apt to alternate at the suture, which is distinct, but not channelled; aperture small, shorter

than one-third of the shell; outer lip with three teeth, the posterior about the middle of the lip and strongest, the other two anterior to it and successively weaker; pillar-lip with a raised margin on which in the fully adult are two or three transverse, short elevations like teeth; canal very short, the whorl constricted behind it. Max. lon. of shell 7.5 [8.7] of aperture 2.0; max. lat. of shell 3.2 [4.4] mm.

Rare in the Caloosahatchee beds.

Respectfully dedicated to Mr. F. J. Lapenotière, of Tampa, to whom we were much indebted for kind assistance in our work. This species recalls *N. acuta* Say, but has a different sculpture, is smaller and more cylindrical. It is much more slender than *N. bidentata* Emmons. It is not known in the recent state, or from other localities than the one above cited.—Dall, 1890.

Holotype: U.S.N.M. 112141 from the Caloosahatchee River, Fla.

The species can be separated from the coexistent Uzitas by the slender outline and the sharp, relatively few and rather distant spirals, tending to become subnodulous at the intersection with the costals.

Distribution: North Carolina: Waccamaw formation, Walkers Bluff on the Cape Fear River, Bladen County; Neills Eddy Landing, 3 miles north of Cronly, Columbus County.

Outside distribution: Pliocene, Caloosahatchee marl, Caloosahatchee River, Fla.

Uzita suffolkensis Gardner, n. sp.

Plate 30, figures 2, 3

Shell small, slender, somewhat scalariform, the spire elevated. Conchal whorls 5½ in the holotype, closely appressed, only very slightly convex, the later turns narrowly tabulated. Nuclear coils about 2½, the initial half turn for the most part submerged; the succeeding whorls also small, smooth, rapidly increasing in size. Axial and spiral sculpture initiated simultaneously. Axials, when typically developed, 11 to 13 to the whorl, very narrow, rather low, rounded, separated by wider interspaces, equisized except at the subvaricose resting stages, and persisting with uniform strength almost, but not quite, to the posterior suture. Spiral sculpture uniform in character from the protoconch to the basal sulcus; primary spirals low, broad fillets, separated by squarely channelled sublinear interspirals, 6 on the later whorls of the spire, 10 on the body; a single secondary introduced directly in front of the suture. Suture line distinct, undulated by the costals of the preceding whorl. Aperture broadly and obliquely lenticular. Labrum subvaricose, broadly arcuated, contracted at the mouth of the anterior canal, denticulate within. Inner margin excavated. Parietal wall heavily calloused. Anterior canal short, the margins proximate. Anterior fasciole cut off from the body by the rather broad, incrementally striated sulcus; arcuate, spirally lirate, and deeply emarginate.

Dimensions of holotype: Height, 10.4 mm.; maximum diameter, 5.2 mm.; diameter at right angles to maximum diameter, 4.0 mm.

Holotype: U.S.N.M. 325406.

Type locality: One mile northeast of Suffolk, Nansemond County, Va. Yorktown formation.

The species is remarkable for the low and very flat spirals.

Distribution: Yorktown formation, 1½ miles north of Suffolk, 1 mile northeast of Suffolk, and 1 mile west of Suffolk, Nansemond County, Va.

North Carolina: Yorktown formation, Swift Creek near the confluence with the Tar River, Edgecombe County.

Uzita consensoides (Olsson)

Plate 30, figures 5, 8, 14

1916. *Nassa consensoides* Olsson, Bull. Am. Paleontology, vol. 5, No. 27, p. 13, pl. 2, fig. 10.

Shell small, with a large rounded body-whorl and a pointed spire; rather numerous, low, straight ribs, which are crossed by unequal spiral bands; nucleus of 3 pointed whorls, smooth at first but with a few ribs on the later portion; post-nuclear whorls 5; the body-whorl with 15 straight, low ribs; spiral sculpture of irregular bands; 1st post-nuclear whorl with 6 equal spirals; the other spire-whorls have generally 5 heavy and 6 fine spirals; the body-whorl with about 21 spirals, strongest on the middle of the whorl; bordering the suture, there are 6 small, closely crowded spirals; a small sulcus encircles the base, covered with spirals; mouth ovate, angulated above; outer lip thickened and denticulate within; inner lip callused and with a few denticles below; spihonal fasciole strong.

Length 11, breadth 6, body-whorl 6 mm.

This species is readily recognized by its large body-whorl, pointed spire, and unequal, spiral bands. In general characters, the species approaches *N. consensa* Ravenel [pl. 30, fig. 21], but is sufficiently distinct for recognition and is the Miocene precursor of that species.

Duplin formation; Natural Well, N. C.—Olsson, 1916.

Dimensions of figured specimen U.S.N.M. 114204, from Duplin formation, 1½ miles northwest of Magnolia, Duplin County, N. C.: Height, 9.8 mm.; greatest diameter, 5.5 mm. Specimen U.S.N.M. 325402 from near the mouth of Swift Creek, Edgecombe County, N. C.: Height, 9.0 mm.; greatest diameter, 5.5 mm.

The Yorktown forms (pl. 30, figs. 8, 14) do not exhibit the full and elevated ribs of the North Carolina topotype (pl. 30, fig. 5) and the pattern of the spirals is not identical. However, the differences probably may be included within the range of individual variation. The young of some of the more elevated species such as *U. smithiana* and *U. neogenensis* are similar in outline, but the spirals are not so broad and more regular than they are in *U. consensoides*.

The species is especially common at the type locality and the nearby marl pits.

Distribution: North Carolina: Yorktown formation, Swift Creek near the confluence with the Tar River, Edgecombe County. Duplin marl, Natural Well, 2 miles southwest of Magnolia, Duplin County. Waccamaw formation, (?) Neills Eddy Landing, 3 miles north of Cronly, Columbus County.

Uzita caloosaensis (Dall)

Plate 30, figure 25

1890. *Nassa caloosaensis* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 134, pl. 9, fig. 7.

Shell small, with three and a half normal and three smooth, turbiniform nuclear whorls; transverse sculpture of (on the last whorl ten) narrow, moderately elevated ribs, with wider interspaces, which completely cross the whorl and have a pointed nodule or angle at the shoulder; varix large and thick; other transverse sculpture, only of faint incremental lines; spiral sculpture of (on the last whorl seven or eight) sharply incised lines, of which two (the posterior fainter and sometimes absent) are in front of the suture and behind the shoulder, which last is formed by an ill-defined ridge connecting the angles of the ribs; on the base or anterior face of the shell are four of these lines rather close together and with their interspaces convex; between the posterior line and the shoulder are two widely separated similar lines; a deep sulcus divides the base from the short, twisted canal, which is externally covered with spiral threading; the suture is distinct, but not channelled, and somewhat wavy from the ribbing; the sides of the whorls are slightly flattened, the spire a little turrited; the aperture is short and broad, pointed behind; in the middle of the outer lip is one stout tooth with smaller lirae in front and, less often, behind it; the inner lip is more or less granulolirate, with a raised outer margin and a tooth on the body near the junction of the outer lip; canal short, narrow. Max. lon. of shell 4.2 [4.6]; max. lat. 2.4 [2.5] mm.

Caloosahatchie marls, rare.—Dall, 1890.

Holotype: U.S.N.M. 112142.

Possibly this is *Nassa moniliformis* Emmons, but his figure is so indefinite and his description so generalized that their identity can by no means be established. *Nassa cornelliana* Olsson, 1914, from Currie, N. C., exhibits a similar sculptural pattern, but the whorls are more slender and not shouldered.

Distribution: North Carolina: Duplin marl, Natural Well, 2 miles southwest of Magnolia, Duplin County. Waccamaw formation, Walkers Bluff, on the Cape Fear River, Bladen County; Neills Eddy Landing, 3 miles north of Cronly, Columbus County.

Outside distribution: Pliocene, Waccamaw formation, Nixons and Tilly Lake, Horry County, S. C. Caloosahatchee marl, Caloosahatchee River, Fla.

Uzita caloosaensis cornelliana (Olsson)

Plate 30, figure 24

1914. *Nassa cornelliana* Olsson, Bull. Am. Paleontology, vol. 5, No. 24, p. 7, pl. 4, fig. 11.

1930. *Alectrion cornelliana* (Olsson). Mansfield, Florida Geol. Survey Bull. 3, p. 76, pl. 8, fig. 4.

Shell small, heavy, elongate; with three and a half smooth nuclear and four subsequent whorls; suture appressed; the first sculpture to be introduced is a transverse ribbing; this is soon followed by four impressed revolving lines; on the body whorl the transverse sculpture consists of seven or eight large, thick ribs, and these are continued in the same line across the earlier whorls, interrupted at the suture; on the body whorl the transverse ribbing is crossed by about nine impressed revolving lines which on the middle of the whorl are separated by wide bands but become more crowded at the base and next to the suture; on the earlier whorls only four revolving lines are present; the ribbing is made only slightly nodose by the revolving lines and there is no pronounced shoulder to the whorls; canal short, straight, with numerous revolving lines and separated from the rest of the shell by a moderate sinus; mouth subovate in shape, with a small sulcus at the posterior commissure; outer lip thickened and with about seven lirae, which alternate in strength; pillar lip callous, smooth and with a raised border; siphonal fasciole strong.

Height 5, greater diameter 2.5 mm.

This species is characterized by its elongate shape, impressed revolving lines and the strong, transverse ribbing. Its nearest related form appears to be *N. caloosaensis* Dall, but differs from that species in its more elongate form, lack of the shoulder on its whorls and its larger size.

Duplin Miocene (?); Currie, N. C.—Olsson, 1914.

Mansfield, 1930, reported the form from the *Cancellaria* zone of the Choctawhatchee formation in Florida and reallocated to *U. cornelliana* the individuals from the Natural Well, the Cape Fear River, and Mayesville which had been incorrectly referred to *U. caloosaensis* s.s. He also suggested a subspecific relationship between the Caloosahatchee form and that described by Olsson. The later whorls of *U. caloosaensis* s.s are obtusely angular, the shoulder is well defined, and the sides are nearly vertical. The periphery on the body is crested by the axial nodes, and the constriction at the base of the body is more abrupt than it is in the subspecies *cornelliana*.

Mansfield's figured specimen, here reproduced, is U.S.N.M. 370147, from Hosford, Liberty County, Fla. The height is 4.6 mm., the diameter 2.5 mm.

Distribution: North Carolina: Duplin marl, Natural Well, 2 miles southwest of Magnolia, Duplin County; "Duplin Miocene (?), Currie, N. C." (Olsson); Waccamaw formation, Walkers Bluff, on the Cape Fear River, Bladen County; Neills Eddy Landing, 3 miles north of Cronly, Columbus County.

Outside distribution: Miocene, Choctawhatchee formation, *Cancellaria* zone, Hosford, Liberty County, Fla. Pliocene, Waccamaw formation, Nixons and Tilly Lake, Horry County, S. C.

Uzita zeta Gardner, n. sp.

Plate 28, figures 1, 7

Shell of moderate dimensions, distinctly scalariform. Whorls 5 exclusive of the 2½ small, smooth, gently rounded, nuclear turns. Spire pagoda-like, elevated; early whorls merely convex, the later, strongly carinated. Body rather slender, the shoulder conspicuously developed. Sculpture initiated by faint arcuate axials; spirals introduced on initial half turn of conch. Adult costae broad, evenly arched, and separated by equally broad, concave intercostals, numbering 11 or 12 to the turn; evanescent on the shoulder. Spirals continuous from nucleus to basal sulcus; very low, proximate fillets, somewhat irregular in width and spacing, though unaffected by the axial sculpture, numbering 11 or 12 on the later whorls of the spire and 18 to 20 on the body. Peripheral spiral more prominent than the rest, the shoulder spirals increasingly feeble toward the suture. Suture distinct; undulated by the costals of the preceding whorl. Aperture more than one third the total height, broadly lenticular. Labrum subvaricose,

evenly arcuate, irregularly lirate within. Labium excavated at the base of the body whorl, heavily calloused; a denticle usually developed near the posterior sulcus and smaller wrinklings behind the feeble marginal fold; intermediate lirae sometimes present. Anterior canal very short. Anterior fasciole cut off from the body by a gutter; arched, spirally sculptured in the young; the spirals supplanted later by heavy incrementals which follow the outline of the deep basal notch.

Dimensions of holotype: Height, 11.5 mm.; diameter, 6.2 mm.

Holotype: U.S.N.M. 497250.

Type locality: Cronly, Columbus County, N. C. Waccamaw formation.

Uzita zeta differs from *U. consensa* (Ravenel), its probable descendant, by the more slender, scalariform outline, the very much more strongly angulated whorls, the partial obliteration of the axial sculpture on the posterior third of the later whorls, and the much coarser spiral sculpture, which is due to elevated lirations rather than to impressed lines.

Mansfield, 1930, described from the *Cancellaria* zone of the Choctawhatchee formation of Florida two subspecies of *Uzita consensa*, but neither exhibits the angular periphery developed on the final whorls of *U. zeta*.

Distribution: Waccamaw formation, Neills Eddy Landing and Cronly, Columbus County, N. C.

Uzita vibex (Say)

Plate 30, figure 23

1822. *Nassa vibex* Say, Acad. Nat. Sci. Philadelphia Jour., 1st ser., vol. 2, p. 231.

1890. *Nassa vibex* Say. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 132.

Shell cancellate, ventricose, cenereous or pale reddish-brown, with two or three irregular, sometimes obsolete darker fascia; body whorl with twelve thick, prominent costa, and about as many revolving filiform lines, which are not much elevated, and but simply crenate the costa and lip; labrum incrassated, with about two more prominent teeth within; labium callous; spire short, rapidly attenuated to an acute tip.

Length three-fifths of an inch.

Inhabits the southern and middle coast.

Cabinet of the Academy and Philadelphia Museum.

Rather rare. I found but four specimens. For the locality of the coast of the middle states, I am indebted to my brother, Mr. B. Say, who brought me a specimen from the shores of New Jersey.—Say, 1822.

Shell of medium size, rather squat, rudely pyramidal. Whorls closely appressed, 5 to 7, exclusive of the 1½ to 2 small, smooth, convex, nuclear turns. Whorls of spire flat-sided, trapezoidal, tapering rapidly; body whorl broadly inflated, abruptly contracted at the base. Surface reticulated; the axials the first to appear. Costae narrow, rounded, slightly irregular, and undulatory, 12 to 14 to the whorl, interrupted at the suture but seldom alternate, retractive, performing about half a turn, separated by concave intercostals of approximately equal width. Spirals low, flat bands, overrunning the costal and intercostal areas; primaries 3 or 4 on the whorls of the spire; the 2 anterior proximate, the posterior near the suture and somewhat isolated from those in front; body primaries about 10; secondaries commonly introduced between the first and second primaries both of the spire and of the body; interspaces may be slightly wider than the primaries. Suture incised, slightly undulated by the costae of the preceding whorl. Aperture broadly lenticular. Labium deeply excavated. Parietal callus heavy, reflected widely over the face of the body and produced backward almost to the suture; the outline included within the labrum and the outer margin of the callus rudely rectangular. Columella fringed with short dentate wrinkles. Labrum posteriorly produced and subvaricose in the adult, flaring toward the anterior canal, lirate within; the anterior and posterior lirae heavier than the intermediate lirae and proximate to and directly opposite correspondingly heavy lirae on the labium, thus partially enclosing the orifices both for the anterior and the posterior siphons. Canal incipient. Anterior fasciole cut off by a gutter from the base of the body; sculptured with incrementals and a few, feeble, irregular spirals; deeply and obliquely emarginate.

The young are relatively higher with a longer anterior canal and lack the characteristic features of the aperture.

The Miocene representatives differ from the Recent in the broader and more prominent costae and in the more inconstant number and spacing of the spirals. The coexistent Tertiary species of similar outline exhibit a closer and, usually, a more regular spiral sculpture.

Dimensions of figured specimen: Height, 16.3 mm.; maximum diameter, 10.0 mm.

A Recent shell is figured, U.S.N.M. 54738, dredged off the Carolina coast, 25 miles southeast of Cape Fear, in 15 fathoms on a sandy bottom.

Distribution: North Carolina: Duplin marl, Natural Well, 2 miles southwest of Magnolia, Duplin County; 2 miles below Lumberton and 4 to 5 miles below Lumberton on the Lumber River, Robeson County. Croatan sand, Slocums Creek, 15 miles below New Bern, Neuse River, Craven County.

Outside distribution: Miocene, Duplin marl, Pee Dee River, Florence(?) County (Tuomey and Holmes); 5 miles southeast of Mayesville, Sumter County, S. C. Pliocene, Caloosahatchee marl, Sanford, Orange County. Caloosahatchee River, Shell Creek and Myakka River, Fla. Pleistocene, Orient, Hillsboro Bay, Hillsboro County; North Creek and Manatee, Manatee County; Eau Gallie, Brevard County; Labelle, Hendry County, Fla. Recent, Boston Harbor to Bahia, in 0 to 3 fathoms on muddy beaches.

Family FASCIOLARIIDAE

Genus FASCIOLARIA Lamarck

1799. *Fasciolaria* Lamarck, Prodrome d'une nouvelle classification des coquilles: Soc. histoire nat. Paris Mém., p. 73.

Type by monotypy: *Murex tulipa* Linnaeus. Recent, on the East Coast from Hatteras to Cartagena.

Fasciolaria sparrowi Emmons

Plate 32, figure 11

1858. *Fasciolaria sparrowi* Emmons, North Carolina Geol. Survey Rept., p. 253, fig. 115.

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

1892. *Fasciolaria* (*Sparrowi* var.?) *acuta* Emmons. Dall. idem, pt. 2, pp. 229, 230.

1930. *Fasciolaria sparrowi* Emmons. Mansfield, Florida Geol. Survey Bull. 3, p. 62, pl. 8, fig. 2.

1940.(?) *Fasciolaria papillosa duplinensis* Burnett Smith, Palaeontographica Americana, vol. 2, No. 11, p. 5, pl. 1 figs. 1. 2.

Shell rather thick, turbinate; whirls six or seven rounded, ornamented with spiral, and rather rounded ribs; ribs of the body-whirl, about ten, striated longitudinally, but obliquely striated on the upper part of the whirl; plaits, three upon the pillar lip; the ribs alternate, being coarser and finer for the ribs which belong strictly to the aperture; aperture larger than the spire.

This species is quite distinct from the former [*Fasciolaria elegans* Emmons], the ribs are less numerous, flatter, and the striae are partly oblique and partly longitudinal, or in the direction of the axis of the shell. The five upper whirls have varices in both species. Rare in the miocene marl bed of Mrs. Purdys, Bladen county. One-half the size.

This fine fossil is dedicated to Thos. Sparrow, Esq., of Beaufort county.—Emmons, 1858.

F. Sparrowi has been poorly described by Emmons, and it is necessary to devote some study to his description in order to understand exactly what his phrases mean. The typical *Sparrowi* differs from the broad specimens of *F. acuta* in the character of the spiral sculpture, which is sparser, not carinate, with rounded or flat-topped, rather widely separated, elevated threads, with the small intercalary thread often wanting. The aperture is flexuous, the outer lip recedes toward the periphery, and then proceeds forward nearly parallel with the axis, so that the incremental lines cross the axis obliquely behind the periphery and axially in front of it, the periphery being marked by one or more stronger spirals, behind which the whorl is flattened toward the suture. The whorls are crossed by ten or twelve rounded, rather prominent, slightly flexuous ribs, which become obsolete toward the suture, and on the last whorl are well marked only toward the periphery. The interspaces of the spirals are more or less channelled, while in *acuta* the spirals are keeled or sharp-edged, and slope evenly toward the middle of the interspaces from the keel. In *acuta* there are no well-defined ribs on the body-whorl, the shell is less flattened in front of the suture, and has a longer and more twisted canal, being, on the whole, a longer and more slender shell, with more crowded sculpture and less regular ribbing. * * *.—Dall, 1892.

Distribution: North Carolina: Duplin marl, Natural Well, Duplin County. Waccamaw formation, Mrs. Purdy's marl bed, Bladen(?) County (Emmons).

Outside distribution: Miocene, Alum Bluff (upper bed), Fla. Mansfield records the species from the *Ecphora* zone of the Choctawhatchee formation of Florida.

Fasciolaria cronlyensis Gardner, n. sp.

Plate 36, figures 1, 2, 3, 6

Shell large, known only from fragmentary material. Protoconch and earliest whorls of conch lost. Spire high and slender, the shoulder inclined at an angle of about 45° and wider than the height of the whorl in front of the shoulder. Sides of whorls nearly vertical; on the later volutions sloping inward slightly toward the axis of the shell. Body slender, drawn out in front into a long neck. Axials blunt, well-rounded, approximately equal in width to the interaxials, noding the periphery and undulating the sides of the whorl but evanescent on the shoulder. Spirals broad and flat, not very regular in width and spacing, 3 or 4 in front of the periphery; shoulder spirals similar in general character but lower and more irregular; base of body girdled with 2 wider spirals; the canal heavily corded. Sutures undulated by the axials, channelled on the later whorls. Outline of aperture lost because of the breaking of the outer lip. Inner margin of aperture feebly sigmoidal. Columellar folds oblique, parallel; the medial fold the most elevated, the posterior scarcely reaching the mouth of the aperture, the anterior formed by the pinched pillar margin. Parietal wall very heavily calloused, the margin of the callus distinct from the body wall. Lip reverted in the umbilical area and free. Anterior fasciole compressed and twisted. Umbilicus a narrow open trough between the anterior fasciole and the reverted inner lip.

Dimensions estimated from 2 cotypes: Height, 175 mm.; diameter, 60 mm.

Cotypes: U.S.N.M. 325389.

Type locality: Neills Eddy Landing, Columbus County, N. C. Waccamaw formation.

The unusual character of the shell, the large size, angular outline and coarse, flattened spiral sculpture seem to justify the description of the species from material so imperfect and so meager.

Distribution: Waccamaw formation, Neills Eddy Landing, Cape Fear River, 3 miles north of Cronly, Columbus County, N. C.

Genus PERISTERNIA Mörch

1852. *Peristernia* Mörch, Catalogus conchyliorum quae reliquit D. Alphonso d'Aguirra et Gadea, Comes de Yoldi, pt. 1, p. 99.

Type by subsequent designation (Cossmann, Essais paléoconchologie comp., vol. 4, p. 47, 1901): *Turbinella nassatula* Lamarck. Recent, in the Indian Ocean.

Shell of medium size, stout, fusiform in outline. Sculpture vigorous and regular and both axial and spiral. Aperture spatulate. Labrum somewhat thickened, lirate within. Labium excavated at the base of the whorl, bearing at the entrance to the canal 1 or 2 prominent plaits. Canal short and slightly recurved. Umbilicus imperforate.

The genus is first recognized in the Eocene and has a meager representation throughout the remainder of the Tertiary. The Recent species are for the most part confined to the warmer waters, particularly to the Indian Ocean and the Polynesian and China seas.

Peristernia filicata Conrad, subsp.?

Plate 28, figure 14

Shell rather heavy, buccinoid. Aperture approximately half the total height. Whorls of conch 4 to 6, convex, rapidly increasing in diameter. Protoconchal whorls decorticated in all the available material. Axial sculpture of broad, rounded, gently and commonly irregularly undulatory costals, usually 10 on the later volutions, separated by narrower intercostals. Spiral sculpture of sharply elevated primaries which tend to strengthen and expand when overriding the secondaries; 1, rarely 2, secondaries intercalated in the interspiral areas. Five or 6 equal and oblique spirals on canal. Suture line impressed, undulated by the costals of the preceding whorl. Characters of aperture and canal similar to those of *P. filicata* (Conrad), 1843.[21]

Dimensions of figured specimen: Height, 17.0 mm.; maximum diameter, 10.3 mm.

Figured specimen: U.S.N.M. 325398.

Type locality: Two miles southeast of Tugwell, Pitt County, N. C. Yorktown formation.

Peristernia filicata differs from the usual examples of the species in the less vigorous and usually less regular and more numerous costals and the less prominent and usually closer and less regular spirals.

The known range of the variant is limited to the Yorktown formation of North Carolina.

Distribution: Yorktown formation, 2 miles southeast of Tugwell, 2⅓ miles north of Standard, 8 to 9 miles southeast of Greenville, 1½ miles west of Greenville, 9 to 10 miles south of Greenville, and 1 mile northwest of Galloway crossroads, Pitt County, N. C.

Family FUSINIDÆ

Genus FUSINUS Rafinesque

1815. *Fusinus* Rafinesque, Analyse de la nature, p. 145. Substitute name for *Fusus* "Lamarck" Brugière, 1789.

Type by monotypy: *Murex colus* Linnaeus. Recent, in the Indo-Pacific.

Dall [22] and Woodring [23] have discussed the involved synonymy of the group, which has been prized for its beauty by collectors since the days of the prebinomial writers. The phylogeny of the genus was studied by Grabau,[24] formerly of Columbia University.

Shell fairly large, many whorled, slender, spindle-shaped. Protoconch of about 1½ volutions; the first large, smooth, and tilted slightly; the last half turn axially costate and cut off 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 into an exceedingly slender canal. Canal slightly warped toward the anterior 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, sharp edged.

Fusinus exilis (Conrad)

Plate 32, figure 10

1832. *Fusus exilis* Conrad, Fossil shells of the Tertiary formations of North America, vol. 1, No. 1, p. 17, pl. 3, fig. 2 (both rear and apertural views).

1856. (?) *Colus exilis* (Conrad). Tuomey and Holmes, Pleiocene fossils of South Carolina, p. 150, pl. 30, fig. 5.

Not *Fusus exilis* Emmons, North Carolina Geol. Survey Rept., p. 251, fig. 111A, 1858.

1861. *Fusus exilis* Conrad, Fossils of the medial Tertiary of the United States, p. 85, pl. 49, fig. 1 (fig. 4 excluded).

1890. *Fusus exilis* Conrad. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, pp. 126, 127.

1910. *Fusus exilis?* Conrad. Engerrand and Urbina, Soc. Geol. Mexicana Bol., vol. 6, p. 127.

Fusiform, elongated, with longitudinal undulated ribs, and revolving striae, acute, elevated and alternately smaller; beak produced, nearly straight; aperture half the length of the shell.

Locality. James River, Va.—Conrad, 1832.

Engerrand and Urbina referred questionably to Conrad's species imperfect material from Zuluzum, Chiapas, Mexico. The specific identity of the forms from Chiapas and from Virginia is extremely doubtful.

Mansfield, 1930, described, under the name of *Fusinus dalli*, a species occurring in the *Ecphora* and *Cancellaria* zones of the Choctawhatchee formation that Dall had included under *F. exilis* in his 1903 checklists. The Florida species is a stouter, more inflated shell, with a much lower spire and a sparser sculptural pattern.

Distribution: Miocene, James River, Virginia. The species is not represented in the later collections.

Outside distribution: Duplin marl?, Pee Dee River, Florence? County, S. C. (Tuomey and Holmes).

Fusinus burnsii (Dall)

Plate 32, figure 5

1861. *Fusus exilis* Conrad, Fossils of the medial Tertiary of the United States, pl. 49, fig. 4 (synonymy and fig. 1 excluded).

1890. *Fusus burnsii* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 126.

F. Burnsii is named in honor of Mr. Frank Burns, of the U. S. Geological Survey, to whose ability and energy as a collector of fossils in the Southern Tertiary I am greatly indebted.

F. Burnsii resembles *F. exilis*, but wants the ribs on the last whorl, which is fuller and rounder, while the earlier whorls are more acute. The spiral threads are minutely notched or serrated by impressed incremental lines on the upper whorls. It also resembles *F. equalis*, which is a more robust shell, with coarser sculpture, and built on a larger scale. There is some

[21] Conrad, T. A., Descriptions of a new genus and of twenty-nine new Miocene, and one Eocene, fossil shells of the United States: Acad. Nat. Sci. Philadelphia Proc., 1st ser., vol. 1, p. 308. Described as *Buccinum (Pollia) filicatum* Conrad.

[22] 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.

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

[24] Grabau, A. W., Phylogeny of *Fusus* and its allies: Smithsonian Misc. Coll. No. 1417, pp. 1–192, 23 text figs., pls. 1–18, 1904.

reason to believe that Mr. Conrad considered *F. Burnsii* as a variety of his *F. exilis*, from a MS. note in one of the books belonging to the late F. B. Meek, but if this was his opinion I cannot join in it. Prof. Meek has also recorded his opinion that the two were distinct.—Dall, 1890.

Type locality: James River, near Smithfield, Va.

Dimensions of figured specimen: Height, 63 mm.; maximum diameter, 22 mm.

Figured specimen: U.S.N.M. 97492, from Petersburg, Va. Yorktown formation.

Shell rather large, 7 or 8 whorls, regularly fusiform. Aperture a little more than half the total height. Maximum diameter at or a little in front of the median line. Spire slender, the volutions convex, tapering gradually to an acute apex. Protoconch of 1½ to 2 whorls; initial turn smooth, convex, tilted, of approximately the same size as the succeeding volution; final half turn of protoconch sculptured with about 12 axial riblets, separated by narrower interspaces. First whorl of conch marked by the initiation of the spiral sculpture. Spirals vigorous, covering the shell from protoconch to base of anterior canal; sharply elevated, in cross section like an inverted **V**, the primaries 4 to 6 on the whorls of the spire and 20 on the body whorl and pillar; smaller sharply ridged secondaries intercalated between the primaries and separated from them by linear interspaces; tertiaries occasionally introduced on the periphery of the final whorl. Typical axial sculpture of some 10 broadly arched, undulating costals, separated by concave intercostals of approximately the same width, strongest on the periphery, weakening anteriorly and commonly evanescing completely before reaching the posterior suture; in the adults, obsolete on the body and in some individuals on the final whorl of the spire; fine crinkled incrementals faintly visible over the entire external surface, least feeble in front of the suture. Anal fasciole obscurely differentiated by the tendency toward the evanescence of the axial sculpture and the much finer spiral sculpture. Pillar rather broad, more sharply sculptured than the rest of the shell; anterior fasciole threaded with 6 crowded inconspicuous lirae. Aperture spatulate. Columellar lip slightly sinuous, contracted at the base of the body whorl. Parietal wall so thinly glazed posteriorly that the spiral sculpture is not obliterated; the callus abruptly thickening at the turn in the columella. Anterior canal long, slender, with parallel margins; obliquely truncate at the base.

The characteristic sculpture of *Fusinus burnsii* (Dall) is distinct from that of its nearest kin. The spirals are prominent, close-set, in cross section like an inverted **V**; the intercalated secondaries of similar outline, thus giving in cross section the contour of a saw with alternating, larger and smaller teeth. In *F. heilprini* Gardner the spirals are flattened on the top and separated by much wider interspaces without intercalated secondaries. In *F. exilis* (Conrad) both the primaries and secondaries are relatively narrower at the base than in *F. burnsii* (Dall) and separated by wider interspaces in which the incrementals are plainly visible.

Mansfield, 1935, described from the *Arca* zone of the Choctawhatchee formation, in Walton County, Fla., *Fusinus alaquaënsis*, closely allied to *F. burnsii* but more slender, and apparently with a less persistent axial sculpture.

Distribution: Virginia: Yorktown formation, Yorktown, York County; Petersburg, Dinwiddie County; 5 miles northeast of Smithfield, and at Fergusson's Wharf, Isle of Wight County; 7 to 7½ miles below Zuni on the Blackwater, Sycamore on the Nottoway, and Maddelys Bluff on the Meherrin River, Southampton County; a quarter of a mile north of Chuckatuck, 1½ miles north of Suffolk, 1½ miles northeast of Suffolk, 1 mile northeast of Suffolk, and half a mile below the Suffolk waterworks dam, Nansemond County.

North Carolina: Yorktown formation, (?)Colerain Landing, on the Chowan River, Bertie County; Shiloh Mills on the Tar River, Edgecombe County; 2 miles southeast of Tugwell on Jacob's Branch, 2⅛ miles north of Standard, 1½ miles west of Greenville on Schoolhouse Branch, Greenville, just east of County bridge, 8 to 9 miles southeast of Greenville and 1 mile northwest of Galloway crossroads, Pitt County.

Fusinus heilprini Gardner, n. sp.

1863. *Neptunea equalis* Conrad (part), Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 560.
Not *Fusus equalis* Emmons, 1858.
1890. *Fusus equalis* Emmons (part). Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 126.
1892. *Fusus equalis* Emmons. Dall, idem, pt. 2, p. 234, pl. 14, fig. 3b.
1909. *Heilprinia equalis* (Emmons). Grabau and Shimer, North American index fossils, vol. 1, p. 775, fig. 1131b.

Shell moderately large, heavy, rather stout for the genus; maximum diameter a little behind the median horizontal. Whorls approximately 7, broadly convex, tapering rapidly to an acute apex. Protoconch small, including a little more than 2 whorls; tilted and immersed at the extreme tip; high and full medially, obliquely flattening on the final half turn; axial costae introduced within the first whorl, more closely spaced toward the close of the final whorl. Opening of conch marked by appearance of initial spiral outlining the shoulder margin and later forming the prominent anterior spiral of the adolescent shell; a second primary, posterior to the first, introduced within the first quarter turn of the conch; 2 secondaries and a sutural cord manifest on the shoulder before the close of the first whorl of the conch. Earlier whorls of conch axially undulated by 9 to 11 broadly arched costals, separated by narrower, more convex intercostals; ribs most strongly defined on earliest volutions, gradually becoming broader and less elevated and evanescing altogether on the later whorls of the adult spire. Spiral sculpture developed over the entire shell; first 2 or 3 turns of the conch sculptured with only 2 narrow, moderately ele-

vated primary lirae which overrun the costals and a few secondaries; later whorls of the spire usually exhibiting 4 to 6 equisized and equispaced lirae on the medial and anterior portions, separated by interspirals of approximately double the width of the spirals, and 4 to 6 finer, more closely spaced lirae on the posterior portion of the whorl. Body sculpture similar in character to that of the spire; 4 or 5 relatively fine, crowded lirae in front of the suture and between them and the opening of the anterior canal, 12 or 14 more elevated and distant lirations; spirals on the canal acute and more prominent than any of those behind them, approximately 10, exclusive of occasional secondaries and 6 or more very fine, crowded, and minutely crenulated lirae on the siphonal fasciole. Incrementals strong, most obvious on the interspirals of the canal. Suture line distinct, impressed. Aperture between two-thirds and three-fourths of the total altitude. Outer lip thin, simple, broadly arcuate, sculptured internally by linear lirations corresponding in position to the interspiral areas of the exterior. Inner lip gently excavated, the curvature less than that of the outer lip. Parietal wall heavily glazed, lirate in harmony with the spirals; the lirae persistent apparently to the apex. Anterior canal long, straight, the margins parallel and proximate, the extremity obliquely truncate.

The specimen figured by Dall in 1892 is considered the holotype.

Dimensions of holotype: Height, 90 mm.; diameter, 38 mm.

Holotype: U.S.N.M. 112381.

Type locality: Natural Well, Duplin County, N. C. Duplin marl.

Emmons, in the report of the North Carolina Survey for 1858, described and poorly figured under the name *Fusus equalis*, a form from Walkers Bluff that is probably identical with *F. caloosaensis carolinensis* Dall. Two of the most striking diagnostics of Heilprin's *F. caloosaensis*, the length of the pillar and the sharp contraction at the base of the body whorl, show up well in Emmons' figure, crude as it is. The sculpture is similar to that of *F. caloosaensis*, except for the apparent restriction of the axials to the earlier whorls, and differs from the species just described in the less numerous and more equispaced spiral lirations. However, the figure is so generalized that it is unsafe, in any case, to count on the verity of the details. The forms commonly assigned to *Fusinus equalis* (Emmons) and now segregated under *F. heilprini* are larger, heavier, more regularly fusiform, with a somewhat shorter, broader pillar, less sharply differentiated from the body whorl; stronger, more numerous spirals, more uniform in size and spacing and a less persistent axial sculpture than that of *F. carolinensis*. Emmons' type locality is Walkers Bluff on the Cape Fear River, N. C., and *F. carolinensis* has not been reported except from the Waccamaw formation of the Carolinas; *F. heilprini*, on the contrary, is confined apparently, to the Duplin marl.

Fusinus heilprini is a stouter shell also than either *F. burnsii* (Dall) or *F. exilis* (Conrad); it differs, furthermore, in the less persistent axial sculpture and a spiral sculpture of obtuse lirations without intercalcaries in place of sharp lirations with intercalcaries as in both *F. burnsii* and *F. exilis*.

Distribution: Duplin marl, Natural Well, 2 miles southwest of Magnolia, and at Mr. W. H. Kornegay's marl pit, 4 miles northeast of Magnolia, Duplin County, N. C.

Fusinus rappahannockensis Gardner, n. sp.

Plate 32, figures 6, 7

Shell slender, fusiform, acutely tapering above and below, whorls 5 or 6. Prontoconch small and smooth; apex of spire so badly decorticated that it is impossible to determine the exact number of turns, though it probably does not exceed 1½. Volutions of conch convex, well rounded at the periphery; early whorls undulated by 13 to 16 axial riblets, gradually weakening on the later whorls and becoming obsolete on the body. Incrementals visible on the fasciole and pillar without the aid of a lens. Almost the entire surface of the shell covered with low, flat, spiral bands; lirae well rounded on the early whorls of the spire, subnodular at the intersection with the costae, broadening and flattening on the final whorl of the spire; the spirals in one of the two cotypes increasing to 4, the second and third the broadest and the most prominent, that nearest the posterior suture relatively weak, the fourth, the last of the primaries to appear, introduced directly behind the anterior suture, partially concealed near its origin by the succeeding whorl but gradually broadening and increasing in prominence. Secondaries about one-half the width of the primaries and separated from them by linear grooves; 17 primaries on the body whorl and pillar, those on the periphery broad, flat, and low, gradually becoming more rounded toward the base of the pillar; equisized secondaries, a little more than half as wide as the primaries regularly inserted on the posterior part of the whorl, becoming more narrow toward the pillar and finally disappearing. Whorls appressed; suture somewhat wrinkled by the incrementals. Anal fasciole wide, slightly concave, persisting well up toward the apex. Aperture obliquely pyriform, the curve unbroken at the posterior commissure. Margin of outer lip crenulated by the spiral lirations, in one individual produced backward so that it conceals the anterior primary of the preceding volutions. Labrum lined with a smooth callus. Columella excavated, covered with a thin wash. Canal rather long, originating abruptly, gently recurved, the margins parallel and proximate. Terminal notch very shallow.

Dimensions: Height of first cotype, 15 mm.; maximum diameter, 7 mm. Height of second cotype, 15.2 mm.; maximum diameter, 6.1 mm.

Cotypes: U.S.N.M. 325397.

Type locality: One to 2 miles below Bowlers Wharf, on the Rappahannock River, Essex County, Va. St. Marys formation.

The species is represented only by the two cotypes.

Fusinus rusticus (Conrad) is perhaps the nearest to this species. The latter is readily separated from it by the more slender outline, the more tapering spire consequent upon the lower ratio between the diameter and height, and the regular undulations confined to the early whorls.

Superfamily VOLUTACEA

Family OLIVIDAE

Genus OLIVA Martyn

1786. *Oliva* Martyn, Universal conchologist, vol. 3, Explanatory table, pl. 111.

Type by subsequent designation (Dall, U.S.N.M. Proc., vol. 29, p. 428, 1905): *Oliva corticata* Martyn. Recent, off the coasts of Guinea.

Oliva idonea Conrad

Plate 38, figures 1, 8

1839. (April) *Oliva idonea* Conrad, Fossils of the medial Tertiary of the United States, No. 1, inside of back cover.

Shell subcylindrical, thick: suture profound; summit of penultimate whorl slightly carinated in consequence of a slight submarginal groove. Length 1⅜ inches, width 1⅛ inches. *Locality*, with preceding [*Serpula virginica* from "near Urbanna, Virg."].—Conrad, 1839.

The figured specimen is presumably the holotype but it exceeds the crude measurements given by Conrad. This middle Miocene representative of the *Oliva reticularis* and *O. sayana* group is broader, relatively, and the maximum diameter falls farther forward than in either the other Tertiary allied species or the Recent forms. The group is abundantly represented in the middle and upper Miocene of the Caribbean region, but the temperature conditions in Miocene times along the middle Atlantic slope were less favorable to warm water forms. *Oliva eborea*, also from the Miocene of Virginia, is similar to *O. idonea* in outline and relative dimensions but seems to be a smaller shell, with an outer lip more flaring anteriorly though not at all expanded directly in front of the commissure.

Oliva idonea is comparatively rare in the St. Marys formation of Urbanna, Va.

Oliva eborea (Conrad)

Plate 38, figure 15

1862. *Dactylus* (*Strephona*) *eboreus* Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 287.

Slightly tumid on the upper part of body whorl; whorls 6 in number, the penultimate contracted below the suture; columella slightly tumid, with numerous acute plaits, and five oblique plaits at base, four of them elongated. Locality. Virginia.—Conrad, 1862.

Holotype?: Acad. Nat. Sci. Philadelphia 1612.

Oliva eborea suggests *O. idonea* in outline and relative dimensions, but it is little more than half as large as the holotype of *O. idonea*, although the development of the callus in *O. eborea* indicates a fully adult shell. In addition, the outer lip flares more widely in front, and the angle at the posterior commissure is more acute than in *O. idonea*. The relatively broad outline and forward placement of the maximum diameter, characters common to both of the species from Virginia, separate them from *O. reticularis* and its subspecies and from the majority of the southern Olivas. *Oliva liodes waltoniana*, from the Shoal River formation of Florida, is about the same size and only slightly more slender. The aperture of the Florida form is not so wide as in the more northern and probably younger species, and the margins of the aperture are more nearly parallel.

Mansfield reports *Oliva eborea* from both the upper and lower parts of the St. Marys formation of the Rappahannock River, Va.

Oliva robesonensis Gardner, n. sp.

Plate 38, figures 16, 17

Shell small for the genus, heavy, porcelaneous, subcylindrical. Surface smooth except for a few incrementals that are scarcely perceptible in the fresh shells though brought out in weathering. Volutions 6 or 7. Spire short, one-third to one-fourth of the entire shell, tapering gradually to a subacute apex. Nucleus not well differentiated. First 2 or 3 coils convex, with well rounded shoulders; remaining whorls of spire trapezoidal. Body whorl slightly globose just anterior to the suture line and somewhat contracted at the base. Suture deeply channelled on the later volutions, shallowing as it approaches the apex; channel formed by undercutting of the base of the whorl posterior to it, limited anteriorly by the sharp edge of the succeeding turn. Aperture about two-thirds the total altitude; narrow with subparallel margins. Outer lip comparatively thin, sharp edged, flaring slightly at the base. Labium a little shorter than the labrum, obliquely truncate near the base. Heavy deposit of callus extending from the posterior margin of the body whorl to the anterior, abruptly thickening near the base; callus sharply demarked by a line which originates back of the posterior commissure, contracts toward the aperture just anterior to the middle of the whorl and abruptly expands at the basal thickening of the deposit; posterior and central portions of callus folded into 10 to 12 wrinkles set at right angles to the axis of the shell; heavier anterior portion sculptured with 3 to 6 sharp ridges that are slightly undercut posteriorly and extend almost but not quite to the basal notch; 2 much thinner additional coats of enamel spread out over the anterior area; the

later of the 2 bounded by a line that originates at the columellar callus just back of the maximum deposition and that after passing the basal notch runs parallel to the margin of the shell at a distance of about 1 millimeter from it and, in some individuals, turns the angle at the base of the labrum and continues up along its outer margin almost to the sutural channel; line marking posterior limit of earlier deposit rising in central portion of labium and extending around the shell, reaching the margin of the labrum at about three-fourths of the distance from the posterior canal. Basal notch oblique and very deep.

Dimensions: Holotype height, 17.2 mm.; maximum diameter, 7.2 mm. Paratype height, 18.4 mm.; maximum diameter, 7.8 mm.

Types: Holotype, U.S.N.M. 325377, from 1 mile west of Lumberton, Robeson County, N. C. Paratype, U. S. N. M. 325379, from 2 miles below Lumberton, Robeson County, N. C. Both holotype and paratype from the Duplin marl.

Oliva robesonensis is a well characterized species. It is separated from *O. reticularis* by the smaller size and the more gradually tapering spiral whorls that exhibit no tendency toward the slight concavity apparent in most of the *reticularis* group. Young *O. reticularis* of the same size as *O. robesonensis* are readily separable by the shorter spire terminating in a more obtuse apex, the more cylindrical outline, the closer contraction of the body whorl anteriorly, the shallower sutural channel, and the absence of the heavy pillar callus. Some specimens of *Olivella mutica* attain the height of this small *Oliva*, but they can be recognized by the less oblique and more shallow basal notch. In addition, the outline of *O. mutica* is more elliptical, the body whorl shorter and the sutural channel less profound.

Distribution: Duplin marl, 4 miles north of Lumberton, 1 mile west of Lumberton, and 2 miles below Lumberton, Robeson County, N. C.

Genus OLIVELLA Swainson

1831. *Olivella* Swainson, Zoological illustrations, 2d ser., vol. 2, pl. 58, and text.

Type by subsequent designation (Dall. U. S. Geol. Survey Prof. Paper 59, p. 31, 1909): *Olivella purpurata* Swainson=*Olivella dama* Mawe. Recent, off the west coast from southern California to the Gulf of California.

Small, polished, cylindrical shells, produced into tapering spires. Suture channelled. Aperture narrow posteriorly, dilated anteriorly. Outer lip simple, sharp. Inner lip calloused near the suture, obliquely plicate in front. Anterior extremity emarginate.

Olivella is smaller than *Oliva*, the spire is higher, and the basal notch more shallow. In the living shells, *Olivella* is further distinguished by having an operculum but no eyes, whereas *Oliva* has eyes but no operculum.

Olivella has not been recorded from strata older than the Eocene.

The distribution of the Recent *Olivella* is similar to that of *Oliva*.

Olivella carolinae Gardner, n. sp.

Plate 38, figures 22, 23

Shell of moderate dimensions, ovate conic. Whorls about 6½ in all, the first turn and a half comprising the small smooth blunt protoconch. Early whorls of conch very narrow, increasing rapidly in width, trapezoidal in profile so that the spire as a whole is evenly tapering. Body broadly rounded, the greatest diameter falling near the median line of the shell. Whorls separated by channelled sutures; the margin undercut behind the suture; the margin in front of the suture, thin and sharp. Surface smooth and in the holotype retaining its high polish. Aperture cuneate, acutely angled posteriorly. Parietal callus heavy; the outer limit clearly defined, descending obliquely from the posterior suture of the body whorl to the callus encircling the terminal notch. A heavy inner pad superimposed, scored with grooves normal to the axis of the shell posteriorly, oblique anteriorly; pillar slightly excavated near its extremity; callus abruptly thickened along the outer margin of this depression. Terminal notch deep, broadly and obliquely U-shaped, the base of the body reinforced by a thin relatively wide band of callus heavier on the labial arm of the notch than on the labral, not continued backward along the margin of the thin outer lip.

Dimensions of holotype: Height, 16.2 mm.; diameter, 7.2 mm.

Holotype: U.S.N.M. 325378.

Type and only locality: One mile west of Lumberton, Robeson County, N. C. Duplin marl.

Olivella carolinae covers relatively large, rather high-spired forms included by some of the earlier authors under *O. mutica* Say and by Dall, 1890, under *O. nitidula* (Dillwyn). It does not seem to be matched by any of the variants in the Choctawhatchee formation of Florida. The large size, about 3 times that of the common *O. mutica*, and the rather high and very regular spire may serve to isolate the species. It has been recognized only at the type locality.

Family VOLUTIDAE

The volutes as a family are separated from the Marginellidae, on the one hand, by the larger size, the unpolished surface, the greater prominence of the anterior canal and the columella bent slightly toward the axis of the shell; from the Mitridae, on the other hand, by the decreasing prominence of the columellar folds anteriorly instead of posteriorly.

Dall,[25] divided the family of the Volutidae into two subfamilies on the basis of the protoconchal characters. The Volutinae he characterized as follows: "Shell with the protoconch shelly and persistent, the adult usually elegantly coloured. * * * operculum usually absent; teeth of the radula usually in one tricuspid series." The name of the second subfamily, the Caricellinae, was incorrectly used by Dall to replace the older Scaphellinae, characterized as follows: "Shell with the protoconch membranous and caducous within the ovicapsule; operculum absent; other characters, much as in *Voluta;* the radula variable, sometimes absent." The name Caricellinae was chosen because the Eocene genus *Caricella* is the ancestral type of the North American volutes possessing a membranous protoconch. All of the forms represented in the North Carolina Tertiary are assignable to the second subfamily.

Genus SCAPHELLA Swainson

1832. *Scaphella* Swainson, Zoological illustrations, 2d ser., vol. 2, pl. 87 (expl. text).
1889. *Scaphella* Swainson em. Dall, Harvard Coll. Mus. Comp. Zoology Bull., vol. 18, p. 147.
1890. *Scaphella* Swainson. Dall. Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 79.
1906. *Maculopeplum* Dall, Nautilus, vol. 19, p. 143. Type *Voluta junonia* Lamarck (sic).
1907. *Maculopeplum* Dall, Smithonian Misc. Coll., vol. 48, pt. 3, p. 370.

Type by subsequent designation (Herrmannsen, Indicis generum malacozoorum, primordia, vol. 2, p. 423, 1848); *Voluta junonia* Chemnitz. Recent, from Cape Lookout to the Florida Keys and the Gulf of Mexico in 10 to 30 fathoms.

The group differs from *Aurinia* in its preservation of normal characters, such as the solid and substantial shell, and well developed columellar plaits, the anterior stronger. It agrees with that genus in starting with a membranous protoconch, which is afterward lost; in having no radula or operculum; and in its style of coloration.—Dall, 1907.

Scaphella trenholmii (Tuomey and Holmes)

Plate 36, figure 5

1856. *Voluta Trenholmii* Tuomey and Holmes, Pleiocene fossils of South Carolina, p. 128, pl. 27, figs. 7, 8.
1890. *Scaphella Trenholmii* Tuomey and Holmes. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 88, pl. 6, fig. 10.
1930. *Maculopeplum trenholmii* (Tuomey and Holmes). Mansfield, Florida Geol. Survey Bull. 3, p. 59, pl. 5, fig. 12.

Shell fusiform, ventricose, whorls compressed above, spirally and transversely striated; striae at the base coarser and wrinkled; spire short, subcancellated, papillated; aperture semilunar; outer lip acute, smooth within; columellar lip very thin, decumbent, almost obsolete, semi-callous not distinguishable from body whorl but by outline and color; columellar varicose or tumid, tortuous, obliquely plaited with three folds.

The tumid ridge which begins at the middle plication on the columellar, is formed by the successive termination of the siphonic notch or beak, and produced by the transverse lines of growth. The semi-callous decumbent lip, described above is obsolete in the adult shell.—Tuomey and Holmes, 1856.

[25] Dall, W. H., Review of the American Volutidae, Smithsonian Misc. Coll., vol. 48, pt. 3, pp. 341–373. 1907.

Type localities: Waccamaw, Georgetown County, and Sumter, Sumter County, S. C.

Dimensions of figured specimen: Height, 68 mm.; maximum diameter, 29 mm.

Figured specimen: U.S.N.M. 114314, from 1½ miles northwest of Magnolia, Duplin County, N. C.

An individual apparently referable to this species, although unusually inflated, bearing 4 plaits instead of 3 and attaining a maximum height of 105 millimeters, was collected in the vicinity of the Natural Well in Duplin County, N. C., by Mr. Joseph Willcox and presented by him to the Wagner Free Institute of Science in Philadelphia.

Scaphella trenholmii is apparently a dependable, though rather rare, cachet of the upper Miocene of the southern Atlantic Coastal Plain.

Distribution: Duplin marl, Duplin County, N. C.

Outside distribution: Miocene, Duplin marl, Waccamaw and Sumter, S. C. (Tuomey and Holmes). Choctawhatchee formation, *Ecphora* zone, Alum Bluff (upper bed), Liberty County, Fla.

Scaphella precursor Gardner, n. sp.

Plate 36, figures 7–9

Scaphella precursor shares the general characteristics of *S. floridana* (Heilprin) from the Caloosahatchee formation, and the young *S. floridana* passes through a stage similar to that of the adult *S. precursor.* The Waccamaw species is a slender shell of probably 4 or 5 whorls. The 19 or 20 ribs on the final whorl of the spire are sharp and V-shaped in cross section; the young *S. floridana* develops 20 similar ribs. The spirals are inconspicuous flat-topped, wavy lirae, fairly regular in spacing, not far from 60, separated in *S. precursor* by interspaces of about twice their breadth, in *S. floridana* by interspaces of a little more than once their breadth. In both species there is a constriction with a pronounced change of sculpture anterior to the sutures. On the body whorl of the young *S. floridana* and the earlier whorls of *S. precursor*, this takes the form of a row of detached nodules not unlike those of *Terebra dislocata* Say. On the later whorls of *S. precursor* these postsutural nodules become obsolete and are replaced by a slightly convex area ornamented with about 8 rather pronounced, wavy spirals. Like the axial markings, the spirals persist within the aperture. The aperture is, unfortunately, badly broken in the two specimens of *S. precursor* that were collected. However, it was probably rather narrow, angulated posteriorly and flaring slightly anteriorly. The columella is straight and quadriplicate. The folds seem to be more conspicuous than those of *S. floridana.*

Dimensions of incomplete cotypes: First cotype height, 78 mm.; diameter, 28 mm. Second cotype height, 88 mm.

Cotypes: U.S.N.M. 325387.

Type locality: Neills Eddy Landing, Cape Fear River, Columbus County, N. C. Waccamaw formation.

Two badly broken adult forms were collected from the marls. It is hoped that further material may furnish the young of this interesting volute.

Genus AURINIA H. and A. Adams

1853. *Aurinia* H. and A. Adams, Genera of Recent Mollusca, vol. 1, p. 166.

Type by monotypy: *Aurinia dubia* Broderip. Recent, from North Carolina to the Florida Keys and the Gulf of Mexico, in 34 to 168 fathoms. Fossil in the late Tertiary of the southeastern Gulf Coastal Plain.

The genus is set apart from *Scaphella* by the development of no more than 2 columellar plaits and the obsolesence of these with age. The shell is thin and the nucleus caricelloid. Dall regarded it as the degenerate descendant of the Eocene *Cœricella*. The group has been restricted to east American waters since its beginnings.

Aurinia obtusa (Emmons)

Plate 36, figure 10

1858. *Voluta obtusa* Emmons, North Carolina Geol. Survey Rept., p. 263, fig. 141.

1863. *Voluta obtusa* Emmons. Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 563 (name only).

1890. *Scaphella (Aurinia) obtusa* Emmons. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 80, pl. 7, fig. 7.

1904. *Scaphella (Aurinia) obtusa* (Emmons). Martin, Maryland Geol. Survey, Miocene, p. 175, pl. 44, fig. 11.

Shell fusiform, contracted above the body-whirl, and forming thereby a subcylindrical spire; spire obtuse, apex papillated and hooked; body-whorl plaited longitudinally at its top; columellar lip furnished with only two plaits.—Emmons, 1858.

Type locality: Mr. Flower's marl pit, Bladen County, N. C.

This species is known almost entirely from immature shells characterized by the bulbous nucleus, terminating posteriorly in an upturned tip, the subangular subtuberculated volutions of the spire, and the more or less shouldered body whorl, sculptured with well-developed incrementals and fine crowded spiral lirations. As in *Aurinia mutabilis*, the 2 plaits terminate abruptly on reaching the aperture. It differs from the former species, however, in the broader, more bulbous protoconch.

A young form collected at Sycamore, Va., is similar in nuclear characters, form, and sculpture to the typical *Aurinia obtusa* but differs in the development of a third, less prominent, plait intercalated midway between the two stronger folds.

The figured specimen in the possession of the Wagner Free Institute of Science was collected by Mr. Joseph Willcox and is 127 millimeters high. It bears the name "*Aurinia obtusa*," but is doubtfully referable to that species.

Distribution: Virginia: Yorktown formation, Yorktown, York County; Sycamore, Southampton County; Hitchcock, Greensville County; a quarter of a mile north of Chuckatuck, 1¼ miles north of Suffolk, 1 mile northeast of Suffolk and at Suffolk, Nansemond County.

North Carolina: Yorktown formation, 1 mile above Branchs Bridge, Northampton County; Murfreesboro and Mt. Pleasant Landing, Hertford County; Colerain Landing, Bertie County; Palmyra Bluff, Halifax County; 1 mile below old Sparta Bridge, Edgecombe County; 8 to 9 miles west of Greenville, 1½ miles west of Greenville, 8 to 9 miles southeast of Greenville, and 1 mile northwest of Galloway crossroads near Winterville, Pitt County. Duplin marl, Natural Well near Magnolia, Duplin County. Waccamaw formation, Neills Eddy Landing on the Cape Fear River near Cronly, Columbus County; City Rock Quarry at Wilmington, New Hanover County. Waccamaw formation(?), Mr. Flower's marl pit, Bladen County.

Outside distribution: Miocene, Calvert formation, Plum Point, Md. St. Marys formation, St. Marys River, Md. Pliocene, Waccamaw formation, Nixons, Tilly Lake, and Todds Ferry, Horry County, S. C.

Family MARGINELLIDAE

Among the more comprehensive papers concerning the Marginellidae may be mentioned Jousseaume's "Coquilles de la famille des marginelles" published in the Revue et Magasin de Zoologie, 1875, and two papers by J. R. LeBrockton Tomlin, "A systematic list of the Marginellidae," including Recent species only, and "A systematic list of the fossil Marginellidae." The first paper appeared in the Proceedings of the Malacological Society of London, vol. 12, parts 5 and 6, pp. 242 to 306, in August and November, 1917; the second in the same journal, vol. 13, in August 1918, and April 1919. The papers served as presidential addresses delivered in successive years, and are an important source of factual information.

Genus MARGINELLA Lamarck

1799. *Marginella* Lamarck, Prodrome d'une nouvelle classification des coquilles: Soc. histoire nat. Paris Mém., p. 70.

Type by monotypy: *Voluta glabella* Linnaeus. Recent, off the West Coast of Africa.

Subgenus VOLVARINA Hinds

1844. *Volvarina* Hinds. Zool. Soc. London Proc., pt. 12, p. 75.

Type by original designation, fide Woodring, 1928: *Marginella avena* Valenciennes. Recent, in the West Indies.

Marginella (Volvarina) avena avenacea Deshayes

Plate 38, figure 11

1844. *Marginella avenacea* Deshayes, Lamarck's Histoire Naturelle animaux sans vertèbres, 2d ed., vol. 10, p. 454.

1890. *Marginella avena* var. *avenacea* Deshayes. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 54.

Shell moderately small, smooth, polished, subcylindrical, the maximum diameter within the posterior half. Volutions 3 to 4, closely wound, the earlier whorls almost but not completely enveloped by the body. Apex obtuse; protoconch not distinguishable from the conch. Surface sculpture absent excepting for submicroscopic incremental striations. Suture line obscure, particularly near the apex. Aperture extending almost, but not quite to the apex of the shell, very narrow, the

margins parallel except for a slight divergence near the anterior extremity. Outer lip simple, projected backward across the body and final whorl of the spire almost to the posterior suture; departure of outer lip from the parietal wall abrupt; margin thickened, inflexed medially, slightly flaring anteriorly. Columellar margin gradually contracting anteriorly. Columellar plaits 4, the 2 medial folds equal and obliquely parallel, the posterior fold more feeble, and more sharply oblique than those in front of it, the anterior fold marginal and more feeble than those behind it. Parietal wall not enameled. Anterior extremity truncate, not emarginate.

Dimensions of figured specimen: Height, 9.6 mm.; maximum diameter, 3.8 mm.

Figured specimen: U.S.N.M. 54998. Living in the West Indies.

Marginella avena avenacea Deshayes is remarkable for its slender subcylindrical outline. *Marginella collina* Olsson, from the Gatun stage, Banana River, Costa Rica, is extremely close to the Recent West Indies species. The only difference observed from a comparison of the figured Recent shell and topotypes of *M. collina* is in the outer lip; that of *M. avena avenacea* is thickened slightly, but the callus is not defined externally; in the fossil species, the thickened outer margin is delimited by a clearly incised linear groove.

Dall characterized the subspecies as a "dwarf *M. avena*."

Distribution: Duplin marl, Natural Well, Duplin County, N. C. Outside distribution: Pliocene, Caloosahatchee marl, Caloosahatchee River, Fla. Recent, Florida and the Antillean region in both shallow and deep water.

Subgenus SERRATA Jousseaume

1875. *Serrata* Jousseaume, Revue mag. zoologie, sér. 3, vol. 3, p. 167.

1928. *Serrata* Jousseaume. Woodring, Carnegie Inst. Washington Pub. 385, p. 239.

Type by tautonymy: *Marginella serrata* Gaskoin. Recent, off Mauritius.

The apparent spire gives to all the members of this group a spindle outline. The narrow aperture is dentate along the thickened outer margin and commonly quadriplicate along the inner edge. The parietal wash is usually heavy. The group is well represented, both in number of species and individuals, in the later Tertiary of the south Atlantic and in mid-American faunas.

Marginella (Serrata) denticulata Conrad?

Plate 28, figure 15

The figured individual suggests *Marginella* (*Serrata*) *denticulata* Conrad [26] but is larger and tends to develop a shoulder. This slight tabulation gives to the shell a subscalariform outline that seems distinctive. In all other essentials it agrees with the type of the species.

Dimensions of figured specimen: Height, 9.3 mm.; diameter, 5.2 mm.

Figured specimen: U.S.N.M. 325380.

Locality: Natural Well, 2 miles southwest of Magnolia, Duplin County, N. C.

Distribution: Duplin marl, Natural Well and environs, Duplin County, N. C. The form is fairly common within this limited area.

Marginella (Serrata) macronuclea Gardner, n. sp.

Plate 28, figure 12

Shell porcellaneous, of medium size, composed of 5½ volutions. Nucleus papilliform, large for the genus, not well differentiated. Later whorls convex, rapidly increasing in size with a tendency toward a tabulation at the suture line. Incrementals plainly visible on the spire, obsolete on the body. Sutures distinct, impressed. Aperture about two-thirds the length of the entire shell. Labrum thickened at the margin, produced backward; an impressed line along the outer margin of the callus from the suture to the anterior extremity; inner denticulation similar to that of *Marginella denticulata* Conrad. Columellar lip slightly convex, furnished with 4 plaits, of which the posterior 2 are stronger, less oblique and more widely separated; the anterior plait, formed by the twisted edge of the pillar, is decidedly the weakest of the 4. Posterior commissure not guttered.

Dimensions of holotype: Height, 8.0 mm.; diameter, 4.4 mm.

Holotype: U.S.N.M. 114497.

The apertural portion is similar to that of *Marginella denticulata* Conrad, but it differs in the relative size and shape of the whorls. The nucleus of *M. macronuclea* is larger, the spire proportionally shorter and more rapidly diminishing, and the body whorl broader at the base. The type is unique.

Type locality: Ruplin marl, Natural Well, 2 miles southwest of Magnolia, Duplin County, N. C.

Subgenus BULLATA Jousseaume

1830 (fide Sherborn). *Volutella* Swainson, Zoological illustrations, ser. 2, vol. 1, pl. 44, expl. text. Type by subsequent designation (Gray, Proc. Zool. Soc. London, pt. 15, p. 142, 1847): *Marginella bullata* Lamarck.

Not *Volutella* Perry, Arcana, sign. B 1, 1810; Conchology, App. pl. 26, 1811=*Vasum* Roeding.

1875. *Bullata* Jousseaume, Rev. mag. zoologie, ser. 3, vol. 3, p. 167.

Type by tautonymy: *Voluta bullata* Born. Recent, off the Brazilian coast. *Marginella bullata* Lamarck, quoting Tomlin, 1917, included *M. bullata* Born and *M. angustata* Sowerby.

The subgenus *Bullata* embraces shells of relatively large size, and cylindrical or ovate cylindrical outline. The spire is involute; the outer lip, reinforced along the margin and, in the subgenotype, feebly dentate within.

[26] Conrad, T. A., On the geology and organic remains of a part of the Peninsula of Maryland: Acad. Nat. Sci. Philadelphia Jour., 1st ser., vol. 6, p. 225, pl. 9, fig. 21, 1830.

There are 4 strong columellar folds but the parietal wall is unwrinkled. The anterior fold is marginal, that behind it of equal strength and parallel to it, the 2 posterior folds less oblique, slightly less produced, and not quite parallel. The anterior extremity is obliquely truncate.

Marginella (Bullata) antiqua Redfield

Plate 38, figure 12

1852. *Marginella antiqua* Redfield, Lyceum Nat. Historv New York Annals, vol. 5, p. 226.
1858. *Marginella olivaeformis* (Tuomey and Holmes) (?). Emmons, North Carolina Geol. Survey Rept., p. 261, fig. 133.
1890. *Marginella antiqua* Redfield. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 56 (name only).

Shell oblong-ovate with polished enamel; lip much thickened without, closely and deeply denticulate within, and extending quite to the summit of the spire which is entirely concealed by a vitreous deposite, aperture narrow, columella with four oblique well developed plaits. Length 1.10 inch (28 millim.) Breadth 0.57 inch (14 millim).

Habitat.—Found in the miocene tertiary deposites of Petersburgh, Va.

Remarks.—It is a pity that this large and striking *Marginella* (for which I am indebted to Chas. M. Wheatley, Esq.) should have lived at a period when no conchologist existed to appreciate its elegance, such as it must have exhibited in its freshness—and it is equally fortunate that it has so well survived the vicissitudes of ages, as to show most of its original beauties, deprived only of color. I am acquainted with no recent species which illustrates its character.—Redfield, 1852.

Dimensions of figured specimen: Height, 35.2 mm.; maximum diameter, 15.7 mm.

Figured specimen: U.S.N.M. 325386, from Duplin marl at Natural Well, 2 miles southwest of Magnolia, Duplin County, N. C.

Marginella taylori Olsson (Bull. Am. Paleontology, vol. 5, No. 27, p. 9, pl. 2, fig. 1) from the Yorktown formation at Chocowinity, N. C., seems to differ from *M. antiqua* Redfield chiefly in its larger size, a doubtful specific character. *M. taylori* measures 47 mm. by 22 mm.; the figured *M. antiqua*, 35.2 mm. by 15.7 mm. There is not sufficient material to evaluate the difference in these figures.

Marginella (*Bullata*) *oviformis* (Conrad) (pl. 31, fig. 15) described from "Virginia" as *Volutella* (*Microspira*) seems to be a related but much broader species. The figured form is presumably the holotype, but it does not show the low spire indicated in Conrad's description and original illustrations.

Marginella (*Volutella*) *maiae* Maury, from the upper Miocene at Springvale, Trinidad, and *M. popenoei* Mansfield, from the *Cancellaria* zone of the Choctawhatchee formation, are larger, more inflated species, similar to one another and to the genotype, *M.* (*B.*) *bullata* Born, from the Brazilian coast.

The species described and figured by Emmons under the name of *Marginella olivaeformis* is probably the true *M. antiqua* Redfield. Both forms occur within the marls, but the latter much more abundantly.

Distribution: Yorktown formation, Petersburg, Dinwiddie County (Redfield), Va.; Yorktown formation, 8 to 9 miles southeast of Greenville, Pitt County. Duplin marl, Natural Well and environs, Duplin County, N. C.

Outside distribution: Miocene, Duplin marl, the Muldrow Place, 5 miles southeast of Mayesville, Sumter County, S. C.

Marginella (Bullata) antiqua subsp.? oliviformis (Tuomey and Holmes)

Plate 38, figures 13, 14

1856. *Porcellana oliviformis* Tuomey and Holmes, Pleiocene fossils of South Carolina, p. 131, pl. 27, figs. 12, 13.

Shell elongated oval, spire profoundly obtuse; aperture linear, labrum tumid, reflexed, profoundly crenulated within, columellar with three equal raised plaits.

This species is unlike any of its fossil congeners. It may be readily distinguished by its profoundly crenulated outer lip, three robust plaits on the columellar, and the aperture which extends from the apex of the spire to the beak. Locality, Sumter District.—Tuomey and Holmes, 1856.

The description and figure of *Porcellana oliviformis* are inconclusive, but the form is probably not *Marginella antiqua* Redfield, with which it has been commonly united. Out of the eleven specimens at hand from Sumter County, S. C., the type area for *M. oliviformis*, only one of them could be united with *M. antiqua* as represented in the marls of Duplin County. The remaining forms have all of them developed a stouter shell and a decidedly more globose body whorl. As a result of the greater globosity, particularly in the posterior half of the shell, the outline is more ovate and less cylindrical, and the outer lip, instead of being subparallel to the axis of the shell, tends toward a posterior flare.

Distribution: Duplin marl, Natural Well, 2 miles southwest of Magnolia, Duplin County, N. C. The form is associated at this locality with the much more common *Marginella antiqua* Redfield.

Outside distribution: Miocene, Duplin marl, Sumter County, S. C.

Genus CYPRAEOLINA Cerulli-Irelli

1911. *Cypraeolina* Cerulli-Irelli, Palaeontographica italica, vol. 17, p. 231.
1928. *Cypraeolina* Cerulli-Irelli. Woodring, Carnegie Inst. Washington Pub. 385, p. 241.

Type by monotypy: *Marginella clandestina* Brocchi. Pliocene and Recent, of the Mediterranean.

Cypraeolina lachrimula (Gould)

Plate 38, figures 20, 21

1862. *Marginella* (*Gibberula*) *lachrimula* Gould, Boston Soc. Nat. History Proc., vol. 8, p. 281.
1889. *Volutella lacrimula* Gould. Dall, Harvard Coll. Mus. Comp. Zoology Bull., vol. 18, p. 142.

Shell minute, cypraeiform, polished. Spire involute. Aperture narrow, crescentic, longer than the body whorl. Outer lip obtuse, broadly arcuate, varicose, the reinforcing callus a flattened band continuous around

the apex of the shell, and fusing with the parietal wash; lip crenulated within. Columella quadriplicate, the anterior fold marginal, that behind it equally sharp and of equal length, the two posterior folds less elevated and scarcely reaching the mouth of the aperture.

Dimensions of figured specimen: Height, 2.0 mm.; maximum diameter, 1.4 mm.

Figured specimen: U.S.N.M. 325381, from Wilson, Wilson County, N. C.

Marginella (*Closia*) *intrina* Mansfield, from the "middle or lower Miocene", 1 mile south of Brasso, Trinidad, differs only in its slightly more globose outline.

Distribution: Rare in the Yorktown formation, 1 mile northeast of Suffolk, Nansemond County, Va.

North Carolina: Yorktown formation, Hamilton Bluff on the Roanoke River, Martin County; Wilson, Wilson County; Colerain Landing, Bertie County. Duplin marl, Natural Well, Duplin County.

Outside distribution: Pliocene, Caloosahatchee marl, Caloosahatchee River, Fla. Recent, Hatteras to Florida Straits, up to 400 fathoms in depth.

Family CANCELLARIIDAE

Genus CANCELLARIA Lamarck

1799. *Cancellaria* Lamarck, Prodrome d'une nouvelle classification des coquilles: Soc. hist. nat. Paris Mém., p. 71.

Type by monotypy: *Voluta reticulata* Linnaeus. Recent, off the coast of Florida and the West Indies.

Cancellaria rotunda Dall

Plate 38, figure 2

1892. *Cancellaria conradiana* Dall var. *rotunda* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 224.

Mr. Willcox has collected at Magnolia, Duplin Co., North Carolina, from the newer Miocene, some fine specimens which appear to be referable to a variety of this species which may take the name *rotunda*. They agree in all essentials with the Pliocene *C. Conradiana* and the recent *reticulata* Linné, except in relative height. In this respect they are intermediate between the two, being taller than the tallest recent specimens and shorter than the *C. Conradiana*. The largest specimen is larger than any specimen either of *reticulata* or *Conradiana* I have seen. It measures 66.25 mm. long, 35.0 mm. in maximum diameter, and exhibits nine whorls, without the nucleus.—Dall, 1892.

Dimensions of holotype: Height, 52.5 mm.; width 28.0 mm.

Holotype: U.S.N.M. 497152.

Type and sole locality: Duplin marl, 1 mile east of Magnolia, Duplin County, N. C.

The group is well established in the upper Miocene and widely distributed through the later Tertiary and Quaternary faunas of the south Atlantic Coastal Plain and Caribbean provinces. It seems to have been a sensitive group, for in the fossil faunas the species and subspecies are, for the most part, short ranging. *Cancellaria reticulata leonensis* Mansfield, from the *Cancellaria* zone of the Choctawhatchee formation of Florida, is a stouter form than *C. rotunda*, with a more inflated body. *Cancellaria barretti* Guppy, of the Bowden fauna of Jamaica, displays a more elevated spire, a shorter body whorl, greater inflation, greater constriction basally, and, apparently, a stronger labial fold. *Cancellaria barretti* has been reported by Olsson from Costa Rica and by several authors from the Dominican Republic. Woodring, 1928, referred the species from Costa Rica to *C. dariena* Toula, 1909, from the Gatun formation of the Canal Zone, and the species from the Dominican Republic to *C. mauryae* Olsson, 1922, of the Dominican Republic and Costa Rica. All the species of the Caribbean provinces exhibit a more highly inflated body whorl than that of the Duplin form. The Caloosahatchee species, *C. conradiana*, however, is at the opposite end of the series, with a higher spire and more slender, less inflated body than *C. rotunda*. Johnson, 1934, reports *C. conradiana* from the Recent faunas of the Gulf of Mexico, but it is not present in the collection of recent shells in the U. S. National Museum. *Cancellaria reticulata*, which may be in the line of descent from *C. barretti* or some other of the relatively stout mid-American species, has been recorded from North Carolina to the Gulf of Mexico in 5 to 30 fathoms.

Cancellaria plagiostoma Conrad

Plate 38, figures 3, 4

1834. *Cancellaria plagiostoma* Conrad, Acad. Nat. Sci. Philadelphia Jour., 1st ser., vol. 7, pt. 1, p. 136.

Shell short subfusiform, with numerous longitudinal ribs and distant obtuse spiral lines; summits of the whorls flattened; shoulder angulated; spire short, the two terminal volutions smooth; apex somewhat papilliform; labrum with dentiform striae within; columella with three plaits; the superior one very prominent, aperture about two-thirds the length of the shell; base subrostrated, twisted, with a small umbilicus.—Conrad, 1834.

Type: Acad. Nat. Sci. Philadelphia 1609.

Locality: James River, Va.

Cancellaria plagiostoma has not been recognized in the later collections but it is very close to *C. tabulata* Gardner and Aldrich (pl. 38, fig. 7) of the Yorktown and Duplin faunas. The type of Conrad's species is only about half the size of *C. tabulata* but shows evidence of immaturity in the undeveloped parietal wash. The whorls are, however, broader and lower than those of the young *C. tabulata* and the axial sculpture more decided. *Cancellaria reticulata* Emmons, 1858, is probably closer to *C. plagiostoma* and *C. tabulata* than to *C. rotunda*, to which it was questionably referred by Dall. Topotypes of *C. cossmanni* Olsson, from the Gatun stage of the Banana River section in Costa Rica, are similar in general characters, but the whorls of the species from Costa Rica are more rounded than those of the species from Virginia and the Carolinas.

Superfamily TOXOGLOSSA

Family TURRIDAE

Genus CRASSISPIRA Swainson

1840. *Crassispira* Swainson, Treatise on malacology, p. 313.
1928. *Crassispira* Swainson. Woodring, Carnegie Inst. Washington Pub. 385, p. 147.

Type by subsequent designation (Herrmannsen, Indicis generum malacozoorum primordia, vol. 1, p. 318, 1847); *Pleurotoma bottae* Valenciennes (*Pleurotoma bottae* auct., Swainson). Recent, on the west coast of Mexico.

Crassispira perrugata (Dall)

Plate 37, figures 16, 22

1890. *Drillia abundans perrugata* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 31.

This form differs from the type by attaining a greater size, by its more inflated whorls, by having nearly twice as many ribs, which are consequently weaker, by its coarser and closer spiral threading, its less excavated and more wrinkled anal fasciole, and the absence of lirae in the throat. I have received some recent specimens from the Mexican coast which approach it very closely. It reaches a length of 29.5 [29] and a width of 8.0 [9.5] mm.—Dall, 1890.

Type locality: Pliocene beds of the Caloosahatchee River, Fla.

Holotype: U.S.N.M. 97317. Figured specimen (U. S. N.M. 113149) from Shell Creek, Charlotte County, formerly a part of De Soto County, Fla.

The differences that separate the late Tertiary *C. perrugata* from the Oligocene *C. abundans* (Conrad), figured for comparison (pl. 37, fig. 18), seem sufficiently important to be considered specific. The group is widespread in the warm-water faunas of the mid-Americas.

Distribution: Waccamaw formation, Neills Eddy Landing, Cape Fear River, 3 miles north of Cronly, Columbus County, N. C.

Outside distribution: Pliocene, Caloosahatchee marl, Caloosahatchee River and Shell Creek.

Genus CLAVATULA Lamarck

1801. *Clavatula* Lamarck, Système des animaux sans vertèbres, p. 84.

Type by monotypy: *Murex turris coronata* Chemnitz. Recent, on the Guinea coast.

Clavatula cornelliana (Olsson)

Plate 37, figures 23, 24

1858. *Pleurotoma elegans* Emmons, North Carolina Geol. Survey Rept., p. 265, fig. 146.
Not *Pleurotoma elegans* De France, 1826.
1863. *Drillia elegans* Emmons. Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 562.
Not *Drillia elegans* Whitfield, 1894, U. S. Geol. Survey Mon. 24, p. 115, pl. 21, figs. 2–4.
1916. *Drillia cornelliana* Olsson, Bull. Am. Paleontology, vol. 5, No. 27, p. 27. Name proposed for preoccupied *Pleurotoma elegans* Emmons.

Shell small, sub-turrited; whorls, about nine, constricted above, ornamented by numerous longitudinal ribs, and traversed by many fine raised spiral lines, which become very distinct upon the pillar lip. The spiral lines are very regular and equidistant. The body whorl has about sixteen ribs.—Emmons, 1858.

Habitat: Tertiary of North Carolina.

Dimensions of figured specimen: Height, 17.6 mm.; maximum diameter 6.5 mm.

Figured specimen: U.S.N.M. 325372, from Walkers Bluff, Cape Fear River, Bladen County, N. C.

The form from New Jersey described by Whitfield in his monograph on the "Mollusca and Crustacea of the Miocene of New Jersey" was found by Martin to represent a distinct species, later described under the name of *Drillia whitfieldi* in the Miocene volume of the Maryland Geological Survey (p. 157, pl. 43, fig. 10).

Clavatula cornelliana (Olsson) is characterized by the flattened whorls; the rather short conical spire, less than half the total length of the shell, the smooth, narrow, protractive ribs, numbering about 16 or 17 on the later whorls and the linear spirals that crowd the intercostal areas. The well-defined, posterior fasciole though devoid of axial sculpture, is feebly lirate, the posterior spiral commonly the strongest.

Drillia chiriquiensis Olsson, from the Gatun stage of Costa Rica, is evidently related. The species from Costa Rica is more slender and the anterior canal apparently longer but the two species present similar sculpture patterns.

Distribution: Yorktown formation, 1½ miles north of Suffolk, Nansemond County, Va. Although the species is represented by a single individual and that an imperfect one, there is no doubt about its determination.

North Carolina: Yorktown formation, 2½ miles northwest of Chocowinity, Beaufort County. Duplin marl, Natural Well, Duplin County. Waccamaw formation, Walkers Bluff, Bladen County; Neills Eddy Landing, Columbus County.

Genus "DRILLIA," Group 1

"*Drilla*" is used in the old generalized sense for those shells which do not seem to conform to the characters of any of the restricted groups, or for those in which the characters are obscured so that the finer definitions are uncertain.

"Drillia" emmonsi Olsson

Plate 37, figure 25

1858. *Pleurotoma tuberculata* Emmons, North Carolina Geol. Survey Rept., p. 265, fig. 147.
Not *Pleurotoma tuberculata* Pusch, 1836.
1892. *Drillia tuberculata* Emmons. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 220.
1916. *Drillia emmonsi* Olsson, Bull. Am. Paleontology, vol. 5, No. 27, p. 147 [27]. New name proposed for preoccupied *Pleurotoma tuberculata* Emmons.
1930. *Clathrodrillia? emmonsi* (Olsson). Mansfield, Florida Geol. Survey Bull. 3, p. 36, pl. 1, fig. 10.

Shell small, thick, sub-acute; whorls, seven or eight; apex sub-tuberculated, constricted above, and traversed spirally by rather coarse raised lines; apex papillated, and the first whorl is spirally lined, and without tubercles or short ribs. It is more widely constricted than the preceding [*Pleurotoma elegans*].—Emmons, 1858.

Habitat: Tertiary beds of North Carolina.

This species recalls *D. leucocyma* Dall, but it is proportionately stouter. It is readily recognized by three or four stout spiral threads, without transverse sculpture, which characterize the first whorl of the shell, following the smooth nucleus of a single turn. There are seven or eight shouldered ribs on the body-whorl in front of the anal fasciole, which is finely spirally threaded, with one strong spiral between it and the suture, which is usually closely appressed.—Dall, 1892.

Dimensions of figured specimen: Height, 8.8 mm.; maximum diameter, 3.3 mm.

Figured specimen: U.S.N.M. 114017, from 1½ miles northwest of Magnolia, Duplin County, N. C.

The species was doubtless named *tuberculata* by Emmons from the characteristic tuberculated appearance of the axial ribs. These are blunt protuberances extending from the fasciole almost or quite to the sutural line. The fasciole is concave, and occupies about one-third of the whorl.

Distribution: Yorktown formation, 1 mile northeast of Suffolk, Nansemond County, Va. Only a single individual has been collected from these marls.

North Carolina: Duplin marl, 1½ miles northwest of Magnolia and Natural Well, Duplin County. Waccamaw formation, Neills Eddy Landing near Cronly, Columbus County; Walkers Bluff, Bladen County, Pliocene, Croatan sand on the Neuse River below New Bern, Craven County.

Outside distribution: Miocene, Duplin marl, 5 miles southeast of Mayesville on the Muldrow Place, Sumter County, S. C.; *Ecphora* and *Cancellaria* zones of the Choctawhatchee formation of Florida; Waccamaw formation at Tilly Lake, Waccamaw River, Horry County, S. C.

"Drillia" pyrenoides (Conrad)

Plate 37, figure 33

1834. *Pleurotoma pyrenoides* Conrad, Acad. Nat. Sci. Philadelphia Jour., 1st ser., vol. 7, pt. 1, p. 139.

1863. *Drillia pyrenoides* Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 562. (Name only).

Shell subulate, turrited, with short oblique, very prominent longitudinal ribs, separated above from the suture by a contraction of the whorls; suture margined by a slightly prominent obtuse line; spiral lines fine on the contraction, but coarser over the ribs and intervening spaces, very prominent and rather distant on the body whorl, with indistinct intermediate lines; sinus of the labrum profound; beak very short and straight; aperture about one [third] of the length of the shell. Length, one inch.

Locality. Same as the preceding [James River near Smithfield, Virginia].—Conrad, 1834.

Holotype: Acad. Nat. Sci. Philadelphia 1602.

The axial costae on the later whorls number 10 or 11, as a rule, and are most prominent on the periphery. They are separated by convex, intercostal areas of approximately the same width. The primary spirals are rather coarse, and somewhat irregular on the body, and finer secondaries are intercalated; the spirals are uniform in strength on the costals and intercostals but most prominent, as a rule, on the periphery of the whorl, thus strengthening the nodular aspect of the axial sculpture. The anal fasciole is rather narrow and somewhat rippled by the ribbing; the spiral threading is commonly obsolete on it, although the incrementals are well developed and even minutely laminar.

"*Drillia*" *pyrenoides* Conrad is a relatively shorter, somewhat stouter shell than the related "*D.*" *tricatenaria* Conrad; the spire tapers more rapidly and the canal is slightly shorter. The axial costae of "*D.*" *pyrenoides* are more nodose than those of "*D.*" *tricatenaria*, though the spirals, both primary and secondary, are fewer, more irregular, and less prominent. On the anal fasciole of many individuals the spiral sculpture is obsolete except for the pre-sutural cord, which is consistently less prominent than in "*D.*" *tricatenaria*.

"*Drillia*" *pyrenoides* recalls "*D.*" *eburnea* Conrad, described from "Virginia."

Distribution: Virginia: Yorktown formation, Petersburg, Dinwiddie County; Smithfield, Isle of Wight County (Conrad).

North Carolina: Yorktown formation, Tar Ferry, near the mouth of Wiccacon Creek and Mount Pleasant Landing on the Chowan River, Hertford County.

"Drillia" eburnea Conrad

Plate 37, figure 21

1862. *Drillia eburnea* Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 285.

1863. *Drillia eburnea* Conrad, idem, p. 562.

Not *Drillia eburnea* Conrad. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 30, 1890.

Turrited; upper part of whorl without ribs and with an impressed revolving line; lower part ribbed, ribs oblique, rounded; surface striated with close impressed revolving lines, finer and obsolete on the upper part of the whorls.—Conrad, 1862.

Shell slender. Whorls about 9 including the small, smooth, blunt nucleus of 1½ to 2 volutions. Axial sculpture of 10 to 12 pinched, protractive ribs extending from the fasciole to the suture, evanescent on the pillar. Spirals impressed, irregularly spaced, undeveloped on the earlier whorls. Fasciole deeply notched at the outer lip.

Holotype: Acad. Nat. Sci. Philadelphia 1608.

Habitat: Virginia.

Distribution: Virginia: Yorktown formation, Yorktown, York County; 1½ miles north of Suffolk, 1¼ miles north of Suffolk, 1 mile northeast of Suffolk, Nansemond County. Rather rare.

North Carolina: Yorktown formation, Wilson, Wilson County. Rare.

"Drillia" distans Conrad

Plate 37, figure 29

1830. *Pleurotoma gracilis* var. Conrad, Acad. Nat. Sci. Philadelphia Jour., 1st ser., vol. 6, pt. 2, p. 225.

1862. *Drillia distans* Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 285.

1904. *Drillia incilifera* var. *distans* (Conrad) (?). Martin, Maryland Geol. Survey, Miocene, p. 156, pl. 42, fig. 9.

Turriculate, whorls 6, scalariform, with distant obtuse ribs on the lower half; suture waved, with an impressed line above it; body whorl with an impressed revolving line above and four

raised revolving lines inferiorly; upper sinus of labrum deep and rounded, lower obsolete. *Locality.* Virginia.—Conrad, 1862.

Holotype: Acad. Nat. Sci. Philadelphia 1603.

Type locality: The type locality is not known more specifically than Virginia, nor has the species been reported from the later Virginia collections. Conrad's type seems a little more heavy and crude than the forms from Maryland, the shell less slender, and the body more abruptly constricted, and it may represent either an individual variation or possibly something of greater importance.

"Drillia" impressa Conrad

Plate 37, figures 30, 31

1862. *Drillia impressa* Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 285.

Elevated, scalariform or turriculate, with short, obtuse ribs; contractions of whorls striated, and having a carinated line near the suture, revolving lines impressed, double, alternated, rugose, volutions 8; base subumbilicated. *Locality.* James River, Virginia.—Conrad, 1862.

Holotype: Acad. Nat. Sci Philadelphia 1606.

"*Drillia*" *impressa* seems to be a taller, more strongly sculptured form of "*D*", *emmonsi* Olsson.

Distribution: Virginia. The species has not been recognized in any of the later collections.

"Drillia" arata Conrad

Plate 37, figures 27, 28

1862. *Drillia arata* Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 285.

1863. *Drillia arata* Conrad, ibid, p. 561.

Turriculate, whorls 9; spire elevated, acute; subscalariform, the contracted portion of the whorls flattened and with perpendicular sides, below this space costate, ribs somewhat oblique and crossed by minute, close lines, which on the body whorl reach the base, obsolete above, distinct inferiorly. Locality. Virginia.—Conrad, 1862.

Holotype and paratype: Acad. Nat. Sci. Philadelphia 1605.

"*Drillia*" *arata* may be referable to *Agladrillia*, a group well represented in the middle and upper Miocene of Florida and mid-America. The shell of *Agladrillia*, however, is characterized by a polish which "*D.*" *arata* does not seem to exhibit.

Distribution: Virginia. The species has not been recognized in any of the later collections.

"Drillia" arctata Conrad?

Plate 37, figure 15

The shell which bears the label "*Drillia arctata* Conrad" (Academy of Natural Sciences Philadelphia 1611) is slightly more than 8 mm. high and less than 3 mm. in diameter. The relationship to "*Drillia*" *arata* Conrad seems very close. I have been unable to find a published record of the species or any record of it in the faunas under observation.

"Drillia" drewi Gardner, n. sp.

Plate 28, figures 3, 10, 22

Shell small, slender; spire high, acutely tapering, the whorls closely appressed. Apex somewhat decorticated so that it is difficult to differentiate conch and protoconch. Possibly an axially sculptured nuclear whorl in addition to the 3¼ smooth turns. Each volution of adult conch sculptured with 8 broadly rounded, undulating, protractive ribs, for the most part continuous, persisting on the earlier whorls from suture to suture but on the later whorls becoming obsolete at the anal fasciole and on the body expiring before reaching the pillar. Intercostal areas hollowed out and depressed below the average level of the shell. Spirals broad, somewhat rounded on top, fairly prominent at the intersection with the costae but almost or altogether obsolete in the intercostal spaces; 2 or 3 on the earlier whorls, 3 or 4 on the later whorls of the adult. Base of the body whorl and the pillar sculptured with lower, more angular, more closely set lirations. Anal fasciole depressed, marked by the absence of any sculpture except incrementals. Sinus narrow, rather deep, placed closer to the periphery than to the posterior suture. Aperture ovate-elongate. Outer lip flaring slightly, simple. Columella concave, calloused, though the callus does not extend beyond the pillar. Canal moderately long for the genus, slightly recurved and emarginate anteriorly.

Dimensions: Holotype height, 13.8 mm.; maximum dimeter, 4.3 mm. Paratype height, 8.7 mm.; maximum diameter, 3.0 mm.

Type and only locality: 1½ miles northwest of Magnolia, Duplin County, N. C. Duplin marl.

Holotype and paratype: U.S.N.M. 114020.

The characteristic features of this rare species are the slender tapering outline, the undulatory axial sculpture, and the broad spiral lirations, confined for the most part to the summits of the costae and the anterior portion of the shell.

I have the pleasure of naming this interesting form in honor of Dr. Gilman Arthur Drew, formerly of the University of Maine, who furnished much valuable and trustworthy data on the Mollusca of the North Atlantic coast.

Genus CARINODRILLIA Dall

1919. *Carinodrillia* Dall, U. S. Nat. Mus. Proc., vol. 56, No. 2288, p. 17.

1928. *Carinodrillia* Dall. Woodring, Carnegie Inst. Washington Pub. 385, p. 153.

Type by original designation: *Clathrodrillia* (*Carinodrillia*) *halis* Dall. Recent, in the Gulf of California.

Carinodrillia? bella (Conrad)

Plate 37, figure 19

1862. *Drillia bella* Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 285.

1863. *Drillia bella* Conrad, idem, p. 561.

Turriculate; whorls 7, scalariform, costate nearly to the suture; ribs distant, obtuse; whole surface with minute revolving raised lines, very minute and close on the contracted space below the suture, reflected labrum callous at the upper end. *Locality.* Virginia.—Conrad, 1862.

Holotype: Acad. Nat. Sci. Philadelphia 1607.

The shell has the appearance of youth and its reference to *Carinodrillia* is dubious. The absence of a posterior cord separates it from other species of similar aspect.

Distribution: Virginia. The species has not been recognized in any of the later collections.

Genus COMPSODRILLIA Woodring

1928. *Compsodrillia* Woodring, Carnegie Inst. Washington Pub. 385, p. 155.

Type by original designation: *Compsodrillia urceola* Woodring. Bowden beds of Jamaica.

Compsodrillia chowanensis Gardner, n. sp.

Plate 37, figure 32

A slender shell of medium size; total number of volutions about 9. Apex decorticated, but apparently the smooth papillate initial whorl is succeeded by a little more than half a turn, on which the sculpture is limited to a medial and a stronger anterior spiral. Remaining volutions both axially and spirally adorned. Axial costae 13 on the later turns, narrow, rounded, undulating the whorls from the anal fasciole to the anterior suture but evanescent on the pillar. Spiral sculpture elaborate; primaries low, flat bands about 0.2 millimeter in breadth, somewhat irregularly spaced; 4 or 5 on the whorls of the spire, twice as many on the body; the 10 lirations on the pillar, narrower and more prominent; between the primaries 1 or 2 secondaries similar to the former in general character and separated from them and from each other by linear interspaces; lacking on the pillar and near the apex. Anal fasciole concave, sculptured with 5 to 7 crowded lirae, that directly in front of the suture the most prominent. Sinus deep, rather narrow, set a little nearer to the periphery than to the posterior suture. Aperture narrow, ovate, terminating in a short emarginate canal.

Dimensions of holotype: Height, 16.5 mm.; diameter, 5.5 mm.

Holotype: U.S.N.M. 325373.

Type locality: Yorktown formation, Colerain Landing, Chowan River, Bertie County, N. C.

The type is unique.

Compsodrillia chowanensis suggests "*Drillia*" *tricatenaria* Conrad, common in the Yorktown formation of Virginia. In "*D.*" *tricatenaria*, however, the primary spirals are less numerous, more rounded, and decidedly more prominent. Furthermore, the secondaries commonly number 4 on the body, whereas in *C. chowanensis* they are not known to exceed 2. The low, flat spirals serve to separate the form from those Caloosahatchee species to which it may bear a superficial resemblance.

Genus CYMATOSYRINX Dall

1889. *Cymatosyrinx* Dall, Harvard Coll. Mus. Comp. Zoology Bull., vol. 18, p. 95.

Type by original designation: *Pleurotoma lunata* Lea. Miocene, of Virginia.

Cymatosyrinx ziczac Gardner, n. sp.

Plate 37, figures 9, 10

Shell of medium size, moderately slender. Protoconch of 1½ turns, the first half-coil partially submerged, the succeeding coil erect and bulbous initially, though flattening rapidly away from the apex. Whorls of conch approximately 8, slightly convex, increasing very gradually in size. Axial costals some 15 to the whorl; narrow, sharp, moderately elevated, rather strongly protractive in front of the fasciole, and persisting with uniform strength from the fasciole to the anterior suture and on the body whorl to the pillar; tending to become irregular and even obsolete toward the aperture; retractive and very much more feeble upon the posterior fasciole, on some specimens merging into exaggerated incrementals. Axial sculpture when well developed thus consisting of a more or less continuous series of sharp riblets which zigzag down the shell from the protoconch to the pillar. Spiral sculpture present on some specimens in the form of faintly incised lines, 5 or 6 to the whorl, and, on the pillar, about 6 irregular, wavy threadlets. Anal fasciole rather narrow, gently constricted, closely appressed against the preceding whorl, exhibiting an axial sculpture, at least, upon the later whorls. Siphonal notch wide and deep, the axis slightly nearer to the periphery than to the anterior suture. Aperture lenticular. Outer lip widely flaring. Inner lip rather sharply constricted. Parietal wall washed with a heavy callus, a rude globule of which is usually deposited at the posterior commissure. Anterior canal very short, rather broad, subtruncate, emarginate.

Dimensions of holotype: Height, 17.2 mm.; maximum diameter, 6.0 mm. Dimensions of paratype: Height, 15.0 mm.; maximum diameter, 5.8 mm.

Holotype and paratype: U.S.N.M. 114036.

Type locality: Natural Well, 2 miles southwest of Magnolia, Duplin County, N. C. Duplin marl.

Cymatosyrinx ziczac differs from the group of "*Drillia*" *lunata* H. C. Lea in the possession of an apparently fortuitous spiral sculpture, the absence of any trace of a cingulum at the base of the body whorl, and the very short subtruncate anterior canal. "*Drillia*"

perpolita Dall is a much smaller and more slender shell, with little or no suggestion of a zigzag axial sculpture.

Cymatosyrinx ziczac may be a synonym of "*Drillia*" *magnoliana* Olsson, 1916. Olsson's species seems smaller and more slender, with a less strongly marked constriction at the base of the body. The figure is poor, however, and the type has not been examined.

Cymatosyrinx tiara Gardner, n. sp.

Plate 37, figure 12

Shell of medium size, slender. Protoconch of 1½ to 2 turns, the first half-coil partially submerged, the succeeding volution tending to become angulated near the posterior third. Whorls of conch approximately 7½, tapering gradually to an acute apex, obscurely carinated near the median line. External sculpture axial only. Costals 17 to 21; more or less oblique little nodes that crown the periphery of the whorl, ceasing abruptly at the posterior margin of the fasciole and evanescing on all but the earliest whorls some distance behind the anterior suture; costals of body whorl similar in character to those on the spire but commonly obsolete toward the aperture. Fasciole gently concave, unusually broad, occupying on the spire at least one-half the entire whorl; slightly thickened and obscurely ridged in front of the suture, thus simulating a feeble, prosutural spiral. Incremental sculpture faintly discernible on the fasciole only. Contraction at base of body whorl delimited by a faint cingulum. Aperture rather narrow; outer lip widely flaring; columellar margin gently concave. Parietal wall thickly glazed, and a rude globule of the callus deposited at the posterior commissure. Posterior siphonal notch deep, closer to the periphery than to the posterior suture. Anterior canal moderately long, rather broad, obliquely emarginate at the extremity.

Dimensions of holotype: Height, 21.2 mm.; maximum diameter, 7.8 mm.; diameter at right angles to maximum diameter, 6.4 mm.

Holotype: U. S. N. M. 114034.

Type locality: Duplin marl, Natural Well, 2 miles southwest of Magnolia, Duplin County, N. C.

Cymatosyrinx tiara Gardner is closely affiliated with "*Drillia*" *lunata* H. C. Lea and "*D.*" *limatula* Conrad, and strongly suggests a "*D.*" *lunata* in which the axial sculpture has been reduced to a circlet of oblique ripples.

Except for a single immature individual from the Duplin marl on the Muldrow Place, 5 miles southeast of Mayesville, Sumter County, S. C., *C. tiara* is restricted in its known distribution to the type locality and its environs.

Genus SYNTOMODRILLIA Woodring

1928. *Syntomodrillia* Woodring, Carnegie Inst. Washington Pub. 385, p. 160.

Type by original designation: *Drillia lissotropis* Dall. Recent, in the West Indies.

Syntomodrillia lissotropis subsp.? scissurata (Dall)

Plate 37, figure 11

1890. *Drillia* (*lissotropis* var.) *scissurata* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 36.

This form is rather stout, like *D. perpolita*, but with more oblique and on the last whorl especially, more crowded and narrower ribs; the fasciole hardly constricts the whorl, which slopes from the suture forward so that its widest part is just behind the next suture, which it seems to overhang. It has not the fine interstitial spiral striation of *D. lissotropis*, but has sparse (on the upper whorls two or three) incised lines, more numerous on the base, where the interstices are slightly elevated and rounded. On the first three or four whorls, after the nucleus, the ribs are largest and subnodulous at the anterior border of the whorl, giving the tip a coronated look. It is almost exactly the size of *D. lissotropis*. Two immature specimens were obtained in the Caloosahatchie beds.—Dall, 1890.

Holotype: U.S.N.M. 97333.

Dimensions of imperfect holotype: Height, 8.6 mm.; diameter, 3.0 mm.

Type locality: Pliocene, Caloosahatchee marl, Caloosahatchee River, Fla.

The single battered specimen throws no light on the affiliations of this group.

Distribution: Waccamaw formation, Neills Eddy Landing, Cape Fear River, 3 miles north of Cronly, Columbus County, N. C.

Genus "DRILLIA," Group 2

The three species following share with *Cymatosyrinx* and *Syntomodrillia* the absence of a well developed spiral sculpture but they have little else in common.

"Drillia" polygonalis Dall ms., n. sp.

Plate 37, figures 2, 3

Shell of medium size, rather broad. Body whorl relatively large, obliquely constricted at the base. Spire conic. Whorls between 8 and 9, including the small smooth protoconch of 1½ to 2 turns. Whorls of conch compressed, fluted with narrow, sharply pinched axial costals, 7 to the whorl, forming an almost continuous series from the apex to the base of the body; evanescent on the fasciole of the later whorls and on the canal. Intercostal areas broadly concave. Spiral sculpture of faintly impressed lines which, unlike the axials, are strongest toward the base of the body and the anterior canal. Posterior fasciole indicated by the closely appressed posterior area and the evanescent axial sculpture. Siphonal notch obsolete. Aperture lenticular. Outer lip arcuate. Inner lip concave, heavily calloused, particularly in front of the feebly guttered posterior commissure. Anterior canal short, broad, ill-defined, obliquely notched at the extremity.

The species is separated from *Drillia pagodula* Dall by the shorter, stouter form, less numerous ribs, more widely flaring outer lip, and more deeply notched anterior canal.

Dimensions of holotype: Height, 15.3 mm.; diameter, 5.9 mm.

Holotype: U.S.N.M. 114044.

Type locality: Duplin marl, one and a half miles northwest of Magnolia, Duplin County, N. C.

Dr. William H. Dall, while working over the Duplin County material, separated and named the form, but it has never before been described nor figured.

Distribution: Duplin marl, Strickland farm, 1½ miles northwest of Magnolia and Natural Well, 2 miles southwest of Magnolia, Duplin County, N. C.

Outside distribution: Miocene, Duplin marl of the Muldrow Place, 5 miles southeast of Mayesville, Sumter County, S. C.

"Drillia" simpsoni Dall

1887. *Pleurotoma* (*Mangilia*?) *simpsoni* Dall, in Simpson, Davenport Acad. Nat. Sci. Proc., vol. 5, p. 54.

1889. *Drillia*? *simpsoni* Dall, Harvard Coll. Mus. Comp. Zoology Bull., vol. 18, p. 91.

1890. *Drillia simpsoni* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 37.

Shell polished, shining, with (including the nucleus) six and a half whorls; nucleus madder-brown, smooth, rather large, blunt, with one and a half turns; remainder transversely ribbed with 8–10 smooth, rounded, nearly straight, stout ribs, extending from suture to suture, which begin with the end of the nuclear part, and fail at the last third of the last whorl, which is marked only by silky fine incremental striae; the spaces between the ribs are equal to or somewhat less than the ribs in width, longitudinal sculpture none, or only occasional extremely faint microscopic lines; whorls not inflated; color, rosy pellucid white, banded in front of the suture with rosy brown, fainter on the ribs, and in the specimen described, extending forward nearly to the periphery of the earlier whorls; the base of the last whorl similarly tinged; the last somewhat varicose rib and the outer thickened lip whitish; aperture and canal very short and wide, and notch deep and large, rounded, leaving no fasciole, the outer lip lightly thickened, arched forward, a slight callus on the columella; interior not lirate in the specimen described.

Lon. 5.75 mm.; last whorl equal to half the total length; maximum diameter of shell, 2.1 mm.—Dall, 1887.

Type: U.S.N.M. 61040.

Type locality: Tampa Bay, Fla.

The apparent presence of an operculum in the living forms excludes this species from the genus *Mangelia*, which it resembles in general aspect.

Distribution: North Carolina: Waccamaw formation, Walkers Bluff, Bladen County; Neills Eddy Landing, Columbus County. Rare at both localities.

Outside distribution: Pliocene, Caloosahatchee marl, Caloosahatchee River, Fla. Recent, Hatteras to Tampa, in 5 to 18 fathoms.

"Drillia" simpsoni cingulata Gardner, n. subsp.

Plate 37, figures 4, 6

The subspecies is separated from typical *Drillia simpsoni* Dall by the *Terebra*-like constriction and sculpture of the posterior part of the whorl. The posterior fasciole is emphasized by the change in direction of the axial ribs from protractive on the anterior portion of the whorl to retractive on the fasciole.

"*Drillia*" *simpsoni cingulata* is separated from *Drillia ebur* Reeve by the more numerous axial ribs and the lower angle between the body and the anterior canal.

Dimensions: Height, 6.4 mm.; diameter, 2.5 mm.

Holotype: U.S.N.M. 114040.

Type locality: Natural Well, Duplin County, N. C.

The name has been used in manuscript by Dr. William H. Dall, but I have been unable to find any record of a description or figure.

Distribution: North Carolina: Yorktown formation, 9 to 10 miles southeast of Greenville, Pitt County. Duplin marl, 1½ miles northwest of Magnolia and Natural Well, 2 miles southwest of Magnolia, Duplin County.

Genus KURTZIELLA Dall

1918. *Kurtziella* Dall, Biol. Soc. Washington Proc., vol. 31, p. 137.

Type by original designation: *Pleurotoma cerina* Kurtz and Stimpson. Recent, on the east coast of the United States.

Kurtziella eritima (Bush)

Plate 37, figure 13

1885. *Mangilia eritima* Bush, Connecticut Acad. Arts and Sci. Trans., vol. 6, pt. 2, p. 456.

1890. *Mangilia quadrata* var. *eritima* Bush. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 40.

Shell large for the genus, composed of eight very angular whorls, which form a sharp pointed regularly tapered, turreted spire. Nucleus very small, regularly coiled, consisting of two and a half shining, light yellow whorls in striking contrast to the dull, rough surface peculiar to the rest of the shell. The first one and a half turns are perfectly smooth, while the last one is crossed by minute, transverse riblets. Suture marked by a conspicuous, rounded undulating cingulus or thread on the preceding whorl. The sculpture consists of prominent straight-angular, alternating ribs (nine on the body-whorl), forming a conspicuous node at the angle, extending from suture to suture. These, with their deeply concave interspaces, are crossed by unequal conspicuous, well-rounded, granulated cinguli and microscopic threads. The first cingulus, defining the shoulder of the whorls, is double with the upper half slightly the larger, the sutural one is the next in size, while between these there are two still finer ones; these are unequally distant from each other, the first and second being much closer together than the others, and the intervening surfaces are covered by unequal, microscopic threads. Above the angle of the whorls the threads alone occur and number about nine. This inequality in the spiral sculpture makes the edges of the transverse ribs very rough and jagged. On the body whorl there are about thirteen cinguli below the shoulder, unequal in size and unequally separated, those on the canal larger and closer together than those just above it, while the fourth one below the angle is so prominent as to make a slight angle in the outline of the whorl. Below this angle the transverse ribs curve in toward the columella following the outline of the outer lip, and extend to the end of the canal, the curvature being most noticeable in a dorsal view. Very fine striae intersect the cinguli and the threads in the direction of the lines of growth, rendering them granular and give the appearance to the shell, when dry, of being covered with a fine gray dust. Aperture long narrow-ovate with a moderately long, rather narrow canal. Outer lip not thickened, with a comparatively thin edge and a broad, moderately deep sinus extending from the suture to the angle. Columella slightly curved; inner lip marked by a narrow stripe of conspicuous red enamel. Color light yellow-brown; interior

of aperture of the same conspicuous red color as the inner lip. In young specimens, this coloring is wanting.

Length, nearly 8 mm; breadth, 3 mm; length of aperture, 3.5 mm; its breadth, 1 mm.—Bush, 1885.

Dimensions of figured specimen: Height, 5.5 mm.; maximum diameter, 2.5 mm.

Figured specimen: U.S.N.M. 86913.

Locality of figured specimen: Off Cape Hatteras in 14 to 19 fathoms.

Some specimens of this species approach very closely to *Mangelia cerina* (Kurtz and Stimpson). The spiral lirations of the former, however, are irregular and more or less rugose, while those of the latter are finer and more uniform. The anterior canal is usually longer in *Kurtziella eritima*, although this is a somewhat variable character in both forms.

Distribution: Yorktown formation, 1 mile northeast of Suffolk, 1½ miles northeast of Suffolk, Nansemond County, Va.

North Carolina: Yorktown formation, 9 to 10 miles southeast of Greenville, Pitt County; Tar Ferry near the mouth of Wiccacon Creek, Hertford County. Duplin marl, Natural Well and environs, Duplin County. Pliocene, Croatan sand, Slocum's Creek, at the confluence with the Neuse River, 15 miles below New Bern, Craven County; Waccamaw formation, Neills Eddy Landing, Cape Fear River, 3 miles north of Cronly, Columbus County. Rather common.

Outside distribution: Miocene, Duplin marl on the Muldrow Place, 5 miles southeast of Mayesville, Sumter County, S. C.; Pliocene, Waccamaw formation, Tilly Lake, Waccamaw River, Horry County, S. C.; Caloosahatchee marl, Caloosahatchee River, Fla. Recent, from Hatteras to Yucatan and the West Indies in less than 50 fathoms.

Genus BELLASPIRA Conrad

1868. *Bellaspira* Conrad, Am. Jour. Conchology, vol. 3, p. 261.

Type by monotypy: *Mangelia virginiana* Conrad. Miocene, of Yorktown, Va.

Bellaspira virginiana (Conrad)

Plate 37, figure 14

1862. *Mangelia Virginiana* Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 286.
1863. *Mangelia Virginiana* Conrad, idem, p. 562.
1868. *Bellaspira virginiana* Conrad, Am. Jour. Conchology, vol. 3, pt. 3, p. 261, pl. 21, fig. 12.

Short-fusiform; whorls 5, subscalariform, or medially angular; ribs prominent, two whorls from the apex smooth; minute revolving lines on the lower half of the penultimate whorl; one or two obsolete revolving lines on the body whorl. *Locality.* Yorktown, Virginia.—Conrad, 1862.

Holotype: Acad. Nat. Sci. Philadelphia 1610.

Distribution: The species has not been recognized in any of the later collections.

Genus ITHYCYTHARA Woodring

1928. *Ithycythara* Woodring, Carnegie Inst. Washington Pub. 385, p. 168.

Type by original designation: *Mangilia psila* Bush. Recent, off the southeast coast of the United States.

Ithycythara psila (Bush)

Plate 37, figure 7

1885. *Mangilia psila* Bush, Connecticut Acad. Arts and Sci. Trans., vol. 6, pt. 2, p. 455, pl. 45, fig. 2.
1890. *Cythara psila* Bush, Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 38.

Shell of moderate size, slender, rather thick, very plain, yellowish white, with a dull lusterless surface. Whorls about six and a half elongated, decidedly angulated, forming an elongated, blunt spire. Suture defined by an indistinct, undulating line. A very few prominent, narrow, straight ribs (six on the body-whorl) cross the whorls from suture to suture, separated by very wide, concave interspaces; a single rounded thread revolves on the periphery at the shoulder of the whorls, scarcely visible on the interspaces, but forming conspicuous, oblong nodules on the ribs. On the body-whorl the ribs continue to the end of the canal curving in from its base, towards the aperture. On the ventral surface of the canal there are five or six very indistinct, oblique striae. The surface is everywhere crossed by conspicuous, flexuous lines of growth. Nucleus rather large, composed of two and a half regularly coiled, nearly smooth, somewhat shining whorls, the second having a row of minute nodules or beads on the periphery. Aperture long, narrow, of nearly uniform width; outer lip thin, nearly straight, broadly rounded anteriorly, with a decided sinus just below the suture; within the aperture, underneath the first external rib, there is a line of small, oblong nodules. Inner lip continuous with the outer, with a thin, free edge. Columella very slightly curved, with a small horizontal fold or tooth about the posterior third.

Length, 6 mm; breadth, 2.5 mm; length of aperture, 3 mm; its breadth, about .8 mm.—Bush, 1885.

Dimensions of figured specimen: Height, 6.1 mm.; maximum diameter, 2.3 mm.

Figured specimen: U. S. Nat. Mus. 92995.

Type locality: Off Cape Hatteras, in 48 fathoms.

Distribution: North Carolina: Waccamaw formation, Neills Eddy Landing, Cape Fear River, 3 miles north of Cronly, Columbus County. Very rare.

Outside distribution: Pliocene, Caloosahatchee marl, Caloosahatchee River, Fla. Recent, Hatteras to Martinique, West Indies. Dredged off the Carolinas in 16 to 50 fathoms.

Genus CRYOTURRIS Woodring

1928. *Cryoturris* Woodring, Carnegie Inst. Washington Pub. 385, p. 178.

Type by original designation: *Cryoturris engonia* Woodring. Miocene, of Bowden, Jamaica.

Cryoturris magnoliana chariessa Gardner, n. subsp.

Plate 37, figure 5

Shell fusiform; aperture a little less than half the entire length of the shell. Nucleus initiated by 1¼ to 1½ smooth, well-rounded whorls, the succeeding turn ornamented by 20 to 25 fine, protractive, axial costae and, on the anterior half of the whorl, by a few microscopic spirals. Whorls of conch 5 to 5½, angular, keeled at or just in front of the median line. Axial sculpture on the figured specimen of narrow, pinched costae, about 8 to the whorl, separated by wide, concave, intercostal areas; costae persistent, as a rule, from suture to suture, though strongest at the periphery and tending to be-

come obsolete on the fasciole; on the body whorl, continuing to the pillar. Surface from nuclear whorls to base of canal crowded with faint, but clear-cut, spiral filaments alternating in size, frosted by the incrementals, separated by linear interspaces. Anal fasciole outlined only by the weakening of the costae and the closer crowding of the spirals. Suture distinct, undulated by the costae of the preceding whorl. Aperture narrowly ovate. Outer lip arcuate, or, in the younger forms, obscurely angulated, at the periphery of the whorl; thin and smooth within. Columella smooth. Parietal wall callused. Anterior canal rather long and slightly recurved, spirally lirate.

Dimensions: Height, 8.5 mm.; maximum diameter, 3.2 mm.

Holotype: U. S. N. M. 325374.

Type and only locality: Neills Eddy Landing, Cape Fear River, 3 miles north of Cronly, Columbus County, N. C. Waccamaw formation.

Cryoturris magnoliana chariessa is well characterized by the fusiform outline, the angular whorls, the relatively few, narrow, elevated axial costae and the crowded spirals. It is distinct from any of the East Coast Tertiary representatives of the genus but closely related to *C. rubella* Kurtz and Stimpson, in the Recent fauna of the Carolina coast. However, *C. rubella* tends to have a more globose body, more numerous volutions, slightly less numerous ribs, and a more thickened outer lip that is in many specimens denticulate within. The lower number of axial riblets, 8 instead of 12 to 14, separates the Waccamaw subspecies from *C. magnoliana* Olsson [27] from the Duplin marl.

Cryoturris cerinella (Dall)

Plate 37, figure 8

1889. *Mangilia cerinella* Dall, Harvard Coll. Mus. Comp. Zoology Bull., vol. 18, p. 113.

M. cerinella recalls *cerina* by its color, is much larger than the genuine *cerina*, more drawn out and slender; it has only six or at most seven ribs, a short aperture, no canal to speak of, and hardly any indentation for a notch; the suture is less appressed and undulate; while the ribs are almost obsolete in the fasciolar region; the angulation is nearly at the periphery and the slopes either way from it are nearly equal. Lon. 11.75 [11.8]; last whorl, 5.87; lat. 3.7[5] mm. North Carolina to Florida and Texas.—Dall, 1889.

Dimensions of figured specimen: Height, 11.8 mm.; maximum diameter, 3.7 mm.

Figured specimen: U.S.N.M. 86909. Punta Rosa, Fla., in 2 fathoms.

Distribution: Waccamaw formation, Neills Eddy Landing, near Cronly, Columbus County, N. C. Very rare.

Outside distribution: Recent, Hatteras to Texas and Bermuda, in 14 to 22 fathoms.

[27] Olsson, Axel, New Miocene fossils: Bull. Am. Paleontology, vol. 5, No. 27, p. 4, pl. 2, fig. 11, 1916.

Genus "MANGELIA" (Leach ms.) Risso

The following species does not seem to be included in any of the restricted groups.

"Mangelia" stellata Stearns

Plate 37, figure 1

1872. *Mangilia stellata* Stearns, Boston Soc. Nat. History Proc., vol. 15, p. 22.

1884. *Mangelia stellata* Stearns. Tryon, Manual of conchology, vol. 6, p. 246, pl. 34, fig. 84.

1890. *Mangilia stellata* Stearns. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 41.

Shell small, fusiform, turrited, yellowish tinged more or less with reddish brown; number of whorls seven, angulated above; suture distinct; sculptured with twelve to thirteen strong, smooth, longitudinal ribs, which extend to the extremity of the basal volution, which also shows near its termination a few revolving lines; intercostal spaces marked by fine incremental striae; aperture narrow, rather oblique, less than half the length of the shell; labrum effuse, externally much thickened, and deeply notched near the suture; canal short; columella somewhat calloused and bent forward.

Measurement: length of largest specimen, .35 inch, lat., .14 inch. * * *

Viewed from above this simple shell has the form of a many short-pointed star.—Stearns, 1872.

Habitat: Tampa Bay, Point Penallis, Pine Key and Long Key, Fla.

The two forms from Neills Eddy Landing are a little shorter and stouter than the type, the whorls more convex, and the spiral lirations stronger. These variations are duplicated, however, in the Recent fauna and in that of the Pliocene Caloosahatchee marl of Florida.

Dimensions of figured cotype: Height, 8.5 mm.; diameter, 3.7 mm.

Figured cotype: U.S.N.M. 86896, from Tampa Bay, Fla.

Distribution: North Carolina: Waccamaw formation, Walkers Bluff, Bladen County; Neills Eddy Landing near Cronly, Columbus County.

Outside distribution: Pliocene, Caloosahatchee marl, Caloosahatchee River, Fla. Recent, Tampa to Key West, in less than 50 fathoms.

Genus GLYPHOSTOMA Gabb

1873. *Glyphostoma* Gabb, Acad. Nat. Sci. Philadelphia Proc. for 1872, p. 270.

Type by monotypy: *Glyphostoma dentiferum* Gabb. Miocene, of the Dominican Republic.

Glyphostoma zoster Gardner, n. sp.

Plate 28, figure 6

Shell small, slender, spindle-shaped. Whorls 7¼ to 7½ in all; high, angular; the steeply sloping shoulder half as wide as the entire whorl. Body drawn out anteriorly; no abrupt constriction at the base. Nucleus of 2 small, smooth whorls, the initial turn inflated and immersed at the tip, the succeeding whorl high; its full, rounded outline becoming increasingly angular toward

the close of the turn. Beginning of conch indicated by a faint change in the shell texture and by the sharpening of the angle which develops into the spiral that outlines the peripheral keel; a second spiral introduced directly behind the suture within the first whorl, and an axial sculpture indicated by a faint rippling of the periphery; a third spiral intercalated between the peripheral and anterior spirals within the second turn. Adult axial sculpture of 9 to 12 rounded, feebly protractive ribs, most elevated at the periphery, dying out on the shoulder, irregular and evanescent on the body. Spirals narrow, elevated threads; the 3 original lirations the true primaries; secondaries intercalated; on the shoulder, 7 to 9 fine, sharp lirae, the anterior slightly more elevated than those behind it and setting off the threaded area as a girdle wound about the shell. Approximately 9 equisized and equispaced lirations of secondary strength on the base of the body and on the obscurely differentiated anterior canal, an equal number of slightly finer threadlets. Aperture rather narrow; set at a low angle to the axis of the shell. Outer lip produced backward slightly on the preceding whorl. Anal notch narrow, deep, symmetrically disposed upon the fasciole; rim heavily calloused. Labral varix heavy, denticulate within. Labium constricted at the base of the body. Parietal wash very thin, but the pillar heavily reinforced and wrinkled normal to the axis. Basal notch broad but not very deep.

Dimensions of holotype: Height, 9.6 mm.; greatest diameter, 4.0 mm.

Holotype: U.S.N.M. 497852.

Type Locality: Natural Well, 2 miles southwest of Magnolia, Duplin County, N. C. Duplin marl.

Glyphostoma zoster may be an antecedent of *G. johnsoni* Dall from the Waccamaw formation of the Cape Fear River. The Duplin shell is more slender, the shoulder more steeply sloping, and both the axial and spiral sculpture less vigorous. The abrupt termination of the ribs at the periphery in *G. johnsoni* sharply defines the posterior fasciole; in *G. zoster* and its subspecies the fasciole is more or less rippled by the continuation of the costals behind the periphery. *Glyphostoma zoster mansfieldi* represents the less slender forms of the *G. zoster* group with more elevated and persistent axials and a more subdued and monotonous spiral sculpture. *Glyphostoma zoster phroudon* is also less slender than *G. zoster* s. s., and the body is relatively larger than either the restricted species or the subspecies *mansfieldi*. It differs further from both of them in the more elevated axials that rather strongly ripple the posterior fasciole.

Distribution: Duplin marl, 1½ miles northwest of Magnolia and Natural Well. 2 miles southwest of Magnolia, Duplin County, N. C.

Glyphostoma zoster mansfieldi Gardner, n. subsp.

Plate 37, figure 17

A rather slender fusiform shell of 2 nuclear and 5¼ to 5½ closely appressed post-nuclear volutions. Aperture almost half the length of the entire shell. Initial whorl smooth, rounded, immersed at the tip; succeeding turn also smooth but less inflated and becoming increasingly angular at the periphery; sculpture first appearing in the form of a spiral cord which later marks the anterior margin of the anal fasciole. Postnuclear whorls slightly keeled at the periphery, flattened in front of the periphery, feebly concave behind it. Costae broad, undulating elevations, 11 on the body, 9 on the final whorl of the spire, persistent from the shoulder to the anterior suture but becoming obsolete posteriorly on the fasciole; costae less prominent on the body than on the spire and tending to evanesce as they approach the labrum; faint incrementals visible, most conspicuous on the fasciole, where they trace the former margin of the sinus. Spiral lirations strong, flattened cords, the primaries 3 or 4 on the later whorls of the spire and the medial portion of the body; secondaries regularly intercalated on the later whorls of the spire, the body, and the pillar. Anal fasciole concave, about half the width of the entire whorl; more or less undulated by the costae; sculptured with 8 to 10 crowded lirae and arcuate incrementals, most obvious posteriorly. Suture closely appressed, slightly waved by the costals of the preceding whorl. Aperture rather wide. Labrum deeply notched posteriorly, widely flaring medially, contracted at the base of the canal; decidedly thickened within, obscurely denticulate. Columella calloused, concave, feebly wrinkled near the extremity of the canal. Anterior fasciole indicated only by the finer threading. Base broadly and obliquely emarginate.

Dimensions of holotype: Height, 9.5 mm.; maximum diameter, 4.0 mm.

Holotype: U.S.N.M. 499116.

Type locality: Natural Well, 2 miles southwest of Magnolia, Duplin County, N. C. Duplin marl.

Glyphostoma zoster mansfieldi lacks the characteristic armature of the genus and is probably not fully mature. The form, nuclear characters, and sculpture pattern are all typical of *Glyphostoma*. It differs from *G. zoster* s. s. and the subspecies *phroudon* in the outline of the whorls and in the low, flat, regular spirals. The subspecies has been recovered only from the Natural Well and nearby outcrops.

Glyphostoma zoster phroudon Gardner, n. subsp.

Plate 37, figure 26

Shell small. Outline roughly biconic, the apparent size of the body increased by the widely flaring labrum. Whorls of spire convex, tapering rather rapidly to an acute apex. Nucleus of about 2 small, smooth whorls;

the initial whorl inflated and immersed at the tip; the succeeding whorl high, the full, rounded outline becoming increasingly angular toward the close of the nuclear stage. Post nuclear whorls closely appressed, 5¼ to 5½, rippled by 10 broad, elevated axials, most prominent on the periphery but persistent to the anterior suture; weakening, however, and becoming obsolete as they cross the anal fasciole; irregular on the body, tending to bifurcate anteriorly and to evanesce before reaching the base of the pillar; terminal rib varicose. Spiral sculpture subdued; primaries low, broad, somewhat flattened, 3 or 4 in front of the periphery on the later volutions of the spire and 2 or 3 on the earlier turns; secondaries regularly intercalated. Anal fasciole broad, about half as high as the entire whorl, feebly undulated, threaded with 8 to 10 crowded lirae; the tracings of the sinus obscure except near the aperture. Aperture narrow, oblique to the axis of the shell. Outer lip produced backward slightly, flaring medially, thin-edged, varicose directly behind the margin. Anal notch deep, symmetrically disposed upon the fasciole, the rim reinforced by the varical callus. Inner varical surface of labrum dentate, the denticle directly in front of the labral notch, the most prominent, that at the margin of the canal oblique, the intermediate denticles elongated at right angles to the edge of the lip. Labium constricted at the base of the body, heavily callused; a single denticle near the opening of the posterior canal and 4 or 5 plications farther forward on the pillar. Anterior fasciole differentiated only by the finer spiral threading; short, broad, and obliquely emarginate.

Dimensions of holotype: Height, 9.3 mm.; maximum diameter, 4.0 mm.

Holotype: U.S.N.M. 325375.

Type locality: One and one-half miles northeast of Fairmont (Ashpole), Robeson County, N. C. Duplin marl.

Glyphostoma zoster phroudon differs both from *G. zoster* s. s. and the subspecies *mansfieldi* in the relatively larger body whorl and consequent apical angle, and in the more elevated axials that are made the more prominent by the overriding primary spirals.

Distribution: North Carolina: Duplin marl, Natural Well, 2 miles southwest of Magnolia, Duplin County; 1½ miles north of Fairmont, Robeson County.

Glyphostoma scoptes Dall

Plate 37, figure 20

1903. *Glyphostoma scoptes* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, pl. 60, fig. 15. (No description.)

Shell slender, spire attenuated. Volutions about 10 in all; closely appressed; tip of spire decollated. Nuclear whorls small and smooth, probably 2 to 2½. Beginning of conch marked by a slight change in the texture of the shell and by the abrupt appearance of a spiral thread which on the later whorls outlines the keel; a second less elevated thread intercalated between it and the anterior suture; axial sculpture indicated at the close of the first half turn by the rippling of the periphery. Adult whorls heavily sculptured. Axial costae undulatory, particularly on the earlier whorls; ranging from 10 on the first 4 whorls of the conch to 15 on the final turn; costae slightly protractive, most prominent on the periphery, almost or altogether absent on the fasciole, weakening toward the anterior suture and, on the body, reduced to feeble riblets crowned by peripheral tubercles; intercostal areas concave and slightly narrower than the rounded costae. Spirals low, flat-topped, straight-sided bands overriding the costae; primaries 2 to each whorl of the spire, that defining the periphery slightly stronger than the one in front of it; an additional, less prominent band back of the periphery, outlining the anterior margin of the fasciole; body lirations 21, similar in character to those on the spire but increasingly narrower and more proximate anteriorly. Anal fasciole occupying nearly half of each of the whorls of the spire, concave in profile, sculptured with numerous, retractive, strongly arcuate, irregular wrinkles and 3 or 4 broad spirals, so low that they can be defined only under high magnification. Suture line not impressed except on the final turns. Aperture oblique to the axis. Outer lip arcuate, varicose but thinning at the margin. Anal notch very deep, symmetrically placed on the fasciole, heavily reinforced by the varical callus. Inner surface of outer lip set with 7 irregular denticles, approximately equispaced, equisized, except for the second from the posterior commissure, which is the most prominent, and for the oblique anterior wrinkle which marks the entrance to the canal. Inner lip excavated posteriorly, washed with callus; 3 oblique wrinkles in front of the posterior siphonal notch; another more nearly at right angles to the axis of the shell, at the base of the body whorl; about 7 transverse folds on the anterior part of the labium. Canal rather long, partially closed anteriorly by the constriction of the margin of the outer lip; anterior fasciole indicated by the finer, closer threading; recurved and broadly emarginate.

Dimensions of holotype: Height, 12.3 mm.; maximum diameter, 4.2 mm.

Holotype: U.S.N.M. 163977.

Type locality: Shell Creek, Fla. Caloosahatchee marl.

The slender outline and many-whorled, attenuated spire separate this species from all others of the genus occurring within the Tertiary of North Carolina.

The form has been figured by Dall but has not been described.

Distribution: Waccamaw formation, Neills Eddy Landing, Cape Fear River, 3 miles north of Cronly, Columbus County, N. C.

Outside distribution: Pliocene, Caloosahatchee marl, Shell Creek, Fla.

Family TEREBRIDAE

Genus TEREBRA Bruguière

1789. *Terebra* Bruguière, Encyclopédie méthodique, Histoire naturelle des vers, vol. 1, p. XV (no species mentioned).
1799. *Terebra* Lamarck, Prodrome d'une nouvelle classification des coquilles: Soc. histoire nat. Paris Mém., p. 71. Sole example, *Buccinum subulatum* Linnaeus.
1908. *Terebra* Bruguière. Dall, Harvard Coll. Mus. Comp. Zoology Bull., vol. 43, No. 6, p. 245.
1923. *Terebra* (Bruguière) Lamarck. Bartsch, Nautilus, vol. 37, pp. 60–64.
1928. *Terebra* Bruguière, Woodring, Carnegie Inst. Washington Pub. 385, p. 135.

Type by monotypy: *Buccinum subulatum* Linnaeus. Recent, in the Indo-Pacific.

Subgenus PARATEREBRA Woodring

1928. *Paraterebra* Woodring, Carnegie Inst. Washington Pub. 385, p. 135.

Type by original designation: *Terebra texana* Dall. Recent, in the Gulf of Mexico and the Caribbean Sea.

Terebra (Paraterebra) unilineata (Conrad)

Plate 38, figures 35, 36

1841. *Cerithium unilineatum* Conrad, Am. Jour. Sci., 1st ser., vol. 41, p. 345, pl. 2, fig. 4.
1843. *Cerithium unilineatum* Conrad, Assoc. Am. Geologists and Naturalists Trans., p. 108, pl. 5, fig. 4.
1856. *Acus unilineata* (Conrad). Tuomey and Holmes, Pleiocene fossils of South Carolina, p. 137, pl. 28, fig. 7.
1858. *Terebra unilineata* Tuomey and Holmes. Emmons, North Carolina Geol. Survey Rept., p. 258, fig. 129.
1863. *Terebra* (*Acus*) *unilineata* Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 565.
1904. *Terebra unilineata* Conrad. Martin, Maryland Geol. Survey, Miocene, p. 138, pl. 40, figs. 1, 2.
1909. *Terebra unilineata* Conrad. Grabau and Shimer, North American index fossils, vol. 1, p. 798, figs. 1173 a, b.

Slightly turrited; volutions with each a spiral impressed line above the middle; space between this line and suture with oblique plicae.—Conrad, 1841.

Shell elevated, turrited, tapering evenly to an acute apex. Whorls 15 to 18, straight-sided, increasing gradually in diameter. Pre-sutural band closely appressed. moderately wide; on the spire, between one-third and one-half the height of the whorl; limited anteriorly by a slightly impressed line that in many specimens becomes obsolete on the later whorls of the adult; a single fortuitous spiral occasionally present on the band. Axial sculpture feeble; some 25 narrow, pinched ridges on the pre-sutural band; rather sharp on the earlier whorls but less conspicuous and more or less obsolete on the later; a row of minute nodules, in line with the axial ridges, developed directly in front of the impressed spiral on the early whorls; on the later whorls, axial sculpture in front of the spiral, restricted to incrementals, retractive posteriorly, somewhat sinous on the base of the whorl. Aperture auriculate. Body abruptly contracted at the base. Columellar lip strongly concave, bearing anteriorly a strong, marginal fold and behind it a feeble second plication. Labrum sharp, simple, broadly arcuate. Anterior canal short, strongly recurved. Siphonal fasciole short, oblique, heavily corrugated, emarginate.

Terebra unilineata Conrad is well characterized by the restriction of the axial sculpture to the posterior half of the whorl. The species attains a considerable height; an individual collected by Mr. Joseph Willcox, and now in the possession of the Wagner Free Institute of Science of Philadelphia, measures 96 mm.

Type locality: Duplin County, N. C.

The form is fairly abundant at the few localities at which it occurs.

Terebra unilineata Conrad may possibly be an ancestral form of the type of the subgenus. The outline is much the same in both, and the Miocene form approaches the dimensions of the Recent species. The presutural band is, however, much wider in the Recent species, and there is no trace in the Miocene form of the sulcus which bisects the band of *T. texana*. The anterior canal is longer in *T. texana* than in *T. unilineata*, but in both species there is a strong marginal fold and behind it an incipient second plication.

Distribution: North Carolina: Duplin marl, Natural Well, 2 miles southwest of Magnolia, Duplin County; 1½ miles northeast of Fairmont and 2 miles below Lumberton, Robeson County.

Subgenus STRIOTEREBRUM Sacco

1891. *Strioterebrum* Sacco, I Molluschi dei Terreni Terziarii del Piemonte e della Liguria, pt. 10, p. 33.

Type by original designation: *Terebra basteroti* Nyst. Miocene, of the Piedmont of Italy.

Terebra (Strioterebrum) carolinensis (Conrad)

Plate 38, figure 30

1841. *Cerithium carolinensis* Conrad, Am. Jour. Sci., 1st ser., vol. 41, p. 345.
1856. *Acus dislocatum* var. *carolinensis* (Conrad). Tuomey and Holmes, Pleiocene fossils of South Carolina, p. 125, pl. 28, fig. 8.
1859. *Terebra dislocata* DeKay (part). Holmes, Post-Pleiocene fossils of South Carolina, p. 70 (pl. 11, fig. 12, excl.).
1863. *Terebra* (*Acus*) *carolinensis* Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 565. (Name only.)

Subulate; whirls with impressed spiral lines and numerous acute longitudinal ribs which are dislocated by a sulcus below the suture. Length, 2¼ inches. Resembles *C. dislocatum*, but is far larger, and has much more numerous and less prominent ribs.—Conrad, 1841.

Holotype: Acad. Nat. Sci. Philadelphia 1601.

Shell slender, elevated-conic; the body constricted abruptly into a short neck. Protoconch small, the initial turn rounded and immersed at the tip, the succeeding volution flattened laterally. Whorls of conch approximately 13; gently and evenly increasing in diameter. Presutural band rather narrow, sharply delimited anteriorly by an incised spiral groove. Axial sculpture of 20 to 25 lirate, slightly irregular ribs which are retractive posteriorly and are truncated by

the pre-sutural sulcus. Spiral sculpture less distinct than the axial; spirals linear or nearly so, somewhat irregular and separated by linear interspaces. Aperture moderately wide. Labrum thin, simple, broadly arcuate. Labium excavated at the base of the body. Parietal wall enameled. Anterior canal short, recurved. Siphonal fasciole oblique, roughened by the incrementals, the posterior margin raised and acute. Terminal notch shallow.

The diameter of the body whorl is greater in proportion to the height than in *Terebra protexta* (pl. 38, fig. 31), and the sculpture is more closely cancellate.

Distribution: Yorktown formation, 1 mile northeast of Suffolk, Nansemond County, Va.

North Carolina: Yorktown formation, 1 mile east of Lizzie, Greene County; 3 miles south of Farmville, Pitt County. Duplin marl, Natural Well, 2 miles southwest of Magnolia, Duplin County; Fairmont, Robeson County.

Outside distribution: Miocene, Duplin marl at the Muldrow Place, 5 miles southeast of Mayesville, Sumter County, S. C.

Terebra (Strioterebrum) neglecta (Emmons)

Plate 38, figure 33

1858. *Terebra neglecta* Emmons, North Carolina Geol. Survey Rept., p. 258.

1863. *Terebra (Acus) neglecta* Emmons. Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 565. (Name only.)

1896 (Apr. 23). *Terebra (Acus) neglecta* Emmons. Dall, U. S. Nat. Mus. Proc., vol. 18, p. 40.

Shell terete; spire composed of many whorls, traversed spirally by a deeply impressed line, dividing it into two unequal parts; the lower has three or four interrupted spiral lines, the upper, none. The ribs of the upper part are more obtuse than the lower, and die out before they reach the dividing impressed line; in the lower, they cross it from line to line.

In this species, the revolving lines are fewer than in the *T. dislocatum*, and in the latter, they are common to both parts of the whorl. In the *unilineata*, there is but one distinct revolving line."—Emmons, 1858.

This unfigured species appears to have been lost sight of, though apparently well characterized. At first sight it would recall *T. dislocata*, but on inspection it is found to differ materially. The sutural band is marked in front by a constriction, not a sulcus, toward which the transverse sculpture becomes obsolete, while the front part of each whorl is somewhat swollen, with the ribs strongest on the periphery. In many specimens the ribbing on the sutural band alternates with that on the whorl. The posterior half of the whorl is smooth or only faintly spirally striated; on the anterior half the spirals, though fine and close, are well-marked. The pillar is smooth and without plaits, while in *T. dislocata* it is biplicate. The shell reaches about 32 mm. in length and 7.5 in maximum diameter, with 15 whorls. The taper of the tip of the spire is more rapid than the rest, instead of being uniformly conical. It was described by Emmons from the Miocene of North Carolina, but was not found by Burns in the Duplin beds—Dall, 1896.

Habitat: North Carolina.

Dimensions of figured specimen: Height, 19.5 mm.; maximum diameter, 5.4 mm.

Figured specimen: U.S.N.M. 11461, from the Miocene of "South Carolina."

Distribution: Virginia: Yorktown formation, Yorktown, York County; upper bed near Suffolk, Nansemond County.

North Carolina: Duplin marl, 2 miles below Lumberton, Robeson County. Very rare.

Outside distribution: Miocene, "South Carolina," no locality specified. Duplin marl on the Muldrow Place, 5 miles southeast of Mayesville, Sumter County, S. C.

Terebra (Strioterebrum) robesonensis Gardner, n. sp.

Plate 38, figure 29

Outline subulate, but stout and heavy for the group; body whorl abruptly contracted into the short neck. Apex broken away; exact number of whorls indeterminable, but probably 8 to 10. Sculpture both axial and spiral, the former dominant. Presutural band well differentiated. Axial costae narrow, sharply elevated, not overridden by the spirals, usually 12 to 14 to the whorl, uniform in strength from the anterior suture to the presutural sulcus, completely dissected, as a rule, and usually suffering a slight offset at the sulcus; interaxial spaces broadly convex, sculptured with 4 or 5 linear grooves equal in size and spacing, none of them trenching the radials, except the gutter which isolates the presutural band. Suture distinct, feebly undulated by the close appression of the whorls and the strength of the axial costae. Characters of aperture obscured by the breaking away of the outer lip. Columella slightly contracted at the base of the body whorl; bearing a marginal plait, and behind it a second less elevated fold. Canal open, very short, recurved, emarginate. Anterior fasciole differentiated by the slightly elevated posterior border, and by the vigor of the incremental sculpture.

Dimensions of imperfect holotype: Height, 21.5 mm.; diameter, 8.0 mm.

Holotype: U.S.N.M. 325370.

Type locality: Two miles below Lumberton, Robeson County, N. C. Duplin marl.

Terebra robesonensis displays an obvious relationship to *T. dislocata* Say, but it is less slender, and the axial sculpture is more vigorous.

The species is recorded only from the type locality.

Terebra (Strioterebrum?) grayi Gardner, n. sp.

Plate 38, figure 34

Shell subulate, not conspicuously slender. Whorls possibly 9 or 10, the apex lost, and the number of whorls not determinable. Axials 13 or 14 on the later volutions; narrow, pinched ridges, most elevated on either side of the suture, commonly obsolete along a narrow area in front of the sulcus. Sulcus not very deep but sharply defined, the area behind it studded with subnodose axials slightly offset from the axials in front of them. Spiral sculpture other than the sulcus restricted to 8 or 9 linear grooves upon the periphery and base of the body whorl; absent on the neck. Suture impressed, minutely crenulated by the axials of the preceding volution. Characters of aperture obscured by the imperfec-

tions of the outer lip. Columella excavated at the base of the body; a feeble fold on the twisted edge of the pillar. Anterior canal short, recurved, emarginate. Anterior fasciole set off from the short neck by the raised posterior margin and by the change in direction of the prominent growth lines.

Dimensions of imperfect holotype: Height, 18.5 mm.; diameter, 5.9 mm.

Holotype: U.S.N.M. 325369.

Type and only locality: Yorktown, York County, Va. Yorktown formation.

Terebra grayi lacks the characteristic reticulate sculpture of the subgenus, but it suggests by the character of its axial sculpture *Terebra neglecta* Emmons, of the Duplin formation of the Carolinas. It differs most obviously in the absence of any trace of spiral sculpture except the spiral that outlines the sutural band and the few grooves upon the periphery and base of the body whorl. The sulcus outlining the band is not deep, but the sides slope toward it both from the anterior and the posterior sutures, so that the whorls have the appearance of being folded along that line.

The species name is given in honor of Mr. J. E. Gray, who manifested great interest in the Terebridae and left his impress upon their systematic arrangement.

Terebra (Strioterebrum) protexta (Conrad) Dall

Plate 38, figure 31

1846. *Cerithium protextum* Conrad, Acad. Nat. Sci. Philadelphia Proc., vol. 3, p. 26.

1889. *Acus protextus* Conrad. Dall, Harvard Coll. Mus. Comp. Zoology Bull., vol. 18, pp. 63, 65.

1890. *Terebra (Acus) protexta* Conrad. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 25.

Subulate, elongated, with longitudinal curved acute costae, and fine revolving lines; whorls 15, slightly convex; ribs divided and somewhat dislocated by an impressed line below the suture; color purplish-black; within the same.

Locality, Tampa Bay?

The specimen described is more than three-fourths of an inch long, but the usual size is less than half an inch.—Conrad, 1846.

Whorls convex, periphery destitute of nodules, whorls crossed by sharp-edged, very flexuous waves; interspaces with crowded spirals and sharp grooves, which do not cut the crest of the waves. Ashy to dark purple; band distinct. Lon. 21.2, lat. 4.7 mm., whorls 15.—Dall, 1889.

Dimensions of figured specimen: Height, 21.4 mm.; maximum diameter, 4.4 mm.

Figured specimen: U.S.N.M. 36077, from the mud flats of Sarasota Bay, Fla.

Shell small, slender, acutely tapering. Body constricted into a short neck. Whorls approximately 15, flattened or slightly convex. Axial sculpture of sharp, subequal and subequispaced, flexuous ribs, 25 to 30 on the final volution. Presutural sulcus distinct but rarely deep enough to truncate the costals. Spiral sculpture of clean-cut, subequal and subequispaced impressed lines that do not, as a rule, override the costals; spirals 5 to 7 on the later whorls of the spire, approximately 9 on the sides of the body whorl, and 9 more crowded sulci on the base. Aperture narrow. Outer lip evenly arcuate. Inner margin sigmoidal. Parietal wall calloused. Pillar bearing a single feeble marginal fold. Canal short, recurved, emarginate. Anterior fasciole deltoid, roughened by the incrementals.

The finely sculptured end members of the *Terebra protexta* series may closely approach the peripheral forms of *T.* (*Strioterebrum*) *concava* (Say) (pl. 38, fig. 32).

Distribution: North Carolina: Waccamaw formation, Walkers Bluff, Bladen County; Neills Eddy Landing, Cape Fear River, 3 miles north of Cronly, Columbus County.

Outside distribution: Miocene, Choctawhatchee formation (*Cancellaria* zone), Harveys Creek, Leon County, Fla. Pliocene, Caloosahatchee marl, Nashua, Putnam County, Fla.; Caloosahatchee River, Shell Creek, Alligator Creek, and Myakka River, Fla. Pleistocene, Delray well at 118 feet depth, Palm Beach County; Labelle, Caloosahatchee River, Hendrey County, Fla. Recent, Hatteras to Veracruz, Mexico, in 3 to 48 fathoms.

Order OPISTHOBRANCHIA

Suborder TECTIBRANCHIATA

Family ACTEONIDAE

Genus ACTEON Montfort

1810. *Acteon* Montfort, Conchyliologie systématique, vol. 2, p. 315.

Type by monotypy: *Voluta tornatilis* Gmelin. Recent, off the west European shores.

Acteon novellus Conrad

Plate 38, figures 24, 26

1834. *Acteon novellus* Conrad, Acad. Nat. Sci. Philadelphia Jour., 1st ser., vol. 7, pt. 1, p. 142.

1863. *Acteon novellus* Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 570. (Name only.)

Shell subcylindrical, very small, with minute crowded impressed spiral lines; columella with an obtuse, not very prominent fold.

Locality. Suffolk, Va.

This species differs in its striae from all our other species; these are more minute and crowded.—Conrad, 1834.

Holotype: Acad. Nat. Sci. Philadelphia 1600. *Acteon ovoides* Conrad, 1830, reported from the Calvert formation through the St. Marys formation of Maryland is similarly sculptured but more slender in outline. The shell figured from the St. Marys of Maryland under the name of *Acteon pusillus* (Forbes) is more rounded.

Distribution: The species is not represented in any of our later collections.

Acteon novellus nansemondensis Gardner, n. subsp.?

Plate 38, figure 25

Shell rather large for the genus; the body broad, the sides of the whorls trapezoidal. Nucleus heterostrophous, small and smooth, the tip immersed, the evident volutions about 1½. Succeeding turns 4½, rapidly increasing in diameter, subtrapezodial, narrowly tabu-

lated. Dominant sculpture spiral, of straight-sided grooves numbering 26 on the body, 7 on the final whorl of the spire, equal in size and spacing, separated by flattened interareas of about double the width of the depressions; type showing an additional spiral on the third groove in front of the posterior suture of the body whorl but this is probably fortuitous; faint incrementals visible alike in the grooves and on the interspaces, but not sufficiently strong to mark the sulci. Suture conspicuously channelled. Aperture holostomous, elongate-ovate, angulated posteriorly, produced and flaring anteriorly. Outer lip sharp, faintly crenulated within. Inner lip sinuous; parietal wall callosed; pillar thickened and reversed, bearing a single oblique, inconspicuous plait.

Acteon novellus nansemondensis, n. subsp.?, is separated from other species of the genus characterized by a strong spiral sculpture, by the angular outline of the whorls, the uniform distribution of the spirals and their nonpunctate character.

Acteon novellus Conrad from the same formation and area is very close and their differences may be even less than subspecific. *Acteon novellus* is larger by a third than the possible subspecies, the banding of *A. n. nansemondensis* seems wider and more regular, the aperture more produced in front and the columellar fold decidely less strong. The two forms may represent in the northern faunas *A. textilis* Guppy of the Floridian and mid-American late Tertiary assemblage. In the southern species the sulci are wider relatively and are evenly lineated by the sharp incrementals.

Dimensions of holotype: Height, 8.0 mm.; maximum diameter, 4.5 mm.

Holotype: U.S.N.M. 325367.

Type locality: One mile northeast of Suffolk, Nansemond County, Va. Yorktown formation.

The type is unique.

Family ATYIDAE

Genus ATYS Montfort

1810. *Atys* Montfort, Conchyliologie systématique, vol. 2, p. 343.

Type by original designation: *Atys cymbulus* Montfort=*Bulla naucum* Linnaeus. Recent, in the Indo-Pacific.

Subgenus ALICULASTRUM Pilsbry

1831. *Alicula* Ehrenberg, Symbolae physicae, seu icones et descriptiones, vol. 4, p. 41, of Mollusca.
Not *Alicula* Eichwald, Naturhistorische Skizze von Lithauen, Volhynien und Podolien in geognostisch-mineralogischen, botanischen, und zooligischen Hinsicht entworfen, p. 214, 1830.

1896. *Aliculastrum* Pilsbry, Manual of conchology, ser. 1, vol. 16, p. 237.

1928. *Aliculastrum* Pilsbry. Woodring, Carnegie Inst. Washington Pub. 385, p. 127.

Type by monotypy: *Bulla cylindrica* Helbling. Recent, in the Indo-Pacific.

Aliculastrum is separated from the typical *Atys* by the less inflated, more cylindrical outline, and the obscure or obsolete plication of the columella. It shares with *Atys*, however, the characteristic twist of the lip behind the vertex.

Atys? (Aliculastrum?) ornata Gardner n. sp.

Plate 38, figures 9, 10

Shell small, heavy for the genus, subcylindrical. Spire immersed, minutely perforate. Body whorl globose. Surface of shell sculptured with some 30 spiral striations, least feebly and most crowded toward the extremities, particularly toward the anterior end. Outer lip approximately vertical, produced posteriorly a little beyond the body whorl; patulous anteriorly. Margin of pillar lip slightly thickened and reversed, nonplicate.

Dimensions of holotype: Height, 2.5 mm.; diameter, 1.5 mm.

Holotype: U.S.N.M. 325368.

Type locality: Three and one-half miles below Palmyra Bluff on the Roanoke River, Halifax County, N. C. Yorktown formation.

The type is unique, except for a fragment of a slightly larger individual. The species is well characterized, however, by the relatively strong spiral sculpture, which is not restricted to the anterior and posterior areas, as in most representatives of the genus, but is present, though more feeble, upon the medial portion as well.

The reference of *ornata* either to *Atys* or *Aliculastrum* is dubious. The characters of the posterior portion of the shell are by no means typical, but the species seems to have more in common with *Atys* than with *Cylichna*, the group to which it was first referred.

Family SCAPHANDRIDAE

Genus ACTEOCINA Gray

1847. *Acteocina* Gray, Zool. Soc. London Proc. for 1847, pt. 15, p. 160.

1850. *Tornatina* Arthur Adams in Sowerby, Thesaurus conchyliorum, pt. 11, p. 554.

Type by original designation: *Acteon wetherellii* Lea. Miocene, of New Jersey.

Acteocina canaliculata vaughani Gardner, n. subsp.

Plate 38, figures 5, 6

In the subspecies *A. c. virginica* (Conrad),[28] the whorls are more tightly coiled than is normal for *A. canaliculata;* in the subspecies *A. c. vaughani* the reverse is true. Consequently, the form is more slender, the spire higher, and the sutures more clearly defined than in the typical *A. canaliculata.*

Dimensions of holotype: Height 4.5 mm., diameter 2.0 mm.

[28] Conrad, T. A., Descriptions of new genera and species of Miocene shells, with notes on other fossil and recent species: Am. Jour. Conchology, vol. 3, p. 257, pl. 21, fig. 2, 1868.

Holotype: U.S.N.M. 497059.

Type locality: Neills Eddy Landing, Cape Fear River, 3 miles north of Cronly, Columbus County, N. C. Waccamaw formation. The form is quite abundant at this single locality.

Genus CYLICHNA Lovén

1846. *Cylichna* Lovén, Index molluscorum Litora Scandinaviae occidentalia habitantium, p. 10; (Öfversigt) Kongl. vetensk. Akad. Förh., Arg. 3, No. 5, p. 142.

Not *Cylichnus* Burmeister, 1844, Handbuch der Entomologie, Band 4 (1), p. 171.

1891. *Bulinella* (part) R. Bullen-Newton, Systematic list of the Edwards collection of British Oligocene and Eocene Mollusca, p. 265.

Type by subsequent designation (Herrmannsen, Indicis generum malacozoorum primordia, vol. 2, Supplementa et corrigenda, p. 42, 1852): *Bulla cylindracea* Pennant. Recent, off the west coast of Europe. Reported from the Pliocene and Pleistocene of Europe.

Cylichna cylindrus (H. C. Lea)

Plate 38, figures 27, 28

1846. *Bulla cylindrus* H. C. Lea, Am. Philos. Soc., new ser., vol. 9, p. 250, pl. 35, fig. 43.

1863. *Bulla cylindrus* H. C. Lea. Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 571 (name only).

Shell subelliptical, acuminate above and below, thick, polished, striate; spire umbilicate; last whorl striate at the base and apex; mouth falcate, wide below; columella reflected. Length .21. Breadth .10 of an inch.—H. C. Lea, 1846.

Locality: Petersburg, Dinwiddie County, Va.

Figured specimen: Acad. Nat. Sci. Philadelphia 1554.

Distribution: Yorktown formation, Virginia. The species has not been reported from any other than the type locality and is not represented in the material at hand.

Cylichna duplinensis (Dall)

Plate 38, figures 18, 19

1896. (Apr. 23) *Retusa* (*Cylichnina*) *duplinensis* Dall, U. S. Nat. Mus. Proc. for 1895, vol. 18, p. 31.

Shell cylindrical, surface marked with lines of growth, which are slightly elevated where they pass over the ridge into the apical perforation, and with fine spiral striae, which on and near the base are alternated with sharper grooves; aperture narrow, as long as the shell; the outer lip straight, behind but little produced, and moderately receding to the suture; in front the outer lip recedes and joins the pillar evenly; pillar very oblique, strong, with an obscure plait, a small chink behind the anterior end; body short, with a little wash of callus; apex of the shell gently rounded over to a cylindrical perforation, with little or no funicular border. Longitude, 6.75 [6.9]; maximum diameter, 2.5 [2.8] mm.

Habitat. Carolinian marl, at the Natural Well, Duplin County, North Carolina, Burns.—Dall. 1896.

Holotype: U.S.N.M. 113876.

Cylichna anthera Gardner, from the Shoal River formation of Florida, shares many of the general characteristics of *C. duplinensis* but the apical portion of *C. anthera* is planed off and unites with the sides of the body in a subacute angle.

Distribution: North Carolina: Duplin marl, Natural Well, Duplin County.

PLATES 24–38

PLATE 24

[The measurements have been checked, but many of the enlargements are to some degree inaccurate.]

FIGURE 1. *Dentalium (Antalis?) waccamawense* Gardner, n. sp. (p. 179). Lateral view of holotype (U. S. Nat. Mus. 325479), from the Waccamaw formation at Robinsons Landing, Cape Fear River, Bladen County, N. C.; length 32.5 millimeters; diameter 3.6 millimeters. × 2.

FIGURE 2. *Dentalium (Antalis?) pliocenum* Tuomey and Holmes (p. 179). Lateral view of specimen (U. S. Nat. Mus. 112722), from the Duplin marl, 2 miles west of Darlington Court House, Darlington County, S. C.; height 16.6 millimeters; diameter 1.8 millimeters. × 3.

FIGURES 3–4. *Dentalium carolinense* Conrad (p. 179).

3. Lateral view of larger specimen (U. S. Nat. Mus. 325480), from the Yorktown formation, 1 mile above Branchs Bridge Northampton County, N. C.; length 41.6 millimeters; diameter 4.4 millimeters.
4. Lateral view of smaller specimen (U. S. Nat. Mus. 325480); length 34.7 millimeters; diameter 4.3 millimeters.

FIGURE 5. *Vermicularia spirata* (Philippi) (p. 202). Tube of specimen (U. S. Nat. Mus. 53487), Recent, from grass below low water, at Key Largo, Fla.

FIGURE 6. *"Vermicularia?" nigricans* Dall (p. 201). Mass of tubes (U. S. Nat. Mus. 27341), Recent, from Sarasota Bay, Fla.

FIGURE 7. *Lemintina granifera tenera* (Dall) (p. 201). Mass of tubes, cotype (U. S. Nat. Mus. 112274), from the Duplin marl, Natural Well, 2 miles southwest of Magnolia, Duplin County, N. C.

FIGURE 8. *Architectonica (Pseudotorinia) nupera* (Conrad) Conrad (p. 200). Apertural view of specimen (U. S. Nat. Mus. 325471), from the Yorktown formation, 2½ to 3 miles below the Seaboard Air Line Railroad bridge, Nottoway River, Southampton County, Va.; height 8.0 millimeters; diameter 13.8 millimeters. × 3.

FIGURE 9. *Architectonica nobilis* "Bolten" Roeding (p. 199). Apertural view of specimen (U. S. Nat. Mus. 83685), Recent, in 49 fathoms, 17 miles east-southeast of Cape Hatteras, N. C.; height 19 millimeters; diameter 35 millimeters.

FIGURE 10. *Diodora catilliformis* (Rogers and Rogers) Pilsbry (p. 182). Apical view of holotype; "length, half an inch." (After Rogers and Rogers.)

FIGURE 11. *Architectonica (Pseudotorinia) nupera* (Conrad) Conrad (p. 200). Apical view of specimen shown in figure 8. × 3.

FIGURE 12. *Lemintina virginica* (Conrad) (p. 202). View of cotype from the St. Marys formation near Urbanna, Va. (After Conrad.)

FIGURE 13. *Architectonica nobilis* "Bolten" Roeding (p. 199). Basal view of specimen shown in figure 9.

FIGURE 14. *Diodora carolinensis* (Conrad) (p. 183). Apical view of specimen (U. S. Nat. Mus. 325478) from the Yorktown formation, Rock Landing, Neuse River, 16½ miles above New Bern, Craven County, N. C.; height 7.3 millimeters; length 20.0 millimeters; width 12.5 millimeters. × 2.

FIGURE 15. *Architectonica (Pseudotorinia) nupera* (Conrad) Conrad (p. 200). Basal view of specimen shown in figure 8. × 3.

FIGURE 16. *Littorina irrorata* (Say) (p. 191). Apertural view of specimen (U. S. Nat. Mus. 59695), Recent, from Hog Island, Va.; height 22.5 millimeters; diameter 16.0 millimeters.

FIGURE 17. *Sinum fragile* (Conrad) (p. 213). Holotype (Acad. Nat. Sci. Philadelphia 1551), from the St. Marys formation from St. Marys River, Md.; sculpture detail. × 6.

FIGURE 18. *Diodora carolinensis* (Conrad) (p. 183). Lateral view of specimen shown in figure 14. × 2.

FIGURE 19. *Diodora catilliformis* (Rogers and Rogers) Pilsbry (p. 182). Apical view of holotype shown in figure 10. × 3½. (After Rogers and Rogers.)

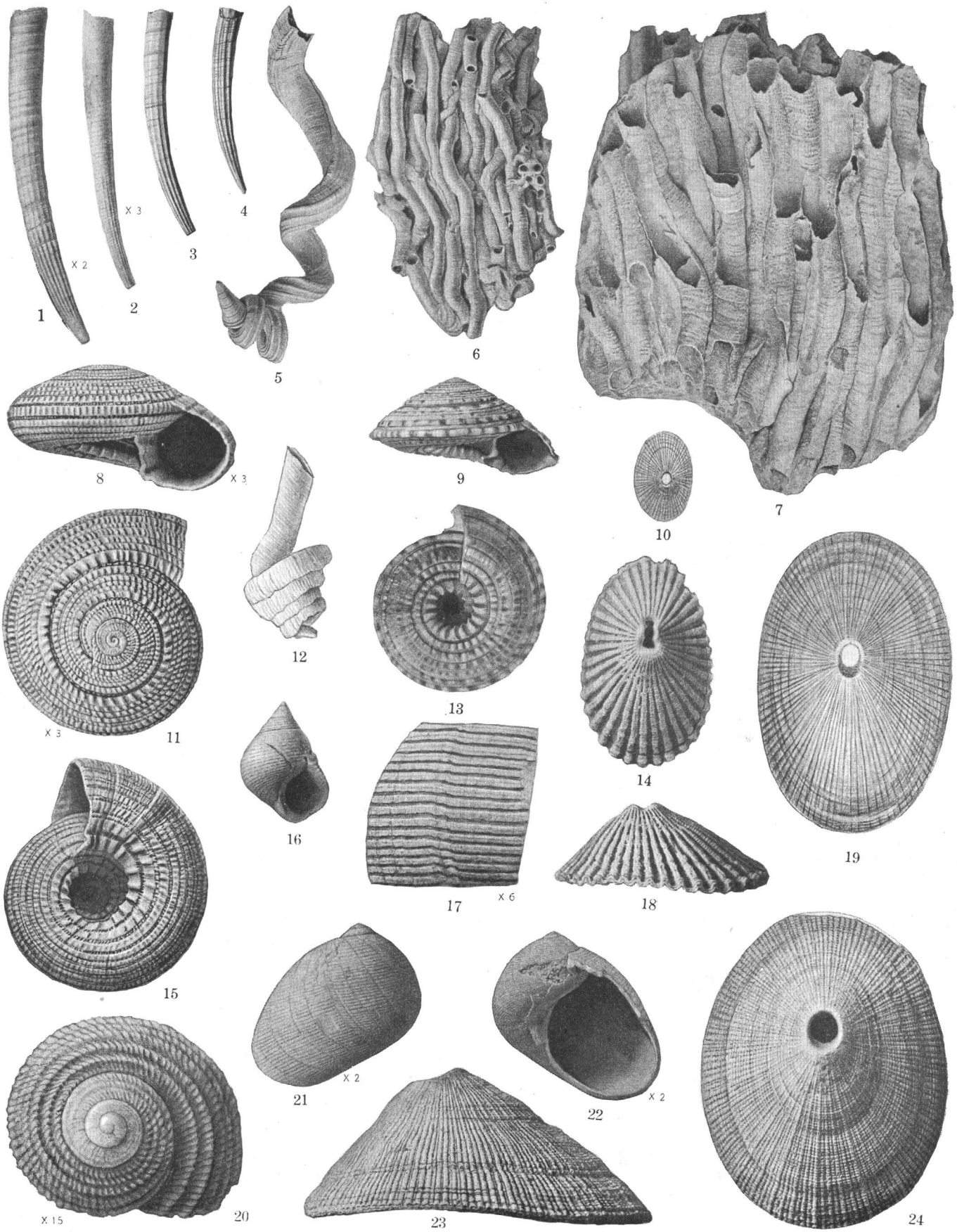
FIGURE 20. *Gibbula americana yorktownensis* Gardner, n. subsp. (p. 187). Apical view of juvenile paratype (U. S. Nat. Mus. 325465), from the Yorktown formation at Colerain Landing, Chowan River, Bertie County, N. C.; height 2.5 millimeters; diameter 3.0 millimeters. × 15.

FIGURES 21–22. *Sinum fragile* (Conrad) (p. 213).

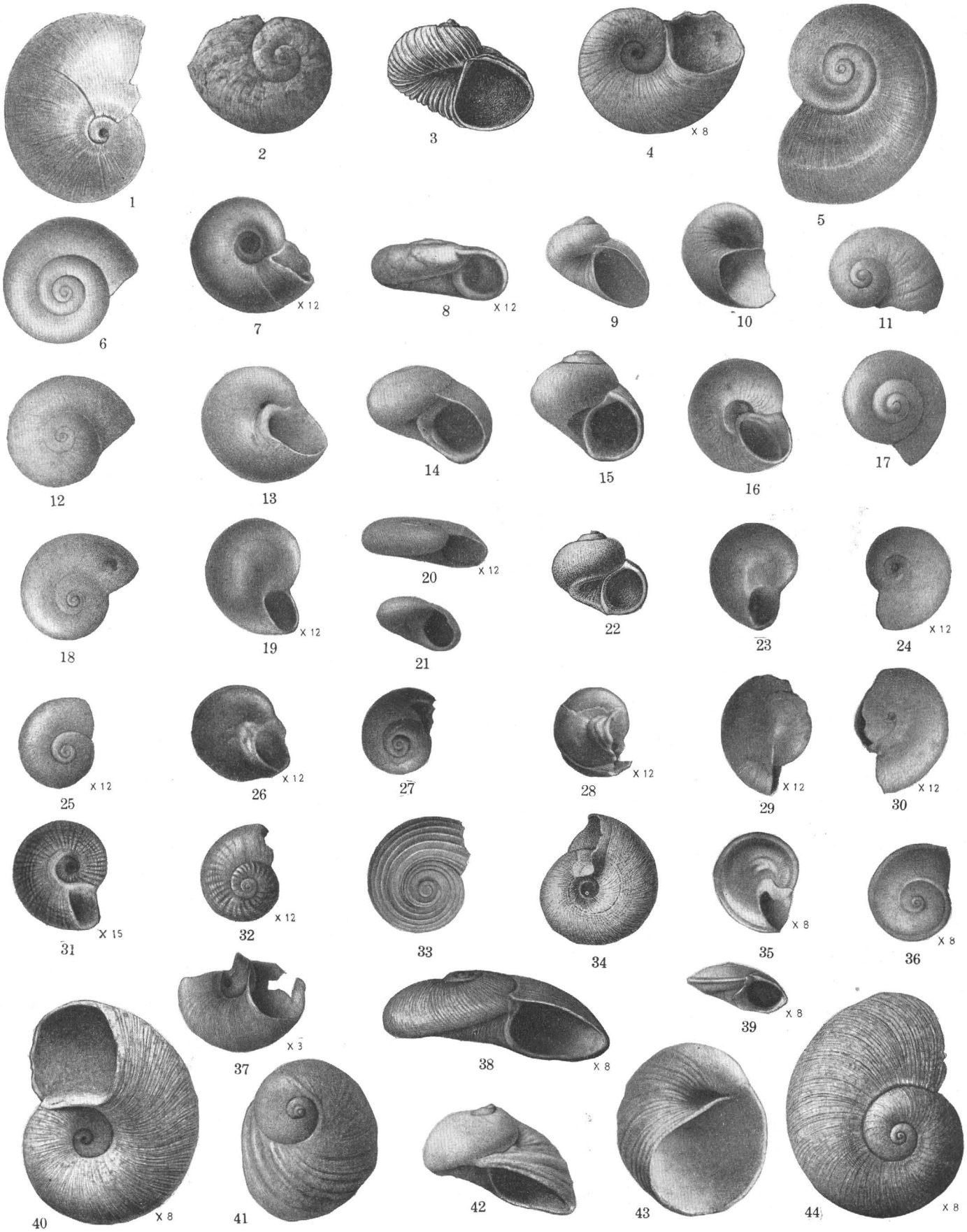
21. Rear view of holotype (Acad. Nat. Sci. Philadelphia 1551), from the St. Marys formation, St. Marys River, Md.; height 16.8 millimeters; diameter 16.5 millimeters. × 2.
22. Apertural view of holotype. × 2.

FIGURES 23–24. *Diodora redimicula virgilina* Gardner, n. subsp. (p. 182).

23. Lateral view of holotype (U. S. Nat. Mus. 325477), from the Yorktown formation, 6 miles below Greenville, Pitt County, N. C.; height 13.7 millimeters; length 32.6 millimeters. × 2.
24. Apical view of holotype. × 2.



SCAPHOPODS AND GASTROPODS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GASTROPODS

PLATE 25

FIGURE 1. *Cochliolepis parasitica* Stimpson (p. 194). Apical view of specimen from the Pleistocene at Simmons Bluff, S. C. × 7. (After Holmes.)

FIGURE 2. *Cochliolepis concava* (H. C. Lea) (p. 194). Apical view of holotype (Acad. Nat. Sci. Philadelphia 1538), from the Yorktown formation at Petersburg, Va. × 8.

FIGURE 3. *Macromphalina duplinensis* (Dall) (p. 195). Apertural view of holotype (U. S. Nat. Mus. 114430) from 1½ miles northwest of Magnolia, Duplin County, N. C.: height 2.75 millimeters; diameter 3.6 millimeters. × 7½. (After Dall.)

FIGURE 4. *Cochliolepis concava* (H. C. Lea) (p. 194). Basal view of holotype shown in figure 2. × 8.

FIGURE 5. *Cochliolepis holmesii* (Dall) (p. 194). Apical view of specimen from the Pleistocene at Cainhoy, Wando River, S. C. × 13. (After Holmes.)

FIGURES 6–8. *"Vitrinella" lipara* (H. C. Lea) (p. 194).

6. Apical view of holotype (Acad. Nat. Sci. Philadelphia 1542), from the Yorktown formation at Petersburg, Va. × 12.
7. Basal view of holotype. × 12.
8. Apertural view of holotype. × 12.

FIGURES 9–11. *Macromphalina*? sp. (p. 195).

9. Apertural view of specimen (U. S. Nat. Mus. 325461). Duplin marl, from the Natural Well, Duplin County, N. C.; height 1.8 millimeters; diameter 1.9 millimeters. × 10.
10. Basal view. × 10.
11. Apical view. × 10.

FIGURES 12–14. *"Pseudorotella" alexanderi* (Olsson) (p. 188).

12. Apical view of specimen (U. S. Nat. Mus. 325460), from the Waccamaw formation at Neills Eddy Landing, Cape Fear River, Columbus County, N. C. × 10.
13. Basal view of specimen. × 10.
14. Apertural view of specimen. × 10.

FIGURES 15–17. *Didianema*? *carolinae* Gardner, n. sp. (p. 191).

15. Apertural view of holotype (U. S. Nat. Mus. 325476), from the Waccamaw formation at Walkers Buff, Cape Fear River, Bladen County, N. C.; height 1.6 millimeters; diameter 1.6 millimeters. × 13½.
16. Basal view of holotype. × 13½.
17. Apical view of holotype. × 13½.

FIGURES 18–20. *Teinostoma smikron* Gardner, n. sp. (p. 187).

18. Apical view of holotype (U. S. Nat. Mus. 325473), from the Waccamaw formation, Neills Eddy Landing, Cape Fear River, Columbus County, N. C.; height 0.7 millimeters; diameter 1.8 millimeters. × 12.
19. Basal view of holotype. × 12.
20. Apertural view of holotype. × 12.

FIGURE 21. *Teinostoma milium* Dall (p. 188). Apertural view of holotype (U. S. Nat. Mus. 113098), from the Caloosahatchee marl, Caloosahatchee River, Fla.; height 0.8 millimeter; diameter 1.5 millimeters. × 12.

FIGURE 22. *Didianema*? *duplinensis* (Dall) (p. 191). Apertural view of holotype (U. S. Nat. Mus. 112661), from the Duplin marl at Natural Well, Duplin County, N. C.: height 1.5 millimeters; diameter 1.8 millimeters. × 10. (After Dall.)

FIGURES 23–24. *Teinostoma nanum* (Isaac Lea) (p. 187).

23. Basal view of holotype (Acad. Nat. Sci. Philadelphia 1569), from the St. Marys formation, St. Marys, Md. × 12.
24. Apical view of holotype. × 12.

FIGURES 25–26. *Teinostoma lenticulare* (H. C. Lea) (p. 188).

25. Apical view of specimen (Acad. Nat. Sci. Philadelphia 1567), from the Yorktown formation at Petersburg, Va. × 12.
26. Basal view of same specimen. × 12.

FIGURES 27–28. *Teinostoma subconicum* (H. C. Lea) (p. 188).

27. Apical view of holotype (Acad. Nat. Sci. Philadelphia 1568), from the Yorktown formation at Petersburg, Va. × 12.
28. Basal view of holotype. × 12.

FIGURES 29–30. *Teinostoma umbilicatum* (H. C. Lea) (p. 188).

29. Basal view of holotype (Acad. Nat. Sci. Philadelphia 1566), from the Yorktown formation at Petersburg, Va. × 12.
30. Apical view of holotype. × 12.

FIGURES 31–32. *Cyclostremiscus obliquè-striatus* (H. C. Lea) (p. 189).

31. Basal view of holotype (Acad. Nat. Sci. Philadelphia 1541), from the Yorktown formation at Petersburg, Va. × 15.
32. Apical view of holotype. × 12.

FIGURE 33. *"Circulus"* (?*supra-nitidus* Wood subsp.) *orbignyi* (Fischer) (p. 189). Apical view of specimen (U. S. Nat. Mus. 112345). From the Waccamaw formation at Tilly Lake, Waccamaw River, Horry County, S. C. × 8.

FIGURE 34. *Solariorbis steirata* (Dall) (p. 189). Basal view of holotype (U. S. Nat. Mus. 112649) from the Cape Fear River, N. C.; height 1.0 millimeter; diameter 2.6 millimeters. × 10. (After Dall.)

FIGURES 35–36. *Teinostoma carinatum* (H. C. Lea) (p. 188).

35. Basal view of specimen (U. S. Nat. Mus. 325474) from Yorktown formation, 1 mile northeast of Suffolk, Va. × 8.
36. Apical view of specimen shown in figure 35.

FIGURE 37. *Cochliolepis leai* (Dall) (p. 194). Basal view of holotype (U. S. Nat. Mus. 113602), from the Duplin marl, 1½ miles northwest of Magnolia, Duplin County, N. C. × 3.

FIGURE 38. *Cochliolepis concava* (H. C. Lea) (p. 194). Apertural view of topotype (U. S. Nat. Mus. 156078), from the Yorktown formation at Petersburg, Va.; height 2.0 millimeters; diameter 5.0 millimeters. × 8.

FIGURE 39. *Teinostoma carinatum* (H. C. Lea) (p. 188). Apertural view of specimen shown in figure 35. × 8.

FIGURE 40. *Cochliolepis concava* (H. C. Lea) (p. 194). Basal view of topotype shown in figure 38. × 8.

FIGURES 41–43. *Macromphalina pierrot* Gardner, n. sp. (p. 195).

41. Apical view of holotype (U. S. Nat. Mus. 325462) from the Waccamaw formation at Neills Eddy Landing, Cape Fear River, Columbus County, N. C.; height 2.0 millimeters; diameter 3.2 millimeters. × 10.
42. Apertural view of holotype. × 10.
43. Basal view of holotype. × 10.

FIGURE 44. *Cochliolepis concava* (H. C. Lea) (p. 194). Apical view of topotype shown in figure 38. × 8.

PLATE 26

FIGURES 1–2. *Calliostoma nottowayense* Gardner, n. sp. (p. 186).

1. Apertural view of holotype (U. S. Nat. Mus. 325466), from the Yorktown formation at Sycamore, Nottoway River, Southampton County, Va.; height 9.3 millimeters; diameter 11.1 millimeters. × 4.
2. Basal view of holotype. × 4.

FIGURES 3–4. *Calliostoma carolinense* Gardner, n. sp. (p. 184).

3. Basal view of holotype (U. S. Nat. Mus. 325472, from the Yorktown formation at Hamilton Bluff, Roanoke River, Martin County, N. C.; height 9.8 millimeters; diameter 11.2 millimeters. × 4.
4. Apertural view of holotype. × 4.

FIGURE 5. *Calliostoma conradi* Gardner, n. sp. (p. 186). Basal view of holotype (U. S. Nat. Mus. 325468), from Yorktown formation at Yorktown, Va.; height 9.8 millimeters; diameter 11.9 millimeters. × 3.

FIGURE 6. *Calliostoma armillatum* (Tuomey and Holmes) (p. 186). Apertural view of specimen (U. S. Nat. Mus. 113060), from near the Natural Well, Duplin County, N. C.; height 6.2 millimeters; diameter 8.8 millimeters. × 4.

FIGURES 7–8. *Calliostoma cyclum* Dall (p. 186).

7. Apertural view of holotype (U. S. Nat. Mus. 113062), from the Natural Well, Duplin County, N. C.; height 3.6. millimeters; diameter 5.2 millimeters. × 7. (After Dall.)
8. Basal view of holotype. × 7. (After Dall.)

FIGURE 9. *Calliostoma conradi* Gardner, n. sp. (p. 186). Apertural view of holotype shown in figure 5. × 3.

FIGURE 10. *Calliostoma labrosum* (Conrad) (p. 185). Apertural view of topotype (U. S. Nat. Mus. 113050), from the James River, Va.; height 7.3 millimeters; diameter 9.3 millimeters. × 4.

FIGURE 11. *Calliostoma basicum* Dall (p. 184). Apertural view of holotype (U. S. Nat. Mus. 113022), from the Yorktown formation at Petersburg, Va.; height 15.4 millimeters, diameter 14.5 millimeters. × 2.

FIGURE 12. *Calliostoma virginicum* (Conrad) (p. 185). Apertural view of specimen (U. S. Nat. Mus. 113036), from Yorktown, Va.; height 12.8 millimeters; diameter 13.2 millimeters. × 3. (After Dall.)

FIGURES 13–14. *Calliostoma hertfordense* Gardner, n. sp. (p. 185).

13. Apertural view of holotype (U. S. Nat. Mus. 325469), from Yorktown formation, 1½ miles above Murfreesboro, Hertford County, N. C.; height 7.3 millimeters; diameter 8.8 millimeters. × 4.
14. Basal view of holotype. × 4.

FIGURE 15. *Calliostoma philanthropum pontoni* Mansfield (p. 184). Apertural view of holotype (U. S. Nat. Mus. 370482), from the Choctawhatchee formation at Harveys Creek, half a mile above abandoned mill, Leon County, Fla.; height 17 millimeters; diameter 17 millimeters. × 2. (After Mansfield.)

FIGURES 16–17. *Calliostoma virginicum gizehi* Gardner, n. subsp. (p. 185).

16. Apertural view of holotype (U. S. Nat. Mus. 325467), from Yorktown formation, zone 2, at Yorktown, Va.; height 9.2 millimeters; diameter 10.5 millimeters. × 3½.
17. Basal view of holotype. × 3½.

FIGURE 18. *Calliostoma ruffinii* (H. C. Lea) (p. 184). Apertural view of holotype (Acad. Nat. Sci. Philadelphia 1548), from the Yorktown formation at Petersburg, Va. × 4.

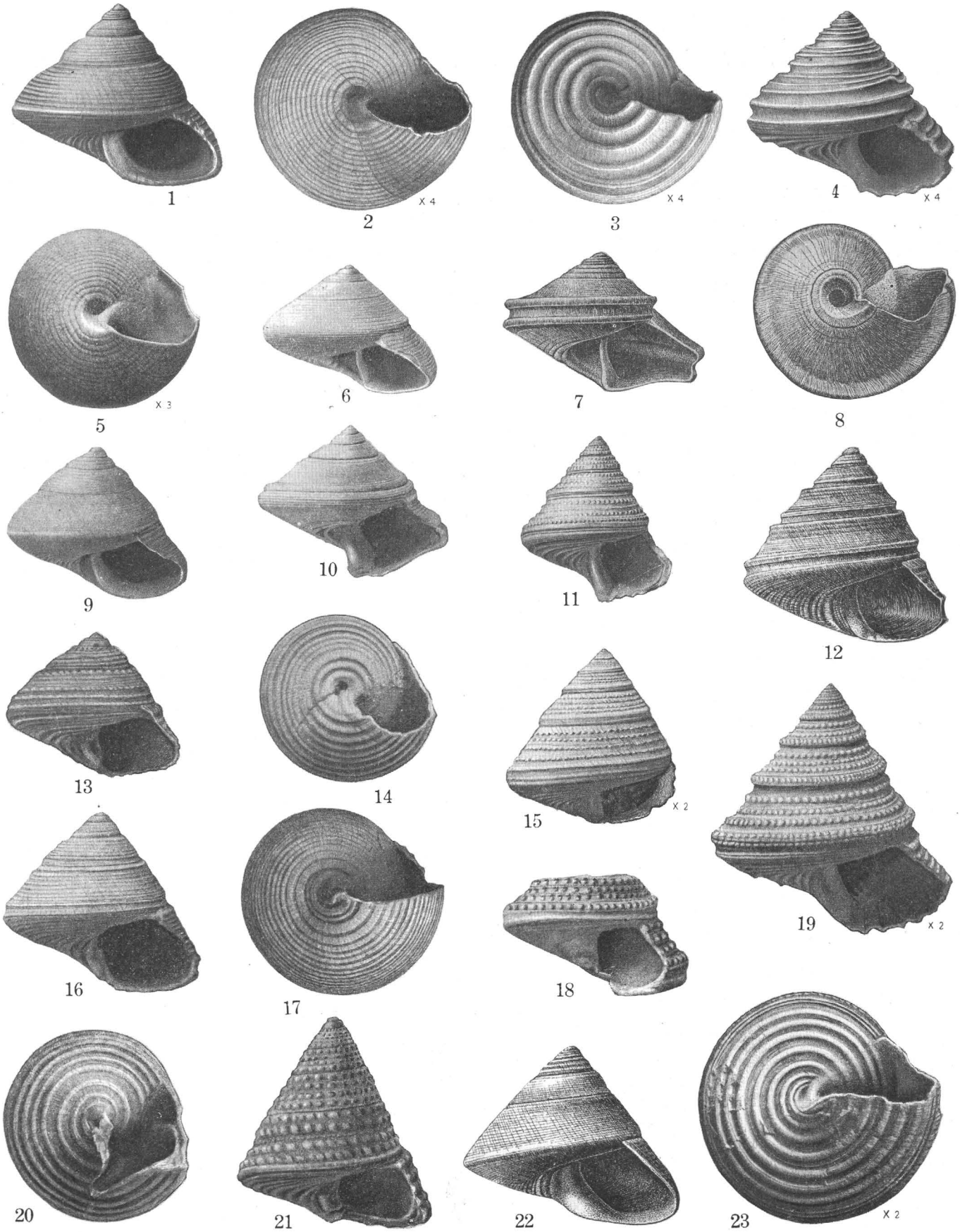
FIGURE 19. *Calliostoma mitchelli* (Conrad) (p. 184). Apertural view of holotype (Acad. Nat. Sci. Philadelphia), from James River, Va. × 2.

FIGURES 20–21. *Calliostoma cheopsi* Gardner, n. sp. (p. 183).

20. Basal view of holotype (U. S. Nat. Mus. 325470), from the Yorktown formation, 8 to 9 miles southeast of Greenville, Pitt County, N. C.; height 11.1 millimeters; diameter 10.0 millimeters. × 4.
21. Apertural view of holotype. × 4.

FIGURE 22. *Calliostoma harrisii* Dall (p. 186). Apertural view of holotype (U. S. Nat. Mus. 113052), from Bellefield, near Yorktown, Va.; height 10.4 millimeters; diameter 11.6 millimeters. × 3½. (After Dall.)

FIGURE 23. *Calliostoma mitchelli* (Conrad) (p. 184). Basal view of holotype shown in figure 19. × 2.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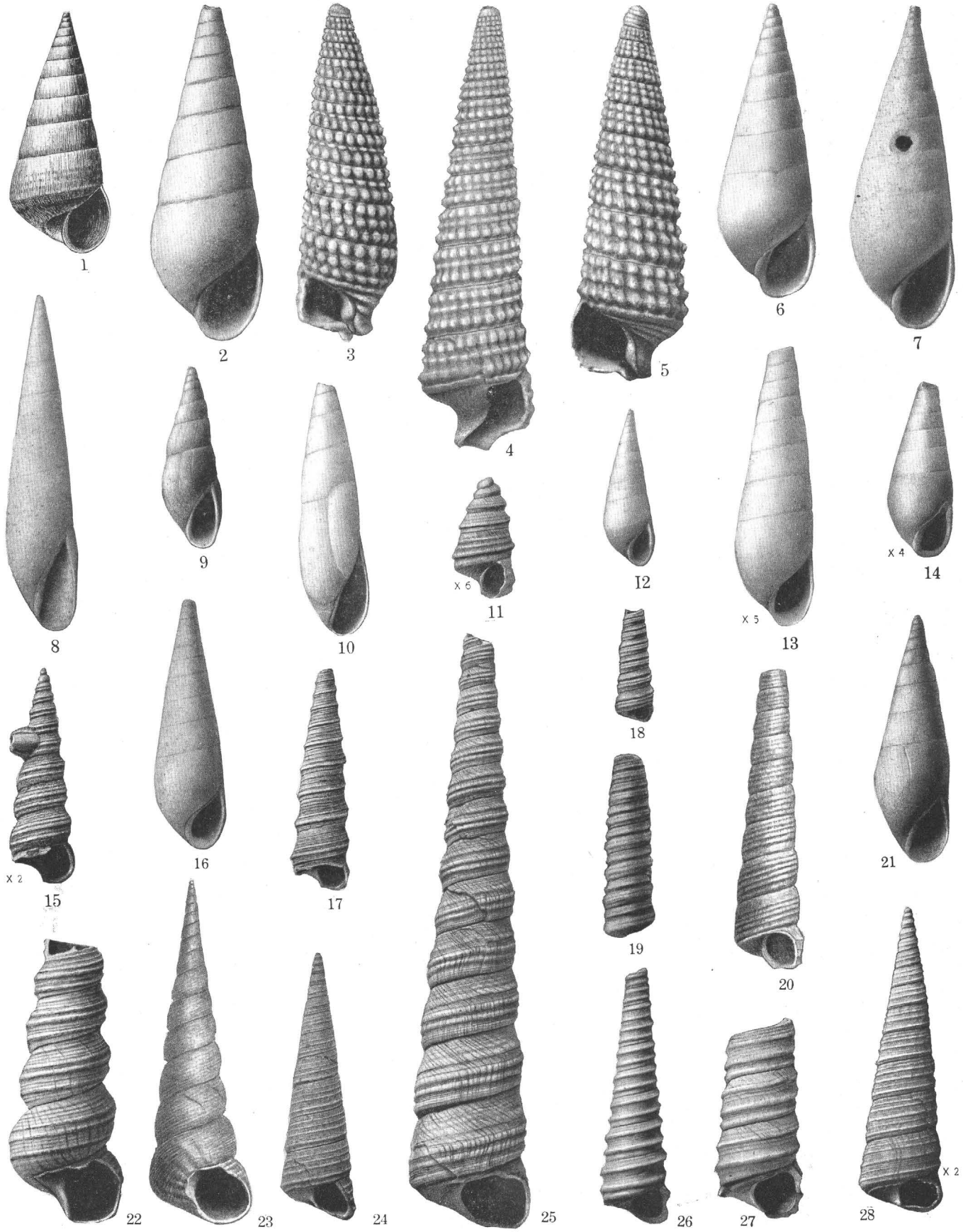
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GASTROPODS

PLATE 27

FIGURE 1. *Niso dalli* Gardner, n. sp. (p. 212). Apertural view of holotype (U. S. Nat. Mus. 113282), from the Waccamaw formation at Mrs. Guion's marl pit, Cape Fear River, Columbus County,? N. C.; height 12.0 millimeters; diameter 5.2 millimeters. × 4. (After Dall.)

FIGURE 2. *Strombiformis* (*Polygireulima*) *spatulata* Gardner, n. sp. (p. 211). Apertural view of holotype (U. S. Nat. Mus. 114166), Duplin marl, from the Natural Well, Duplin County, N. C.; height of incomplete holotype 7.9 millimeters; diameter 2.7 millimeters. × 8.

FIGURE 3. *Triphora dupliniana* (Olsson) (p. 205). Apertural view of topotype (U. S. Nat. Mus. 114256), Duplin marl, from the Natural Well, Duplin County, N. C.; height 5.8 millimeters; diameter 1.7 millimeters. × 10.

FIGURE 4. *Cerithiopsis* (*Laskeya*) *emersonii persubulata* Gardner, n. subsp. (p. 204). Apertural view of holotype (U. S. Nat. Mus. 325445), Pleistocene, from the Bolten Phosphate Co., Stono River, Charleston County, S. C.; height of incomplete holotype 12.4 millimeters; diameter 3.2 millimeters. × 7.

FIGURE 5. *Triphora bartschi* (Olsson) (p. 205). Apertural view of specimen (U. S. G. S. 114255), 1½ miles northwest of Magnolia, Duplin County, N. C.; height 7.0 millimeters; diameter 2.1 millimeters. × 10.

FIGURE 6. *Strombiformis* (*Polygireulima*) *eborea* (Conrad) (p. 212). Apertural view of specimen (U. S. Nat. Mus. 325440) from the Yorktown formation, half to three-fourths of a mile above Edenhouse Point, Chowan River, Bertie County, N. C.; height 8.4 millimeters; diameter 2.8 millimeters. × 6.

FIGURE 7. *Strombiformis* (*Polygireulima*) *magnoliana* (Gardner and Aldrich) (p. 212). Apertural view of holotype (U. S. Nat. Mus. 114165), from Magnolia, Duplin County, N. C.; height 7.5 millimeters; diameter 2.5 millimeters. × 8. (After Gardner and Aldrich.)

FIGURE 8. *Strombiformis dalli* Gardner and Aldrich (p. 209). Apertural view of holotype (U. S. Nat. Mus. 112196), from the Caloosahatchee marl, Caloosahatchee River, Fla; height 9.8 millimeters; diameter 1.95 millimeters. × 6. After Gardner and Aldrich.)

FIGURE 9. *Strombiformis biconica* Gardner, n. sp. (p. 210). Apertural view of paratype (U. S. Nat. Mus. 325439), from the Waccamaw formation at Neills Eddy Landing, Cape Fear River, Columbus County, N. C.; height 2.3 millimeters; diameter 0.8 millimeter. × 15.

FIGURE 10. *Strombiformis juncea* Gardner, n. sp. (p. 210). Apertural view of incomplete holotype (U. S. Nat. Mus. 325444), from the Waccamaw formation at Neills Eddy Landing, Cape Fear River, Columbus County, N. C.; height 4.5 millimeters; diameter 1.2 millimeters. × 10.

FIGURE 11. *Turritella pilsbryi* Gardner (p. 196). Apertural view of juvenile paratype (U. S. Nat. Mus. 325457), from the Yorktown formation, zone 1, at Schmidts Bluff, 4½ miles below Claremont Wharf, James River, Surrey County, Va. × 6.

FIGURES 12–13. *Strombiformis bartschi* (Gardner and Aldrich) (p. 211).

12. Apertural view of paratype (U. S. Nat. Mus. 325441), from the Yorktown formation, 2 miles below Yorktown, York, Va.; height 5.9 millimeters; diameter 2.0 millimeters. × 5.
13. Apertural view of paratype (U. S. Nat. Mus. 325443), from the Yorktown formation, Rock Landing, Craven County, N. C.; height of incomplete individual 10.2 millimeters; diameter 3.0 millimeters. × 5.

FIGURE 14. *Strombiformis lina* Gardner, n. sp. (p. 211). Apertural view of incomplete holotype (U. S. Nat. Mus. 325442), Duplin marl, from the Natural Well, Duplin County, N. C.; height 9.0 millimeters; diameter 3.5 millimeters. × 3½.

FIGURE 15. *Turritella plebeia carinata* Gardner, n. subsp. (p. 196). Apical whorls of holotype (U. S. Nat. Mus. 325453), from the St. Marys formation, one-fourth of a mile below Jones Point, Essex County, Va.; height 20 millimeters; diameter 6 millimeters. × 2.

FIGURE 16. *Strombiformis bartschi* (Gardner and Aldrich) (p. 211). Apertural view of holotype (U. S. Nat. Mus. 114163), from Duplin marl, 1½ miles northwest of Magnolia, Duplin County, N. C.; height 16.0 millimeters; diameter 4.2 millimeters. × 3. (After Gardner and Aldrich.)

FIGURE 17. *Turritella alticostata* Conrad (p. 196). Apertural view of incomplete specimen (U. S. Nat. Mus. 325455), from the Yorktown formation, 1½ miles above Murfreesboro, Hertford County, N. C.; height 41.0 millimeters; diameter 11.0 millimeters.

FIGURES 18–19. *Turritella* (*Torcula*) *terstriata* Rogers and Rogers (p. 198). Incomplete specimens (U. S. Nat. Mus. 325456), from the Yorktown formation, zone 1; 3 miles northeast of Walkerton, King and Queen County, Va.

18. Apertural view of smaller specimen; height 21.0 millimeters; diameter 7.3 millimeters.
19. Rear view of larger specimen; height 33.5 millimeters; diameter 9.6 millimeters.

FIGURE 20. *Turritella etiwanensis* (Tuomey and Holmes) (p. 196). Apertural view of holotype from Duplin marl on the Pee Dee River, Florence? County, S. C. (After Tuomey and Holmes.)

FIGURE 21. *Strombiformis biconica* Gardner, n. sp. (p. 210). Apertural view of holotype (U. S. Nat. Mus. 114167), Duplin marl, from the Natural Well, N. C.; height 5.6 millimeters; diameter 1.7 millimeters. × 8.

FIGURE 22. *Turritella plebeia carinata* Gardner, n. subsp. (p. 196). Apertural view of incomplete specimen (U. S. Nat. Mus. 325454), from the Yorktown formation, half a mile below Suffolk waterworks dam, Nansemond County, Va.; height 26.9 millimeters; diameter 10.5 millimeters. × 2.

FIGURE 23. *Turritella holmesii* Dall (p. 198). Apertural view of holotype from the Duplin marl near Darlington, S. C. (After Tuomey and Holmes.)

FIGURE 24. *Turritella* (*Torculoidella*) *duplinensis* Gardner and Aldrich (p. 197). Apertural view of holotype (U. S. Nat. Mus. 499110, from 1½ miles northwest of Magnolia, Duplin County, N. C.; height 24.0 millimeters; diameter 6.5 millimeters. × 2. (After Gardner and Aldrich.)

FIGURE 25. *Turritella pilsbryi* Gardner (p. 196). Apertural view of incomplete holotype (U. S. Nat. Mus. 325457), from the Yorktown formation, zone 1, Schmidts Bluff, 4½ miles below Claremont Wharf, James River, Surry County, Va.; height 110.5 millimeters; diameter 22.9 millimeters.

FIGURES 26–27. *Turritella* (*Torcula*) *terebriformis* Dall (p. 199). Incomplete specimens (U. S. Nat. Mus. 113479), from the Choptank formation, Choptank River, one-fourth to one-half mile below Barkers Landing, Talbot County, Md.

26. Immature specimen showing adolescent sculpture. × 2.
27. Fragment of adult showing adult sculpture. × 1.

FIGURE 28. *Turritella* (*Torculoidella*) *duplinensis* Gardner and Aldrich (p. 197). Apertural view of specimen (U. S. Nat. Mus. 370359), from the *Cancellaria* zone of the Choctawhatchee formation, Harveys Creek, Leon County, Fla.; height 27.5 millimeters; diameter 7.9 millimeters. × 2. (After Mansfield.)

PLATE 28

FIGURE 1. *Uzita zeta* Gardner, n. sp. (p. 252). Rear view of holotype (U. S. Nat. Mus. 497250), from the Waccamaw formation at Cronly, Columbus County, N. C.; height 11.5 milimeters; diameter 6.2 millimeters. × 4.

FIGURE 2. *Anachis* (*Costoanachis*) *milleri* Gardner, n. sp. (p. 231). Apertural view of holotype (U. S. Nat. Mus. 325413), from the Yorktown formation, Wilson, Wilson County, N. C.; height 13.5 millimeters; diameter 5.6 millimeters. × 3.

FIGURE 3. *"Drillia" drewi* Gardner, n. sp. (p. 267). Apical whorls of paratype (U. S. Nat. Mus. 114020), from Duplin marl, 1½ miles northwest of Magnolia, Duplin County, N. C. × 10.

FIGURES 4–5. *Urosalpinx phrikna* Gardner and Aldrich (p. 223).

4. Rear view of holotype (U. S. Nat. Mus. 325423), Duplin marl, from the Natural Well, Duplin County, N. C.; height 20 millimeters; diameter 10.4 millimeters. × 2.
5. Apertural view of paratype (U. S. Nat. Mus. 325423), from the Natural Well, Duplin County, N. C.; height 23.4 millimeters; diameter 13.0 millimeters. × 1½.

FIGURE 6. *Glyphostoma zoster* Gardner, n. sp. (p. 272). Apertural view of holotype (U. S. Nat. Mus. 497852), Duplin marl, from the Natural Well, Duplin County, N. C.; height 9.6 millimeters; diameter 4.0 millimeters. × 5.

FIGURE 7. *Uzita zeta* Gardner, n. sp. (p. 252). Apertural view of holotype shown in figure 1. × 4.

FIGURE 8. *Aesopus* sp. (p. 233). Apertural view of juvenile (U. S. Nat. Mus. 325408), from Neills Eddy Landing, Cape Fear River, Columbus County, N. C.; height 3.2 millimeters; diameter 1.45 millimeters. × 12.

FIGURE 9. *Urosalpinx suffolkensis* Gardner, n. sp. (p. 225). Apertural view of holotype (U. S. Nat. Mus. 325425), from the Yorktown formation, 1 mile northeast of Suffolk, Nansemond County, Va.; height of imperfect holotype 31.0 millimeters; diameter 15.8 millimeters.

FIGURE 10. *"Drillia" drewi* Gardner, n. sp. (p. 267). Apertural view of holotype (U. S. Nat. Mus. 114020), from Duplin marl, 1½ miles northwest of Magnolia, Duplin County, N. C.; height 13.8 millimeters; diameter 4.3 millimeters. ×3.

FIGURE 11. *Urosalpinx phrikna* Gardner and Aldrich (p. 223). Apical whorls of paratype (U. S. Nat. Mus. 325423), Duplin marl, from the Natural Well, Duplin County, N. C. × 10.

FIGURE 12. *Marginella* (*Serrata*) *macronuclea* Gardner, n. sp. (p. 262). Apertural view of holotype (U. S. Nat. Mus. 114497), Duplin marl, from the Natural Well, Duplin County, N. C.; height 8.0 millimeters; diameter 4.4 millimeters. × 3.

FIGURE 13. *Aesopus* sp. (p. 233). Apertural view of juvenile (U. S. Nat. Mus. 325408), from Neills Eddy Landing, Cape Fear River, Columbus County, N. C.; height 3.7 millimeters; diameter 1.6 millimeters. × 12.

FIGURE 14. *Peristernia filicata* Conrad, subsp.? (p. 255). Apertural view of holotype (U. S. Nat. Mus. 325398), from the Yorktown formation, 2 miles southeast of Tugwell, Pitt County, N. C.; height 17.0 millimeters; diameter 10.3 millimeters. × 1½

FIGURE 15. *Marginella* (*Serrata*) *denticulata* Conrad? (p. 262). Apertural view of specimen (U. S. Nat. Mus. 325380), Duplin marl, from the Natural Well, Duplin County, N. C.; height 9.3 millimeters; diameter 5.2 millimeters. × 4.

FIGURE 16. *Caecum ibex* Dall (p. 204). Lateral view of holotype (U. S. Nat. Mus. 113421), from the Waccamaw formation, Mrs. Guion's marl pit, Cape Fear River, N. C.; height 5.5 millimeters; diameter at anterior extremity 0.8 millimeter. × 7. (After Dall.)

FIGURE 17. *Caecum virginianum* Meyer (p. 203). Lateral view of specimen (U. S. Nat. Mus. 325451), from the Yorktown formation, Benn's Church, Isle of Wight County, Va.; height 3.5 millimeters; diameter at anterior extremity 0.8 millimeter. × 5.

FIGURE 18. *Caecum regulare* Carpenter (p. 203). Lateral view of specimen (U. S. Nat. Mus. 325449), from the Waccamaw formation at Neills Eddy Landing, Cape Fear River, Columbus County, N. C.; height 3.0 millimeters; diameter at anterior extremity 0.7 millimeter. × 5.

FIGURE 19. *Caecum glabrum* Montagu (p. 203). Anterior extremity and lateral view of specimen from the Coralline Crag of Sutton, England; length "1/16 of an inch." × 10. (After Wood.)

FIGURE 20. *Caecum cooperi* S. Smith (p. 204). Lateral view of specimen (U. S. Nat. Mus. 325452), from Waccamaw formation at Neills Eddy Landing, Cape Fear River, Columbus County, N. C.; height 3.7 millimeters; diameter at anterior extremity 0.8 millimeter. × 5.

FIGURE 21. *Epitonium* (*Spiniscala*) *edgecombense* Gardner, n. sp. (p. 207). Apertural view of incomplete holotype (U. S. Nat. Mus. 325431), from the Yorktown formation, half a mile above Bells Bridge, Tar River, Edgecombe County, N. C.; height 6.3 millimeters; diameter 3.0 millimeters. × 3.

FIGURE 22. *"Drillia" drewi* Gardner, n. sp. (p. 267). Apertural view of paratype (U. S. Nat. Mus. 114020), from 1½ miles northwest of Magnolia, Duplin County, N. C.; height 8.7 millimeters; diameter 3.0 millimeters. × 2½.

FIGURE 23–25. *Aesopus? smithfieldensis* (Mansfield) (p. 233).

23. Rear view of juvenile (U. S. Nat. Mus. 325409), from the Yorktown formation at Colerain Landing, Bertie County, N. C. × 10.
24. Apertural view of juvenile. × 10.
25. Apertural view of holotype (U. S. Nat. Mus. 352438), from the Yorktown formation, 2 miles north of Smithfield, Isle of Wight County, Va.; height 3.8 millimeters; diameter 1.6 millimeters. × 8. (After Mansfield.)

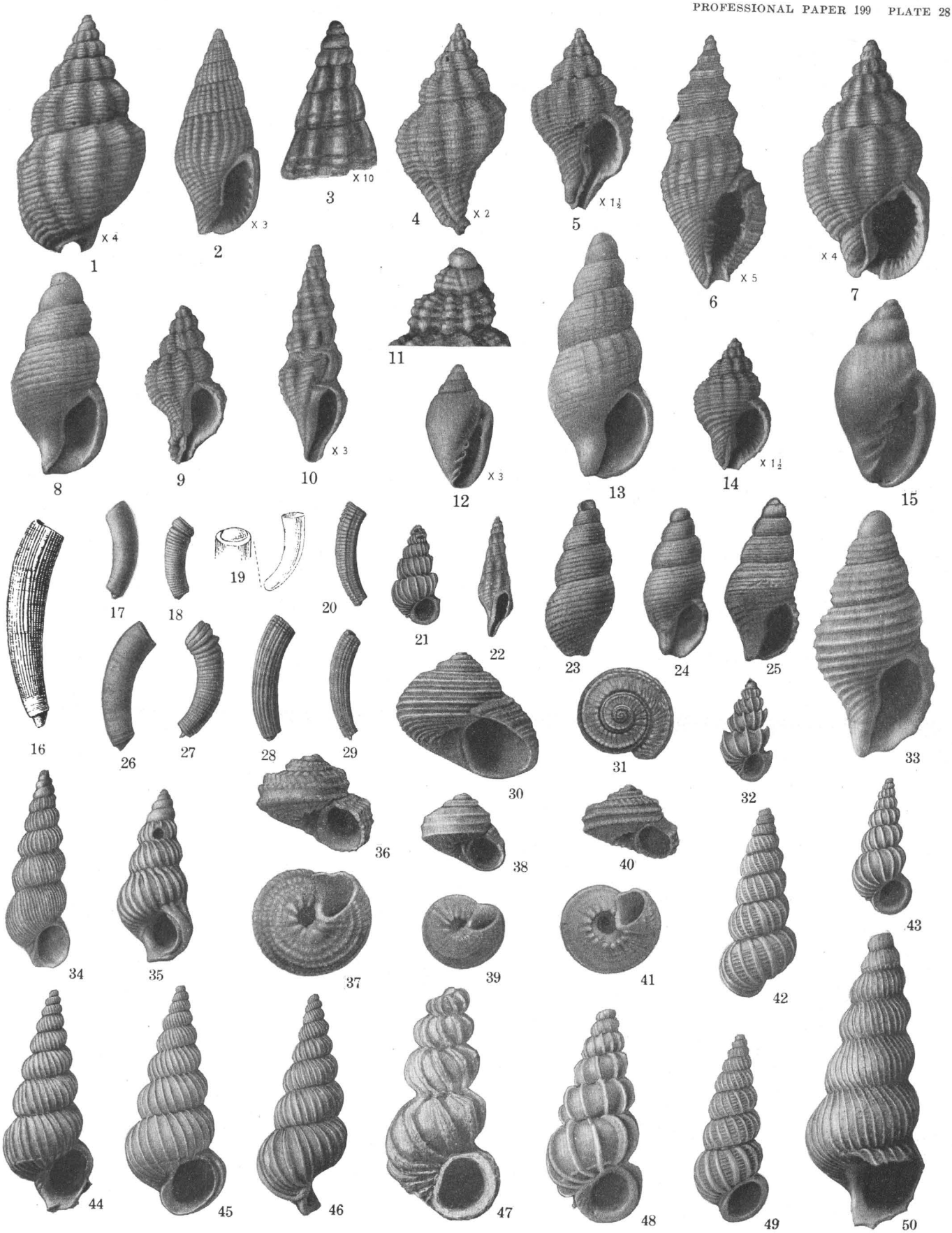
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PLATE 28—Continued

FIGURE 26. *Caecum flemingi* Gardner and Aldrich (p. 203). Lateral view of holotype (U. S. Nat. Mus. 325448), from the Waccamaw formation at Neills Eddy Landing, Cape Fear River, Columbus County, N. C.; height 3.7 millimeters; diameter at anterior extremity 1.0 millimeter. × 6.

FIGURE 27. *Caecum floridanum* Stimpson (p. 203). Lateral view of specimen (U. S. Nat. Mus. 53490), Recent, in grass below low water, from Lower Matacumba Key, Fla.; height 3.5 millimeters; diameter at anterior extremity 0.95 millimeter. × 6.

FIGURE 28. *Caecum stevensoni* Meyer (p. 204). Lateral view of specimen (U. S. Nat. Mus. 325450) from the Yorktown formation, 1 mile northeast of Suffolk, Nansemond County, Va.; height 4.4 millimeters; diameter at anterior extremity 1.0 millimeter. × 5.

FIGURE 29. *Caecum cooperi* S. Smith (p. 204). Lateral view of specimen (U. S. Nat. Mus. 325452), from Neills Eddy Landing, Cape Fear River, Columbus County, N. C.; height 3.7 millimeters; diameter at anterior extremity 0.8 millimeter. × 5.

FIGURE 30. *Gibbula americana yorktownensis* Gardner, n. subsp. (p. 187). Apertural view of holotype (U. S. Nat. Mus. 325463), from the Yorktown formation, 1 mile northeast of Suffolk, Nansemond County Va.; height 4.5 millimeters; diameter 4.7 millimeters. × 5.

FIGURE 31. *Liotia* (*Arene*) *pergemma* Gardner, n. sp. (p. 190). Apical view of paratype (U. S. Nat. Mus. 325475), from the Waccamaw formation at Neills Eddy Landing, Cape Fear River, Columbus County, N. C.; height 3.8 millimeters; diameter 5.0 millimeters. × 4.

FIGURE 32. *Epitonium* (*Spiniscala*) *robesonense* Gardner, n. sp. (p. 207). Apertural view of holotype (U. S. Nat. Mus. 325437), from the Duplin marl, 1½ miles northeast of Fairmont, Robeson County, N. C.; height 5.2 millimeters; diameter 2.6 millimeters. × 4.

FIGURE 33. *Aesopus* sp. (p. 233). Apertural view of juvenile (U. S. Nat. Mus. 325411), from the Yorktown formation, Colerain Landing, Chowan River, Bertie County, N. C. × 15.

FIGURE 34. *Epitonium* (*Hyaloscala*) *junceum* Gardner, n. sp. (p. 206). Apertural view of holotype (U. S. Nat. Mus. 114157), Duplin marl from the Natural Well, Duplin County, N. C.; height 4.2 millimeters; diameter 1.4 millimeters. × 9.

FIGURE 35. *Epitonium* (*Hyaloscala*) *fasciatum* Gardner, n. sp. (p. 206). Apertural view of holotype (U. S. Nat. Mus. 114156), Duplin marl, from the Natural Well, Duplin County, N. C.; height 3.6 millimeters; diameter 1.5 millimeters. × 9.

FIGURES 36–37. *Liotia* (*Arene*) *pergemma* Gardner, n. sp. (p. 190).

36. Apertural view of holotype (U. S. Nat. Mus. 497853), from Waccamaw formation at Cronly, Columbus County, N. C.; height 4.8 millimeters; diameter 5.9 millimeters. × 4.
37. Basal view of holotype. × 4.

FIGURES 38–39. *Liotia* (*Arene*) *gemma* (Tuomey and Holmes) (p. 190). Specimen (U. S. Nat. Mus. 113088), Duplin marl, from the Natural Well, Duplin County, N. C.; height 3.6 millimeters; diameter 4.2 millimeters.

38. Apertural view. × 4.
39. Basal view. × 4.

FIGURES 40–41. *Liotia* (*Arene*) *pergemma* Gardner, n. sp. (p. 190).

40. Apertural view of paratype shown in figure 31. × 4.
41. Basal view of paratype shown in figure 31. × 4.

FIGURE 42. *Epitonium* (*Cinctiscala*) *antillarum* (De Boury) (p. 207). Rear view of specimen (U. S. Nat. Mus. 325432), from the Yorktown formation, 1½ miles below Tar Ferry, Wiccacon Creek, Hertford County, N. C.; height 12.0 millimeters; diameter 4.8 millimeters. × 3.

FIGURE 43. *Epitonium* (*Clathrus*) *bolteni* Gardner, n. sp. (p. 208). Apertural view of holotype (U. S. Nat. Mus. 325438), from the Yorktown formation, 9 to 10 miles south of Greenville, Pitt County, N. C.; height 8.5 millimeters; diameter 3.8 millimeters. × 3.

FIGURES 44–46. *Epitonium* (*Pictoscala*) *pratti* Gardner, n. sp. (p. 209).

44. Apertural view of imperfect paratype (U. S. Nat. Mus. 325435), from the Yorktown formation, 1 mile northeast of Suffolk, Nansemond County, Va.; height 20.6 millimeters; diameter 8.5 ± millimeters. × 2.
45. Apertural view of holotype (U. S. Nat. Mus. 325434), from the Yorktown formation, 1 mile southeast of Chocowinity, Beaufort County, N. C., height 14.8 millimeters; diameter 6.4 millimeters. × 3.
46. Rear view of paratype shown in figure 44. × 2.

FIGURE 47. *Epitonium* (*Clathrus*) *muldrowi* Gardner and Aldrich (p. 208). Apertural view of holotype (Acad. Nat. Sci. Philadelphia), from the Duplin marl, 5 miles southeast of Mayesville, Sumter County, S. C.; height 6.0 millimeters; diameter 3.0 millimeters. × 7. (After Gardner and Aldrich.)

FIGURE 48. *Epitonium* (*Clathrus*) *microstoma* (H. C. Lea) (p. 208). Apertural view of holotype (Acad. Nat. Sci. Philadelphia 1537) from the Yorktown formation, Petersburg, Va.; height 6.7 millimeters; diameter 3.0 millimeters. × 6.

FIGURE 49. *Epitonium* (*Cinctiscala*) *antillarum* (De Boury) (p. 207). Apertural view of specimen shown in figure 42. × 3.

FIGURE 50. *Epitonium* (*Hyaloscala*) *carolinae* Gardner, n. sp. (p. 205). Apertural view of incomplete holotype (U. S. Nat. Mus. 114155), Dulplin marl, from the Natural Well, Duplin County, N. C.; height 7.0 millimeters; diameter 2.7 millimeters. × 8.

PLATE 29

FIGURE 1. *Ficus papyratia caloosahatchiensis* (Smith) (p. 217). Apertural view of specimen (U. S. Nat. Mus. 325427), from the Caloosahatchee marl, Caloosahatchee River, Fla.; height 87 millimeters; diameter 43 millimeters. × 1.

FIGURE 2. *Cypraea (Cypraeorbis) carolinensis* Conrad (p. 214). Section specimen (Wagner Free Inst. Sci. Philadelphia), from the Duplin marl, Natural Well, Duplin County, N. C.; length 72.5 millimeters; lateral diameter 45 millimeters. × 1.

FIGURE 3. *Sconsia hodgii* (Conrad) (p. 215). Apertural view of specimen from the Duplin marl of the Pee Dee River, Florence? County, S. C. × 1. (After Tuomey and Holmes).

FIGURE 4. *Ficus papyratia caloosahatchiensis* Smith (p. 217). Rear view of specimen shown in figure 1.

FIGURES 5–6. *Colubraria aclinica* Tucker and Wilson (p. 216).

5. Apertural view of specimen (U. S. Nat. Mus. 114089), from the Duplin marl, 1½ miles northwest of Magnolia, N. C.; height 9 millimeters; diameter 3.3 millimeters. × 4.
6. Body whorl of fully adult individual (U. S. Nat. Mus. 114089), from 1½ miles northwest of Magnolia, N. C.; diameter 6.7 millimeters. × 1½.

FIGURE 7. *Cypraea (Cypraeorbis) carolinensis* Conrad (p. 214). Apertural view of immature specimen (Wagner Free Inst. Philadelphia), from the Duplin marl, Natural Well, Duplin County, N. C. (?); length 42 millimeters.

FIGURES 8–9. *Trivia pediculus* (Linnaeus) (p. 214). Specimen (U. S. Nat. Mus. 325430), from the Waccamaw formation at Neills Eddy Landing, Cape Fear River, Columbus County, N. C.; length 11.5 millimeters; lateral diameter 8.0 millimeters.

8. Apertural view. × 2.
9. Dorsal view. × 2.

FIGURES 10–11. *Trajana pyta* Gardner, n. sp. (p. 221).

10. Apertural view of holotype (U. S. Nat. Mus. 497151), Duplin marl, from the Natural Well, Duplin County, N. C.; height 17.3 millimeters; diameter including varices 10.8 millimeters. × 2½.
11. Protoconch of paratype. × 10.

FIGURES 12–13. *Eupleura caudata* (Say) (p. 222). Juvenile specimen (U. S. Nat. Mus. 325420), from the Yorktown formation, 1 mile northeast of Suffolk, Va.; height 14.3 millimeters; diameter including varices 6.5 millimeters.

12. Apertural view. × 2.
13. Rear view. × 2.

FIGURES 14–15. *Tritonalia? barbitoides* Gardner, n. sp. (p. 220).

14. Rear view of holotype (U. S. Nat. Mus. 325429), from Yorktown formation at Yorktown, York County, Va.; height 18.7 millimeters; diameter including varices 9.5 millimeters.
15. Apertural view of holotype.

FIGURE 16. *Tritonalia cellulosa* (Conrad) (p. 219). Apertural view of specimen (U. S. Nat. Mus. 61013), Recent, in Tampa Bay, Fla.; height 13.5 millimeters; diameter 7.8 millimeters. × 2.

FIGURE 17. *Eupleura caudata sulcidentata* Dall (p. 222). Apertural view of specimen (U. S. Nat. Mus. 54393), Recent, from Egmont Key, Fla.; height 23.9 millimeters; diameter 13.5 millimeters.

FIGURES 18–19. *Eupleura caudata* (Say) (p. 222). Specimen (U. S. Nat. Mus. 352421), from the Waccamaw formation, Neills Eddy Landing, Cape Fear River, Columbus County, N. C.; height 25 millimeters; diameter 12 millimeters.

18. Apertural view. × 2.
19. Rear view. × 2.

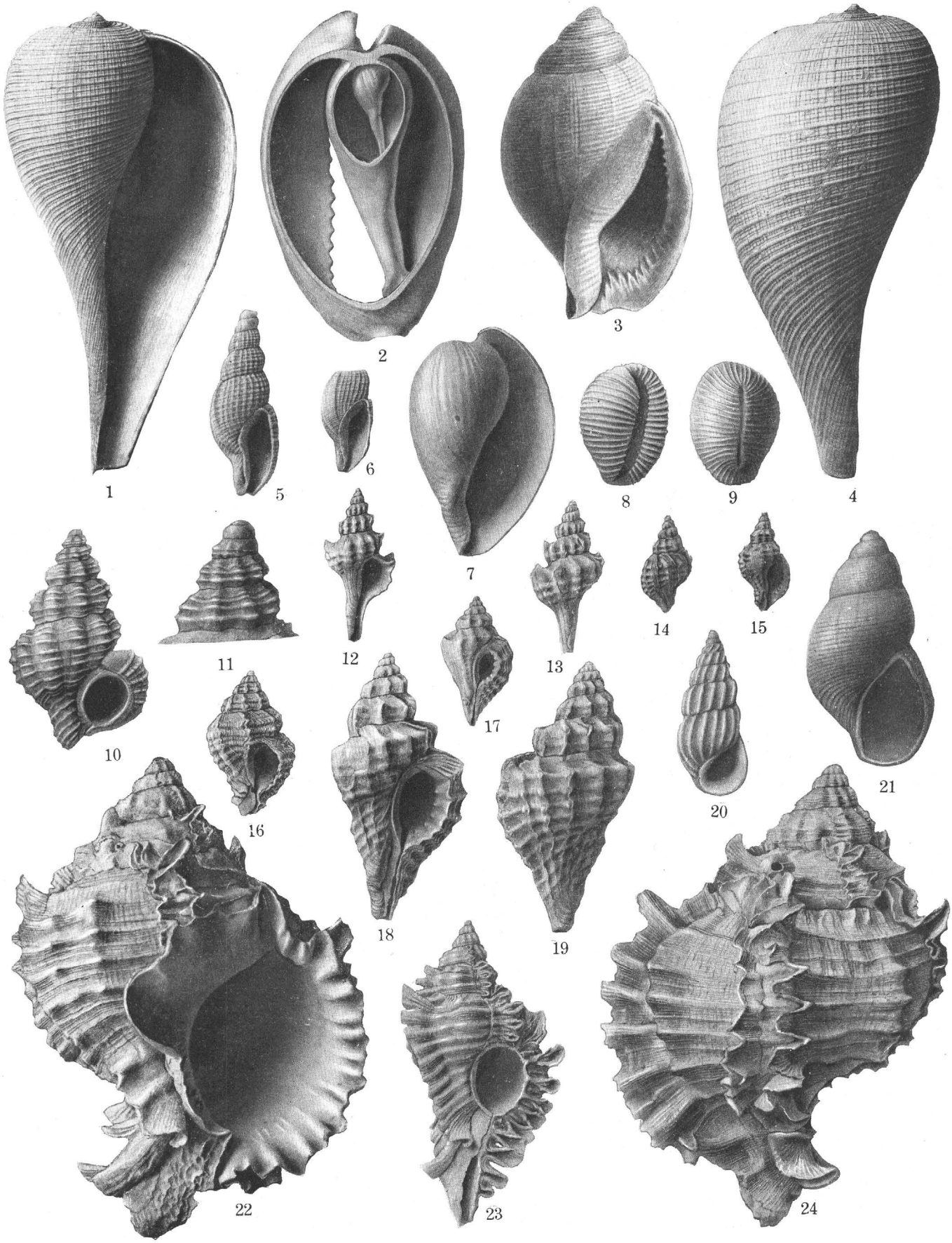
FIGURE 20. *Rissoina (Schwartziella) harpa* Gardner, n. sp. (p. 193). Apertural view of holotype (U. S. Nat. Mus. 325446), from the Waccamaw formation at Walkers Bluff, Cape Fear River, Bladen County, N. C.; height 3.7 millimeters; diameter 1.6 millimeters. × 8.

FIGURE 21. *Rissoa geraea* Dall (p. 192). Apertural view of specimen (U. S. Nat. Mus. 325464), from the Waccamaw formation at Neills Eddy Landing, Cape Fear River, Columbus County, N. C.; height 3.0 millimeters; diameter 1.5 millimeters. × 15.

FIGURE 22. *Murex (Phyllonotus) pomum* Gmelin (p. 219). Apertural view of specimen (U. S. Nat. Mus. 325426), from the Waccamaw formation at Neills Eddy Landing, Cape Fear River, Columbus County, N. C.; height 91.5 millimeters; diameter including varices 64.0 millimeters.

FIGURE 23. *Murex (Chicoreus) rufus* Lamarck (p. 218). Apertural view of specimen (U. S. Nat. Mus. 168848), Recent, off Sanibel Island, Fla.; height 57 millimeters; diameter excluding varices 22 millimeters; diameter including varices 30 millimeters.

FIGURE 24. *Murex (Phyllonotus) pomum* Gmelin (p. 219). Rear view of specimen shown in figure 22.



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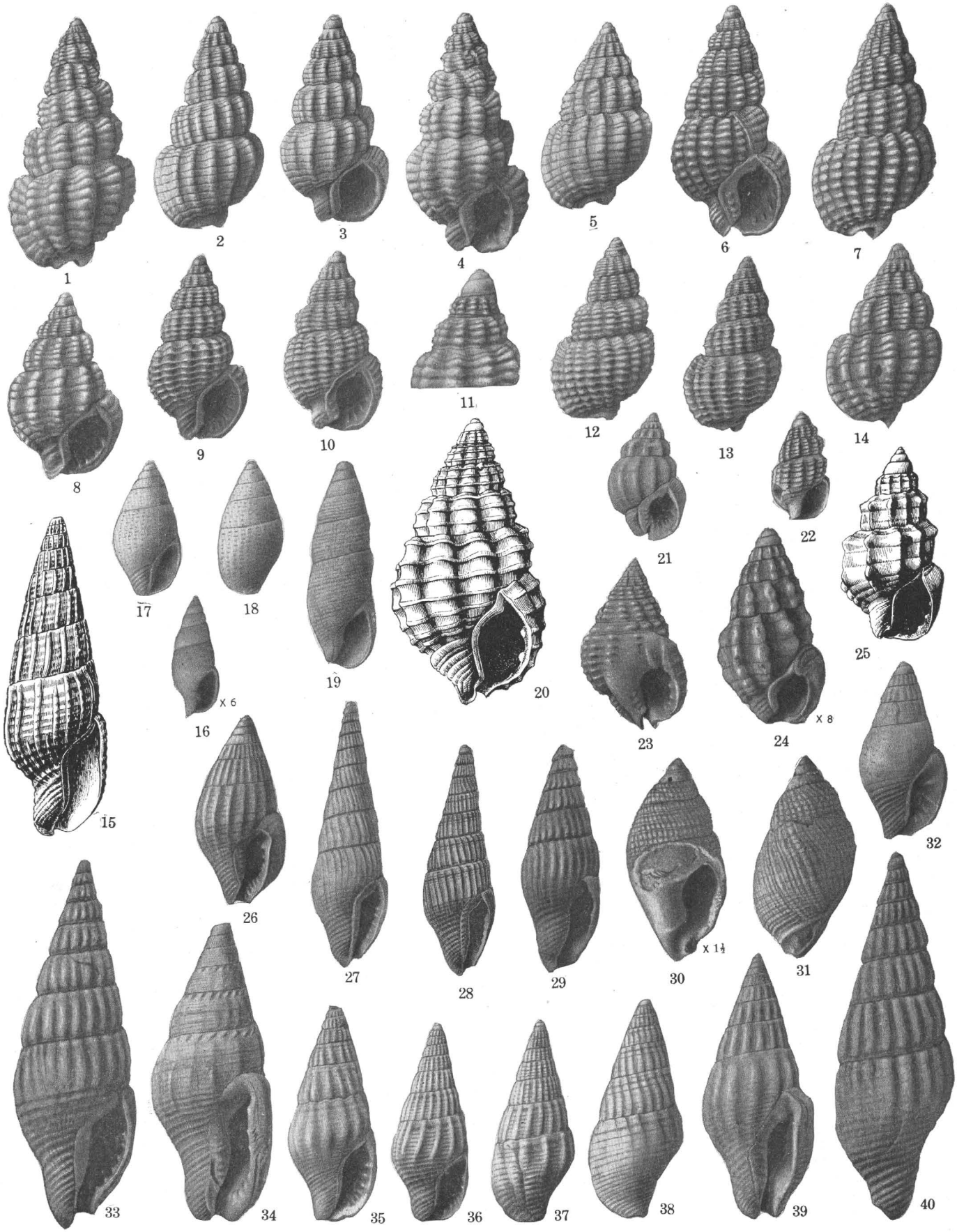
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GASTROPODS

PLATE 30

FIGURE 1. *Uzita smithiana* (Olsson) (p. 248). Rear view of topotype (U. S. Nat. Mus. 114200), from the Natural Well, 2 miles southwest of Magnolia, Duplin County, N. C.; height 12.2 millimeters; diameter 6.1 millimeters. × 4.

FIGURES 2–3. *Uzita suffolkensis* Gardner, n. sp. (p. 251).

2. Rear view of holotype (U. S. Nat. Mus. 325406), from the Yorktown formation, 1 mile northeast of Suffolk, Nansemond County, Va.; height 10.4 millimeters; diameter 5.2 millimeters. × 4.
3. Apertural view of holotype. × 4.

FIGURE 4. *Uzita smithiana* (Olsson). (p. 248). Apertural view of specimen shown in figure 1. × 4.

FIGURE 5. *Uzita consensoides* (Olsson) (p. 251). Rear view of specimen (U. S. Nat. Mus. 114204), from 1½ miles northwest of Magnolia, Duplin County, N. C.; height 9.8 millimeters; diameter 5.5 millimeters. × 3½.

FIGURES 6–7. *Uzita neogenensis* (Gardner and Aldrich) (p. 249).

6. Apertural view of holotype (U. S. Nat. Mus. 325403), from the Waccamaw formation at Cronly, Columbus County, N. C.; height 12.4 millimeters; diameter 6.0 millimeters. × 3½. (After Gardner and Aldrich.)
7. Rear view of holotype. × 4. (After Gardner and Aldrich.)

FIGURE 8. *Uzita consensoides* (Olsson) (p. 251). Apertural view of specimen (U. S. Nat. Mus. 325402), from the Yorktown formation near the mouth of Swift Creek, Edgecombe County, N. C.; height 9.0 millimeters; diameter 5.5 millimeters. × 4.

FIGURES 9–10. *Uzita chowanensis* Gardner, n. sp. (p. 249).

9. Apertural view of holotype (U. S. Nat. Mus. 325405), from the Yorktown formation at Colerain Landing, Chowan River, Bertie County, N. C.; height 9.4 millimeters; diameter 5.0 millimeters. × 4.
10. Apertural view of paratype (U. S. Nat. Mus. 325404), from the Yorktown formation, 1½ miles below Tar Ferry, Wiccacon Creek, Hertford County, N. C.; height 9.0 millimeters; diameter 4.8 millimeters. × 4.

FIGURE 11. *Uzita smithiana* (Olsson) (p. 248). Apical whorls of topotype (U. S. Nat. Mus. 114200), from the Natural Well, 2 miles southwest of Magnolia, Duplin County, N. C. × 8.

FIGURES 12–13. *Uzita chowanensis* Gardner, n. sp. (p. 249).

12. Rear view of paratype shown in figure 10. × 4.
13. Rear view of holotype shown in figure 9. × 4.

FIGURE 14. *Uzita consensoides* (Olsson) (p. 251). Rear view of specimen shown in figure 8. × 4.

FIGURE 15. *Anachis* (*Thiarinella*) *camax* Dall (p. 227). Apertural view of holotype (U. S. Nat. Mus. 112146), from the Caloosahatchee marl, Caloosahatchee River, Fla.: height 14.9 millimeters; diameter 4.7 millimeters. × 4. (After Dall.)

FIGURE 16. *Mitrella waccamawensis* Gardner, n. sp. (p. 226). Apertural view of holotype (U. S. Nat. Mus. 325417), from the Waccamaw formation at Neills Eddy Landing, Cape Fear River, Columbus County, N. C.; height 3.8 millimeters; diameter 1.55 millimeters. × 6.

FIGURES 17–18. *Mitrella lunata* (Say) (p. 225).

17. Apertural view of specimen (U. S. Nat. Mus. 325419), from the Waccamaw formation at Neills Eddy Landing, Cape Fear River, Columbus County, N. C.; height 3.6 millimeters; diameter 1.8 millimeters. × 7.
18. Rear view of specimen shown in figure 17. × 7.

FIGURE 19. *Aesopus stearnsii* (Tryon) (p. 232). Apertural view of specimen (U. S. Nat. Mus. 93309), Recent, in 15 fathoms, sandy bottom, 25 miles southeast from Cape Fear, N. C.; height 4.9 millimeters; diameter 1.7 millimeters. × 8.

FIGURE 20. *Uzita bidentata* (Emmons) (p. 250). Apertural view of specimen (U. S. Nat. Mus. 112140), from the Caloosahatchee marl, Caloosahatchee River, Fla.; height 7.0 millimeters; diameter 3.7 millimeters. × 8. (After Dall.)

FIGURE 21. *Uzita consensa* (Ravenel) (p. 251). Apertural view of specimen (U. S. Nat. Mus. 86985), Recent, in 15 fathoms, sandy bottom, 25 miles southeast from Cape Fear, N. C.; height 11.6 millimeters; diameter 7.3 millimeters. × 2.

FIGURE 22. *Uzita impressa* (H. C. Lea) (p. 250). Apertural view of holotype (Acad. Nat. Sci. Philadelphia). (After H. C. Lea.)

FIGURE 23. *Uzita vibex* (Say) (p. 253). Apertural view of specimen (U. S. Nat. Mus. 54738), Recent, in 15 fathoms, sandy bottom, 25 miles southeast of Cape Fear, N. C.; height 16.3 millimeters; diameter 10.0 millimeters. × 2.

FIGURE 24. *Uzita caloosaensis cornelliana* (Olsson) (p. 252). Apertural view of specimen (U. S. Nat. Mus. 370147), from the Choctawhatchee formation at Hosford, Liberty County, Fla.; height 4.6 millimeters; diameter 2.5 millimeters. × 8. (After Mansfield.)

FIGURE 25. *Uzita caloosaensis* (Dall) (p. 252). Apertural view of holotype (U. S. Nat. Mus. 112142), from the Caloosahatchee marl, Caloosahatchee River, Fla.; height 4.6 millimeters; diameter 2.5 millimeters. × 8. (After Dall.)

FIGURE 26. *Anachis* (*Costoanachis*) *obesa* (C. B. Adams) (p. 229). Apertural view of specimen (U. S. Nat. Mus. 54283), Recent, in Samana Bay, Dominica; height 5.55 millimeters; diameter 2.7 millimeters. × 6½.

FIGURE 27. *Anachis* (*Thiarinella*) *styliola obsoleta* Gardner and Aldrich (p. 227). Apertural view of holotype (U. S. Nat. Mus. 114216), Duplin marl, from the Natural Well, Duplin County, N. C.; height 16.6 millimeters; diameter 4.8 millimeters. × 3. (After Gardner and Aldrich.)

FIGURE 28. *Anachis* (*Thiarinella*) *styliola* (Dall) (p. 227). Apertural view of holotype (U. S. Nat. Mus. 113259), from the Waccamaw formation, at Mrs. Guion's marl pit, Cape Fear River, Columbus? County, N. C.; height 16.5 millimeters; diameter 4.9 millimeters. × 2½. (After Dall.)

FIGURE 29. *Anachis* (*Thiarinella*) *styliola obsoleta* Gardner and Aldrich (p. 227). Apertural view of stout variant (U. S. Nat. Mus. 325414), from the F. M. Wilson marl pit, 1 mile east of Magnolia, Duplin County, N. C.; height 11.4 millimeters; diameter 4.2 millimeters. × 4. (After Gardner and Aldrich.)

FIGURES 30–31. *Ilyanassa wilmingtonensis* Gardner, n. sp. (p. 244).

30. Apertural view of holotype (U. S. Nat. Mus. 325400), from the Waccamaw formation at the City Rock Quarry, Wilmington, N. C.; height 25.5 millimeters; diameter 12.4 millimeters. × 1½.
31. Rear view of holotype. × 1½.

FIGURE 32. *Strombina anomala* (Gardner and Aldrich) (p. 232). Apertural view of holotype (U. S. Nat. Mus. 499112), Duplin marl, from the Natural Well, Duplin County, N. C.; height 5.2 millimeters; diameter 2.5 millimeters. (After Gardner and Aldrich.)

FIGURE 33. *Anachis* (*Thiarinella*) *virgilina* Gardner, n. sp. (p. 228). Apertural view of holotype (U. S. Nat. Mus. 325412), from the Yorktown formation 8 to 9 miles southeast of Greenville, Pitt County, N. C.; height 18.5 millimeters; diameter 6.3 millimeters. × 4.

FIGURE 34. *Anachis* (*Costoanachis*) *avara amydra* (Dall) (p. 230). Apertural view of holotype (U. S. Nat. Mus. 112145), from the Caloosahatchee marl, Caloosahatchee River, Fla.; height 14.6 millimeters; diameter 6.4 millimeters. × 4.

FIGURE 35. *Anachis* (*Costonachis*) *avara similis* (Ravenel) (p. 230). Apertural view of specimen (U. S. Nat. Mus. 325416), from the Yorktown formation, 1 mile northeast of Suffolk, Nansemond County, Va.; height 13.3 millimeters; diameter 5.5 millimeters. × 3.

FIGURES 36–37. *Anachis* (*Costoanachis*) *avara translirata* (Ravenel) (p. 229).

36. Apertural view of specimen (U. S. Nat. Mus. 325415), from the Waccamaw formation at Neills Eddy Landing, Cape Fear River, Columbus County, N. C.; height 12.5 millimeters; diameter 5.0 millimeters. × 3.
37. Rear view of specimen shown in figure 36. × 3.

FIGURE 38. *Anachis* (*Costoanachis*) *avara similis* (Ravenel) (p. 230). Rear view of specimen shown in figure 35. × 3.

FIGURE 39. *Anachis* (*Costoanachis*) *avara caloosaensis* Dall (p. 231). Apertural view of holotype (U. S. Nat. Mus. 112144), from the Caloosahatchee marl, Caloosahatchee River, Fla.; height 15.6 millimeters; diameter 6.4 millimeters. × 3.

FIGURE 40. *Anachis* (*Thiarinella*) *virgilina* Gardner, n. sp. (p. 228). Rear view of holotype shown in figure 33. × 4.

PLATE 31

FIGURE 1. *Ilyanassa arata* (Say) (p. 243). Apertural view of specimen (U. S. Nat. Mus. 112377), from the Waccamaw formation on Waccamaw River, S. C.; height 21.0 millimeters; diameter 13.8 millimeters. (After Dall.)

FIGURE 2. *Ilyanassa irrorata* (Conrad) Conrad (p. 244). Apertural view of specimen from the Pliocene of South Carolina. × 2. (After Tuomey and Holmes.)

FIGURE 3. *Ilyanassa sexdentata* (Conrad) (p. 245). Apertural view of specimen (U. S. Nat. Mus. 124953), from Duplin marl, 1½ miles northwest of Magnolia, Duplin County, N. C.; height 20.8 millimeters; diameter 10.7 millimeters. × 1½.

FIGURE 4. *Ilyanassa schizopyga* Dall (p. 246). Apertural view of holotype (U. S. Nat. Mus. 124945), from Waccamaw formation, Mrs. Purdy's marl pit on the Cape Fear River, Bladen? County, N. C.; height 32 millimeters; diameter 18 millimeters.

FIGURE 5. *Ilyanassa obsoleta* (Say) (p. 245). Apertural view of specimen from the Pleistocene of Federalsburg, Caroline County, Md. × 2. (After Clark.)

FIGURE 6. *Ilyanassa johnsoni* (Dall) (p. 247). Apertural view of holotype (U. S. Nat. Mus. 124961), from Waccamaw formation, Mrs. Purdy's marl bed on the Cape Fear River, Bladen? County, N. C.; height 19.5 millimeters; diameter 13.5 millimeters. (After Dall.)

FIGURES 7–8. *Ilyanassa scalaspira* (Conrad) (p. 247).

7. Rear view of specimen (U. S. Nat. Mus. 325407), from the Duplin marl, 1½ miles northeast of Fairmont, N. C.; height 21.4 millimeters; diameter 12.6 millimeters. × 2.
8. Apertural view. × 2.

FIGURE 9. *Ilyanassa isogramma* Dall (p. 245). Apertural view of holotype (U. S. Nat. Mus. 124948), from Yorktown formation at Bellefield, York River, Va.; height 24 millimeters; diameter 14 millimeters. × 2. (After Dall.)

FIGURE 10. *Ilyanassa granifera* (Conrad) (p. 246). Apertural view of specimen (U. S. Nat. Mus. 124951), from Yorktown formation, half to three-fourths of a mile below Yorktown, Va.; height 23.5 millimeters; diameter 13.5 millimeters. × 2.

FIGURES 11–12. *Ilyanassa harpuloides* (Conrad) (p. 248).

11. Apertural view of specimen (U. S. Nat. Mus. 325401), from the Yorktown formation, 2 miles southeast of Tugwell, N. C.; height 23 millimeters; diameter 13 millimeters. × 2.
12. Rear view of specimen shown in figure 11. × 2.

FIGURE 13. *Urosalpinx stimpsoni* Gardner, n. sp. (p. 224). Apertural view of paratype (U. S. Nat. Mus. 325424), from the Waccamaw formation, Neills Eddy Landing, Cape Fear River, Columbus County, N. C.; height 33.6 millimeters; diameter 18.5 millimeters. × 2.

FIGURE 14. *Ptychosalpinx altilis* (Conrad) Gill (p. 233). Rear view of specimen (U. S. Nat. Mus. 325399), from the Yorktown formation, 1 mile northeast of Suffolk, Va.; height 30.0 millimeters; diameter 18.5 millimeters.

FIGURE 15. *Marginella (Bullata) oviformis* (Conrad) (p. 263). Apertural view, presumably of holotype (Acad. Nat. Sci. Philadelphia 1617), from "Virginia."

FIGURE 16. *Ptychosalpinx laqueata* (Conrad) Conrad (p. 234). Apertural view of specimen (U. S. Nat. Mus. 124937), from the Yorktown formation at Petersburg, Va.; height 37 millimeters; diameter 20.5 millimeters.

FIGURE 17. *Ptychosalpinx altilis* (Conrad) Gill (p. 233). Apertural view of specimen shown in figure 14.

FIGURE 18. *Ptychosalpinx tuomeyi* (H. C. Lea) (p. 236). Apertural view of holotype from the Yorktown formation at Petersburg, Va. (After H. C. Lea.)

FIGURES 19–20. *Urosalpinx trossula* (Conrad) (p. 223).

19. Rear view of specimen (U. S. Nat. Mus. 325422), from the Yorktown formation, 8 to 9 miles southeast of Greenville, Pitt County, N. C.; height 28.7 millimeters; diameter 14.0 millimeters. × 1½.
20. Apertural view of specimen shown in figure 19. × 1½.

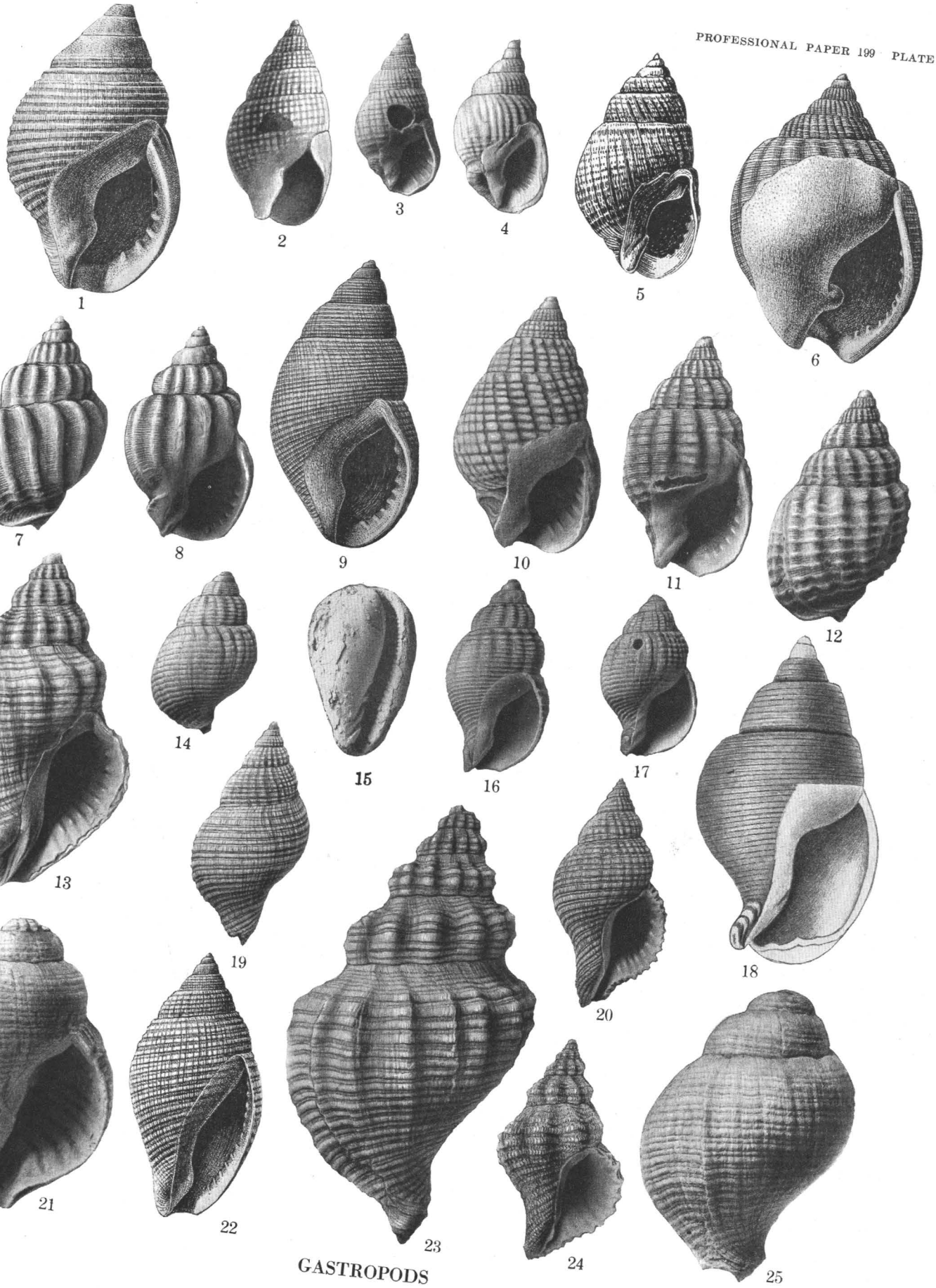
FIGURE 21. *"Ptychosalpinx" bilix* (Conrad) Conrad (p. 236). Apertural view of holotype (Acad. Nat. Sci. Philadelphia 1614), from James River, Va.; height 28 millimeters; diameter 19 millimeters. × 2.

FIGURE 22. *Pisania (Celatoconus) nux* Dall (p. 237). Apertural view of lectotype (U. S. Nat. Mus. 114188), Duplin marl, from the Natural Well, Duplin County, N. C.; height 26.2 millimeters; diameter 12.5 millimeters. × 1½. (After Dall.)

FIGURE 23. *Urosalpinx stimpsoni* Gardner, n. sp. (p. 224). Rear view of holotype (U. S. Nat. Mus. 325424), from the Waccamaw formation at Neills Eddy Landing, Columbus County, N. C.; height 42.0 millimeters; diameter 23.5 millimeters. × 2.

FIGURE 24. *Urosalpinx perrugata* (Conrad) (p. 224). Apertural view of specimen (U. S. Nat. Mus. 94298), Recent, in Tampa Bay, Fla.; height 20.7 millimeters; diameter 12.0 millimeters. × 2.

FIGURE 25. *"Ptychosalpinx" bilix* (Conrad) Conrad (p. 236). Rear view of specimen shown in figure 21. × 2.



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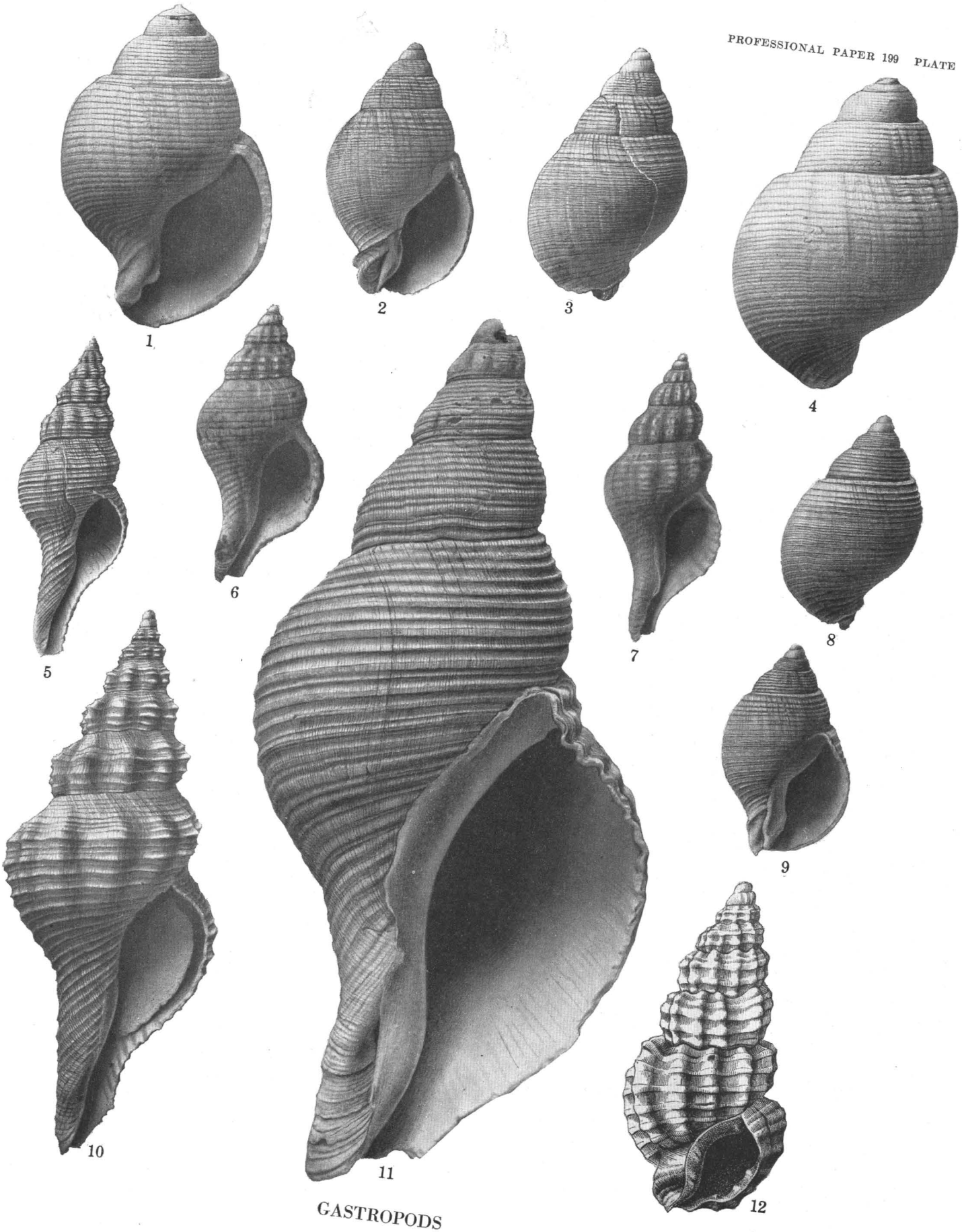

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PLATE 32

FIGURE 1. *Ptychosalpinx fossulata* (Conrad) Conrad (p. 235). Apertural view of holotype (Acad. Nat. Sci. Philadelphia 1616); height 30.9 millimeters; diameter 21.6 millimeters. × 2.

FIGURES 2–3. *Ptychosalpinx multirugata* (Conrad) Conrad (p. 235).

2. Apertural view of holotype (Acad. Nat. Sci. Philadelphia 1615), from the Duplin marl at the Natural Well, N. C.; height 24.9 millimeters; diameter 14.2 millimeters. × 2.
3. Rear view of holotype shown in figure 2. × 2.

FIGURE 4. *Ptychosalpinx fossulata* (Conrad) Conrad (p. 235). Rear view of holotype shown in figure 1. × 2.

FIGURE 5. *Fusinus burnsii* (Dall) (p. 255). Apertural view of specimen (U. S. Nat. Mus. 97492), from the Yorktown formation at Petersburg, Va.; height 63 millimeters; diameter 22 millimeters.

FIGURES 6–7. *Fusinus rappahannockensis* Gardner, n. sp. (p. 257). Cotypes (U. S. Nat. Mus. 325397), from the St. Marys formation, 1 to 2 miles below Bowlers Wharf, Rappahannock River, Essex County, Va.

6. Apertural view of first cotype; height 15 millimeters; diameter 7 millimeters. × 4.
7. Apertural view of second cotype; height 15.2 millimeters; diameter 6.1 millimeters. × 4.

FIGURES 8–9. *Ptychosalpinx fossulata* (Conrad) Conrad (p. 235).

8. Rear view of paratype (Acad. Nat. Sci. Philadelphia 1616). × 2.
9. Apertural view of specimen shown in figure 8. × 2.

FIGURE 10. *Fusinus exilis* (Conrad) (p. 255). Apertural view of specimen in Wagner Free Institute of Science.

FIGURE 11. *Fasciolaria sparrowi* Emmons (p. 254). Apertural view of specimen in Wagner Free Institute of Science.

FIGURE 12. *Uzita lapenotierei* (Dall) (p. 250). Apertural view of holotype (U. S. Nat. Mus. 112141), from the Pliocene of the Caloosahatchee River, Fla.; height 8.7 millimeters; diameter 4.4 millimeters. (After Dall.)

PLATE 33

FIGURE 1. *Busycon* (*Sycotypus*) *concinnum* Conrad (p. 242). Apertural view of specimen (U. S. Nat. Mus. 325396), from the Waccamaw formation at Walkers Bluff, Cape Fear River, Bladen County, N. C.; height (tip decorticated) 76.0 millimeters; diameter 37.5 millimeters.

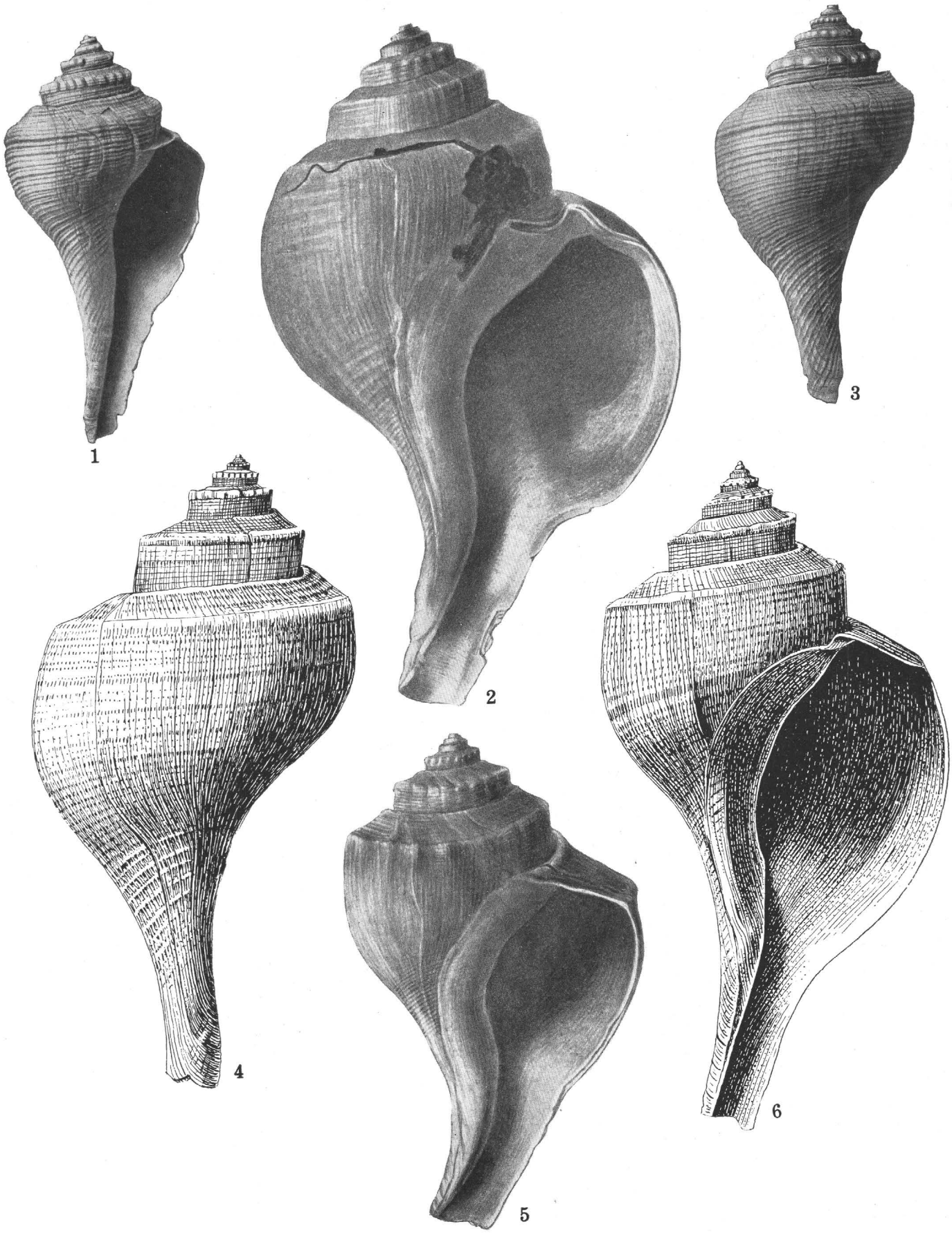
FIGURE 2. *Busycon* (*Sycotypus*) *conradii* Tuomey and Holmes (p. 242). Apertural view of specimen from the Duplin marl, Sumter County, S. C. (After Tuomey and Holmes.)

FIGURE 3. *Busycon* (*Sycotypus*) *concinnum* Conrad (p. 242). Rear view of specimen shown in figure 1.

FIGURE 4. *Busycon* (*Sycotypus*) *canaliculatum* Linnaeus (p. 242). Rear view of specimen from the Pleistocene at Wailes Bluff near Cornfield Harbor, St. Marys County, Md. (After Clark.)

FIGURE 5. *Busycon* (*Sycotypus*) *canaliculatum canaliferum* Conrad (p. 242). Apertural view of specimen from the Waccamaw formation on Waccamaw River, Horry? County, S. C. (After Tuomey and Holmes.)

FIGURE 6. *Busycon* (*Sycotypus*) *canaliculatum* Linnaeus (p. 242). Apertural view of specimen shown in figure 4. (After Clark.)



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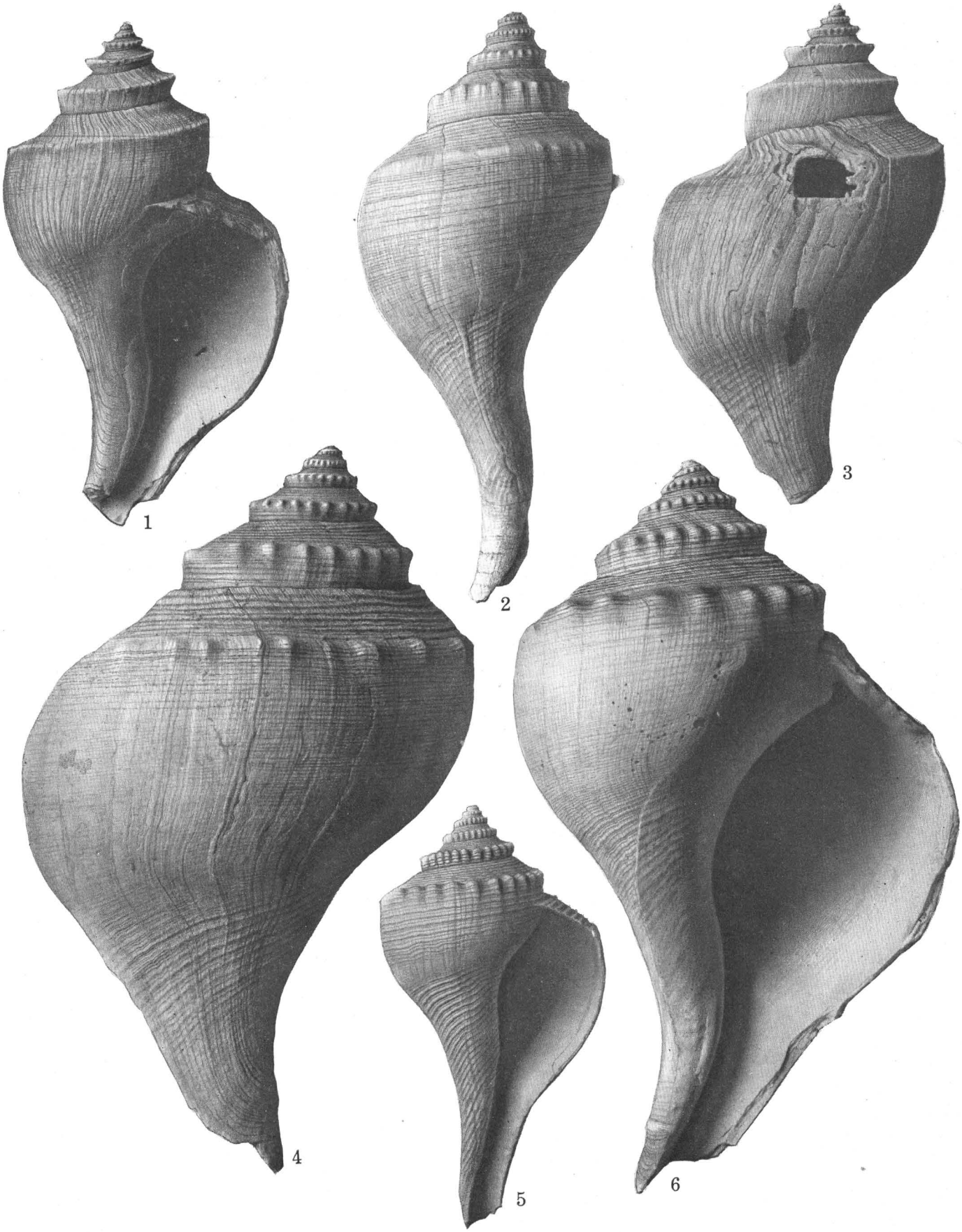

GASTROPODS

PLATE 34

FIGURE 1. *Busycon willcoxi* Gardner, n. sp. (p. 240). Apertural view of incomplete holotype (U. S. Nat. Mus. 325391), from the Waccamaw formation on the Cape Fear River, N. C.; height 97.5 millimeters; diameter 56.0 millimeters.

FIGURE 2. *Busycon amoenum* Conrad (p. 238). Rear view of specimen (U. S. Nat. Mus. 325395), from the Waccamaw formation at Neills Eddy Landing, Cape Fear River, Columbus County, N. C.; height (tip decorticated) 113.0 millimeters; diameter (aperture broken) 52.5 millimeters.

FIGURE 3. *Busycon willcoxi* Gardner, n. sp. (p. 240). Rear view of holotype shown in figure 1.

FIGURES 4–6. *Busycon amoenum* Conrad (p. 238). Specimens (U. S. Nat. Mus. 325392), from the Waccamaw formation at Neills Eddy Landing, Cape Fear River, Columbus County, N. C.

4. Rear view of larger individual; height 143 millimeters; diameter 82 millimeters.
5. Apertural view of adolescent individual; height 79.0 millimeters; diameter 39.5 millimeters.
6. Apertural view of specimen shown in figure 4.

PLATE 35

FIGURE 1. *Busycon perversum robesonense* Gardner, n. subsp. (p. 239). Rear view of holotype (U. S. Nat. Mus. 325394), from the Duplin marl, 4 miles north of Lumberton, Robeson County, N. C.; height 61 millimeters; diameter 29 millimeters. × 2.

FIGURE 2. *Busycon bladenense* Gardner, n. sp. (p. 239). Rear view of paratype (U. S. Nat. Mus. 325390), from the Waccamaw formation at Walkers Bluff, Cape Fear River, Bladen County, N. C.; height 73.0 millimeters; diameter 37.5 millimeters.

FIGURE 3. *Busycon perversum robesonense* Gardner, n. subsp. (p. 239). Apertural view of holotype shown in figure 1. × 2.

FIGURE 4. *Busycon bladenense* Gardner, n. sp. (p. 239). Apertural view of holotype (U. S. Nat. Mus. 325390), from the Waccamaw formation at Walkers Bluff, Cape Fear River, Bladen County, N. C.; height of imperfect specimen 83.5 millimeters; diameter 45.0 millimeters.

FIGURE 5. *Busycon amoenum* Conrad (p. 238). Rear view of juvenile specimen (U. S. Nat. Mus. 325392), from the Waccamaw formation at Neills Eddy Landing, Cape Rear River, Columbus County, N. C.; height 30.5 millimeters; diameter 14.5 millimeters. × 5.

FIGURE 6. *Busycon carinatum* Conrad (p. 240). Rear view of holotype (Acad. Nat. Sci., Philadelphia, 1680).

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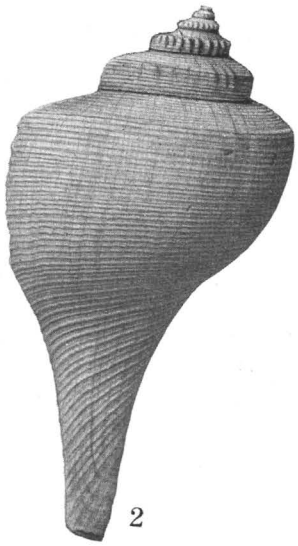

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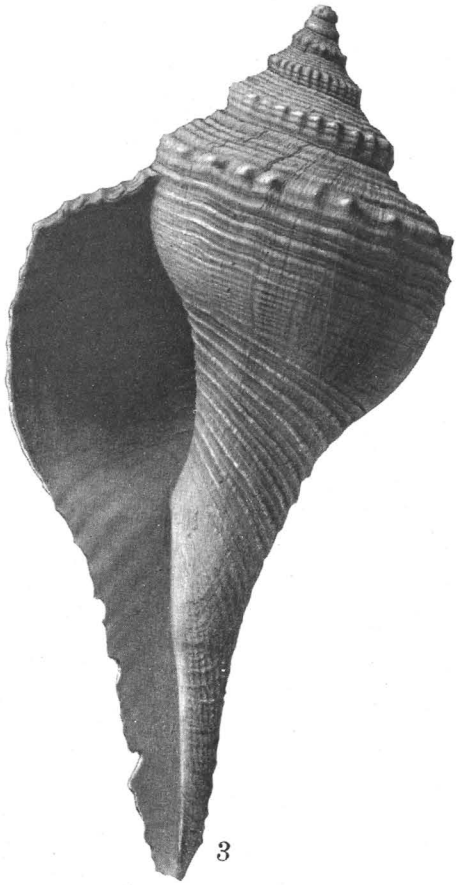

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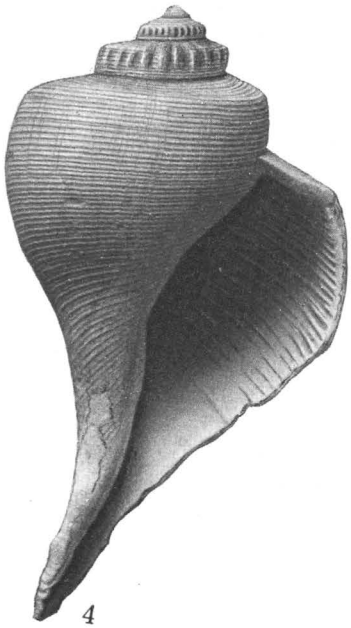

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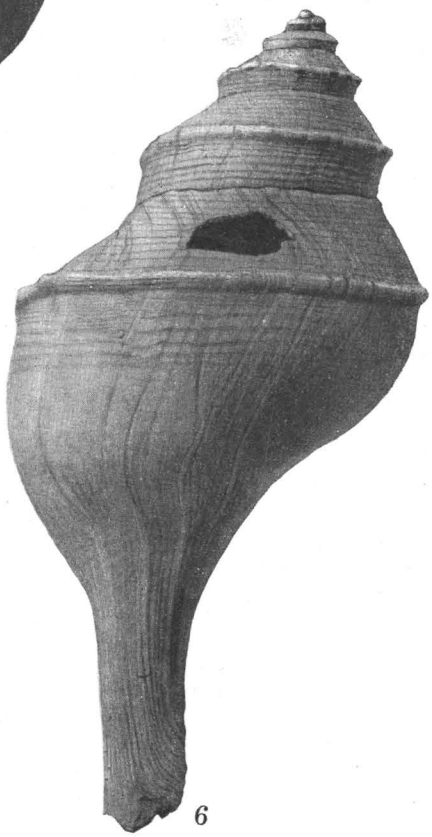

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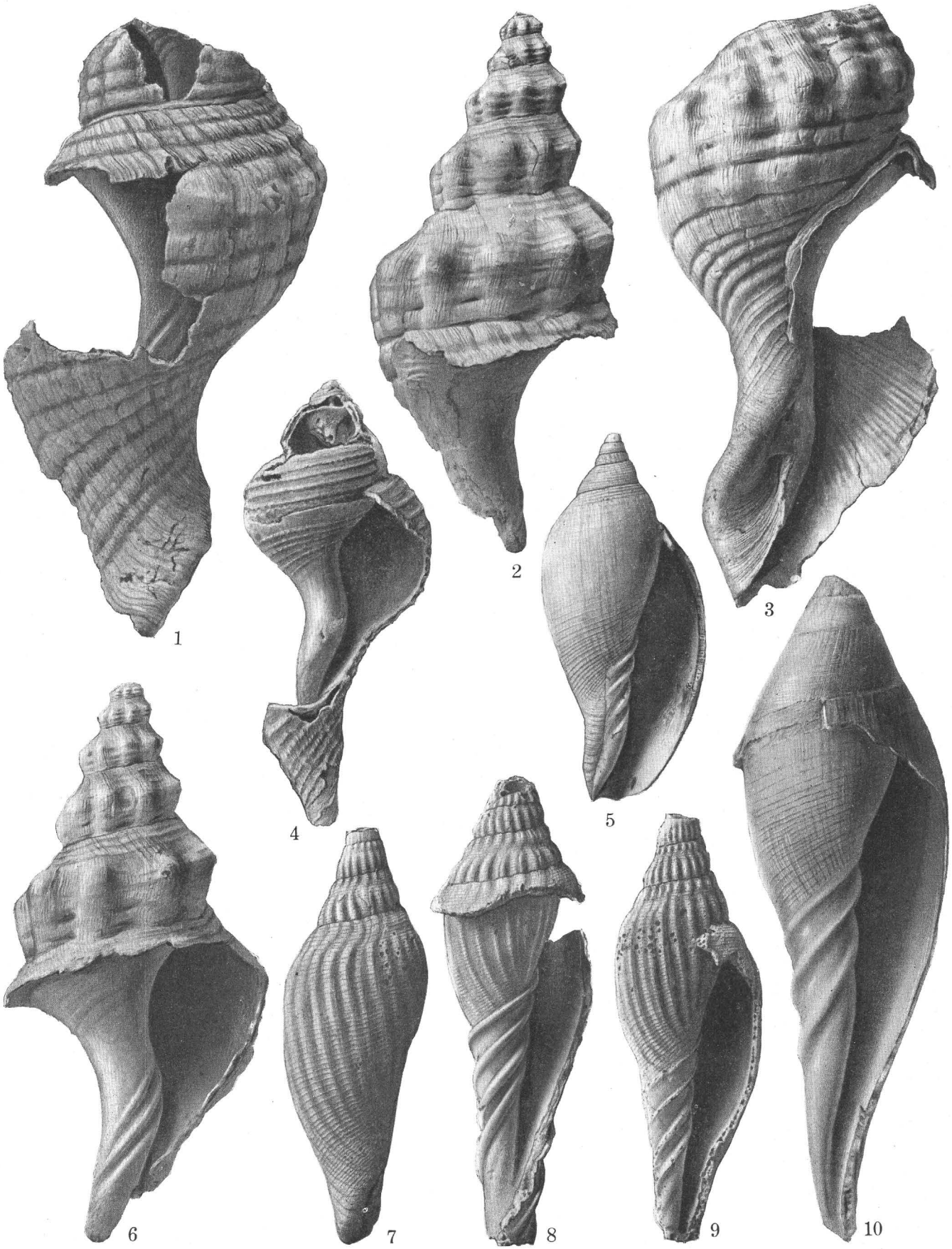

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PLATE 36

FIGURES 1–3. *Fasciolaria cronlyensis* Gardner, n. sp. (p. 254). Two cotypes, both incomplete, one the spire, and the other the body of different individuals (U. S. Nat. Mus. 325389), from the Waccamaw formation at Neills Eddy Landing, Cape Fear River, Columbus County, N. C.

1. Rear view of body.
2. Rear view of spire.
3. Apertural view of body shown in figure 1.

FIGURE 4. *Busycon chowanense* Gardner, n. sp. (p. 241). Rear view of holotype (U. S. Nat. Mus. 325393), from the Yorktown formation half to three-fourths of a mile above Edenhouse Point, Chowan River, Bertie County, N. C.; height (tip broken away) 79 millimeters.

FIGURE 5. *Scaphella trenholmii* (Tuomey and Holmes) (p. 260). Apertural view of specimen (U. S. Nat. Mus. 114314), from 1½ miles northwest of Magnolia, Duplin County, N. C.; height 68 millimeters; diameter 29 millimeters. (After Mansfield.)

FIGURE 6. *Fasciolaria cronlyensis* Gardner, n. sp. (p. 254). Apertural view of spire shown in figure 2.

FIGURES 7–9. *Scaphella precursor* Gardner, n. sp. (p. 260). Two cotypes, both incomplete (U. S. Nat. Mus. 325387), from the Waccamaw formation at Neills Eddy Landing, Cape Fear River, Columbus County, N. C.

7. Rear view of cotype; height of incomplete specimen 78 millimeters; diameter 28 millimeters.
8. Apertural view of second cotype; height of incomplete specimen 88 millimeters.
9. Apertural view of cotype shown in figure 7.

FIGURE 10. *"Aurinia obtusa"* (Emmons)? (p. 261). Apertural view of specimen in Wagner Free Institute of Science.

PLATE 37

FIGURE 1. *"Mangelia" stellata* Stearns (p. 272). Apertural view of cotype (U. S. Nat. Mus. 86896), Recent, from Tampa Bay, Fla.; height 8.5 millimeters; diameter 3.7 millimeters. × 6.

FIGURES 2–3. *"Drillia" polygonalis* Dall ms., n. sp. (p. 269).

2. Apertural view of holotype (U. S. Nat. Mus. 114044), from Duplin marl, 1½ miles northwest of Magnolia, Duplin County, N. C.; height 15.3 millimeters; diameter 5.9 millimeters. × 2.
3. Rear view of holotype. × 2.

FIGURE 4. *"Drillia" simpsoni cingulata* Gardner, n. subsp. (p. 270). Apertural view of holotype (U. S. Nat. Mus. 114040), Duplin marl, from the Natural Well, Duplin County, N. C.; height 6.4 millimeters; diameter 2.5 millimeters. × 4.

FIGURE 5. *Cryoturris magnoliana chariessa* Gardner, n. subsp. (p. 271). Apertural view of holotype (U. S. Nat. Mus. 325374), from the Waccamaw formation at Neills Eddy Landing, Cape Fear River, Columbus County, N. C.; height 8.5 millimeters; diameter 3.2 millimeters. × 3½.

FIGURE 6. *"Drilla" simpsoni cingulata* Gardner, n. subsp. (p. 270). Rear view of holotype shown in figure 4. × 4.

FIGURE 7. *Ithycythara psila* (Bush) (p. 271). Apertural view of specimen (U. S. Nat. Mus. 92995), Recent, from off Cape Hatteras in 48 fathoms; height 6.1 millimeters; diameter 2.3 millimeters. × 8.

FIGURE 8. *Cryoturris cerinella* (Dall) (p. 272). Apertural view of specimen (U. S. Nat. Mus. 86909), Recent, from Punta Rosa, Fla., in 2 fathoms; height 11.8 millimeters; diameter 3.7 millimeters. × 4.

FIGURES 9–10. *Cymatosyrinx ziczac* Gardner, n. sp. (p. 268).

9. Apertural view of holotype (U. S. Nat. Mus. 114036), Duplin marl, from the Natural Well, Duplin County, N. C.; height 17.2 millimeters; diameter 6.0 millimeters. × 3.
10. Apertural view of paratype (U. S. Nat. Mus. 114036), height 15.0 millimeters; diameter 5.8 millimeters. × 3.

FIGURE 11. *Syntomodrillia lissotropis* subsp? *scissurata* (Dall) (p. 269). Rear view of imperfect holotype (U. S. Nat. Mus. 97333), from the Caloosahatchee marl, Caloosahatchee River, Fla.; height 8.6 millimeters; diameter 3.0 millimeters. × 6.

FIGURE 12. *Cymatosyrinx tiara* Gardner, n. sp. (p. 269). Apertural view of holotype (U. S. Nat. Mus. 114034), Duplin marl, from the Natural Well, Duplin County, N. C.; height 21.2 millimeters; diameter 7.8 millimeters. × 3.

FIGURE 13. *Kurtziella eritima* (Bush) (p. 270). Apertural view of specimen (U. S. Nat. Mus. 86913), Recent, from off Cape Hatteras in 14 to 19 fathoms; height 5.5 millimeters; diameter 2.5 millimeters. × 8.

FIGURE 14. *Bellaspira virginiana* (Conrad) (p. 271). Apertural view of holotype (Acad. Nat. Sci. Philadelphia 1610). × 8.

FIGURE 15. *"Drillia" arctata* Conrad? (p. 267). Apertural view of holotype (Acad. Nat. Sci. Philadelphia 1611). × 4.

FIGURE 16. *Crassispira perrugata* (Dall) (p. 265). Apertural view of holotype (U. S. Nat. Mus. 97317), from the Caloosahatchee marl, Caloosahatchee River, Fla.; height 29.0 millimeters; diameter 9.5 millimeters. × 1½.

FIGURE 17. *Glyphostoma zoster mansfieldi* Gardner, n. subsp. (p. 273). Apertural view of holotype (U. S. Nat. Mus. 499116) Duplin marl, from the Natural Well, Duplin County, N. C.; height 9.5 millimeters; diameter, 4.0 millimeters. × 6.

FIGURE 18. *Crassispira abundans* (Conrad) (p. 265). Apertural view of specimen (U. S. Nat. Mus. 325371), from Vicksburg, Miss.; height 17.8 millimeters; diameter 5.2 millimeters. × 3.

FIGURE 19. *Carinodrillia? bella* (Conrad) (p. 268). Apertural view of holotype (Acad. Nat. Sci. Philadelphia 1607). × 4.

FIGURE 20. *Glyphostoma scoptes* Dall (p. 274). Apertural view of holotype (U. S. Nat. Mus. 163977), from the Caloosahatchee marl at Shell Creek, Fla.; height 12.3 millimeters; diameter 4.2 millimeters. (After Dall.)

FIGURE 21. *"Drillia" eburnea* Conrad (p. 266). Apertural view of holotype (Acad. Nat. Sci. Philadelphia 1608). × 4.

FIGURE 22. *Crassispira perrugata* (Dall) (p. 265). Apertural view of specimen (U. S. Nat. Mus. 113149), from the Caloosahatchee marl at Shell Creek, Charlotte County, Fla.; height 22.5 millimeters; diameter 8.0 millimeters. × 2½.

FIGURES 23–24. *Clavatula cornelliana* (Olsson) (p. 265).

23. Apertural view of specimen (U. S. Nat. Mus. 325372), from the Waccamaw formation at Walkers Bluff, Cape Fear River, Bladen County, N. C.; height 17.6 millimeters; diameter 6.5 millimeters. × 3.
24. Rear view. × 3.

FIGURE 25. *"Drillia" emmonsi* Olsson (p. 265). Apertural view of specimen (U. S. Nat. Mus. 114017), from Duplin marl, 1½ miles northwest of Magnolia, Duplin County, N. C.; height 8.8 millimeters; diameter 3.3 millimeters. × 6.

FIGURE 26. *Glyphostoma zoster phroudon* Gardner n. sp. (p. 273). Apertural view of holotype (U. S. Nat. Mus. 325375), from the Duplin marl, 1½ miles northeast of Fairmont, Robeson County, N. C.; height 9.3 millimeters; diameter 4.0 millimeters. × 7.

FIGURES 27–28. *"Drillia" arata* Conrad (p. 267).

27. Rear view of holotype (?) (Acad. Nat. Sci. Philadelphia 1605). × 4.
28. Apertural view of paratype (?) (Acad. Nat. Sci. Philadelphia 1605). × 4.

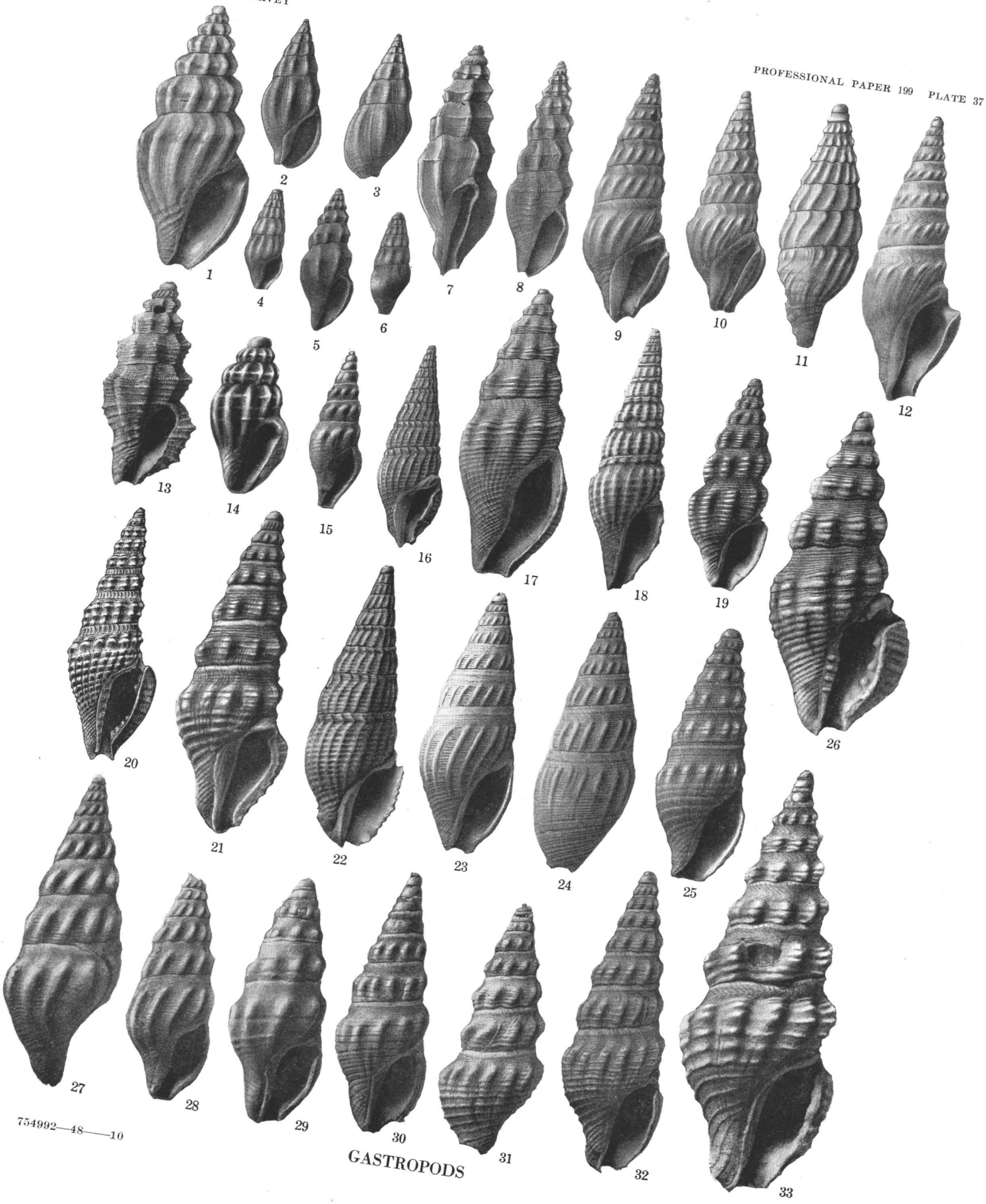
FIGURE 29. *"Drillia" distans* (Conrad) (p. 266). Apertural view of holotype (Acad. Nat. Sci. Philadelphia 1603). × 2½.

FIGURES 30–31. *"Drillia" impressa* Conrad (p. 267).

30. Apertural view of holotype (Acad. Nat. Sci. Philadelphia 1606). × 2.
31. Rear view of holotype. × 2.

FIGURE 32. *Compsodrillia chowanensis* Gardner, n. sp. (p. 268). Apertural view of holotype (U. S. Nat. Mus. 325373), from the Yorktown formation at Colerain Landing, Chowan River, Bertie County, N. C.; height 16.5 millimeters; diameter 5.5 millimeters. × 4.

FIGURE 33. *"Drillia" pyrenoides* (Conrad) (p. 266). Apertural view of holotype (Acad. Nat. Sci. Philadelphia 1602). × 4.



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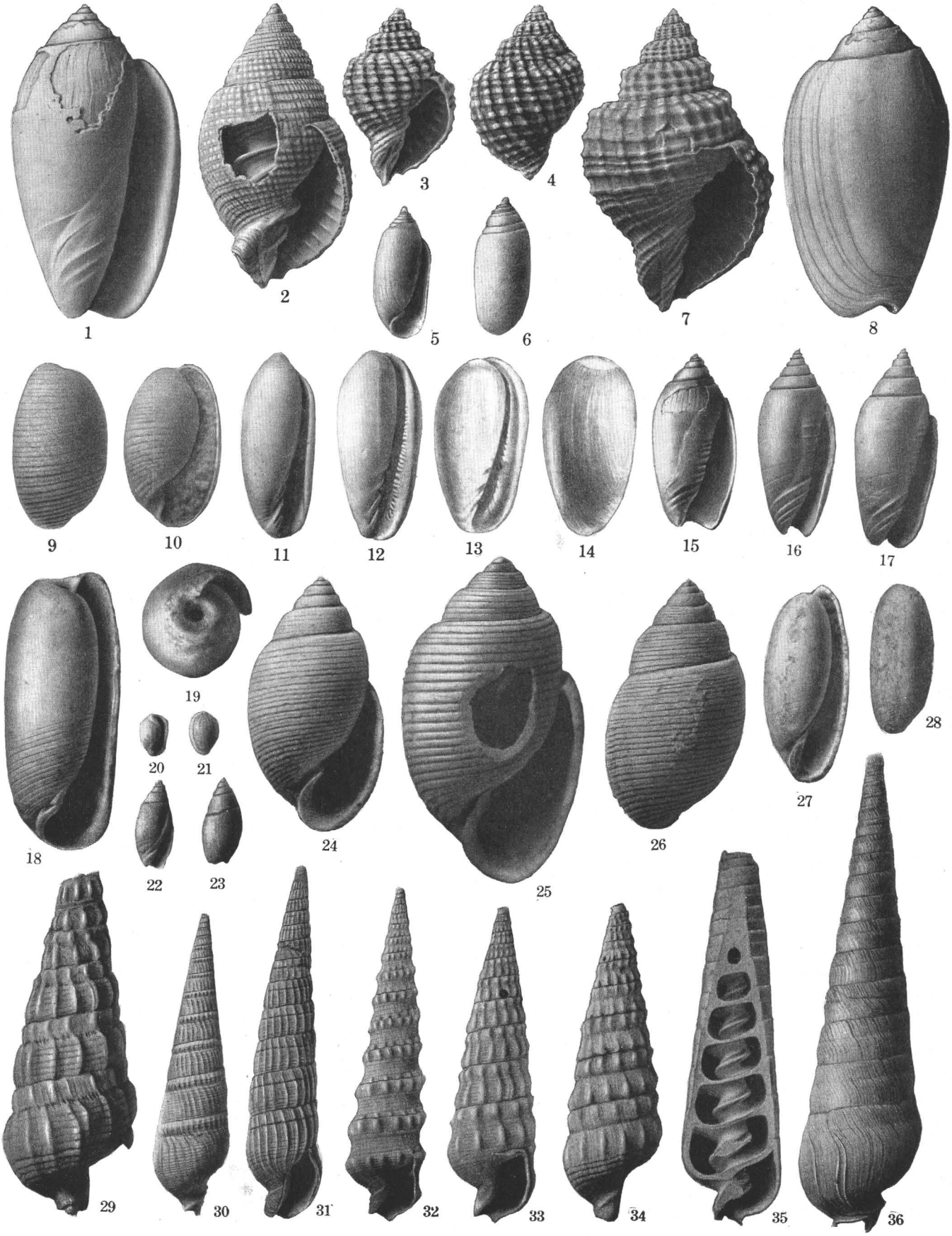
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GASTROPODS

PLATE 38

FIGURE 1. *Oliva idonea* Conrad (p. 258). Apertural view of holotype (?) (Acad. Nat. Sci. Philadelphia 1613). × 1 (?).

FIGURE 2. *Cancellaria rotunda* Dall (p. 264). Apertural view of holotype (U. S. Nat. Mus. 497152), from Duplin marl, 1 mile east of Magnolia, Duplin County, N. C.; height 52.5 millimeters; diameter 28.0 millimeters.

FIGURES 3–4. *Cancellaria plagiostoma* Conrad (p. 264).

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