UNITED STATES DEPARTMENT OF THE INTERIOR

THE MOLLUSCAN FAUNA OF THE ALUM BLUFF GROUP OF FLORIDA

PART VI. PTEROPODA, OPISTHOBRANCHIA AND CTENOBRANCHIA (IN PART)

GEOLOGICAL SURVEY PROFESSIONAL PAPER 142–F

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Professional Paper 142—F

THE MOLLUSCAN FAUNA OF THE ALUM BLUFF GROUP OF FLORIDA

BY
JULIA GARDNER

PART VI. PTEROPODA, OPISTHOBRANCHIA, AND CTENOBRANCHIA (IN PART)

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CONTENTS

ILLUSTRATIONS

LIST OF LOCALITIES

The following list shows the localities cited by number in the text and tables:

2211. Lower bed, Alum Bluff, Liberty County, Fla.
2212. Tenmile Creek, 1 mile west of Baileys Ferry, Calhoun County, Fla.
2213. 1 mile below Baileys Ferry, Chipola River, Calhoun County, Fla.
2214. Tenmile Creek, 1 mile west of Baileys Ferry, Calhoun County, Fla.
2238. Flournoy's millrace, 2 miles east of Argyle, Walton County, Fla.
2564. McClelland farm, 1 mile below Baileys Ferry, Calhoun County, Fla.
2645. McClellan farm, Shoal River, 5 miles northwest of Mossyhead, Walton County, Fla.
2646. Oak Grove, Yellow River, Okaloosa County, Fla.
2652. Horse Creek, 1½ miles south of Oak Grove, Okaloosa County, Fla.
3417. Alum Bluff, 35 miles below railroad bridge over Apalachicola River, Liberty County, Fla.
3419. McClelland farm, 1 mile below Baileys Ferry, Calhoun County, Fla.
3731. Near Mossyhead, sec. 6, T. 3 N., R. 21 W., Walton County, Fla.
3732. Dave Adams Mill Creek, sec. 2, T. 3 N., R. 21 W., Walton County, Fla.
3733. Three-fourths mile west of Shell Bluff, Shoal River, Walton County, Fla.
3742. Shell Bluff, Shoal River, Walton County, Fla.
3747. 8 miles southwest of Lake De Funiak, Walton County, Fla.
3748. Summerville millrace, 1 mile east of Argyle, Walton County, Fla.
3749. Allen Senterfeit's mill, 3 or 4 miles north of Campton, Okaloosa County, Fla.
3856. 6 miles west-northwest of Mossyhead, Walton County, Fla.
5079. One-half mile below Shell Bluff, Shoal River, Walton County, Fla.
5080. First ravine below Shell Bluff, Shoal River, Walton County, Fla.
5184. First ravine below Shell Bluff, Shoal River, Walton County, Fla.
5193. Crowder's Crossing, 1½ miles below Shell Bluff, Shoal River, Walton County, Fla.
5195. First ravine below Shell Bluff, Shoal River, Walton County, Fla.
5618. 3½ miles southwest of De Funiak Springs, Walton County, Fla.
5630. 100 yards below Oak Grove Bridge, Yellow River, Okaloosa County, Fla.
5631. Oak Grove Bridge, Yellow River, Okaloosa County, Fla.
5632. Oak Grove, Yellow River, Okaloosa County, Fla.
5633. Oak Grove, Yellow River, Okaloosa County, Fla.
6175. Left bank of Suwannee River three-fourths mile above White Springs, Columbia County, Fla.
6776. Spring on left bank of Suwannee River about 100 yards above Rock Island and about half a mile above White Springs, Columbia County, Fla.
7054. 400 feet below bridge, Oak Grove, Okaloosa County, Fla.
7055. Old Senterfeit mill, 4½ miles southwest of Laurel Hill, Okaloosa County, Fla.
7148. Gastropod Gulch, 5½ miles southeast of Bainbridge, Decatur County, Ga.
7151. Tenmile Creek, Calhoun County, Fla.
7183. Alum Bluff (lower bed), Liberty County, Fla.
7256. Look and Tremble Shoals, Chipola River, Calhoun County, Fla.
7257. Sexton's marl bed, sec. 11, T. 1 N., R. 10 W., Tenmile Creek, Calhoun County, Fla.
7261. Upper Alaqua Lethu (?) Bluff, near De Funiak Springs, Walton County, Fla.
7264. De Funiak *Cardium* beds, Alaqua, Walton County, Fla.
7468. Sopchoppy, Wakulla County, Fla.
7893. Boynton Landing, Choctawhatchee River, Washington County, Fla.

THE MOLLUSCAN FAUNA OF THE ALUM BLUFF GROUP OF FLORIDA

By JULIA GARDNER

PART VI. PTEROPODA, OPISTHOBRANCHIA, AND CTENOBRANCHIA (IN PART)

INTRODUCTION

Part VI (F) of Professional Paper 142, the first part of the Gastropoda of the Alum Bluff group, covers all of the opisthobranchs and eight large families of the ctenobranchs. No land shells have been reported and only 2 pteropods, so that the order of the opisthobranchs is represented chiefly by the 36 species and subspecies of tectibranchs.

In the molluscan fauna of the Alum Bluff group the bivalves are by far the more numerous in individuals, but the univalve fauna is more varied and includes a greater number of species. Possibly for the reason that many of the gastropods are carnivorous or subsist in part on a meat diet—witness the "drill shells"—they range more widely and are able to maintain themselves in an unfavorable environment but meet with stronger competition, which reduces their numbers. The bivalves are more restricted in their diet and by their diet, and though they are more rigidly excluded from an unfavorable environment, if the environment be favorable they more commonly thrive in great numbers. This general trait of molluscan distribution is well exemplified in the groups treated in the first part of this chapter. Two hundred and forty-one species and subspecies have been discriminated, but less than 10 percent of these are conspicuous in the number of individuals. The Terebras in the Shoal River formation, the turritids of the old *Turris* and *Surcula* types in the Chipola and Shoal River, and *Conus* and *Cancellaria* in the Shoal River stand out by reason of their abundance. The turritids are representatives of groups widespread and prolific in the mid-American Tertiary, and the common Terebras, cones, and Cancellarias in the Shoal River are of unusual interest because they are so closely related to mid-American species. The relatively slight representation in the Oak Grove sand is doubtless a reflection of the cooler water during that stage. The opisthobranchs are many of them inhabitants of the deeper waters, and some of them are pelagic, so that as a group they are not good indicators of early Tertiary shore conditions or of relationships to contemporary faunas. The Terebras and turritids, cones, Cancellarias, olives, Marginellas, and Mitras, on the contrary, took their place in the littoral life of the period, and their remains reflect much more sharply the current ecology and the relationship to the molluscan faunas of nearby shores.

Distribution of Pteropoda, Opisthobranchia, and Ctenobranchia (in part) in the Alum Bluff group of Florida and Georgia

[pr, prolific; a, abundant; c, common; r, rare; p, present. The localities within each formation are arranged in geographic order from north to south and from west to east]

Species	Chipola formation																Aldrich collection, Johns Hopkins University	Cornell University collections	Florida—Oak Grove sand							
	Georgia	Florida																								
	7148	7893	2212	2214	7257	2213	2564	3419	7151	7256	2211	7183	3417	7468	6175	6776			2646	5632	5631	5630	5633	7054	2652	7055	3749
Vaginella chipolana Dall					p	a			p																		
Cuvierina columnella (Rang)											(?)																
Acteon textilis (Guppy)																											
korphys Gardner, n. sp						c	(?)p	c			c	r															
fusulus Dall						r																					
luculi Maury																			r								
hamadryados Maury								(?) r											a	c	r		p	p			
chipolanus Dall						c	p	p																			
Acteocina sphalera Gardner, n. sp																			a	p			r	r			r
incisula (Dall)						r					a					(?) r											
incisula curtoides Gardner, n. subsp			r		r	a	p	p	p		p	p															
incisula kolos Gardner, n. subsp			r		r	c	c	c	r																		
persimilis (Dall)						c		r			p																
rusa Gardner, n. sp																											
fischeri (Dall)					r	c	r	p	p																		
Sulcularia prosulcata Gardner, n. sp		r				p			r		p	r					(?)										
chipolana (Dall)					r	a	p	p	p								p		a	c	p	r	r	c			
Cylichnella biplicata (H. C. Lea)						r													pr	a	c		c	a			
Volvula oxytata Bush					r	c	r	r	r																		
oxytata dodona Gardner, n. subsp																			a	c	p		r	p			
phoinicoides Gardner, n. sp																											
Scaphander langdoni Dall						c		r			c	p			p												

Distribution of Pteropoda, Opisthobranchia, and Ctenobranchia (in part) in the Alum Bluff group of Florida and Georgia—Continued

[pr, prolific; a, abundant; c, common; r, rare; p, present. The localities within each formation are arranged in geographic order from north to south and from west to east]

Species	Chipola formation															Aldrich collection, Johns Hopkins University	Cornell University collections	Florida—Oak Grove sand								
	Georgia	Florida																							
	7148	7393	2212	2214	7257	2213	2564	3419	7151	7256	2211	7183	3417	7468	6175	6776			2646	5632	5631	5630	5633	7054	2652	7055	3749
Atys oedemata Dall						p			r		p																
(Aliculastrum) obscuratus Dall							p	c			p	p															
(Roxaniella) gracilis Dall						c	p	c	p		c								r								
Cylichna decapitata (Dall)						c	p		r																		
quercinensis (Dall)																			a	c	p		r	p			
anthera Gardner, n. sp																											
Bulla striata Bruguière						c		c	r		a																
striata waltonensis Gardner, n. subsp																											
Haminaea pompholyx Dall					r	p		p			c																
Abderospira chipolana Dall						p																					
funiakensis Gardner, n. sp																											
Ringicula chipolana Dall											r																
boyntoni Gardner, n. sp		r																									
semilimata Dall		p	r			r			p											r				r			
stiphera Gardner, n. sp																			r	r							
Dolabella aldrichi Dall						r	r				r	r															
Terebra (Paraterebra) sulcifera Sowerby?			r					r																			
(Paraterebra) odopoia Gardner, n. sp			a			a	r		r																		
(Strioterebrum) pupiformis Gardner, n. sp																											
(Strioterebrum) gausapata Brown and Pilsbry																											
(Strioterebrum) bipartita Sowerby																											
(Strioterebrum) spirifera Dall																			p	(?)p				(?)r			
(Strioterebrum) waltonensis Gardner, n. sp																											
(Strioterebrum) waltonensis tribaka Gardner, n. subsp																											
(Strioterebrum?) eskata Gardner, n. sp																											
(Strioterebrum) rabdota Gardner, n. sp																											
(Strioterebrum) langdoni Dall		(?)r				a	p	c	r		c			(?)r					(?)p	(?)p							
(Strioterebrum) chipolana Dall						r																					
(Strioterebrum) langdoni perpunctata Dall						c														(?)r							
(Strioterebrum) rapta Gardner, n. sp																											
Spineoterebra psilis (Dall)																			p	r							
Terebra aulakoessa Gardner, n. sp																			r								
Polystira albidoides Gardner, n. sp			a			a	c	a			c						p										
(Pleuroliria) tenagos Gardner, n. sp																											
sp. aff. P. tenagos Gardner, n. sp																				r			r				
Hemipleurotoma eileta Gardner, n. sp																											
bitropis Gardner, n. sp																											
Fusiturricula paraservata Gardner, n. sp						c	p	p																			
Fusiturricula? glaphura Gardner, n. sp																											
Knefastia glypta Gardner, n. sp							r	r																			
Knefastia? waltonia Gardner, n. sp																											
Crassispira boadicea (Dall)																			c	r	r			r			
meunieri (Maury)						r												p									
calligona (Maury)						c	(?)r	r										p									
calligona paraconsors Gardner, n. subsp?						r		r																			
calligonoides Gardner, n. sp																											
Clavatula panopla Gardner, n. sp											a	r					p										
eleutheria Gardner, n. sp											c						p										
kalliglypta Gardner, n. sp								r									p										
grabaui (Maury)						r		r			r							p									
apoia Gardner, n. sp							p	p																			
polyploka Gardner, n. sp						r	r	r																			
euparypha Gardner, n. sp						(?)r	r	r	(?)p																		
anthera Gardner, n. sp						(?)p	r	p																			
proebenina Gardner, n. sp																											
libertalis Gardner, n. sp											p	r															
vandenbroecki (Maury)		r				c	r											p									
habra Gardner, n. sp						c	c																				
compsa Gardner, n. sp							c	c			r						p										
elatocompsa Gardner, n. sp						r	c	c									p										
"Drillia" stonemani Maury																		p									
nemoralis Maury																											
Carinodrillia cymatoides Gardner, n. sp						c																					
Agladrillia aulakoessa Gardner, n. sp						a	p	c	r																		
dryados (Maury)																											
subvaricosa Gardner, n. sp																			r								
empera Gardner, n. sp																											
Eumetadrillia dodona Gardner, n. sp																			c	p							
rabdotacona Gardner, n. sp																											
"Drillia" prion Gardner, n. sp						c	p	c			c	r					p										
prion paraprion Gardner, n. subsp							c	c									p										
coryphodes Gardner, n. sp						c	r	p									p										
eurysoma Gardner, n. sp																											
micronota Gardner, n. sp																											
trimitrodita Gardner, n. sp						p		r																			
centrodes Gardner, n. sp																											
zosta Gardner, n. sp																											
trypanion Gardner, n. sp																											
pycnoklosta Gardner, n. sp																											
waltoniana Gardner, n. sp																											
pachycheila Gardner, n. sp																			p	p							
"Mangelia" anthetika Gardner, n. sp						r	r	p																			
Kurtziella prionota Gardner, n. sp																											
thektapleura Gardner, n. sp																			(?)r				r				
websteri (Maury)						p		r										p									
stephanophora Gardner, n. sp																											
ramondi (Maury)																			c	p	r		r	p			
"Mangelia" teirata Gardner, n. sp																			r								
Saccharoturris centrodes Gardner, n. sp						p	r	r																			
Cryoturris daidalea Gardner, n. sp		r				p		r			r																
"Mangelia" pyrgota Gardner, n. sp		r				r		r																			

Distribution of Pteropoda, Opisthobranchia, and Ctenobranchia (in part) in the Alum Bluff group of Florida and Georgia—Continued

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Ithycythara defuniak Gardner, n. sp																											
compsacosta Gardner, n. sp		r				c	p		r																		
tarri (Maury)																			c	c	p	r	r	p			
Ithycythara? radinos Gardner, n. sp					r	r	p	p																			
"Mangelia" clarae Maury																		p									
asteria Gardner, n. sp							r																				
lissa Gardner, n. sp						c	c	c									p										
phrixae Gardner, n. sp																											
louisae (Maury)						p					(?)p							p									
Brachycythara dasa Gardner, n. sp						p	p	p									p										
"Mangelia" klimakota Gardner, n. sp							r	r			c	r															
stypteria Gardner, n. sp											r																
sextoni Gardner, n. sp					r																						
cryptopleura Gardner, n. sp							r	p																			
"Cythara" chariessa Gardner, n. sp						r		p	r																		
barbadoides Gardner, n. sp					r	c	p	p																			
isabellae (Maury)						(?)p		c	r									p									
basilissa Gardner, n. sp																											
anthera Gardner, n. sp						r	r	r																			
Lioglyphostoma tyro Gardner, n. sp								r																			
rusum Gardner, n. sp							p	p																			
Glyphostoma harrisi Maury						c	p	r	r									p									
peri-eilema Gardner, n. sp						(?)p	r	r																			
tiarophoron Gardner, n. sp											p						p										
ischnon Gardner, n. sp						r																					
typhon Gardner, n. sp						p																					
belonoides Gardner, n. sp						r		r																			
nannophues Gardner, n. sp						p		(?)r																			
aldrichi Maury																			c	p				r			
chipolanum Gardner, n. sp							r																				
xeston Gardner, n. sp																											
Nannodiella nemorensis (Maury)								r											p	r	r						
Microdrillia hebetika Gardner, n. sp						p	r	r	r																		
Bela nassoides Gardner, n. sp																											
Conus demiurgus Dall		(?)	p			p	c	a			p																
isomitratus Dall			a			c	p		r					(?)r														
sulculus Dall			a			p	p	p	p		p	r															
dodona Gardner, n. sp																			a				p	p			
chipolanus Dall						a	c	c	r						(?) r												
corrugatus Gardner, n. sp		(?)r				p	p												a	a			c	c			
fusiformis Gardner, n. sp																							r				
turbinopsis Gardner, n. sp																											
waltonensis Aldrich																											
waltonensis anodosus Gardner, n. subsp																											
submoniliferus Gardner, n. sp																											
molis Brown and Pilsbry																			r								
draperi Maury																		p									
nemorideditus Maury																	p										
Cancellaria defuniak Gardner, n. sp																											
subtiarophora Gardner, n. sp																											
waltoniana Gardner, n. sp																											
druidarum Gardner, n. sp																			c	p	r		r	r		r	
stibara Gardner, n. sp																			r	r							
mitrodita Gardner, n. sp								r																			
pinguis Gardner, n. sp																											
spherotopleura Gardner, n. sp																											
bifoliata Aldrich																			p	r							
aldrichi Gardner, n. sp		r				r											p										
paramoorei Gardner, n. sp						p	r	r																			
desmotis Gardner, n. sp						p																					
ancycla Gardner, n. sp			r			r																					
runchaena Gardner, n. sp																				(?) r							
(Trigonostoma) sphenoidostoma Gardner, n. sp																											
(Narona) atraktoides Gardner, n. sp																											
(Aphera) waltonensis (Aldrich)																											
Oliva liodes Dall			p				p	r	c										p		r				r	r	
liodes waltoniana Gardner, n. subsp																											
(Omogymna) martensii Dall			c			c	p	p																			
Olivella eutacta Dall						p	r	r																			
cotinados Gardner, n. sp						r	p	p											p	r							
oryzoides Gardner, n. sp		p			p	a	c	c	c																		
cofacorys Gardner, n. sp						p	p	p																			
eleutheria Gardner, n. sp		p									a	p															
dasa Gardner, n. sp																											
Ancilla chipolana Dall							c	c																			
Marginella (Serrata) chipolana Maury						p	p	p			p							p									
(Serrata) euancycla Gardner, n. sp						p	p	p			p																
(Serrata) xanthophaës Gardner, n. sp		r	(?)p			p	p	p												r							
(Serrata) denticulatoides Maury						(?)p					(?) r								c								
(Serrata) brithia Gardner, n. sp						c																					
(Serrata) cornelliana Maury																		p									
(Serrata) vadosa Gardner, n. sp																											
(Serrata) vadosa ischna Gardner, n. subsp																											
(Serrata) coloba Gardner, n. sp		r	p			c	p	p			c	p															
(Serrata) coloba conoispira Gardner, n. subsp			r			c	r	p			c								p	p				r			
(Serrata) nanna Gardner, n. sp											c	r															
(Serrata) critha Gardner, n. sp			p			c	p	p			c								p	p	r			r			
(Serrata) eurystoma Gardner, n. sp							p	p			p																
(Volvarina) oryzoides Gardner, n. sp						r		r			c																
(Egouena) apalachee Gardner, n. sp											c	r															
(Egouena) lipara Gardner, n. sp			p			a	c	c			c																
(Egouena) lipara lepta Gardner, n. subsp						p	r	p			p																
(Egouena) capsa Gardner, n. sp											p																
(Egouena) aurora Dall						r																					

Distribution of Pteropoda, Opisthobranchia, and Ctenobranchia (in part) in the Alum Bluff group of Florida and Georgia—Continued

[pr, prolific; a, abundant; c, common; r, rare; p, present. The localities within each formation are arranged in geographic order from north to south and from west to east

Species	Chipola formation															Aldrich collection, Johns Hopkins University	Cornell University collections	Florida—Oak Grove sand							
	Georgia	Florida																							
	7148	7893	2212	2214	7257	2213	2564	3419	7151	7256	2211	7183	3417	7468	6175	6776			2646	5632	5631	5630	5633	7064	2652	7055	3749
Marginella (Egouena) eleutheria Gardner, n. sp											a																
(Egouena) eleutheria dasa Gardner, n. subsp		r				r	r	p			p																
(Persicula) calhounensis Maury							o	c			a	r					p	p									
(Persicula) progravida Gardner, n. sp	r																										
(Persicula) majuscula Gardner, n. sp																			r	r							
(Gibberula) dryados (Maury)																			a	c	r		r	p			
(Gibberula) chondra Gardner, n. sp		r				c	p	c	p		c	p															
(Gibberula) waltoniana Gardner, n. sp																											
(Gibberula) sp											p																
Cypraeolina defuniak Gardner, n. sp																											
pyrenoides Gardner, n. sp		r				p	r	p	r		p	r															
Lyria pycnopleura Gardner, n. sp						p	p	p																			
Caricella (Atraktus) pycnoplecta Gardner, n. sp																											
Mitra acteoglypha Gardner, n. sp						r																					
(Pleioptygma) prodroma Gardner, n. sp			p		r	c	p	p			p						p										
(Tiara) mitrodita Gardner, n. sp		r	p			c	p	p	p																		
(Tiara) desmia Gardner, n. sp																											
Vexillum (Uromitra) climax Gardner, n. sp			r																								
(Uromitra) climacoton Gardner, n. sp																								r			
(Uromitra) barnardense (Maury)						c	p	p									p	p									
(Uromitra) myttone (Maury)																		p									
(Uromitra) scopuli (Maury)											c							p									
(Uromitra) triptum Gardner, n. sp																											
(Uromitra) ctenotum Gardner, n. sp																											
(Uromitra) hamadryas Gardner, n. sp																			a	c	p		p	p			
(Uromitra) cnestum Gardner, n. sp		r				p	p	r																			
(Uromitra) mangilopse Gardner, n. sp						c	p	p																			
(Uromitra) mikkulum Gardner, n. sp											p	r															
(Uromitra) amblipleura Gardner, n. sp		(?) r				r	p	p																			
(Uromitra) berkeyi (Maury)						(?) r												p									
Perplicaria prior Maury																		p									
Strigatella isabellae (Maury)			r			r		(?) r										p									
Conomitra apalachee Gardner, n. sp						p	p	p			(?) r																
Cymakra poncei Gardner, n. sp						r	r																				

Species	Aldrich collection, Johns Hopkins University	Cornell University collections	Florida—Shoal River formation																	
			3856	2645	3732	3742	3731	5080	5184	5195	5079	5193	3733	2238	3748	3747	7261	7264	5618
Vaginella chipolana Dall																			
Cuvierina columnella (Rang)																			
Acteon textilis (Guppy)						(?) p													
korphys Gardner, n. sp																			
fusulus Dall																			
luculi Maury	p	p																	
hamadryados Maury		p				(?) p													(?) r
chipolanus Dall																			
Acteocina sphalera Gardner, n. sp					r	a			r		a		p		p			r	
incisula (Dall)																			
incisula curtoides Gardner, n. subsp																			
incisula kolos Gardner, n. subsp																			
persimilis (Dall)																			
rusa Gardner, n. sp					r	c					c							r	r
fischeri (Dall)																			
Sulcularia prosulcata Gardner, n. sp						p									p			r	r
chipolana (Dall)																			
Cylichnella biplicata (H. C. Lea)															(?) c	(?) p	(?) r	(?) p	(?) a
Volvula oxytata Bush						r													r
oxytata dodona Gardner, n. subsp						p					r					r			
phoinicoides Gardner, n. sp			r			p									r				p
Scaphander langdoni Dall																			
Atys oedemata Dall	p																		
(Aliculastrum) obscuratus Dall																			
(Roxaniella) gracilis Dall						r													
Cylichna decapitata (Dall)																			
quercinensis (Dall)																			
anthera Gardner, n. sp						c					(?) p				(?) p				r
Bulla striata Bruguière																			
striata waltonensis Gardner, n. subsp											c	r							
Haminea pompholyx Dall																			
Abderospira chipolana Dall																			
funiakensis Gardner, n. sp																			r
Ringicula chipolana Dall																			
boyntoni Gardner, n. sp																			
semilimata Dall											r				p				
stiphera Gardner, n. sp						r										r	(?) r	r	p
Dolabella aldrichi Dall																			
Terebra (Paraterebra) sulcifera Sowerby?			r			p			r										
(Paraterebra) odopoia Gardner, n. sp						r			r										
(Strioterebrum) pupiformis Gardner, n. sp			p			(?) r													
(Strioterebrum) gausapata Brown and Pilsbry			r			(?) r													
(Strioterebrum) bipartita Sowerby			r												(?) p			(?) r	
(Strioterebrum) spirifera Dall			c				r				r								
(Strioterebrum) waltonensis Gardner, n. sp			pr	r	r	c	r	r	p	p				r					r
(Strioterebrum) waltonensis tribaka Gardner, n. subsp			a		p	c	r		p	r					p				
(Strioterebrum?) eskata Gardner, n. sp			c																
(Strioterebrum) rabdota Gardner, n. sp			c			r												r	

Distribution of Pteropoda, Opisthobranchia, and Ctenobranchia (in part) in the Alum Bluff group of Florida and Georgia—Continued

[pr, prolific; a, abundant; c, common; r, rare; p, present. The localities within each formation are arranged in geographic order from north to south and from west to east]

Species	Aldrich collection, Johns Hopkins University	Cornell University collections	Florida—Shoal River formation																
			3856	2645	3732	3742	3731	5080	5184	5195	5079	5193	3733	2238	3748	3747	7261	7264	5618
Terebra (Strioterebrum) langdoni Dall																			
(Strioterebrum) chipolana Dall																			
(Strioterebrum) langdoni perpunctata Dall																			
(Strioterebrum) rapta Gardner, n. sp			r			c													
Spineoterebra psilis (Dall)																			
Terebra aulakoessa Gardner, n. sp																			
Polystira albidoides Gardner, n. sp																			
(Pleuroliria) tenagos Gardner, n. sp			pr	p	r	a	c	r							r				r
sp. aff. P. tenagos Gardner, n. sp																			
Hemipleurotoma eileta Gardner, n. sp			a		r	c	r	r											p
bitropis Gardner, n. sp			p																
Fusiturricula paraservata Gardner, n. sp																			
Fusiturricula? glaphura Gardner, n. sp			c			c													
Knefastia glypta Gardner, n. sp																			
Knesfastia? waltonia Gardner, n. sp			r	r	r	r													
Crassispira boadicea (Dall)	p																		
meunieri (Maury)																			
calligona (Maury)																			
calligona paraconsors Gardner, n. subsp?																			
calligonoides Gardner, n. sp					r	a			r						r				r
Clavatula panopla Gardner, n. sp																			
eleutheria Gardner, n. sp																			
kalliglypta Gardner, n. sp																			
grabaui (Maury)																			
apoia Gardner, n. sp																			
polyploka Gardner, n. sp																			
euparypha Gardner, n. sp																			
anthera Gardner, n. sp																			
proebenina Gardner, n. sp											r								
libertalis Gardner, n. sp																			
vandenbroecki (Maury)																			
habra Gardner, n. sp																			
compsa Gardner, n. sp																			
elatocompsa Gardner, n. sp																			
"Drillia" stonemani Maury																			
nemoralis Maury		p																	
Carinodrillia cymatoides Gardner, n. sp																			
Agladrillia aulakoessa Gardner, n. sp																			
dryados (Maury)		p																	
subvaricosa Gardner, n. sp											r								
empera Gardner, n. sp			a			a			r					r					
Eumetadrillia dodona Gardner, n. sp																			
rabdotacona Gardner, n. sp			pr	r	p	pr		r	(?)r	r					p				
"Drillia" prion Gardner, n. sp																			
prion paraprion Gardner, n. subsp																			
coryphodes Gardner, n. sp																			
eurysoma Gardner, n. sp			r																
microneta Gardner, n. sp			r			r													
trimitrodita Gardner, n. sp																			
centrodes Gardner, n. sp						c													
zosta Gardner, n. sp			p			c													
trypanion Gardner, n. sp			r			c													
pycnoklosta Gardner, n. sp						r													
waltoniana Gardner, n. sp			c		r	a													
pachycheila Gardner, n. sp																			
"Mangelia" anthetika Gardner, n. sp																			
Kurtziella prionota Gardner, n. sp			r			c									p				c
thektapleura Gardner, n. sp																			
websteri (Maury)																			
stephanophora Gardner, n. sp											p								
ramondi (Maury)	p	p																	
"Mangelia" teirata Gardner, n. sp																			
Saccharoturris centrodes Gardner, n. sp																			
Cryoturris daidalea Gardner, n. sp																			
"Mangelia" pyrgota Gardner, n. sp																			
Ithycythara defuniak Gardner, n. sp																		p	
compsacosta Gardner, n. sp																			
tarri (Maury)	p	p																	
Ithycythara? radinos Gardner, n. sp																			
"Mangelia" clarae Maury																			
asteria Gardner, n. sp																			
lissa Gardner, n. sp																			
phrixae Gardner, n. sp			p			c									r				
louisae (Maury)																			
Brachycythara dasa Gardner, n. sp																			
"Mangelia" klimakota Gardner, n. sp																			
stypteria Gardner, n. sp																			
sextoni Gardner, n. sp																			
cryptopleura Gardner, n. sp																			
"Cythara" chariessa Gardner, n. sp																			
barbadoides Gardner, n. sp																			
isabellae (Maury)																			
basilissa Gardner, n. sp						r													
anthera Gardner, n. sp																			
Lioglyphostoma tyro Gardner, n. sp																			
rusum Gardner, n. sp																			
Glyphostoma harrisi Maury																			
peri-eilema Gardner, n. sp																			
tiarophoron Gardner, n. sp																			
ischnon Gardner, n. sp																			
typhon Gardner, n. sp																			
belonoides Gardner, n. sp																			
nannophues Gardner, n. sp																			
aldrichi Maury	p	p																	
chipolanum Gardner, n. sp																			
xeston Gardner, n. sp			p			c													

Distribution of Pteropoda, Opisthobranchia, and Ctenobranchia (in part) in the Alum Bluff group of Florida and Georgia—Continued

[pr, prolific; a, abundant; c, common; r, rare; p, present. The localities within each formation are arranged in geographic order from north to south and from west to east]

Species	Aldrich collection, Johns Hopkins University	Cornell University collections	Florida—Shoal River formation																
			3856	2645	3732	3742	3731	5080	5184	5195	5079	5193	3733	2238	3748	3747	7261	7264	5618
Nannodiella nemorensis (Maury)	p	p				r									r				
Microdrillia hebetika Gardner, n. sp																			
Bela nassoides Gardner, n. sp			r			r													
Conus demiurgus Dall																			
isomitratus Dall																			
sulculus Dall																			
dodona Gardner, n. sp																			
chipolanus Dall																			
corrugatus Gardner, n. sp																			
fusiformis Gardner, n. sp																			
turbinopsis Gardner, n. sp			p																
waltonensis Aldrich			pr	p	c	a	a	c	a										
waltonensis anodosus Gardner, n. subsp			pr	p		a	a	c	a	p									
submoniliferus Gardner, n. sp					p														
molis Brown and Pilsbry																			
draperi Maury																			
nemorideditus Maury	p	p																	
Cancellaria defuniak Gardner, n. sp																			p
subtiarophora Gardner, n. sp			p			p				r					r				
waltoniana Gardner, n. sp			pr		r	pr	r		c	r				r	p			r	r
druidarum Gardner, n. sp											p								
stibara Gardner, n. sp																			
mitrodita Gardner, n. sp																			
pinguis Gardner, n. sp					r	c			r										
spherotopleura Gardner, n. sp			p			p									r				
bifoliata Aldrich	p																		
aldrichi Gardner, n. sp																			
paramoorei Gardner, n. sp																			
desmotis Gardner, n. sp																			
ancycla Gardner, n. sp																			
runchaena Gardner, n. sp			r		r	p					r								
(Trigonostoma) sphenoidostoma Gardner, n. sp						p					r								
(Narona) atraktoides Gardner, n. sp			p			p					p								
(Aphera) waltonensis (Aldrich)						p													
Oliva liodes Dall																			
liodes waltoniana Gardner, n. subsp			a	r	r	a	c	r	p	r	?)r	r	r		p				
(Omogymna) martensii Dall																			
Olivella eutacta Dall																			
cotinados Gardner, n. sp											p								
oryzoides Gardner, n. sp																			
cofacorys Gardner, n. sp																			
eleutheria Gardner, n. sp																			
dasa Gardner, n. sp						p													r
Ancilla chipolana Dall																			
Marginella (Serrata) chipolana Maury																			
(Serrata) euancycla Gardner, n. sp																			
(Serrata) xanthophaës Gardner, n. sp																			
(Serrata) denticulatoides Maury	p										(?)p								
(Serrata) brithia Gardner, n. sp																			
(Serrata) cornelliana Maury																			
(Serrata) vadosa Gardner, n. sp			p			a			r									r	r
(Serrata) vadosa ischna Gardner, n. subsp						a									r			r	p
(Serrata) coloba Gardner, n. sp																			
(Serrata) coloba conoispira Gardner, n. subsp																			
(Serrata) nanna Gardner, n. sp																			
(Serrata) critha Gardner, n. sp																			
(Serrata) eurystoma Gardner, n. sp																			
(Volvarina) oryzoides Gardner, n. sp																			
(Egouena) apalachee Gardner, n. sp																			
(Egouena) lipara Gardner, n. sp																			
(Egouena) lipara lepta Gardner, n. subsp																			
(Egouena) capsa Gardner, n. sp																			
(Egouena) aurora Dall																			
(Egouena) eleutheria Gardner, n. sp																			
(Egouena) eleutheria dasa Gardner, n. subsp																			
(Persicula) calhounensis Maury																			
(Persicula) progravida Gardner, n. sp																			
(Persicula) majuscula Gardner, n. sp																			
(Gibberula) dryados (Maury)	p	p																	
(Gibberula) chondra Gardner, n. sp																			
(Gibberula) waltoniana Gardner, n. sp			r			c													
(Gibberula) sp																			
Cypraeolina defuniak Gardner, n. sp																		r	r
pyrenoides Gardner, n. sp																			
Lyria pycnopleura Gardner, n. sp																			
Caricella (Atraktus) pycnoplecta Gardner, n. sp					r	r													
Mitra acteoglypha Gardner, n. sp																			
(Pleioptygma) prodroma Gardner, n. sp																			
(Tiara) mitrodita Gardner, n. sp																			
(Tiara) desmia Gardner, n. sp			p			p													
Vexillum (Uromitra) climax Gardner, n. sp																			
(Uromitra) climacoton Gardner, n. sp																			
(Uromitra) barnardense (Maury)																			
(Uromitra) myttone (Maury)																			
(Uromitra) scopuli (Maury)																			
(Uromitra) triptum Gardner, n. sp			c			a	r				r				r				
(Uromitra) ctenotum Gardner, n. sp						c													r
(Uromitra) hamadryas Gardner, n. sp																			
(Uromitra) cnestum Gardner, n. sp																			
(Uromitra) mangilopse Gardner, n. sp																			
(Uromitra) mikkulum Gardner, n. sp																			
(Uromitra) amblipleura Gardner, n. sp																			
(Uromitra) berkeyi (Maury)																			
Perplicaria? prior Maury																			
Strigatella isabellae (Maury)																			
Conomitra apalachee Gardner, n. sp																			
Cymakra poncei, Gardner, n. sp																			

SYSTEMATIC DESCRIPTIONS

Phylum MOLLUSCA

Class GASTROPODA

Subclass EUTHYNEURA

Order PTEROPODA

Suborder THECOSOMATA

Family CAVOLINIDAE

Genus VAGINELLA Daudin

1800. *Vaginella* Daudin, Soc. philomathique Bull. 43, p. 145.

Monotype: *Vaginella depressa* Daudin (Burdigalien of Dax, near Bordeaux).

Shell ovate, longitudinally compressed, tapering rather abruptly to an acute apex; aperture medially expanded along the horizontal axis, commonly constricted along the vertical, narrowly elliptical or somewhat 8-shaped in cross section.

Vaginella has a restricted distribution in the south European and east coast Tertiary beds. The single species in the Alum Bluff group is abundant at the type locality in the Chipola formation, but it has not been reported from any other horizon. Two individuals differing from *V. chipolana* Dall in the more slender outline and the less pronounced and abrupt apical constriction were collected at Oak Grove, but the apertures are so imperfect that they have not been named.

Vaginella chipolana Dall

Plate XXXVII, figures 1, 2

1892. *Vaginella chipolana* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 431.

1898. *Vaginella chipolana* Dall, op. cit., vol. 3, pt. 4, pl. 23, figs. 4, 5.

Shell small, polished, marked only with fine incremental lines; posterior end truncate, the foramen small, circular; on each side of it, extending in a direct line a little more than one-third the length of the shell, is a fine, thread-like keel, which gradually fades away; transverse diameter nearly twice the anteroposterior diameter; shell inflated, the ventral surface more so than the dorsal, but the dorsal and ventral plates resemble one another more nearly toward the anterior end; anterior foramen as wide as the shell, marginate, the dorsal margin with a median flexure, the ventral simply arched, the whole margin in the completely adult shell somewhat reflected. Altitude of shell, 5.5; transverse diameter, 3.2 [3.6]; anteroposterior maximum diameter, 1.75 [2.0] millimeters.—Dall, 1892.

Cotypes (3): U. S. Nat. Mus. No. 124911.

Dimensions (second cotype): Profile, height 5.2 millimeters; transverse diameter, 2.4 millimeters; anteroposterior maximum diameter, 1.9 millimeters.

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

The species is restricted in its known distribution to the environs of the type locality, but it is found in considerable abundance within that small area.

Occurrence: Chipola formation, 7257^{p}, 2213^{a}, 7151^{p}.

Vaginella floridana Collins [1]

1934. *Vaginella floridana* Collins, Johns Hopkins Univ. Studies in Geology, no. 11, p. 216, pl. 13, figs. 22–23.

Shell small, slender, evenly tapering. Apex truncated, closed by a septum, narrow, laterally compressed. Maximum inflation about middle of shell length, dorso-ventrally compressed near aperture. Aperture large, elongate, its ends projecting slightly beyond the lateral margins of the shell. Lips recurved and slightly thickened. Dorsal lip projecting beyond the ventral. Lateral keels faint, extending from apex for about one-half the shell length. Outer surface showing only faint growth lines.

Type material: Holotype, length 5.5, millimeters; dorso-ventral diameter, 1.4 millimeters; lateral diameter, 2.0 millimeters. U. S. National Museum No. 371900.

Type Locality: Chipola formation, lower Miocene, The Woodyard, three-fourths of a mile above Shell Landing, Holmes Creek, Washington County, Fla. (lower bed), U. S. Geological Survey Station 10609.

The species is much more slender and tapering than *V. chipolana* and is shorter, not so strongly constricted near the upper end, and more slender posteriorly than *V. clavata* (Gabb) from the California Miocene. It approaches *V. austriaca* Kittl from the Austro-Hungarian Miocene in outline, but has a relatively greater dorso-ventral diameter.—Collins, 1934.

The holotype remains unique.

The type locality, "The Woodyard", recalls the days of the wood-burning river steamboats, when replenishing fuel was assembled at certain intervals along the banks of the navigable streams.

Genus CUVIERINA Boas

1827. *Cuvieria* Rang, Annales sci. nat., sér. 1, vol. 12, p. 322. Not *Cuvieria* Peron, 1807.

1886. *Cuvierina* Boas, Spolia atlantica, p. 131.

1888. *Cuvierina*, Pelseneer, *Challenger* Rept., vol. 23, pt. 45, Pteropoda, p. 66.

Type (by monotypy): *Cuvieria columnella* Rang. (Recent in the Atlantic Ocean.)

Shell straight, elongated, with a smooth surface, with the posterior half conical and pointed, generally caducous in the adult. The anterior half is swollen medianly, but constricted behind the aperture. A partition, concave in front, is found toward the middle of the entire length of the shell, and close beside this the truncation is formed. The transverse section is circular, except toward the aperture, where it is a little compressed, and appears somewhat reniform. Behind the aperture the shell is contracted but bulges out again toward the partition. The embryonic portion is separated from the rest of the shell by a shallow constriction.—Pelseneer, 1888.

Less than half a dozen fossil species have been reported, all of them from the Tertiary of southern Europe. The recent representatives of the genus are apparently all referable to the single species that serves as the type.

The form is restricted in the Alum Bluff group to the Chipola formation at Alum Bluff.

[1] This species was inserted after the report had been transmitted. It is not included in the table showing distribution (pp. 251–256), and The Woodyard does not appear in the locality list (p. III).

Cuvierina columnella (Rang)

1827. *Cuvieria columnella* Rang, Annales sci. nat., sér. 1, vol. 12, p. 323, pls. 14, 45, B, figs. 1–8.
1835. *Cuvieria oryza* Benson, Asiatic Soc. Bengal Jour., vol. 4, p. 698.
1850. *Triptera columnella* Gray, Catalogue of the Mollusca in the collection of the British Museum, pt. 2, Pteropoda, p. 23.
1850. *Cuvieria urceolaris* Mörch, Catalogus conchyliorum quae reliquit C. P. Kierulf, p. 32, pl. 1, fig. 8.
1852. *Cuvieria columnella* Rang. Souleyet, in Eydoux and Souleyet, Voyage autour du monde sur la corvette *La Bonite*, Zoologie, vol. 2, p. 205, pl. 12, figs. 1–11.
1879. *Triptera columella* Pfeffer, K. Akad. Wiss. Berlin Monatsber., pp. 243–244, fig. 18.
1879. *Triptera cancellata* Pfeffer, idem, pp. 243–245, fig. 19.
1888. *Cuvierina columnella* Rang. Pelseneer, *Challenger* Rept., vol. 23, pt. 45, Pteropoda, p. 67.
1889. *Cuvierina columnella* Rang. Dall, U. S. Nat. Mus. Bull. 37, p. 82, pl. 66, fig. 117.
1892. *Cuvierina columella* Rang. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 431.
1934. *Cuvierina columnella* (Rang). Collins, R. Lee, A monograph of the American Tertiary pteropod mollusks: Johns Hopkins Univ. Studies in Geology, no. 11, pp. 222–224, pl. 14, figs. 6–7.

La coquille solide, vitrée, brillante et polie, est renflée un peu en arrière de son milieu; le prolongement postérieur de ses parois est extrêmement mince et fragile et la partie qui correspond à la face dorsale est un peu plus longue que l'autre.

Nous l'avons recontrée dans la mer des Indes, et depuis lors un individu qui n'en diffère que par un peu plus de renflement dans le milieu, a été trouvé dans la mer du sud, par M. Busseuil, Chirurgien major de la frégate la *Thétis*. Cette coquille n'a que 0.011 de longueur.—Rang, 1827.

Shell very thin and hyaline in texture, elongate, subcylindrical, the maximum diameter behind the median horizontal, abruptly constricted and obtusely truncate posteriorly. Aperture sinuous, symmetrically inflated medially; slightly oblique to the axis of the shell, laterally compressed and somewhat reniform in outline.

Dall reports the species from the "Older Miocene of the Chipola beds, from the lower bed at Alum Bluff, Chattahoochee River, Florida", and "living in both oceans from north latitude 43° to south latitude 40°, floating at or near the surface." This is the only record of the form in strata older than the Pleistocene. In order, possibly, to forestall any question of the validity of his determination, Dall stated:

Two specimens of this well-known and characteristic pteropod were obtained, as noted by Mr. Burns. One of them is as perfect as if collected yesterday from the surface of the sea, though of course less translucent. They are absolutely indistinguishable from the recent shell.

The pteropods are free-swimming pelagic organisms borne by the currents, and they are, therefore, exceptionally good indicators of surface conditions. They occupy a relatively small space in the systematic literature of fossil faunas. Collins' monograph[1a] presents an exhaustive study of a restricted group in which little more than a perfunctory interest has heretofore been displayed. From an incomplete review of the fossil records, Collins ventures the statement that "enough evidence has been assembled to indicate that the total number of valid fossil species is probably more than double that of the Recent species." The uniformity of surface conditions necessary to account for a Miocene-Recent range of *C. columnella* might conceivably have been maintained, not in any given area but over a shifting fluid surface. However, as a matter of record, the pteropod species do not range over perceptibly greater periods of time than other groups of Mollusca.

Dall's material, on which he based his identification of *C. columnella*, included a perfect specimen, 8.0 millimeters long, with a lateral diameter of 2.2 millimeters and a dorso-ventral diameter of 2.3 millimeters, and a second fragmentary shell, both of them under U. S. Nat. Mus. No. 112611 and U. S. Geological Survey locality 2211. Collins has figured the perfect shell and has analyzed the contents, which include several species of recent pteropods.

This in itself is not so remarkable, but the fact that some of the *Globigerina*-like foraminiferal shells are bright pink in color like some of the tests in ooze samples from the present ocean bottom immediately raises a question as to the validity of Dall's Miocene record of *C. columnella*. The appearance of the shell and the nature of the contents, so far as they can be observed, gives the specimen a very modern aspect, which is comparable with that of recent pteropod ooze specimens. The shell contents are not cemented but are merely closely packed, a few of the included tests can be shaken about by moving the shell slightly, and there are no observable traces of quartz or other inorganic sand grains. The broken specimen in the same vial does not have any material on the interior, but it is as clear as the perfect shell.—Collins, 1934.

For that reason, Collins is inclined to believe that the shell which he so beautifully figures is "a recent shell that was mixed in some way with the Miocene material either before Dall examined it" or, a much less probable hypothesis, "that it is not the original specimen, but a recent one introduced by mistake at a later date." The included pteropod species are all of them recent forms without Tertiary records. No later material has been found by way of verification of this lower Miocene occurrence of *Cuvierina columnella* (Rang).

Occurrence: Chipola formation, locality 2211[r].

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.)

[1a] Collins, R. L., A monograph of the American Tertiary pteropod mollusks: Johns Hopkins Univ. Studies in Geology no. 11, pp. 137–324, 7 pls., 1934.

Shell thin, ovate; spire usually prominent, acutely tapering; nucleus rather small, twisted heterostrophous; characteristic sculpture of axially striate spiral grooves; aperture entire, elongate; rounded anteriorly; columella furnished with a single, slightly oblique plication; umbilicus imperforate.

The genus is indicated in the Triassic and reached its maximum development in the Eocene, though it has persisted with diminished prominence through the later Tertiary to the present day. The living species, though comparatively few in number, have a wide geographic range.

Acteon is represented in the Alum Bluff group by six species, only one of which is found at more than a single horizon. Three out of the six are restricted in their distribution to the Chipola formation, and a fourth, the characteristic Oak Grove species, *A. hamadryados* Maury, may possibly occur at the earlier horizon as well. It may also persist into the Shoal River, but this is more doubtful. It is, however, rather abundant at Oak Grove and with the exception of the unique *A. luculi* Maury is the only member of the genus reported from that horizon. The most interesting feature in the Shoal River *Acteon* fauna is the occurrence of a species very closely related to *A. textilis* (Guppy), a characteristic Bowden form. The recent Acteons are for the most part deep-water forms, many of them penetrating to the abysses. *Acteon punctostriatus* Adams, the form which is apparently most closely related to the Alum Bluff species, has been reported from Cape Cod to Haiti in 7 to 63 fathoms.

Spiral sculpture developed over the entire conch:
- Spirals upon the initial whorl of the conch less than 8:
  - Altitude approximately twice the maximum diameter:
    - Altitude of spire approximately one-third that of the entire shell; spiral sulci squarely channeled, narrower in the adult than the divides. *Acteon textilis* (Guppy.)
    - Altitude of spire approximately one-fourth that of the entire shell; spiral sulci not squarely channeled, usually wider in the adult than the divides ..... *Acteon korphys* Gardner, n. sp.
  - Altitude much more than twice the maximum diameter ..... *Acteon fusulus* Dall.
- Spirals upon the initial whorl of the conch 8 or more. *Acteon luculi* Maury.

Spiral sculpture not developed over the entire conch:
- Altitude approximately twice the maximum diameter. *Acteon hamadryados* Maury.
- Altitude more than twice the maximum diameter. *Acteon chipolanus* Dall.

Acteon textilis (Guppy)

Plate XXXVII, figure 5

1873. *Tornatella textilis* Guppy, Sci. Assoc. Trinidad Proc., vol. 2, No. 2, pt. 10, p. 77, pl. 1, fig. 4 (reprint, 1921, Harris, Bull. Am. Paleontology, vol. 8, p. 209).

1874. *Tornatella textilis* Guppy, Geol. Mag., dec. 2, vol. 1, p. 407, pl. 16, fig. 4; p. 437 (list).

1903. *Actaeon textilis* (Guppy) Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1582 (list).

1922. *Actaeon costaricensis* Olsson, Bull. Am. Paleontology, vol. 9, p. 206a, pl. 18, fig. 15.

Oval-oblong, solid, a little ventricose, closely cancellated by numerous spiral riblets and finer longitudinal threads most distinct in the spiral grooves. Spire short, conic. Whorls about 7. Aperture elongate, narrow, dilated anteriorly into a canal. Columella twisted, bearing a single stout fold. Outer lip sharp, finely dentated by the spiral riblets. Length, 17; breadth, 9 millimeters.—Guppy, 1873.

Holotype: U. S. Nat. Mus. No. 115434.

Figured specimen: U. S. Nat. Mus. No. 371047.

Type locality: Jamaica (Miocene).

The only apparent differences between the Bowden species and the few imperfectly preserved and probably juvenile specimens from Shoal River are the relatively wider and more evenly planed and polished interspiral areas of the earlier form.

Occurrence: Shoal River formation, locality No. ?3742[p], Shell Bluff, Shoal River, Walton County, Fla.

Acteon korphys Gardner, n. sp.

Plate XXXVII, figures 6, 7

Shell rather small for the group; moderately heavy, slender. Whorls 5 to 6 in all, including the 1¼ to 1½ small, inflated, nuclear turns. Tip immersed; initial half turn set at right angles to the axis of the shell, the succeeding protoconchal turn gradually swinging round to the plane of the conch. Whorls of the spire minutely and obscurely tabulated posteriorly, very feebly convex laterally; body whorl broadly and symmetrically rounded. Spiral sculpture developed over the entire surface of the conch; spirals very low and broad, 6 or 7 upon the later whorls of the spire, 33 upon the body, the 3 directly in front of the suture narrower and more closely spaced than those upon the medial portion of the whorl; spirals upon the base of the body becoming increasingly narrower, sharper, and more crowded toward the extremity. Interspiral grooves narrower than the spirals, not squarely chiseled. Incremental filaments very sharp and regularly spaced, most clearly visible in the interspiral channels but in some specimens overriding the spirals. Sutures very deeply impressed. Aperture narrowly lobate, acutely angulated posteriorly, sharply rounded anteriorly. Outer lip broken in the type but thin, sharp, marginally crenate, and smooth within in another individual referred to the same species. Parietal wall thinly glazed. Columella reinforced, bearing a single very prominent twisted fold which merges into the reverted labial margin. Anterior end of aperture narrow, thickened, somewhat expanded and patulous. Umbilicus imperforate.

Dimensions: Height, 6.1 millimeters; maximum diameter, 3.1± millimeters; altitude of aperture, 4.5 millimeters.

Holotype: U. S. Nat. Mus. No. 328398.

Type locality: No. 3419, McClelland farm, 1 mile below Baileys Ferry, Calhoun County, Fla.

Acteon korphys is more slender than *A. textilis* (Guppy), to which it is allied. The spire is relatively

lower and the whorls fewer and more rapidly decreasing in size; the spirals are relatively wider and less uniform in size and spacing; and the entire aspect of the sculpture is much more subdued.

The species is apparently restricted to the Chipola formation. Young individuals that are relatively stouter than the adults are rather common, but mature forms are very rare, and all that have been found are more or less imperfect.

Occurrence: Chipola formation, localities 2213[c], ?2564[p], 3419[c], 2211[c], 7183[r].

Acteon fusulus Dall

Plate XXXVII, figure 8

1896. *Actaeon (Rictaxis) fusulus* Dall, U. S. Nat. Mus. Proc., vol. 18, p. 23.

1903. *Actaeon fusulus* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1632, pl. 59, fig. 3.

Shell small, very slender; specimens decollate, but originally with 5 or more whorls; surface polished, slightly striated by the incremental lines; whorls spirally grooved by about 25 strong, channeled grooves, which become more close-set anteriorly; these grooves are crossed by elevated incremental lines, regularly equidistant and close-set, giving a punctate appearance to the grooves; the interspaces near the suture considerably wider than the grooves and flattened, anteriorly equal to the grooves and somewhat rounded, and elevated so as to look threadlike; suture distinct, not deep; aperture narrow, rounded in front, crenulated on the edge by the sculpture, the outer lip rounded in front but not quite continuous with the obliquely truncate pillar; pillar short, concave, with a strong plait behind at its junction with the body. Longitude of decollate type, 7.5; of last whorl, 6; of aperture, 4.5; maximum diameter, 2.5 [2.9] millimeters.

Habitat: Chipola beds, with the last species [*Acteon chipolanus* Dall].

Type [holotype]: U. S. Nat. Mus. No. 113863; also specimens in Mr. Aldrich's collection.

This is a peculiar and characteristic species, not like any heretofore known from American Tertiary or recent faunae and easily recognized by its slender, drawn-out form and sharp spiral sculpture.—Dall, 1896.

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

The species is known only from the holotype and a second imperfect individual.

Occurrence: Chipola formation, locality No. 2213[r].

Acteon luculi Maury

1910. *Actaeon luculi* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 4, pl. 1, fig. 1.

Shell small, immature, 3-whorled, the nucleus smooth, the succeeding whorls sculptured with fine spiral striae. Aperture oval; outer lip thin. When more specimens are obtained this may prove to be the young of the following species [*Acteon hamadryados* Maury].

Length of shell, 2; greatest width, 1 millimeter.

Oak Grove, Santa Rosa County, Fla. Mr. Aldrich's collection.—Maury, 1910.

The nucleus is relatively rather large and coiled 1½ times. The initial turn is laterally compressed and immersed at the tip; the final half turn of the nucleus broadly inflated. The dividing line between the conch and protoconch is indicated by a slight break in the shell and by the initiation of the conchal sculpture. The whorls of the conch are broadly rounded, very narrowly tabulated posteriorly, and, in the unique and immature type, number 2¼. The spiral sulci with which the conch is sculptured are exceedingly fine, regularly spaced, about 8 on the whorls of the spire and three times as many upon the body. There is just a suggestion of an incremental grating in the channels. The divides are flat and two or three times as broad as the channels. The sutures are deeply impressed. The anterior portion of the aperture is broken away and its outline lost. The posterior angulation, however, is rather acute. The absence of glaze upon the parietal wall is probably an age character rather than a specific character. The nature of the columellar fold is obscured by the imperfection of the specimens.

This is certainly not the young of *A. hamadryados* Maury, for in that species, even in the juveniles, the grooving is restricted for the most part to the medial and anterior portions of the body, whereas in *A. luculi* it is uniformly developed over the entire surface.

In no other described species from the Alum Bluff group is the spiral sculpture upon the early whorls of the conch so fine and the incremental sculpture so little in evidence as in this minute form.

Occurrence: Oak Grove sand, locality 2646[r], Aldrich collection, Johns Hopkins University.

Acteon hamadryados Maury

Plate XXXVII, figures 9, 10

1910. *Actaeon hamadryados* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 4, pl. 1, fig. 2.

Shell small, with an acute spire and tumid body whorl, 5-whorled; suture distinct, deeply channeled; lower two-thirds of the body whorl ornamented with incised spiral lines which tend to alternate in strength above and become much closer and more sharply cut toward the base; outer lip simple; aperture elliptical; pillar with a moderately strong plait. Length of shell, 4; greatest width, 2 millimeters.

Oak Grove, Fla. Cornell University collection.—Maury, 1910.

Shell rather small and not very heavy, subovate. Spire varying in relative elevation but usually less than half as high as the entire shell. Whorls 6 in the type, 7 in a larger but less perfect specimen. Nucleus very small, slightly tilted, inflated, and immersed at the tip; not clearly differentiated from the conch. Whorls of the spire broader but very feebly inflated, minutely tabulated posteriorly, increasing regularly and rather rapidly in size. Body whorl more rounded than those of the spire. External surface highly polished. Spiral sculpture restricted to the anterior portion of the whorl, except for a fortuitous spiral, which revolves directly in front of the suture line; one, or in some specimens two of the 11 or 12 striae visible on the anterior half of the whorls of the spire; in the larger individuals 15 spirals on the body, becoming increasingly deeper and more closely spaced anteriorly. Incrementals forming

a microscopically fine grating in the incised linear channels. Sutures deeply impressed, usually following upon or just in front of the second spiral. Aperture narrow, very slightly oblique, obtusely angulated posteriorly, sharply rounded anteriorly. Outer lip thin, sharp, broadly arcuate, obscurely crenulated at the margin, smooth within. Base of body well rounded. Columella bearing a single heavy fold which merges into the reverted labium. Parietal wall thinly glazed. Anterior extremity of aperture reinforced, slightly expanded and patulous. Umbilicus imperforate.

Dimensions of figured specimen: Height, 6.2 millimeters; maximum diameter, 3.2 millimeters.

Figured specimen: U. S. Nat. Mus. No. 349797.

Locality: No. 5632, Oak Grove, Yellow River, Okaloosa County, Fla. *Acteon hamadryados* is the Oak Grove representative of the group of *Acteon lineatus* Lea, of the Eocene, and *Acteon punctostriatus* C. B. Adams, of the late Tertiary and Recent. Though obviously very closely allied with the members from the later formations it does not seem specifically identical with any of them. The Oak Grove form is characterized by the minute tabulation of the whorls of the spire, which gives to the contour a scalar aspect not shared by any of the Pliocene or Recent representatives. The initial turn of the species is also apparently more inflated than the nuclei of *A. punctostriatus*. The spirals, though varying somewhat in number and disposition, are as a rule more numerous upon *Acteon hamadryados*, and the spiral that is commonly developed directly in front of the suture has not been observed in *A. punctostriatus*. *Acteon cubensis*, from the Dominican Republic seems to be very much more closely related to *A. punctostriatus* and is possibly specifically identical with it. *Acteon chipolanus* Dall, the Chipola analog, is thinner and more highly polished, with a more slender outline and a relatively higher spire, fainter incremental striae, and more restricted spirals. A few young individuals from Chipola seem, however, to be specifically identical with the Oak Grove form, but further material may prove this reference incorrect. The Shoal River representatives are few and immature but are probably distinct by reason of the relatively higher shells, less feeble incrementals, more deeply impressed spirals, and more persistent posterior spiral. In the general character of the sculpture they approach very closely *A. lineatus* Lea, but they are more slender and exhibit a somewhat more prominent and more persistent labial plication.

Occurrence: Chipola formation, locality ?3419[r] (juveniles); Oak Grove sand, localities 2646[a], 5632[c], 5631[r], 5633[p], 7054[p]; Shoal River formation, localities ?5618[r], ?3742[p].

Acteon chipolanus Dall

Plate XXXVII, figure 11

1896. *Actaeon chipolanus* Dall, U. S. Nat. Mus. Proc., vol. 18, p. 23.

1903. *Actaeon chipolanus* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, pl. 59, fig. 11.

Shell small, fusiform, with 6 whorls; an elevated spire, acute except for the rather blunt apical whorl, brilliantly polished all over and sculptured only by a few incised lines in front of the periphery, and becoming more crowded anteriorly; suture distinct, almost channeled; nucleus small, rounded, the sinistral part buried in the whorl; aperture about equal to the spire, narrow, rounded in front, with a thin edge continuous with the pillar; pillar thin, with a single plait; umbilical region impressed. Altitude, 6.3; major diameter, 2.6 [2.8] millimeters.

Habitat: Chipola beds (2213), 1 mile below Baileys Ferry, Calhoun County, Fla.

Types [holotype]: No. 113860, U. S. Nat. Mus.; also specimens in the collection of T. H. Aldrich.—Dall, 1896.

Acteon chipolanus Dall is more slender and not so heavy as the closely allied *A. hamadryados*. The spire is relatively more elevated than in the Oak Grove species. The external surface is more highly polished, the spiral sculpture as a rule more restricted, and the incremental striae fainter. The incised spiral, which is commonly present directly in front of the suture in *A. hamadryados*, has not been observed in *A. chipolanus*.

Occurrence: Chipola formation, localities 2213[c], 2564[p], 3419[p].

Family ACTEOCINIDAE

Genus ACTEOCINA Gray

1847. *Acteocina* Gray, Zool. Soc. London Proc. for 1847, pt. 15, p. 160.

1850. *Tornatina* Arthur Adams, Thesaurus conchyliorum, pt. 11, p. 554.

Type by (original designation): *Acteon wetherilli* Lea. (Miocene of New Jersey.)

The name *Acteocina* was used by Gray in 1847 as a possible subgenus of *Acteon*. He gave no description, but he chose as his type "*Acteon wetherellii* Lea," which is not an *Acteon* but a member of the group formerly known under Adams's name *Tornatina*.

Shell small, cylindrical or fusiform, thin, inflated; nucleus papillate and heterostrophous; spire evolute; sutures channeled; little or no sculpture; aperture narrow, commonly sublinear, rounded anteriorly; outer lip simple; columella reinforced, monoplicate; imperforate.

The recent Acteocinas are for the most part denizens of the warmer waters, ranging in depth from the littoral zone to more than 200 fathoms.

Seven species and subspecies have been recognized in the Alum Bluff group. Five out of the 7—3 species and 2 subspecies—are restricted in their distribution to the Chipola formation. The other 2 forms occur in the Shoal River formation. One of them, *A. sphalera*, is rather common at Oak Grove as well and is indeed the only *Acteocina* occurring at that horizon. The other, *A. rusa*, is apparently peculiar to the Shoal River formation.

Columellar fold not sulcated:
- Body whorl not crenulated at the shoulder:
  - Surface of body covered with microscopically fine spiral striae; anterior extremity sharply rounded. *Acteocina sphalera* Gardner, n. sp.
  - Spiral striae absent or restricted to anterior turn; anterior extremity broadly rounded:
    - Height usually exceeding 3 millimeters; spire more or less depressed ..... *Acteocina incisula* (Dall) s. l.
      - Sides of whorls perpendicular ..... *Acetocina incisula* (Dall) s. s.
      - Whorls more or less arched toward the shoulder:
        - Shell relatively high, slender ..... *Acteocina incisula curtoides* Gardner, n. subsp.
        - Shell relatively low, broad ..... *Acteocina incisula kolos* Gardner, n. subsp.
    - Height rarely exceeding 3 millimeters; spire turreted ..... *Acteocina persimilis* (Dall).
- Body whorl crenulated at the shoulder ..... *Acteocina rusa* Gardner, n. sp.

Columellar fold sulcated; shoulder of body whorl arched over the spire ..... *Acteocina fischeri* (Dall).

Acteocina sphalera Gardner, n. sp.

Plate XXXVII, figure 12

Shell uncommonly large and solid for the genus, subcylindrical, smoothly rounded at the extremities. Spire evolute but very much depressed, only the nucleus projecting for any distance beyond the last whorl. Protoconch minute, heterostrophous; initial turn coiled at right angles to the plane of the shell, doubled sharply upon itself, the tip immersed. Succeeding volutions 3 or 4, the sutures so deeply channeled that the earliest whorl of the conch is commonly sunk below the succeeding turn. Outer margin of the sutural channel sharply elevated and acute. External surface of ultima smooth except for incrementals and for exceedingly fine spiral striae, which in fresh individuals cover the entire whorl. Aperture narrow, widening in front by reason of the slight expansion of the outer lip and the constriction of the body. Labrum thin, sharp, slightly expanding medially in a vertical plane but feebly constricted horizontally, a little patulous anteriorly. Inner lip heavily reinforced and armed with a single oblique plication, which gradually flattens out and merges into the excavated pillar. Parietal wall evenly and rather heavily glazed. Anterior extremity thickened, obliquely truncate.

Dimensions: Height, 9.0 millimeters; maximum diameter, 4.4 millimeters.

Holotype: U. S. Nat. Mus. No. 351021.

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

Acteocina sphalera suggests *A. myrmecoon* Dall in its cylindrical outline and evenly rounded ends. It attains much higher maximum dimensions, however, and has a more deeply excavated pillar. Furthermore, the spiral lineation upon *A. sphalera*, though exceedingly faint, is a constant character that has not been observed in the later Tertiary species.

The dimensions vary within the Alum Bluff in a bewildering manner. The maximum is reached at the type locality, where the species is abundantly represented by individuals exceeding 6 millimeters in height. Half a mile below Shell Bluff, at the same horizon as the common *Acteocina*, is a form which, except for its size and a tendency toward a less depressed spire and more rounded body, does not differ in any constant character from *A. sphalera* from the type locality. The average height at the locality mentioned is about 4 millimeters. At Oak Grove the common species has an average height of 5 to 6 millimeters, and, though the spire seems as a rule a little more elevated than that of *A. sphalera* from the type locality at Shoal River, still almost all the individual variations occurring at one locality can be matched at the other. There is apparently no chronologic factor involved, for the Oak Grove mutant is almost exactly intermediate in its characters between the two mutants from the Shoal River formation. The variation is more probably the result of some local condition, possibly a question of the food supply.

Occurrence: Oak Grove sand, localities 2646[a], 5632[p], 5633[r], 7054[r]; 3749[r]. Shoal River formation, 3732[r], 3742[a], 5184[r], 5079[a], 3733[p], 3748[p], 7264[r].

Acteocina incisula (Dall)

Plate XXXVII, figure 13

1896. *Tornatina incisula* Dall, U. S. Nat. Mus. Proc., vol. 18, p. 25.

1903. *Tornatina incisula* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, pl. 59, fig. 8.

Shell small, subcylindrical, slightly larger anteriorly, aperture as long as the shell; spire coiled in one plane, so that in profile only the small bulbous nucleus projects above the last whorl; surface smooth, hardly polished, marked only with incremental lines, and in some specimens with a few faint incised spiral lines about the base; suture deeply channeled, its margins produced and sharp, forming the posterior end of the shell, except for the minute globular nucleus, which, when not lost, is quite conspicuous; whorls about 4, the last enveloping; aperture very narrow and deeply notched at the suture, anteriorly rounded, the thin, sharp, outer lip passing insensibly into the short, stout, arched pillar, which is bounded on the left by a sharp groove, sometimes deepened to a chink, and carries a single oblique, sharp plait; a thin callus covers the body, and the outer lip is somewhat produced in the middle. Longitude of shell, 5.5 [6.4]; maximum diameter, 2.5 [2.9] millimeters.

Habitat: Chipola beds (2211, 2212, 2213), Florida, where it is abundant.

Types: No. 113872, U. S. Nat. Mus.; and in the collection of T. H. Aldrich.—Dall, 1895.

This species is more slender than *T. canaliculata* Say, and has the spire so coiled as to be invisible and the sutural channel extremely deep and sharp-edged.—Dall, 1896.

Cotypes (3): U. S. Nat. Mus. No. 113872.

Three specimens filled with the characteristic Alum Bluff matrix have been set aside, attached to a card and labeled "figured specimens." The two individuals from the Chipola River (U. S. Nat. Mus. No. 113867) bear no inscription to indicate that they are type material, and the measurements are not exact for the individuals from either the Chipola River or Alum Bluff, though they approximate more closely the latter.

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

The typical *Acteocina incisula* (Dall), characterized by the perpendicular sides of the body and the sharp, posterior margins produced beyond the penult, is restricted, except for a few individuals, to the type locality. Most of the Chipola River representatives show a tendency toward an arching in front of the shoulder; the sutures are as a rule less deeply incised and the spire consequently less depressed. The entire group is limited in its distribution to the horizon of the Chipola formation.

Occurrence: Chipola formation, localities 2213^{r}, 2211^{a}, ?6776^{r}.

Acteocina incisula curtoides Gardner, n. subsp.

Plate XXXVII, figure 14

Shell subcylindrical, rounded toward the extremities. Spire depressed. Nucleus small but conspicuously elevated, paucispiral, closely coiled at right angles to the plane of the conch. Conch of 3 volutions, the whorls smooth except for faint striae upon the anterior portion and separated from one another by deeply channeled sutures. Outer edge of sutural groove acute. Aperture narrow, the posterior half with parallel margins. Outer lip thin, sharp, expanding in harmony with the growth lines; discrete from the body at the commissure, very slightly patulous in front. Parietal wall thinly glazed. Columella reinforced, bearing a single oblique fold, which flattens upon reaching the opening and merges into the thickened labial margin. Pillar excavated. Anterior extremity rounded.

Dimensions: Height, 4.1 millimeters; maximum diameter, 2.0 millimeters.

Holotype: U. S. Nat. Mus. No. 328408.

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

Acteocina incisula curtoides is separated from *A. incisula* s. s. by the feeble constriction of the body toward the shoulder and by the less sharply incised sutural channel. The subspecies varies in relative proportion and in the degree of depression of the spire, but does not exhibit the perpendicular sides that characterize *A. incisula* s. s. From the new subspecies *A. incisula kolos* it is separated by the higher and more slender outline. The difference in the relative proportions in the end members is so striking that it seems scarcely credible that they should be included within the limits of a single species, but the gradations are uninterrrupted. *Acteocina sphalera*, from the Oak Grove sand and Shoal River formation, shows the miniature cask-shaped outline of *A. curtoides* but differs in possessing a very fine spiral striation covering the entire body.

Occurrence: Chipola formation localities 2212^{r}, 2213^{a}, 7257^{r}, 2564^{p}, 3419^{p}, 2211^{p}, 7183^{p}, and 7151^{p}.

Acteocina incisula kolos Gardner, n. subsp.

Plate XXXVII, figure 15

Shell rather small, solid, subcylindrical, broadly rounded at the extremities. Protoconch small, central in position, well rounded, set at right angles to the plane of the shell, doubled closely upon itself and immersed at the smaller end. Whorls of conch 3. Spire low but distinctly visible. External surface smooth except for exceedingly faint incrementals. Sutures widely and deeply channeled. Outer edge not very sharp. Aperture narrow, becoming increasingly so posteriorly. Outer lip thin edged, expanded parallel to the body in harmony with the growth lines, almost imperceptibly constricted equatorially. Parietal wall smoothly glazed. Columellar lip thickened, reversed, monoplicate, the fold rather prominent and oblique, merging at its outer extremity into the margin of the reverted labium. Pillar feebly excavated in front of the fold. Anterior portion of aperture reinforced, feebly reflexed, very slightly patulous.

Dimensions: Height 3.5 millimeters; maximum diameter, 1.8 millimeters.

Holotype: U. S. Nat. Mus. No. 328415.

Type locality: No. 3419, McClelland farm, 1 mile below Baileys Ferry, Calhoun County, Fla.

Acteocina incisula kolos is separated both from *A. incisula* s. s. and from the subspecies *curtoides* by the relatively short, stout outline. The sides are less nearly perpendicular than in *A. incisula*, but they have not the broad symmetrical curvature that characterizes the typical *A. curtoides*.

Occurrence: Chipola formation, localities 2212^{r}, 7257^{r}, 2213^{c}, 2564^{c}, 3419^{c}, 7151^{r}.

Acteocina persimilis (Dall)

Plate XXXVII, figure 16

1896. *Tornatina persimilis* Dall, U. S. Nat. Mus. Proc., vol. 18, p. 26.

1903. *Tornatina persimilis* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, pl. 59, fig. 22.

Shell small, short, subcylindrical, of about 3 whorls beside the nucleus, the spire moderately prominent, somewhat variable as usual in this group, the suture distinct, bordered by a narrow, shallow channel; aperture narrow behind, wider in front; outer lip thin, prominently arched, and very slightly constricted in the middle; in front rounding gently into the pillar, which has a groove behind it and is chiefly composed of a single, not much arched nor very prominent, plait. Longitude of largest specimen, 3 [2.9]; maximum diameter, 1.25 [1.35] millimeters.

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Habitat: Chipola beds (2213), Calhoun County, Fla.; a young specimen from Oak Grove, Santa Rosa County, Fla., also probably belongs to this species.

Types [holotype]: No. 112607, U. S. Nat. Mus. and in the collection of Mr. Aldrich.

This species is the precursor and probably the ancestor of *T. canaliculata* Say, which appears in the Chesapeake Miocene and persists to the present day. It differs from it in its smaller size and by its (on the average) more cylindrical shape, most of the specimens of *canaliculata* showing a tendency to be widest at the shoulder of the whorl. The Chipola specimens are more uniform than the ordinary *canaliculata*, yet if they occurred in the same faunal horizon might fairly be regarded as a dwarf race of that species.—Dall, 1896.

Acteocina persimilis is isolated from all of its congeners by its small size, rather angular outline, and turreted spire.

The young individual from Oak Grove mentioned by Dall is not referable to this species.

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

Acteocina rusa Gardner, n. sp.

Plate XXXVII, figure 17

Shell small and rather thin, cylindrical in outline. Shoulder acutely angulated. Sides of the whorls, both those of the spire and the body, almost perpendicular. Anterior extremity strongly but smoothly rounded. Nucleus minute, made up of two well-rounded, compact whorls, closely coiled in a single plane at right angles to the plane of the conch, the smaller whorl symmetrically placed within the larger, both of them vertically truncated at their union with the conch. Conch sharply differentiated from the protoconch both by a change in texture and by the initiation of the incremental sculpture. Whorls of conch, 3, strongly and almost horizontally tabulated in the type. Outer margin of the shoulder slightly raised and minutely puckered by an exaggerated incremental sculpture. Incrementals obliquely striating the shoulder but appearing on the sides of the whorls of the spire as numerous low, rounded costae, much less regular, however, in size and spacing upon the body and evanescing within the posterior third. Sutures impressed, rarely channeled. Aperture narrow, expanded below by reason of the constriction of the body. Outer lip thin, sharp, extending a short distance beyond the posterior commissure, acutely angulated at the shoulder, widely flaring parallel to the body and in harmony with the direction of the growth lines. Pillar excavated, reinforced, bearing a single rather prominent oblique fold, which merges into the discrete margin of the reverted inner lip. Parietal wall thinly glazed. Anterior extremity of aperture thickened, expanded, obscurely truncate.

Dimensions: Height, 3.1 millimeters; maximum diameter, 1.7 millimeters.

Holotype: U. S. Nat. Mus. No. 351030.

Type locality: No. 3742, Shell Bluff, Shoal River, 5 or 6 miles west of Mossyhead, Walton County, Fla.

Acteocina rusa varies most widely in the degree of elevation of the spire. In the type the first two whorls of the conch are coiled almost in a single plane, and the body suture drops only a little in front of the shoulder of the preceding whorl. In other individuals from the type locality the spire is evenly scalariform and approximately one-fourth as high as the entire shell. The shoulder of the body is in some specimens not horizontal but rather steeply sloping and the sutures rather deeply channeled. The characteristic features of the species are the rather low dimensions, straight-sided, angular whorls, and very strong incremental sculpture manifested in riblets upon the whorls of the spire and in the puckered margin of the shoulder of the body. The species is apparently restricted in its distribution to the Shoal River formation.

Occurrence: Shoal River formation, localities 3732[r], 3742[c], 5079[c], 7264[r], 5618.[r]

Acteocina fischeri (Dall)

Plate XXXVII, figure 18

1896. *Tornatina fischeri* Dall, U. S. Nat. Mus. Proc., vol. 18, p. 26.
1903. *Tornatina fischeri* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1633, pl. 60, fig. 25.

Shell small, ovate, rounded at both ends, spire almost concealed, of 2½ whorls; body slightly wider behind the middle of the shell; aperture as long as the shell, deeply notched at the suture, which is channeled but whose outer margins arch over and nearly conceal the spire, probably closing altogether in some specimens; aperture narrow, rather contracted in front, the outer lip thin, arched in the direction of its growth and slightly incurved in the middle, sharp, anteriorly rounding into the short, spirally twisted pillar, which has a groove behind it and also a sharp, shallow groove on the plait, making it look double, though the distal end is single; the body shows a thin wash of callus; surface of the shell when perfect, brilliantly polished, smooth. Longitude, 2.5; maximum diameter, 1.25 [1.5] millimeters.

Habitat: Chipola beds (2213), Chipola River, Fla.

Types [holotype]: No. 113871, U. S. Nat. Mus., and in the collection of Mr. Aldrich.

The groove on the plait is a characteristic feature.

This species is named in honor of Dr. Paul Fischer, the distinguished author of the "Manuel de conchyliologie."—Dall, 1896.

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

Acteocina fischeri (Dall) is well characterized by its small, solid shell, the winding of the posterior portion of the body over the depressed spire, and the sulcated columellar fold.

Occurrence: Chipola formation, localities 7257[r], 2213[c], 2564[r], 3419[p], 7151[p].

Genus SULCULARIA Dall

1921. *Sulcularia* Dall, U. S. Nat. Mus. Bull. 112, pp. 61, 202.

Type (by original designation, p. 202): *Bulla sulcata* D'Orbigny. (Recent off the Florida coast and in the West Indies.)

Dall created *Sulcularia* as a section under *Retusa* Brown, but Woodring [2a] raised the section to generic rank and cited the error in the usual designation of the type of *Retusa*. *Sulcularia* is a Tertiary and Recent group restricted in its known distribution to the mid-American waters, both Atlantic and Pacific.

Shell rather small, slender, subcylindrical, medially constricted, tapering posteriorly; spire involute, perforate; outer surface axially sulcate; aperture longer than the body, produced posteriorly, patulous anteriorly; columella monoplicate; umbilicus a mere chink.

Only two species have been recognized in the Alum Bluff group—one commonly distributed through the Chipola and Shoal River formations and possibly occurring in the Oak Grove sand as well, the other rather abundant in the Chipola formation and Oak Grove sand.

External surface axially sulcate.
Sulcularia prosulcata Gardner, n. sp.
External surface not axially sulcate.—*Sulcularia chipolana* (Dall).

Sulcularia prosulcata Gardner, n. sp.

Plate XXXVII, figure 19

Shell involute, subcylindrical, slightly sinuous, perceptibly and abruptly inflated a little in front of the median horizontal. External surface very finely sulcate axially, as if swept by a microscopic rake. Aperture longer than the body, produced and sharply constricted posteriorly, patulous and more smoothly rounded anteriorly. Outer lip thin, sharp, reflected over the body parallel and proximate to it except in the anterior fourth. Inner lip simple, reverted, the edge sharp, discrete, and cut off from the base of the body by a narrow depression. Parietal wall free from callus. Apex deeply perforate. Umbilicus imperforate.

Dimensions: Height, 3.9 millimeters; maximum diameter, 1.5 millimeters.

Holotype: U. S. Nat. Mus. No. 351034.

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

Sulcularia prosulcata is undoubtedly very closely related genetically to *S. sulcata* (D'Orbigny). The Alum Bluff form runs almost twice as high as the Recent, however, although its diameter is increased by only a half. The differences, though not critical, are so persistent that it seems worth while to recognize them in the nomenclature. The Chipola representatives are even more slender than those from the Shoal River, and their diameter is, as a rule, more uniform.

The recent analog *Sulcularia sulcata* (D'Orbigny) occurs from Hatteras to Guadeloupe in 14 to 31 fathoms.

Occurrence: Chipola formation, localities 7893[r], 2213[p], 7151[r], 2211[p], 7183[r], Oak Grove sand, Aldrich collection?, Shoal River formation, localities 3742[p], 3748[p], 7264[r], 5618[r].

[2a] Woodring, W. P., Miocene mollusks from Bowden, Jamaica, pt. 2: Carnegie Inst. Washington Pub. 385, p. 123, November 1928.

Sulcularia chipolana (Dall)

Plate XXXVII, figure 20

1896. *Retusa chipolana* Dall, U. S. Nat. Mus. Proc., vol. 18, p. 28.
1903. *Retusa chipolana* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, pl. 59, fig. 9.

Shell elongate-pyriform, posteriorly attenuated, smooth, except for lines of growth; spire sunken, with a small perforation over it; aperture very narrow, except in front, as long as the shell, produced behind the suture at the margin of the apical pit; outer lip thin, straight, rounded insensibly into the pillar in front; pillar lip simple, thin, reflected, with a groove behind it; body with little or no callus. Longitude, 5.5; maximum diameter, 2.25 [2.35] millimeters.

Habitat: Chipola beds (2213), on the Chattahoochee, and also at Oak Grove, on the Yellow River.

Types [2 cotypes]: No. 113879, U. S. Nat. Mus., and in the collection of Mr. Aldrich.—Dall, 1896.

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

Sulcularia chipolana (Dall), though invariably preserving in the adult the characteristically angular outline, varies rather widely in relative proportions. The Oak Grove forms run a little smaller than those from the Chipola and seem to be a little more nearly cylindrical. This is probably concomitant with the lesser dimensions, for the immature individuals are, both in the Chipola and the Oak Grove, more nearly uniform in diameter than the fully mature.

The species is rather common and widely distributed in the Chipola formation and the Oak Grove sand, but it has not been recognized in the Shoal River formation.

Occurrence: Chipola formation, Aldrich collection, localities 7257[r], 2213[a], 2564[p], 3419[p], 7151[p]. Oak Grove sand, localities 2646[a], 5632[c], 5631[p], 5630[r], 5633[r], 7054[c].

Genus CYLICHNELLA Gabb

1873. *Cylichnella* Gabb, Acad. Nat. Sci. Philadelphia Proc., p. 273.

Type (by monotypy): *Bulla bidentata* D'Orbigny. (Recent in the West Indies.)

Shell subcylindrical, spire sunken; mouth narrow behind, widened in advance; columella with two folds.

This genus has the external form of *Cylichna*, but it has two distinct folds. The upper one is sharp and prominent like that of *Actaeon*, while the lower is more oblique and winds around the columella more like that of *Cylichna*.—Gabb, 1873.

Pilsbry [3] notes in his monograph on the tectibranchs that

the soft parts of the species (*Cylichnella bidentata* Gabb) are unknown; so that we do not yet know whether this group belongs to Tornatinidae or Scaphandridae.

The shell differs further from *Cylichna* in the more ovate, less cylindrical outline and imperforate apex.

[3] Pilsbry, H. A., Manual of conchology, vol. 15, p. 325, 1893.

Cylichnella has been reported from the Eocene of the lower Loire. It is certainly present in the Tertiary beds of the southern Atlantic States from the Miocene upward. The recent species are apparently restricted in their distribution to the east coast of North America from Maine southward.

Cylichnella biplicata (H. C. Lea)

Plate XXXVII, figures 21, 22

1844. *Bulla biplicata* H. C. Lea, Boston Soc. Nat. Hist. Proc., vol. 1, p. 204.
1847. *Bulla biplicata* H. C. Lea, Boston Soc. Nat. Hist. Jour., vol. 5, p. 286, pl. 24, fig. 2.
1873. *Utriculus biplicatus* H. C. Lea. Tryon, American marine conchology, p. 104, pl. 13, fig. 213.
1885. ?*Cylichna biplicata* (Lea). Bush, Connecticut Acad. Arts and Sci. Trans., vol. 6, pt. 2, p. 467, pl. 45, fig. 14.
1885. ?*Cylichna biplicata* (Lea). Bush, in Verrill, U. S. Comm. Fish and Fisheries Rept. for 1883, App. D., p. 84 [586].
1889. *Cylichnella bidentata* D'Orbigny. Dall, Harvard Coll., Mus. Comp. Zoology, Bull., vol. 18, p. 46 (part).
1889. *Tornatina* (*Cylichnella*) *bidentata* D'Orbigny. Dall, U. S. Nat. Mus. Bull. 37, p. 86, pl. 41, fig. 14.
Not *Bulla bidentata* D'Orbigny, 1845, in Sagra, Historia de la isla de Cuba, pt. 2, vol. 5, p. 63.
1893. *Cylichna* (*Cylichnella*) *bidentata* D'Orbigny. Pilsbry, Manual of conchology, vol. 15, p. 325, pl. 22, fig. 42, pl. 27, fig. 9 (synonymy excluded).
1895. *Cylichnella bidentata* var. *galvestonensis* Harris, Bull. Am. Paleontology, vol. 1, no. 3, p. 14, pl. 3, fig. 2.

Testa cylindrica, subquadrata, crassa, albida, polita, eburnea; spira occulta; anfractu ultimo superne calloso, inferne striis transversis parvis; apertura superne arctata, ovata; columella plica magna et parva. Long., 0.15; lat., 0.07 poll. Hab. Cape May.—H. C. Lea, 1844.

Shell cylindrical, subquadrate, thick, whitish, polished, ivory-like; spire concealed; last whorl with a callus above, and small transverse striae below; mouth narrow above, ovate below; columella with a large and a small fold. Longitude, 0.15; latitude, 0.07 poll.

Habitat: Shore of New Jersey, near Cape May.

Remarks: The striae on the base are small and insignificant. The columella has a large oblique fold, about one-fourth the length of the shell from the base; below this, it takes an undulation, scarcely deserving the name of a fold, and descends suddenly to join the outer lip. The columella is continuous posteriorly, and, above, it widens out into a callus at the region of the spire, where it turns round, and is produced into the outer lip. The substance of the shell is thick, smooth, and ivorylike.

There is no danger of confounding this little shell with any of the genus in the United States. The two folds at once distinguish it, and it is the only species with an occulted spire and plicate columella.—H. C. Lea, 1847.

Figured specimens: U. S. Nat. Mus. No. 371050, from locality 5618, 3½ miles southwest of DeFuniak Springs, Walton County, Fla.; U. S. Nat. Mus. No. 371051, from locality 2646, Oak Grove, Yellow River, Santa Rosa County, Fla.

The relationship of this group of forms is very involved. In 1845—not 1841, as has been so frequently cited—D'Orbigny described a species, *Bulla bidentata*, which, if his text and figure are accepted, is characterized by a cylindrical outline, a sunken but umbilicate spire, the development of spiral sculpture over the entire shell, and a deeply excavated pillar. In 1844 Lea published his *Bulla biplicata*. This form is characterized by a subquadrate outline, an imperforate apex, the restriction of the spirals to the anterior portion of the shell, and the shallow excavation of the pillar. Neither the types of these species nor any specimens from the type localities are available for consultation, but there is ample evidence, both in the descriptions and the figures, that the forms are specifically distinct. In 1884 Miss Bush assigned a large number of individuals found off Hatteras to *Cylichna biplicata* and figured a typical specimen from this area. In the absence of authentic specimens of *C. biplicata* her determinations have been tentatively accepted, although they are more probably incorrect. The inspection of her rather extensive duplicate material indicates that the specimens are very similar in outline to *C. bidentata* Gabb and that they are constantly more slender, more rounded, and less abruptly constricted anteriorly than Lea's figured type of *C. biplicata* from Cape May. They are, however, a little less inflated than D'Orbigny's figured type, less strongly plicate, and less deeply excavated along the pillar, and for the most part sulcated only upon the anterior third. The species which she figured was reproduced in Bulletin 37 of the United States National Museum under the name *Cylichnella bidentata* D'Orbigny. This figure was considered typical for *C. bidentata* by Harris, and he described under the name *C. bidentata galvestonsis* n. var. a form which he separated because it was relatively stouter than the type. His figure of the variety *galvestonensis* is very close to Lea's original figure of *C. biplicata*—much closer, indeed, than that of Miss Bush's reproduced by Dall—so that if varietal rank is to be given to any form it must be to the more slender race and not to the stouter.

There is a considerable range of variation in relative proportions in the Alum Bluff representatives. The species is exceedingly abundant at Oak Grove and is common in the vicinity of DeFuniak Springs, in Walton County; a single, somewhat battered individual was found in the Chipola formation. The Oak Grove specimens are certainly identical with the Recent forms off Hatteras. Those from DeFuniak Springs run a little stouter, so that it is possible to separate large lots, although individuals from one series may be matched exactly by individuals from another. Because of the existing confusion in the synonymy, no systematic value has been placed upon these mutations.

Occurrence: Chipola formation, locality 2213^{r}. Oak Grove sand, localities 2646^{pr}, 5632^{a}, 5631^{c}, 5633^{c}, 7054^{a}. Shoal River formation, localities 3748?^{c}, 3747?^{p}, 7261?^{r}, 7264?^{p}, 5618?^{a}.

Genus VOLVULA Arthur Adams

1850. *Volvula* Arthur Adams, in Sowerby, Thesaurus conchyliorum, pt. 11, p. 558.

Type (by subsequent designation, Bucquoy, Dautzenberg, and Dollfus, 1886, Moll. Roussillon, vol. 1, pt. 13, p. 533): *Volvula rostrata* A. Adams. (Recent off Australia.)

Shell subcylindrical, beaked at both ends; spire concealed; aperture narrow; inner lip with a single obsolete fold.—A. Adams, 1850.

The genus is unusually well characterized among the tectibranchs by the rostrate or spinose posterior extremity.

Volvula has been recognized in most of the large Tertiary faunas, both American and European. Between 25 and 50 recent species have been described from various parts of the globe, most of them, however, from the warm temperate and tropical waters at depths not greater than 100 fathoms.

Two species and a subspecies have been recognized in the Alum Bluff—one of them a form which has persisted with no appreciable modification of the test from the Miocene to the Recent. This species, *Volvula oxytata* Bush, is most abundant in the Chipola formation but is present in the Shoal River as well. The subspecies characterizes the Oak Grove sand, although that also occurs in the Shoal River formation. The second species is apparently new and restricted to the Shoal River.

Diameter more than one-third the height; outline minutely fusiform ..... *Volvula oxytata* Bush s. l.
Apical portion smooth or sculptured with exceedingly faint incised spirals ..... *Volvula oxytata* Bush s. s.
Apical portion sculptured with approximately half a dozen incised spirals equal in prominence to those upon the anterior portion of the shell. *Volvula oxytata dodona* Gardner, n. subsp.
Diameter approximately one-third the height; outline minutely cylindrical ..... *Volvula phoinicoides* Gardner, n. sp.

Volvula oxytata Bush

Plate XXXVII, figures 23, 24

1885. *Volvula* sp. Bush, in Verrill, U. S. Comm. Fish and Fisheries Rept. for 1883, App. D, p. 84 [586].
1885. *Volvula oxytata* Bush, Connecticut Acad. Arts and Sci. Trans., vol. 6, pt. 2, p. 468, pl. 45, fig. 12.
1893. *Volvula oxytata* Bush. Pilsbry, Manual of conchology, vol. 15, p. 235, pl. 26, fig. 63.

Shell rather small, somewhat cylindrical, with a sharp, spike-like apex and a tapering, rounded anterior end, rather thin, semitransparent, somewhat lustrous, with 4 or 5 very fine, indistinct, punctate spiral lines on each end and very indistinct, microscopic striae on the intervening surface. Aperture long, very narrow, expanded anteriorly; outer lip thin, following the curvature of the body whorl to just below the middle, where it continues in a straight line and joins the inner lip in a broad curve; inner lip very thin, slightly reflected over a slight umbilical chink. Color bluish white under a pale-yellow epidermis.

Length of one of the largest specimens, 4 millimeters; breadth, 1.5 millimeters. Not uncommon in 7 to 17 fathoms.—Bush, 1885.

Height of figured specimen, 2.8 millimeters; maximum diameter, 1.2 millimeters.

Figured specimen: U. S. Nat. Mus. No. 371048, from locality 7151, Tenmile Creek, Calhoun County, Fla.

Volvula oxytata Bush runs approximately the same range of variation in relative proportions and in the strength of development of spiral lineation on the apical area in both the fossil and the Recent species. The stouter, more strongly rounded individuals, upon which the posterior spirals are as strong as the anterior though more restricted have been isolated as a subspecies under the name *dodona*. This subspecies is especially characteristic of the Oak Grove sand, although it is present in the Shoal River formation. *Volvula oxytata* s. s. is best represented in the Chipola.

The Recent forms have been dredged along the east coast from Hatteras to Cuba in 5 to 63 fathoms.

Occurrence: Chipola formation, localities 7257[r], 2213[c], 2564[r], 3419[r], 7151[r]. Shoal River formation, localities 3742[r], 5618[r].

Volvula oxytata dodona Gardner, n. subsp.

Plate XXXVII, figure 25

Shell minutely fusiform, more acutely tapering posteriorly than anteriorly. Spire involute, entirely concealed. Body whorl inflated, the maximum diameter a little behind the median horizontal. External surface smooth except for faintly incised lines, somewhat irregular in size and spacing, half a dozen or so surrounding the apex and approximately twice as many upon the anterior third. Posterior extremity constricted and attenuated into an obtuse spine. Inner lip folded over upon the body, the fold in many specimens slightly open, leaving a narrow apical chink. Outer lip thin, sharp, feebly arched posteriorly, parallel to and proximate to the body for about half the length of the shell. Body gently but perceptibly contracted in front of the median horizontal. Parietal wash thin. Anterior extremity obtusely truncate. Pillar reinforced, obscurely monoplicate.

Dimensions: Height, 4.0 millimeters; maximum diameter, 1.6 millimeters.

Holotype: U. S. Nat. Mus. No. 349823.

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

The subspecies, which is characteristic of the Oak Grove horizon although recognized also in the Shoal River, is relatively stouter and more strongly inflated than the normal species and is further discriminated by the presence of incised lines upon the posterior as well as upon the anterior portion of the shell. These lines are present in some of the true *V. oxytata*, but they are fortuitous and exceedingly faint.

Occurrence: Oak Grove sand, localities 2646[a], 5632[c], 5631[p], 5633[r], 7054[p]. Shoal River formation, localities 3742[p], 5079[r], 3747[r].

Volvula phoinicoides Gardner, n. sp.

Plate XXXVII, figure 26

Shell a minute cylinder about three times as high as it is wide and approximately uniform in diameter. Spire involute, entirely concealed. External surface smooth except for microscopically fine, close-set, minutely crenulated, incised lines upon the anterior fourth. Aperture very narrow, produced beyond the body both in front and behind. Outer lip thin, sharp, curved over the body parallel and proximate to it except along the basal constriction. Apex closed or narrowly perforate. Apical extremity rostrate or obtusely spinose. Outer lip obliquely truncate behind, dropping in almost a vertical from the truncation to the rounded anterior extremity. Parietal wall free from glaze. Pillar reinforced, obscurely twisted.

Dimensions: Height, 4.5 millimeters; maximum diameter, 1.5 millimeters.

Holotype: U. S. Nat. Mus. No. 351037.

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

Volvula phoinicoides suggests in general outline a minute date seed. It is much more elongate relatively and more uniformly cylindrical in outline than *Volvula oxytata* and its subspecies *dodona*. It is further characterized by the numerous finely and irregularly crenulated, incised lines crowded upon the anterior portion of the shell. *Volvula phoinicoides* is apparently restricted in its distribution to the Shoal River formation.

Occurrence: Shoal River formation, localities 5618^{p}, 3856^{r}, 3742^{p}, 3748^{r}.

Family SCAPHANDRIDAE

Genus SCAPHANDER Montfort

1810. *Scaphander* Montfort, Conchyliologie systématique, vol. 2, p. 335.

Type (by original designation): *Bulla lignaria* Linnaeus. (Recent off the west coast of Europe.)

Shell entirely external, involute, subcylindrical or ovate; large for the group. Spire concealed, imperforate. External surface covered with an epidermis, usually ornamented with a fine spiral grooving. Aperture relatively very large, narrow, produced, and sinuated posteriorly; dilated and patulous anteriorly. Outer lip thin, sharp. Columella revolving around a hollow axis. Columellar lip simple in the typical form, broadly concave, the margin reflexed and closely appressed. Parietal wall thinly glazed.

The genus may have been initiated as early as the Cretaceous. At least it was present throughout the Tertiary. The Recent species are few, but they have a very wide latitudinal and bathymetric range. *Scaphander punctostriatus* Mighels has been reported from waters off the west coast of Norway and from the Azores in 1,000 fathoms. It has also been reported along the east coast of North America from Maine to the Gulf of Mexico and Barbados at depths ranging from 46 to 1,467 fathoms.

The single species from the Alum Bluff group is restricted to the Chipola formation.

Scaphander langdoni Dall

Plate XXXVII, figure 27

1896. *Scaphander langdoni* Dall, U. S. Nat. Mus. Proc., vol. 18, p. 28.

1903. *Scaphander langdoni* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, pl. 59, fig. 10.

Shell small, rather slender for the genus, with the spire concealed and covered by a small, rather shallow pit; aperture wide, as long as the shell, with a wide sutural sinus, a straight outer lip, gradually rounded into the pillar in front; pillar simple, solid; body with little or no callus; surface polished, transversely marked by lines of growth and frequently by small, narrow, parallel waves, stronger toward the middle of the whorl; spiral sculpture of fine, rather distant, punctate, incised lines, uniformly disposed but varying somewhat in different specimens; there is no constriction of the whorl in front of the sutural keel and no groove behind the pillar; the axis is widely pervious, revealing the spire. Longitude 13 [8.9]; maximum diameter 6.5 [5.1] millimeters.

Habitat: Chipola beds (2211, 2213).

Type: No. 113884, U. S. Nat. Mus.; also in the collection of Mr. Aldrich.

This species is more attenuated behind than *S. primus* Aldrich, and less so than the recent *S. watsoni* Dall; in proportions and sculpture and combination of characters this little species does not appear to agree closely with any of those previously known from the region. It is named in honor of Mr. D. W. Langdon, lately of the State survey of Alabama, and to whom are due the first section of the Alum Bluff locality and the discrimination of the Chattahoochee group of rocks.—Dall, 1896.

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

A single individual, no. 113884, from Alum Bluff, the most nearly perfect among many but not the largest, has been mounted, figured, and designated as the type by Dall. This shell may be accepted as the holotype, although the measurements are those of a larger individual.

In the specimens from the Chipola River the body whorl is relatively more slender and the aperture more produced and dilated anteriorly than in those from the type locality. The Chipola material, however, is so imperfect that it is not possible to tell whether the differences are individual, varietal, or specific.

Occurrence: Chipola formation, localities 2213^{c}, 3419^{r}, 2211^{c}, 7183^{p}, 6175^{p}.

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.)

Shell very thin, inflated, commonly globose, ovate or cylindrical; spire involute, occulted; external surface spirally sulcate, as a rule, toward the extremities, free from sculpture medially; aperture arcuate, more produced than the body both anteriorly and posteriorly, sharply constricted behind the vertex and, in the true *Atys*, twisted or plicate upon its inner margin; outer lip thin, sharp, expanded, patulous anteriorly; inner lip short, usually obliquely plicate or truncate; umbilicus in the typical forms narrowly perforate.

The existence of typical *Atys* in the fossil state has been denied by Cossmann, but an Alum Bluff species, *A. oedemata* Dall, though relatively small, exhibits all the characteristic shell features of the genus. This form, together with *Atys* (*Aliculastrum*) *obscuratus* Dall is restricted to the Chipola formation, and *A.* (*Roxaniella*) *gracilis* Dall is most closely identified with that horizon, although a single individual referable to the species has been found in the Oak Grove sand and another in the Shoal River formation.

Inner margin of aperture twisted behind the vertex:
Labial plication moderately prominent; outline globose.
Atys oedemata Dall.
Labial plication obscure or obsolete; outline subcylindrical.
Atys (*Aliculastrum*) *obscuratus* Dall.
Inner margin of aperture not twisted behind the vertex; body whorl with an obscure equatorial girdle.
Atys (*Roxaniella*) *gracilis* Dall.

Atys oedemata Dall

Plate XXXVII, figure 28

1896. *Atys oedemata* Dall, U. S. Nat. Mus. Proc., vol. 18, p. 28.
1903. *Atys oedemata* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, pl. 59, fig. 24.

Shell small, inflated, rapidly attenuated in front and behind, periphery prominent; aperture as long as the shell, extending behind the inner lip and descending, with a twist, upon the apical region of the concealed spire; the shell is sharply constricted just in front of the apex, and the vortex thus included is swollen and strongly transversely wrinkled; surface of the shell polished, spirally grooved toward each end, smooth toward the periphery; aperture rather narrow, somewhat angulated at both apices; pillar straight, reflected, with a narrow groove behind it; outer lip thin, simple. Longitude, 4.5; maximum diameter, 2.5 millimeters.

Habitat: Chipola beds (2213), Chipola River, Fla.

Types [3 cotypes]: No. 113889, U. S. Nat. Mus., and in the collection of Mr. Aldrich.

It is probable that all the specimens which have served for this description are immature, but it is quite certain they are not the young of any species of *Atys* now known from our Tertiary.—Dall, 1896.

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

Atys oedemata Dall is unusually well characterized among the superficially similar species by its high medial inflation. It has not been found except at the type horizon.

Occurrence: Chipola formation, localities 2213^{p}, 7151^{r}, 2211^{p}. Aldrich collection.

Subgenus ALICULASTRUM Pilsbry

1896. *Aliculastrum* Pilsbry, Manual of conchology, ser. 1, vol. 16, p. 237 = *Alicula* Ehrenberg, 1831.
1831. *Alicula* Ehrenberg, Symbolae physicae, seu icones et descriptiones Mammalium, Avium, Insectorum et animal. evertebrates, Insectis (no pagination; p. 41 of Moll.).
Not *Alicula* Eichwald, 1830, Naturhistorische Skizze von Lithauen, Volhynien u. Podolien in geognostischmineralogischen, botanischen u. zoologischen Hinsicht, p. 214.
1928. *Aliculastrum* Woodring, Miocene mollusks from Bowden, Jamaica: 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.

There have been reports of the presence of this subgenus in the Tertiary beds, but the group is so confused that its time limits cannot be established from check lists alone. In the Recent seas it is much the best represented of all the subdivisions of *Atys*.

A few Miocene species seem to be properly referable to this group.

Atys (Aliculastrum) obscuratus Dall

Plate XXXVII, figure 29

1896. *Atys obscurata* Dall, U. S. Nat. Mus. Proc., vol. 18, p. 30.
1903. *Atys obscurata* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, pl. 59, fig. 4.

Shell small, wider than *A. gracilis*, and differing from it in having the lateral profile evenly curved, so that no indication of the equatorial swelling is visible in it; the aperture is proportionately wider and less produced behind; the inner lip above the spire is more strongly twisted; there is a shallow pit, but no perforation, at the spire, nor is there any thickened striated rim at the margin of the pit; the spiral grooving, though similarly distributed, is rather sharper than in *A. gracilis* and the pillar less obviously twisted; it is obliquely truncate, narrow, and has behind it a narrow but obvious groove. Longitude, 4 [4.2]; maximum diameter, 2 [2.1] millimeters.

Habitat: Lower bed at Alum Bluff (2211) and the Miocene marl of Bowden Jamaica (Bland).

Types [2 cotypes]: Nos. [6153 Bowden, Jamaica, Bland], 113893, U. S. Nat. Mus.

Only two specimens were obtained at Alum Bluff, but the species does not seem to stand in with any of the others. It is a typical *Atys* and not an *Acrostemma*.—Dall, 1896.

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

The Bowden individuals included by Dall under *A. obscuratus* were considered by Woodring to be specifically distinct and were described by him under the name of *Atys* (*Aliculastrum*) *morantensis* Woodring.[3a] They were separated because they taper more rapidly at the ends than the Chipola species and because of the

[3a] Woodring, W. P., Miocene mollusks from Bowden, Jamaica: Carnegie Inst. Washington Pub. 385, p. 128, pl. 2, figs. 15, 16, 1928.

narrower apical perforation and more obscure sculpture. The type material of *A. obscuratus* is therefore restricted to the two individuals included under U. S. Nat. Mus. No. 113893.

The character of the greatest systematic importance in separating *A. obscuratus* from *A. gracilis* is the development in the former of a twist in the inner margin of the apertural lip behind the vertex.

Occurrence: Chipola formation, localities 2564[p], 3419[c], 2211[p], 7183[p].

Subgenus ROXANIELLA Monterosato

1884. *Roxaniella* Monterosato, Nomenclatura generica e specifica di alcune conchiglie mediterranee, Palermo, p. 145.

1889. = ?*Acrostemma* Cossmann, Catalogue illustré des coquilles fossiles de l'Éocène des environs de Paris, vol. 4, p. 318. Type, *Bulla coronata* Lamarck.

Monotype: *Cylichna jeffreysi* Weinkauff. (Recent in the Mediterranean.)

Roxaniella is separated from the true *Atys* by the absence of any fold or twist in the lip behind the vertex. The outline is usually cylindrical and the columella is obscurely twisted and sulcated.

Pilsbry[4] has expressed the opinion that

> It is likely that *Atys* should be restricted to those forms in which the upper lip has an angular fold above its insertion in the vertex, and the forms lacking this feature may then be removed to constitute one or two distinct genera. We prefer to leave the genus in its old limits, believing that this is preferable to a reassortment of its contents prior to the necessary examination of the soft parts in the various subgenera proposed. No really intelligent systematic work can be done in this group by the shells alone.

Pilsbry's policy in hesitating to modify further a badly muddled group until conclusive evidence of relationships is at hand is continued.

Atys (Roxaniella) gracilis Dall

Plate XXXVII, figure 30

1896. *Atys* (*Acrostemma*) *gracilis* Dall, U. S. Nat. Mus. Proc., vol. 18, p. 29.

1903. *Atys* (*Acrostemma*) *gracilis* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, pl. 59, fig. 15.

Shell small, slender, with the aperture longer than the body, which is obscurely enlarged about the middle, slopes biconically from this girdle above to the apex and below to the region just behind the upper end of the pillar, from whence it is more rapidly attenuated to the anterior end of the shell; spire sunken, the pit varying in size in different specimens, the margin slightly thickened and transversely striated; middle of the whorl smooth, but the distal portions more or less distinctly spirally grooved; the lines of growth are feeble; aperture narrow, especially behind, where it is a good deal produced above the apex, with its inner lip slightly twisted; in front the pillar is twisted and faintly grooved, with a shallow chink behind it; in front it is obscurely obliquely truncate where it joins the anterior curve of the outer lip. Longitude 5 [5.1]; maximum diameter, 2 [2.1] millimeters.

Habitat: Chipola beds (2211, 2213).

Types [four cotypes]: No. 113892, U. S. Nat. Mus., and in the collection of Mr. Aldrich.

M. Cossmann notes that this section forms a passage, as it were, from *Cylichna* to *Atys*, but it would seem to the writer that it is more nearly related to the latter and should rank as a section of *Atys* rather than of *Cylichna*.—Dall, 1896.

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

Atys gracilis Dall is more readily separated from the coexistent members of the genus by the sinuous outline of the body than it is by the absence of the twist in the inner apertural margin—a constant character, to be sure, but one that can be observed only by the aid of a lens. The species is common and widely distributed in the Chipola formation, and two individuals have been found outside of it, one at Oak Grove and another at Shell Bluff.

Occurrence: Chipola formation, localities 2213[c], 2564[p], 3419[c], 7151[p], 2211[c]. Oak Grove sand, locality 2646[r]. Shoal River formation, locality 3742[r].

Genus CYLICHNA Lovén

1846. *Cylichna* Lovén, Öfversigt K. vetensk. Akad. Förh., Arg. 3, No. 5, p. 142.

Not *Cylichnus* Burmeister, 1844, Handbuch der Entomologie, Band 4 (1), p. 171.

1891. *Bulinella* R. B. Newton, Systematic list of the Edwards collection of British Oligocene and Eocene Mollusca, p. 265 (in part).

Type (by subsequent designation, Herrmannsen, Indices generum malacozoorum, 1852, p. 42): *Bulla cylindracea* Pennant. (Recent off the west coast of Europe. Reported from the European Pliocene and Pleistocene.)

Shell small, subcylindrical; spire involute; apex sunken and, in the young at least, perforate. External surface smooth except for faint spiral striae; aperture narrow dilated anteriorly; outer lip thin, sharp, longer than the axis of the body; pillar reinforced, monoplicate; umbilicus closed or narrowly perforate.

Cylichna has been reported from strata as old as the Triassic. Between 75 and 100 Recent species have been described, ranging in latitude from the Arctic seas to the Tropics and in depth from less than 25 fathoms to almost 2,000 fathoms.

The three species that have been differentiated from the Alum Bluff group are very closely related but not identical, and each is apparently peculiar to a single horizon. All three are fairly well represented, the Oak Grove form being possibly the most abundant and the most widely distributed.

Bullen-Newton wished to discard *Cylichna* because of the priority of *Cylichnus*, a genus of the Coleoptera. Such a procedure would be entirely within the law, but a law which it seems unnecessary and unfortunate to enforce in this case where the danger of confusion is so slight.

[4] Pilsbry, H. A., Manual of conchology, vol. 15, p. 262, 1893.

Body whorl approximately uniform in diameter from apex to base:
External surface polished; sculpture restricted to a few linear grooves on the anterior portion of the shell. *Cylichna decapitata* (Dall).
External surface rather dull; sculptured with crowded, finely crenulated striae which are strongest anteriorly but which in some specimens persist over the entire shell. *Cylichna anthera* Gardner, n. sp.
Body whorl reaching its maximum diameter a little behind the median line; sculptured with very fine and somewhat irregular striae, commonly restricted to the anterior portion, in some specimens present on the medial and posterior portions as well ..... *Cylichna quercinensis* (Dall).

Cylichna decapitata (Dall)

Plate XXXVII, figure 31

1896. *Retusa (Cylichnina) decapitata* Dall, U. S. Nat. Mus. Proc., vol. 18, p. 30.
1903. *Retusa (Cylichnina) decapitata* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, pl. 59, fig. 20.

Shell small, subcylindrical, smooth except for lines of growth, generally polished, with a few revolving striae on the base; spire sunken, perforate, below a very shallow pit with the edge more or less rounded over; aperture as long as the shell, narrow; the outer lip sharp, simple, straight, with a deep sutural sinus and anteriorly receding and then rounding imperceptibly into the pillar; pillar twisted, obscurely ridged, with a minute chink behind it; the body with a thin wash of callus. Longitude, 5.25 [5.4]; maximum diameter, 2 [2.3] millimeters.

Habitat: Chipola beds (2213).

Types: No. 113886, U. S. Nat. Mus., and in Mr. Aldrich's collection.—Dall, 1896.

The single individual, No. 113886, which is mounted, figured, and designated, may be accepted as the holotype.

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

Cylichna decapitata (Dall) is more highly polished than either of the other two Alum Bluff forms. The spirals are usually linear grooves, few and restricted to the anterior portion of the shell; in most of the Shoal River specimens and some of the Oak Grove the entire external surface is shagreened with microscopically fine, closely crowded, wavy striae.

Occurrence: Chipola formation, localities 2213[c], 2564[p], 7151[r].

Cylichna quercinensis (Dall)

Plate XXXVII, figure 32

1896. *Retusa (Cylichnina) quercinensis* Dall, U. S. Nat. Mus. Proc., vol. 18, p. 31.
1903. *Retusa (Cylichnina) quercinensis* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, pl. 59, fig. 17.

Shell small, resembling *C. decapitata*, but smaller, more solid than *C. decapitata* of the same size and proportionately a good deal shorter, the apical pit wider, the posterior commissure of the aperture less produced, the pillar shorter and more oblique and twisted, and with a more distinct furrow behind it; the young *C. decapitata* is attenuated anteriorly, but the *C. quercinensis*, which is evidently adult, is not so; the anterior spiral striation is barely perceptible with a glass. Longitude, 2.5; maximum diameter, 1.3 millimeters.

Habitat: Alum Bluff beds, at Oak Grove, Yellow River, Santa Rosa County, Fla.; L. C. Johnson.

Type [holotype]: No. 131528, U. S. Nat. Mus.

This species is small but cannot be referred to the young of any of the other species known from the region.—Dall, 1896.

Type locality: Oak Grove, Santa Rosa County, Fla.

Dall's species was described from an immature or stunted individual, but his differentiation from *C. decapitata* holds good for the normal adults, which commonly attain an altitude of 4.0 millimeters and a maximum diameter of 1.6 millimeters. In these the altitude is relatively higher than in the type but a little lower than in *C. decapitata;* the body inflation of the Oak Grove species is less uniform, however, than that of the Chipola and the aperture more produced anteriorly, so that the two forms are readily separable by their contour alone. On many individuals the sculpture is manifested merely in a few striae upon the anterior third, less regular in size and spacing than in *C. decapitata,* but in some forms the striae are greatly increased in number and are present over the entire shell. Such individuals are with difficulty separable from miniature *C. anthera* Gardner, which has a similar sculpture. The maximum dimensions are lower in the Oak Grove race than in that from the Shoal River, the body whorl is less cylindrical, the sides of the shell more arcuate, and the labial plication a little more prominent.

Occurrence: Oak Grove sand, localities 2646[a], 5632[c], 5631[p], 5633[r], 7054[p].

Cylichna anthera Gardner, n. sp.

Plate XXXVII, figure 33

Shell a minute cylinder with sides approximately parallel and perpendicular, a truncated posterior extremity, and a broadly rounded anterior end; thin and evenly rolled. Spire involute. Apical perforation small but deep, the surface sloping gently inward toward the pit from the obtusely angulated periphery. External surface smooth except for incrementals strongest posteriorly, and a very faint spiral striation irregular and crowded anteriorly, growing increasingly fainter toward the apex but in some specimens discernible as a microscopically fine lineation over the entire shell. Outer lip thin, sharp, incrementally arcuate, following the curve of the body, slightly produced and deeply emarginate posteriorly, patulous and broadly rounded anteriorly. Body whorl sharply constricted at the base. Parietal wall very thinly washed with callus. Pillar slightly oblique, heavily reinforced, the reverted margin sharp and discrete. A single obscure fold near the base of the body. Umbilical chink narrow but deep.

Dimensions: Height, 5.0 millimeters; maximum diameter, 2.2 millimeters.

Holotype: U. S. Nat. Mus. No. 351046.

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

Cylichna anthera runs a little longer than *C. decapitata* (Dall), the species which it most closely resembles in the adult state, and it is more conspicuously cylindrical in outline. It is, furthermore, less highly polished and is spirally lineated over a greater or less extent of its surface by exceedingly fine, crowded, crenulated striae quite unlike the faint incised lines that occur on the anterior portion of the recent *C. bidentata* (D'Orbigny). The characters of the apical region are very similar in the two species. The immature forms are very similar to *C. quercinensis* (Dall), which is so abundant at the Oak Grove horizon. They run, however, a little higher relatively and a little more uniform in diameter. The sculpture is more commonly present over the entire shell in *C. anthera*, and the labial plication is a little more feeble.

Occurrence: Shoal River formation, localities 3742[c], ?5079[p], ?3748[p], 5618[r].

Family BULLIDAE

Genus BULLA Linnaeus

1758. *Bulla* Linnaeus, Systema naturae, 10th ed., p. 725.
Not *Bulla* Linnaeus, idem, p. 427 (used as a section of *Gryllus* [Orthoptera]).
1810. *Bulla* Montfort, Conchyliologie systématique, vol. 2, p. 331.
1815. *Bullaria* Rafinesque, Analyse de la nature, p. 142 (new name for *Bulla* Linnaeus).
1908. *Bullaria* Dall, Harvard Coll., Mus. Comp. Zoology, Bull., vol. 43, no. 6, p. 243.
1928. *Bulla* Woodring, Miocene mollusks from Bowden, Jamaica: Carnegie Inst. Washington Pub. 385, p. 129.

Type (by subsequent designation, Montfort, Conchyliologie systématique, vol. 2, p. 331): *Bulla ampulla* Linnaeus. (Recent in the Indo-Pacific.)

Woodring discusses fully the vicissitudes in the nomenclature of this genus.

Shell solid, of medium or relatively large dimensions, ovate to subglobose; spire involute; apex perforate; surface smooth or spirally striated at the extremities; aperture as long as the axis of the shell, dilated anteriorly; outer lip arcuate, sharp; inner lip simple; pillar and parietal wall calloused; umbilicus imperforate.

The genus has been in existence since the Mesozoic and is represented today in all the warm and temperate seas.

Posterior extremity compressed.
Bulla sp. aff. *B. striata* Bruguière.
Posterior extremity broadly rounded.
Bulla striata waltonensis Gardner, n. subsp

Bulla striata Bruguière

1798. *Bulla striata* Bruguière, Encyclopédie méthodique, vol. 2' pl. 358, figs. 2a, 2b (no description).
1822. *Bulla striata* Bruguière. Lamarck, Histoire naturelle des animaux sans vertèbres, vol. 6, pt. 2, p. 33.
1836. *Bulla striata* Bruguière. Deshayes, in Lamarck, idem, vol. 7, p. 668.
1836. *Bulla striata* Bruguière. Philippi, Enumeratio molluscorum Siciliae (Berolini), p. 121.
1844. *Bulla striata* Bruguière. Philippi, Enumeratio molluscorum Siciliae (Halis Saxonum), p. 95.
1890. *Bulla striata* Bruguière. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 17.
1893. *Bulla striata* Bruguière. Pilsbry, Manual of conchology, vol. 15, p. 332, pl. 37, figs. 42–46.

Pilsbry, who has based his inferences on world-wide collections, has described the species as follows:

Shell moderately solid, oblong-subcylindrical or oblong-ovate, tapering toward the ends; whitish, mottled and clouded all over with purplish and usually showing an indistinct girdle of heavier, darker blotches above the middle; surface smooth, usually showing under a lens an excessively fine, close spiral striation, and having deeper-spaced grooves toward the base and a few near the vertex. Toward the top the body whorl is rather compressed, the vertex being a very narrowly rounded, compressed margin around the wide open and deep apical umbilicus, which is closely spirally grooved within * * * Aperture narrow above, wider below; columella with a brown-stained, lunate, reflexed callus; parietal callus thin. Mediterranean Sea; Atlantic coasts of Portugal and Morocco; Pliocene of Florida (Dall), and living at Clearwater Harbor, W. Florida (Johnson).

The group is represented in the Chipola, but only by imperfect or immature individuals. The adults have preserved no characters that would separate them from the Caloosahatchee race of *Bulla striata*, but the young are more slender and more constricted and compressed posteriorly than any which have been observed in the meager juvenile material from either the Recent or the Tertiary faunas. It seems certain that further collections will show constant differences that will serve to isolate the Chipola forms both from the Recent and later Tertiary members and from the West Indian race, but any valuation of the differences from the material at present available would be worthless. The Chipola race is separated from the Shoal River representatives by the more attenuated and compressed posterior extremity, larger apical perforation, and, as a rule, by the presence of a few feeble spirals surrounding the apex.

Occurrence: Chipola formation, localities 2213[c], 3419[c], 7151[r], 2211[a].

Bulla striata waltonensis Gardner, n. subsp.

Plate XXXVII, figures 34, 35

Shell thin, inflated, oval-cylindrical in outline, the maximum diameter of the body near the median horizontal. Spire involute, apical perforation small but very deep; posterior extremity smoothly rounded, not sharply compressed nor attenuated, feebly striated within. External surface smooth except for incremental striae and a dozen or so irregular and irregularly spaced spiral striae upon the anterior third. Aperture longer than the body, moderately wide, somewhat arcuate behind, widening anteriorly. Outer lip thin, sharp, expanding both axially and incrementally, posteriorly produced and abruptly recurved toward the body, patulous and smoothly rounded anteriorly.

Inner margin of aperture a loose, inverted sigma. Body whorl broadly convex. Pillar broadly concave. Labium thickened and reversed over the pillar, its outer margin discrete and separated from the body by a very narrow chink. Parietal wall thinly glazed.

Dimensions: Height, 16.5 millimeters; maximum diameter, 9.5 millimeters.

Holotype: U. S. Nat. Mus. No. 351054.

Type locality: No. 5079, 5 miles west of Mossyhead, Walton County, Fla.

Bulla striata waltonensis is obviously a member of the *striata* group, but it does not seem to be identical with any of the described races. No other race has been noted which combines the subcylindrical outline, broadly rounded posterior extremity, and restriction of the spiral sculpture to the anterior portion of the shell.

The young differ from the young of the Chipola form in the stronger and more even inflation, the more feeble and restricted spiral sculpture, the much smaller apical perforation, and the rounded rather than sharply compressed apical margin.

Occurrence: Shoal River formation, localities 5079[c], 5193[r].

Family AKERATIDAE

Genus HAMINAEA Leach

1847. *Haminaea* Leach, in Gray, Annals and Mag. Nat. Hist., 1st ser., vol. 20, p. 268.

1847. *Haminea* Gray, Zool. Soc. London Proc., p. 161.

Type (by subsequent designation, Gray, Zool. Soc. London Proc., 1847): *Bulla hydatis* Linnaeus. (Recent in the Mediterranean and north to southern England.)

Shell very thin, inflated, oval or subcylindrical; spire involute; external surface finely striated; aperture as long as the shell, narrow posteriorly, broader and somewhat patulous in front; outer lip thin, sharp, nearly vertical in the medial portion; columella thin, not glazed or plicate.

Haminaea has been an inconspicuous element in the molluscan faunas from the Cretaceous to the Recent.

The genus is represented in the Alum Bluff group by a single species, restricted in its distribution to the Chipola formation.

Haminaea pompholyx Dall

Plate XXXVII, figure 36

1896. *Haminea pompholyx* Dall, U. S. Nat. Mus. Proc., vol. 18, p. 32.

1903. *Haminea pompholyx* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, pl. 59, fig. 16.

Shell small, thin, subglobular, widest behind the middle; surface marked with fine incremental lines and spiral striae, hardly visible except under a glass; apex impressed, aperture wide, outer lip thin, arched axially and incrementally, receding in front and imperceptibly merging with the oblique, slightly thickened, twisted pillar, which from below is pervious; body with a thin wash of callus; shell slightly narrowed in its anterior third. Longitude, 6.5; maximum diameter, 5.5 millimeters.

Habitat: Chipola beds (2211), Florida.

Types: No. 113895–113897, U. S. Nat. Mus.; and in the Aldrich collection.

This species is shorter and more globose than any of the recent forms of the coast.—Dall, 1896.

Lectotype: U. S. Nat. Mus. No. 113896.

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

The species varies slightly in relative proportions and in the prominence and extent of the spiral sculpture. In many of the forms from the Chipola River the entire surface is lineated, but in most of the individuals from Alum Bluff the sculpture is restricted to the anterior and posterior thirds. In very fresh specimens there is an exceedingly thin layer of cuticle, which is very finely wrinkled axially but which presents no trace of a spiral sculpture. The forms from the Chipola River are all imperfect or immature, but it is not probable that the differences which they exhibit are of systematic value.

Occurrence: Chipola formation, localities 7257[r], 2213[p], 3419[p], 2211[c].

Genus ABDEROSPIRA Dall

1896. *Abderospira* Dall, U. S. Nat. Mus. Proc., vol. 18, p. 32.

Type (by original designation): *Bullina* (*Abderospira*) *chipolana* Dall. (Chipola formation of Florida.)

In the typical *Bullina* the spire is exposed or even elevated; in the fossil about to be described the apex of the spire is hidden, as in *Bulla*, and marked only by a perforation. This difference seems worthy of sectional discrimination. Type *B.* (*A.*) *chipolana* Dall.—Dall, 1896.

Shell involute, perforate, ovate; body whorl inflated; external surface sculptured with spiral sulci, commonly punctated by the incrementals; aperture longer than the body, slightly produced posteriorly and patulous anteriorly; columella simple; umbilicus narrow but deep.

Abderospira Dall is separated both from *Bullina* Ferussac and *Micromelo* Pilsbry by the involute, perforate spire and the absence of any plication upon the pillar. It differs further from *Bullina* in the more evenly rounded anterior extremity and the more open umbilicus. In *Micromelo* the umbilicus is entirely closed. Though these differences may possess little systematic value, yet the relation between the hard and the soft parts is so slight in many of the tectibranchs that it seems better to run the danger of overrating the obvious shell characters and keep the groups distinct until the relationships can be definitely established from the soft parts.

The genus is restricted in its known distribution to the Miocene of Florida. Only two species have been reported from the Alum Bluff group—one restricted to its type locality in the Chipola formation, the other to its type locality in the Shoal River formation.

Outline subcylindrical, interspiral channels not conspicuously punctate ..... *Abderospira chipolana* Dall.
Outline subglobose, interspiral channels conspicuously punctate. *Abderospira funiakensis* Gardner, n. sp.

Abderospira chipolana Dall

Plate XXXVII, figure 37

1896. *Bullina (Abderospira) chipolana* Dall, U. S. Nat. Mus. Proc., vol. 18, p. 32.
1903. *Micromelo (Abderospira) chipolana* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, pl. 59, fig. 23.

Shell small, ovate, strongly sculptured, umbilicated, with a perforate apex and hidden spire; surface sculptured with numerous sharp spiral grooves with wider polished interspaces, crossed by distinct, equally spaced incremental lines, more feeble on the interspaces, but reticulating or punctuating the grooves; aperture as long as the shell; outer lip axially nearly straight, incrementally slightly arched, thin, with a simple edge and smooth internal surface; posterior sinus with a moderate notch, anterior end rounded; pillar thin, emarginate, with a deep groove behind it, outside of which is a well-marked ridge bounding a narrow but deep umbilicus; body with a thin wash of callus; apex perforate, much as in *Bulla striata*. Longitude, 4.5 [4.6]; maximum diameter, 3 millimeters.

Habitat: Chipola beds (2213), Chipola River, Florida, collected by Burns; and near Gatun, Isthmus of Darien, by Rowell.

Types [holotype]: No. 113894, U. S. Nat. Mus.; and in Mr. Aldrich's collection.—Dall, 1896.

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

The occurrence of the species on the Isthmus has not been verified.

Abderospira chipolana Dall is less globose and more subdued in external ornamentation than its Shoal River analog, *A. funiakensis*.

Occurrence: Chipola formation, locality 2213[p].

Abderospira funiakensis Gardner, n. sp.

Plate XXXVII, figure 38

Shell small, subglobose. Spire involute. Apex perforate. Spiral sculpture developed over the entire shell; the spirals low, broad fillets, 24 upon the type, the 8 medial spirals broader, lower, and more closely spaced than those either in front of or behind them, the fillets growing increasingly narrower and more elevated toward the extremities, particularly toward the anterior; interspiral areas regularly and strongly punctated by the incremental filaments, the punctae most conspicuous toward the extremities, where the interspiral channels are the widest and deepest. Aperture more produced than the shell both posteriorly and anteriorly; feebly arcuate, constricted behind by the intrusion of the body. Outer lip thin, sharp, finely crenate marginally, posteriorly produced and sharply rounded, patulous and slightly expanded anteriorly. Parietal wall thinly glazed. Pillar reinforced, nonplicate, forming the apertural wall of the elongated umbilical area. Umbilicus very narrow but deeply perforate, threaded with three fine spirals.

Dimensions: Height, 4.5 millimeters; maximum diameter, 3.3 millimeters.

Holotype: U. S. Nat. Mus. No. 352058.

Type locality: No. 5618, 3½ miles southwest of DeFuniak Springs, Fla.

Abderospira funiakensis is much more globose than *A. chipolana* Dall, its only Alum Bluff congener. The Shoal River species is, furthermore, less deeply perforate apically and more strongly and regularly sculptured both spirally and incrementally.

Occurrence: Shoal River formation, locality 5618[r].

Family RINGICULIDAE

Genus RINGICULA Deshayes

1838. *Ringicula* Deshayes, in Lamarck, Histoire naturelle des animaux sans vertèbres, 2d ed., vol. 8, p. 342.

Type (by subsequent designation, Gray, 1847, Zool. Soc. London Proc., p. 140): *Auricula ringens* Lamarck. (Eocene of the Paris Basin.)

Shell small, ventricose; spire relatively short; nucleus heterostrophous; surface of shell smooth or spirally striate; aperture narrow, oblique to the axis of the shell, dilated and more or less emarginate anteriorly; outer lip thickened and reflected, smooth or finely plicate within; columella excavated, calloused, furnished posteriorly as a rule with a strong tubercular denticle and anteriorly with two prominent transverse plaits; parietal wash very heavy, continuous with the thickened margin of the outer lip; umbilicus imperforate.

The genus has been noted in the Cretaceous deposits of Europe and India as well as in those of North America. Some 70 species are reported from the various Tertiary horizons, and about 35 from the temperate and tropical waters of today.

There is nothing of significance in the distribution of the Alum Bluff Ringiculas. Two out of the four species represented are restricted to the Chipola formation. A third species has been collected from the Oak Grove sand and Shoal River formation; a fourth not only from these two but from the Chipola formation as well. None of the four, however, have been reported from any formation other than those of the Alum Bluff group.

The Recent members of the genus occur for the most part in waters over 50 fathoms in depth.

Spiral sculpture developed over the entire conch:
  Shell rather stout, distinctly tabulated at the posterior suture ..... *Ringicula chipolana* Dall.
  Shell rather slender, not distinctly tabulated at the posterior suture ..... *Ringicula boyntoni* Gardner, n. sp.
Spiral sculpture not developed over the entire conch:
  Whorls of spire subangular; spire subscalariform. *Ringicula semilimata* Dall.
  Whorls of spire broadly rounded; spire obtuse, not subscalariform ..... *Ringicula stiphera* Gardner, n. sp.

Ringicula chipolana Dall

Plate XXXVII, figure 39

1896. *Ringicula chipolana* Dall, U. S. Nat. Mus. Proc., vol. 18, p. 25.

1903. *Ringicula chipolana* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, pl. 58, fig. 9.

Shell small, elevated, slender, faintly grooved all over, with 4½ whorls; spire about equal to the aperture, which is longer than wide, with a callous body lip and reflected margin. Longitude, 2.2; maximum diameter, 1.4 [1.3] millimeters.

Habitat: Chipola beds (2211); in the lower bed at Alum Bluff, Chattahoochee River, Fla.

Type [holotype]: No. 113865, U. S. Nat. Mus.

This species is intermediate in size between *R. floridana* and *R. guppyi* and is sculptured like them but has the form of *R. semilimata*, especially the elevated spire, but with a proportionately narrower mouth. It differs from the very similar *R. biplicata* Lea by the absence of any denticles or lirae on the outer lip when mature.—Dall, 1896.

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

The type remains unique.

Occurrence: Chipola formation, locality 2211[r].

Ringicula boyntoni Gardner, n. sp.

Plate XXXVII, figures 40, 41

Shell minute but rather solid, highly polished, ovate conical, tapering gradually to an obtuse apex. Aperture more than half the length of the entire shell. Whorls 5 in all, 2 of them included in the smooth, shining protoconch. Initial turn minute, almost entirely immersed in the succeeding turn; second nuclear whorl rather strongly inflated and increasing rapidly both in altitude and diameter, flattening slightly toward its end; dividing line between conch and protoconch indicated merely by a slightly exaggerated incremental. Whorls of conch moderately elevated, minutely tabulated at the shoulder, very broadly rounded at the periphery. Spiral sculpture initiated on the final half of the first whorl, the anterior spirals being the first to appear; sculpture well established by the opening of the second whorl of the conch; spirals very faintly impressed lines, subequal and subequispaced, though inclined to be less faint and more closely spaced anteriorly, 7 on the penult of the type, increasing to twice that number upon the body; the spirals upon the base of the body more deeply impressed than those behind them; interspiral areas flattened, about double the width of the spirals. Axial sculpture restricted to microscopically fine incremental striae. Suture lines impressed. Aperture narrow, oblique, somewhat pyriform in outline, obtusely angulated, the posterior commissure rounded, a little patulous anteriorly, completely framed by a very heavy, sharply defined glaze. Outer lip margined by a broad band of heavy callus, which on the inner surface is produced medially into an obtuse denticle. Wash produced backward at the posterior commissure almost halfway across the penult. Inner wall of aperture abruptly constricted at the base of the body, heavily reinforced. Parietal plait prominent, placed nearly opposite the projection on the inner margin of the outer lip. Columellar folds 2, more elevated than the parietal fold, the anterior, marginal fold a little the stronger of the two. Anterior notch narrow and deep, almost but not quite cutting through the enamel that surrounds the anterior extremity.

Dimensions: Length, 1.6 millimeters; maximum diameter, 0.8 millimeters; length of aperture, 1.2 millimeters.

Holotype: U. S. Nat. Mus. No. 371049.

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

Ringicula boyntoni is, as a rule, more slender than the coexisting *R. semilimata* Dall. The spiral sculpture of *R. boyntoni*, however, is not restricted but is developed over the entire conch with the exception of the early part of the first turn, and the parietal tooth is more prominent. *R. chipolana*, which resembles *R. boyntoni* in the character of the spiral sculpture, is a little larger and stouter, with a much more decided tabulation at the posterior suture. The species is rare at the single locality at which it occurs.

Occurrence: Chipola formation, locality, 7893[r].

Ringicula semilimata Dall

Plate XXXVII, figure 42

1896. *Ringicula semilimata* Dall, U. S. Nat. Mus. Proc., vol. 18, p. 24.

1903. *Ringicula semilimata* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, pl. 60, fig. 24.

Shell minute, of 3½ whorls; spire about equal to the aperture; surface polished, suture distinct, not deep, the spire a little turreted and rather pointed; whorls smooth behind the periphery, in front of it evenly spirally grooved, with wider interspaces; aperture wide, with a thickened and reflected margin; outer lips slightly patulous and thickest at the middle; pillar with two strong plaits, the body with comparatively little callus, only the oldest and most callous showing a parietal denticle, the outer lip extending in front of the pillar, the canal in the adult very narrow and oblique. The size varies. Latitude, 1 to 1.2; longitude, 1.5 to 2 millimeters.

Habitat: Chipola beds (2212, 2213), Calhoun County, and Alum Bluff beds, at Oak Grove, Santa Rosa County, Fla.

Types [holotype]: No. 113111, U. S. Nat. Mus.; also specimens in the collections of Mr. Aldrich and the Geological Survey of Alabama.

This species appears to be rather rare; it most nearly resembles *R. guppyi* Dall, which is grooved all over and has a less slender spire. The parietal tooth in *R. guppyi* is rarely absent, even in specimens hardly mature; in *R. semilimata* only the very oldest and most callous specimen shows any trace of it.—Dall, 1896.

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

Ringicula semilimata Dall is best characterized among its Alum Bluff congeners by the subangular, subscalariform spire. It differs widely in relative

proportions, and most of the individuals observed are relatively more elevated than the figured type.

Occurrence: Chipola formation, localities 7893[p], 2212[r], 2213[r], 7151[p]. Oak Grove sand, localities 5632[r], 7054[r]. Shoal River formation, localities 5079[r], 3748[p].

Ringicula stiphera Gardner, n. sp.

Plate XXXVII, figures 43, 44

Shell small, solid, squat, made up of 2 or 2¼ nuclear turns and 3 conchal volutions. Initial whorl of protoconch small and smooth and for the most part submerged; the final volution of the protoconch also smooth but increasing rapidly in size and elevation anteriorly, rather strongly inflated except for a slight flattening just behind the line of junction with the conch. Whorls of conch very broadly rounded, increasing rapidly but uniformly in size. Spiral sculpture restricted in the type to the anterior half of the whorl, so that, on the spire, it is entirely concealed by the succeeding volution, except for a single striation on the penult directly behind the suture; spirals manifested on the body as faintly incised lines, which become more closely spaced and decreasingly feeble toward the extremity. Incremental sculpture exceedingly faint and irregular. Sutures impressed but not channeled. Aperture rudely lobate, oblique to the axis of the shell. Outer lip very much thickened, patulous anteriorly, produced backward for a short distance upon the preceding volution; callus abruptly excavated along the inner margin near the posterior commissure, giving a pseudodenticulate aspect to the anterior extremity of the depression. Inner lip very much thickened and reflected, constricted at the base of the well-rounded body. Parietal denticle prominent and persisting far within the aperture, placed about midway between the commissure and the pillar. Pillar very short and heavily reinforced, bearing two strongly elevated, oblique, parallel plications, the anterior marginal, the posterior set about halfway up the pillar; parietal wash very heavy, its margin sharply defined and rudely parallel with the inner margin of the aperture, continuous with the reinforced margin of the outer lip; anterior notch wide and rather deep.

Dimensions: Height, 2.8 millimeters; maximum diameter, 1.8 millimeters.

Holotype: U. S. Nat. Mus. No. 352132.

Type locality: No. 7264, DeFuniak, "*Cardium* beds", Alaqua, Walton County, Fla.

Ringicula stiphera, like many others of the group, varies widely in the area covered by the spiral lineation. In some individuals as many as 6 spirals have been observed upon the medial and anterior portion of the whorl and 2 upon the posterior, but none have been found in which the entire surface is regularly lineated.

Ringicula stiphera is lower and more uniform in relative proportions than *R. semilimata* Dall, and the whorls are more strongly and evenly rounded. The range of variation in sculpture is very similar in the two species.

Occurrence: Oak Grove sand, localities 2646[r], 5632[r]. Shoal River formation, localities 3742[r], 3747[r], 7261?[r], 7264[r], 5618[p].

Family APLYSIDAE

Genus DOLABELLA Lamarck

1801. *Dolabella* Lamarck, Systême des animaux sans vertèbres, p. 62.

Type (by monotypy): *Dolabella callosa* Lamarck= *Dolabella rumphii* Cuvier. (Recent in the Indo-Pacific.)

Shell internal, heavy, solid, cuneate or hatchet-shaped, loosely coiled, paucispiral; posterior area defined by a sulcus; external surface more or less calloused, at least in the apical region.

The genus is characteristic of shallow, muddy bottoms and, in the recent seas, is restricted to the Indo-Pacific and Australian shores as far as New South Wales and to the west coast of Mexico. The Miocene species, the only one reported from the Tertiary beds of the east coast and Gulf regions—indeed, the only fossil species certainly referable to the genus—probably found its way across from the Pacific when there was free communication in the Panama area. It is restricted in its distribution to the Chipola formation and is represented by less than half a dozen individuals.

Dolabella aldrichi Dall

Plate XXXVII, figure 45

1890. *Dolabella aldrichi* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 18, pl. 10, fig. 7a.

Shell large, thick, subspiral, of about (when perfect) 1½ whorls; apex showing signs of the existence of a winglike appendage, as in other species of the genus; exterior smooth or slightly transversely waved, with a shallow sulcus outside the cycloidal pillar, vertex with a spirally grooved or irregular surface; pillar with a flattened or roughly sulcate face below, rounded above; interior smooth; shell widening as it grows, the edge imperfect in the specimens. Height, 33[18.0]; breadth (broken), 25; thickness of shell, up to 5.0 millimeters.

Lower Miocene shell bed, Alum Bluff, western Florida.

This is the first species of the genus described from our Tertiaries and recalls the original type *D. rumphii*, which is, however, less spiral and regular in form.—Dall, 1890.

Holotype: U. S. Nat. Mus. No. 97490.

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

The apex of the spire is concealed by a calcareous glaze, and the external surface is widely spread with a wash sufficient to obscure the undulatory, concentric sculpture of the surface.

Dolabella aldrichi Dall is not only the sole representative of the genus in the Chipola formation, the horizon to which it is restricted, but the only fossil species of *Dolabella* that has yet been certainly recorded.

Occurrence: Chipola formation, localities 2213[r], 2564[r], 2211[r], 7183[r].

Subclass STREPTONEURA

Order CTENOBRANCHIA

Suborder STENOGLOSSA

Superfamily TOXOGLOSSA

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. hist. nat. Paris Mém., p. 71. Sole example, *Buccinum subulatum* Linnaeus. (Recent in the Indo-Pacific.)

1908. *Terebra* Dall, Harvard Coll., Mus. Comp. Zoology, Bull., vol. 43, no. 6, p. 245.

1923. *Terebra* Bartsch, Nautilus, vol. 37, pp. 60–64.

1928. *Terebra* Woodring, Carnegie Inst. Washington Pub. 385, p. 135.

Type (by monotypy): *Buccinum subulatum* Linnaeus. (Recent in the Indo-Pacific.)

The nomenclature of *Terebra* is much involved, partly because of the confusion consequent upon an early error in figuring the animal and partly because the natural groups into which the animal and shell characters fall are not altogether parallel. Dall, in his report of 1908 upon the *Albatross* dredgings, reviewed the synonymy of the old *Terebra* and subdivided it primarily upon the characters of the radula, secondarily on the shell characters. *Terebra* is there defined as follows:

> Radula edentulous, the proboscis forming a voluminous, muscular, evertible sac, in which the prey may be enfolded and its juices squeezed out and absorbed. The presence of a poison gland may be explained by supposing the secretion to paralyze the living prey when taken into the sac. Eyes terminal on very short small tentacles, and a long slender verge without appendages, are present. * * *
>
> The larval shell throughout the group is the same, except in number of whorls. It is blunt, glassy, smooth, and forms a shorter or longer subcylindrical spire. It is usually dark-colored. The nepionic shell may agree in sculpture with the adult portion or may be entirely different, its sculpture gradually becoming modified with growth. So far as reported the operculum is uniformly subannular, ovoid, narrow with a terminal nucleus.

The conch is slender, turreted, acuminate, and polygyrate. The external surface is smooth or axially, reticulately, or more rarely spirally sculptured. The most conspicuous feature of the ornamentation is commonly a deep sulcus revolving at a short distance in front of the suture and parallel to it. The aperture is ovate or quadrate and terminates anteriorly in a short recurved canal.

Terebra is abundantly represented throughout the Cenozoic, and the Recent species are widely distributed, though most prolific in the inshore waters of the warm temperate and tropical seas.

In the Alum Bluff group 16 species and subspecies have been surely recognized. By far the most abundant representation, in number of species and of individuals, is in the Shoal River formation; 11 out of the 16 species have been identified from this horizon and of the 11, 8 or half of the entire number, are restricted to it; 6 of the 8 peculiar species are new: the seventh, *T. gausapata* Brown and Pilsbry, was described from the Gatun formation, Panama; the eighth, *T. bipartita* Sowerby, originally described from the Dominican Republic, has been reported from Panama. *T. spirifera* Dall, a closely allied form also described from the Dominican Republic, may be present in the Oak Grove sand as well as in the Shoal River formation. Two other species with West Indian allies, *T. sulcifera?* Sowerby and *T. odopoia*, are common to the Chipola and Shoal River formations. Aside from these 2 species 3 other species have been recognized in the Chipola formation. Only 1 of the 3, *T. chipolana* Dall, described from a unique type, is certainly restricted. The other 2, the common *T. langdoni* and its subspecies *perpunctata*, are possibly present in the Oak Grove sand. The Oak Grove *Terebra* fauna is curiously meager. Although 5 species and subspecies are present, only 2 of these are determinable with absolute certainty. Both are restricted, but one of them is a unique type. The other is referable to *Spineoterebra* rather than to the true *Terebra*. Two of the 3 unrestricted species are allied to Chipola forms, and 1 to a Shoal River and West Indian species.

So far as the evidence from *Terebra* goes it certainly points consistently toward the alliance of the Panamanian and Dominican faunas with the Shoal River rather than with those from the earlier formations.

Presutural sulcus developed both on the earlier and later whorls and in the costal and intercostal areas:
Columella biplicate, the two folds approximately equal:
Surface not spirally lirate:
Shell turreted, sulcus impressed but not squarely channeled:
Surface raised in front of the sulcus, thus forming a secondary band--- *Terebra* (*Paraterebra*) *sulcifera* Sowerby?
Surface not raised in front of the sulcus----- *Terebra* (*Paraterebra*) *odopoia* Gardner, n. sp.
Shell pupiform, sulcus squarely channeled----- *Terebra* (*Strioterebrum*) *pupiformis* Gardner, n. sp.
Surface spirally lirate:
Shell pupiform; sulcus squarely channeled----- *Terebra* (*Strioterebrum*) *pupiformis* Gardner, n. sp.
Shell acuminate, not pupiform; sulcus commonly deeply impressed but not squarely channeled:
Spirals equal, separated only by linear interspaces exceeding four upon the penult.
Terebra (*Strioterebrum*) *gausapata* Brown and Pilsbry.
Spirals commonly inequal, separated by more than linear interspaces and rarely more than four:
Spirals overriding the axials with undiminished vigor----- *Terebra* (*Strioterebrum*) *spirifera* Dall.
Spirals more or less obsolete at the intersection with the costals:
Costals dissected by the sulcus; spirals usually regular and sharply defined.
Terebra (*Strioterebrum*) *bipartita* Sowerby.
Costals depressed but not dissected by the sulcus; spirals usually irregular and ill defined.
Terebra (*Strioterebrum*) *waltonensis* Gardner, n. sp.
Columella biplicate, the posterior fold obscure and not persistent to the aperture:
Spirals irregular and ill defined but developed over the entire surface except the sutural band.
Terebra (*Strioterebrum*) *waltonensis* Gardner, n. sp., s. s.
Spirals ill defined and commonly obsolete, in many specimens restricted to the anterior portion of the whorls or even to the body alone----- *Terebra* (*Strioterebrum*) *waltonensis tribaka* Gardner, n. subsp.
Columella smooth or bearing an obscure marginal fold:
Axial sculpture vigorous; spiral sculpture absent or developed only upon the base of the body.
Terebra (*Strioterebrum*) *eskata* Gardner, n. sp.
Both axial and spiral sculpture developed:
Altitude approximately four times the diameter; sulcus rather wide and squarely channeled.
Terebra (*Strioterebrum*) *rabdota* Gardner, n. sp.
Altitude approximately five times the diameter; sulcus very narrow and commonly obscure in mounting the costals.
Terebra (*Strioterebrum*) *langdoni* Dall.
Both axial and spiral sculpture almost or entirely obsolete except for the deeply impressed presutural sulcus.
Terebra (*Strioterebrum*) *chipolana* Dall.
Presutural sulcus restricted to the intercostal areas:
Costals uniform in prominence between the sutures, not nodose posteriorly:
Spiral sculpture developed:
Spirals appearing as more or less sharply defined and elevated lirations--- *Terebra* (*Strioterebrum*) *langdoni* Dall s. s.
Spirals reduced to more or less obsolete striations and the sulcus to an intercostal pit.
Terebra (*Strioterebrum*) *langdoni* subsp. *perpunctata* Dall.
Spiral sculpture not developed----- *Terebra* (*Strioterebrum*) *rapta* Gardner, n. sp.
Costals more or less nodose posteriorly----- *Spineoterebra psilis* (Dall).
Presutural sulcus restricted to the later whorls----- *Terebra aulakoessa* Gardner, n. sp.

Subgenus PARATEREBRA Woodring

1928. *Paraterebra* Woodring, Miocene mollusks from Bowden, Jamaica, pt. 2: Carnegie Inst. Washington Pub. 385, p. 135.

Type (by original designation): *Terebra texana* Dall. (Recent in the Gulf of Mexico and the Caribbean Sea.)

Shell large, generally moderately slender. Aperture relatively narrow. Outer lip inflected forward at about a third of distance from suture to base of anterior canal. Anterior canal relatively long, producing a wide constricted area behind siphonal fasciole, bearing a wide, deep notch. Siphonal fasciole correspondingly wide, limited by a high thread and bearing more or less prominent growth lamellae. Columella bearing a basal fold. Columella and parietal wall covered with thick layer of callus. Sculpture of early whorls consisting of a sutural band, below which lies a narrower band, and of fine axial ribs curved forward. Sculpture partly or completely disappearing on later whorls. The relatively narrow aperture and long anterior canal, rather strongly inflected outer lip, and heavy callus separate *Paraterebra* from *Terebra* s. s. *Oxymeris* Dall (Proc. U. S. Nat. Mus., vol. 26, p. 951, 1903; substitute name for *Acus* ("Humph.") Gray, Proc. Zool. Soc. London, pt. 15, p. 139, 1847, not *Acus* Edwards 1771; type, by original designation (Gray), *Terebra maculata* Lamarck; Recent, Indo-Pacific) has a wider and more flaring aperture, shorter anterior canal, no thick layer of callus, and its outer lip descends almost vertically from the suture and then bends backward and forward in a broad sweeping curve.—Woodring, 1928.

Terebra (Paraterebra) sulcifera Sowerby?

Plate XXXVIII, figure 1

1850. *Terebra sulcifera* Sowerby, Geol. Soc. London Quart. Jour., vol. 6, p. 47.

Testa aculeiformis, anfractibus plurimis, oblique transversim sulcatis, prope suturam incrassatis, sulcis spiralibus duobus prope suturam admotis, tertio antico subobsoleto ad basin anfractus remoto.—Sowerby, 1850.

Type locality: Near San Jago, Dominican Republic.

Dimensions of figured specimen: Height of broken specimen; 47.0 millimeters; maximum diameter, 14.5 millimeters.

Figured specimen: U. S. Nat. Mus. No. 371052, from locality 3419, 1 mile below Baileys Ferry, Chipola River, Calhoun County, Fla.

Shell acuminate; ribs very numerous, bent slightly backward in front of the sutural band but forward upon it, obliquely sulcated transversely, thickened near the suture; two spiral sulci revolving near the suture with a third more or less obsolete near the base; no other spiral sculpture developed; two subequal columellar folds.

The identity of the Alum Bluff species with the unfigured species described not very adequately by Sowerby from the Dominican Republic is uncertain.

Terebra sulcifera Sowerby? approaches *T. inaequalis* Sowerby by the evanescence of the second spiral and the raised band behind it.

Occurrence: Chipola formation, localities 2212[r], 3419[r]. Shoal River formation, localities 3856[r], 3742[p], 5184[r].

Terebra (Paraterebra) inaequalis Sowerby

1850. *Terebra inaequalis* Sowerby, Geol. Soc. London Quart. Jour., vol. 6, p. 47.

1873. *Terebra robusta* Gabb, Geology of Santo Domingo, Am. Philos. Soc. Trans., vol. 15, p. 224.
Not *T. robusta* Hinds: Zool. Soc. London Proc., p. 149, 1843.

1896. *Terebra gabbi* Dall, U. S. Nat. Mus. Proc., vol. 18, p. 34.
Not *Terebra inaequalis* Sowerby. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1576, 1903 (Check list of Chipola fossils).

Testa turrito-subulata, subcylindracea, anfractibus planulatis, longitrorsum plicato-costellatis, postice linea impressa cinctis, costellis posticis obliquis, anticis arcuatis; anfractu ultimo antice subangulato; columella antice biplicata.—Sowerby, 1850.

Holotype: British Museum.

Type locality: Near San Jago, Dominican Republic.

Shell large, strong, with a slender, strongly sculptured spire, and later smoother, rapidly enlarging whorls, with a nearly peripheral, narrow, spiral color band, which, even in the fossil, sometimes is clearly perceptible; on the earlier whorls the upper half is occupied by a wider sutural and an anterior narrower elevated band, separated from each other by a well-marked sulcus; they are crossed obliquely by fine, sharp, regularly spaced elevated lines with wider interspaces, which on the rest of the whorl have a vertical or axial direction to the suture; in the specimen before me about a dozen (partly decollate) whorls exhibit this sculpture, the whole shell being microscopically spirally striated; the sculpture then becomes obsolete, the following four whorls being nearly smooth, except for incremental lines, while they rapidly become more rounded; suture distinct; aperture with the outer lip somewhat receding in the middle; inner lip moderately callous; pillar half a turn inside the aperture showing a prominent basal keel; canal twisted, with a distinct fasciole. Diameter of spire at decollation, 2.75; maximum diameter of twelfth subsequent whorl, 24; longitude of (decollate) shell, 70 mm.

Habitat.—Older Miocene of Santo Domingo at the Potrero, River Amina, Bland; Gabb, various localities on the same island.

Types.—No. 113751, U. S. Nat. Mus.; and in the Academy of Natural Sciences, Philadelphia.

The species has hardly more in common with the Pacific *T. robusta* Hinds than the fact that the sculpture is obsolete on the later whorls. It grows much larger than the dimensions given above, and the last whorls become much swollen.—Dall, 1896.

Terebra gabbi was introduced by Dall to replace *Terebra robusta* of Gabb, a name first used by Hinds for a West Coast species not, as Gabb supposed, identical with that from the Dominican Republic. The shell described by Dall is from the Gurabo formation, Middle Miocene. Sowerby's type of *inaequalis* is not figured but Woodring obtained from the British Museum the loan of the holotype which he found to be conspecific with Dall's *Terebra gabbi*. The tip of Dall's *gabbi* is broken but the perfect specimen must have measured between 75 and 80 millimeters in height and the diameter is 18, not 24, millimeters. Miss Maury's species, *Terebra calhounensis*, is not so large but the dimensions are comparable, and the sculpture tends to become obsolete on the later whorls. The whorls increase more uniformly in diameter, however, in Miss Maury's figure than they do in Dall's type and the basal constriction seems less marked in her Chipola species. The two forms do not appear to be identical, nor does either one of them seem to be the species commonly represented in the Chipola and rarely in the Shoal River. The earlier form, *Terebra odopoia* Gardner, n. sp., is not so large, decidedly more slender, with uniformly increasing whorls, a persistent axial and spiral sculpture, and a more strongly constricted body.

Terebra (Paraterebra) calhounensis Maury

1910. *Terebra calhounensis* Maury, Bull. Am. Paleontology, vol. 4, No. 21, p. 4, pl. 1, fig. 3.

Shell of moderate but varying size; largest specimen 12 or 13 whorled; spiral sculpture of a single groove incising the upper portion of the whorls. This groove closely resembles the suture, and with it and the included area forms a spiral band, 1 to 3 millimeters wide. Transverse sculpture on the earlier whorls of sharp, subequal, close-set riblets (much less conspicuous but more irregularly nodular on the sub-sutural bands than on the remaining part of the whorls); on the later whorls the riblets are progressively weaker and become nearly obsolete on the body whorl. Length of largest specimen 65, greatest width 15 millimeters.

Chipola marls, Baileys Ferry, Fla.

Cornell University collection.—Maury, 1910.

There is no shell in our collections which seems to be identical with Miss Maury's species. *Terebra odopoia* is smaller with less numerous and less rapidly increasing whorls, and a more persistent sculpture.

Occurrence: Chipola formation. Baileys Ferry, Calhoun County, Fla. (Cornell University collections.)

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Terebra (Parateredra) odopoia Gardner, n. sp.

Plate XXXVIII, figure 2

1903. *Terebra inaequalis* Sowerby. Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1576 (name only in check list of Chipola fossils).

Not *Terebra inaequalis* Sowerby, 1850.

Dimensions of holotype: Height, 38.0± millimeters; maximum diameter, 7.0 millimeters.

Shell slender, turreted, acuminate, the perfect adult performing probably as many as 20 complete volutions. Whorls flattened, closely appressed, divided into two unequal portions by a narrow but deep sulcus that revolves in front of the suture, cutting the whorl into two unequal parts, the anterior of which is a little less than twice as wide as the posterior. Nuclear characters unknown. Sculpture dominantly axial; costals narrow and rather pinched, 23 in the figured specimen, arcuate in front of the sulcus, retractive, oblique, or feebly arcuate behind the sulcus, almost or entirely dissected by the sulcus; spiral sculpture absent except for exceedingly faint and irregular, more or less fortuitous striae upon the medial portion of the whorl. Suture distinct, less conspicuous than the groove in front of it. Aperture rather narrow, the outer lip slightly bowed, the inner abruptly constricted at the base of the body. Pillar short, recurved at its extremity, biplicate, the two folds approximately equal and not very prominent; the posterior of the two the continuation of the sharply raised posterior margin of the fasciole, the anterior fold marginal. Siphonal fasciole incrementally striated, strongly differentiated, cut off from the base of the body by a smoothly concave depression. Parietal wall thinly glazed; terminal notch quite deep.

The number of costals varies widely; 23 is rather below the normal, and not uncommonly they run up to 28.

The Shoal River representatives, which are for the most part imperfect and immature, seem a little stouter than those from the Chipola, and the sulcus is apparently somewhat less posterior.

Holotype: U. S. Nat. Mus. No. 371053.

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

Terebra odopoia exhibits the uniformly slender outline of *Terebra haitensis* Dall and the same general type of sculpture, but the whorls of the Dominican species are more numerous, and there is in front of the presutural band a secondary band which on the early whorls in *haitensis* is clearly defined and subnodose, though on the later whorls it is less conspicuous. Nothing of the sort is indicated on either the earlier or the later whorls of the Chipola species and unlike another Dominican *Parateredra*, *P. inaequalis* Sowerby, the sculpture does not become obsolete upon the later whorls but persists to the aperture.

Occurrence: Chipola formation, localities 2212[a], 2213[a], 2564[r], 7151[r]. Shoal River formation, localities 3742[r], 5184[r].

Subgenus STRIOTEREBRUM Sacco

1891. *Strioterebrum* Sacco, 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.)

Testa turrita. Anfractus longitudinaliter costulati, transversim striolati, sulco transverso subsuturale (sat profundo) ornati.—Sacco, 1891.

Strioterebrum includes the slender, usually small, and reticulately sculptured species with well-marked sutural bands. The aperture in the group is narrow and terminates in a narrow recurved canal, emarginate at its extremity. The siphonal fasciole is clearly defined, and the parietal wall is commonly washed with a thin callus. Vestiges of two columellar folds are usually though not invariably present—the posterior commonly indicated by a swelling upon the pillar rather than by a defined plication. Bartsch[4a] based the major classification of the Terebridae upon the number and character of the columellar folds, but the study of the Alum Bluff Terebras indicates that Woodring[5] is correct in his observation that there is a certain intergrading in the pillar characters of the major groups and that these characters cannot be considered of more than specific value.

Terebra (Strioterebrum) pupiformis Gardner, n. sp.

Plate XXXVIII, figure 3

Shell slender, pupiform, of moderate size and elevation. Nuclear characters not determinable. Whorls probably 12 or 13 in the perfect adult, increasing in size somewhat more rapidly in the apical region than away from it; whorls of spire flattened laterally, their outline obscured by the vigorous ornamentation. Body sharply constricted at the base. External sculpture uniform in character from apex to aperture. Presutural sulcus wide and squarely and deeply channeled, the band behind it a little less than one-third as wide as the entire whorl. Axials elevated, acutely rounded upon their summits, interrupted at the sulcus, 20 upon the ultima of the type but running as low as 15 in other individuals, feebly arcuate upon the spire, somewhat sinuous upon the body and persistent to the margin of the fasciole; sutural band narrow, nodulated by the continuation of the costae across it. Intercostal areas narrowly concave, microscopically reticulated in unweathered surfaces by the incrementals and still finer spiral striae; other spiral sculpture absent in the type. Fortuitous and ill-defined lirae developed upon the anterior portion of the later whorls in other individuals referred to the same species. Suture lines deeply im-

[4a] Bartsch, Paul, Nautilus, vol. 37, No. 2, pp. 60–64, 1923.

[5] Woodring, W. P., Miocene mollusks from Bowden, Jamaica, pt. 2: Carnegie Inst. Washington Pub. 385, p. 137, 1928.

pressed, undulated by the costae of the preceding volution. Aperture imperfect in all the specimens available, probably rather narrow. Labium abruptly constricted at the base of the body. Pillar very short, biplicate, the anterior fold marginal, the posterior close behind it and parallel to it, broader and rather more elevated than the anterior. Parietal wall heavily glazed. Siphonal fasciole very short, corrugated, sharply elevated along its posterior margin, cut off from the base of the body by a smoothly concave depression. Anterior canal short, recurved. Terminal notch broad but shallow.

Dimensions: Height, 24.0± millimeters; maximum diameter, 6.0 millimeters.

Holotype: U. S. Nat. Mus. No. 351062.

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

Terebra pupiformis is isolated by the pupiform outline, the squarely channeled sulcus, the vigor of the axial sculpture, and the biplicate columella. None of the coexisting species are readily confused with it. The immature specimens from Shell Bluff show a much more decided spiral sculpture than any from the type locality. In sculpture characters *T. pupiformis* is intermediate between *Paraterebra* and *Strioterebrum*.

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

Terebra (Strioterebrum) gausapata Brown and Pilsbry

Plate XXXVIII, figure 4

1911. *Terebra gausapata* Brown and Pilsbry, Acad. Nat. Sci. Philadelphia Proc., p. 340, pl. 22, figs. 8, 9.

A small, slowly tapering species, with very slightly convex whorls and well-impressed, undulating suture. Sutural band limited by a deep, narrow sulcus and, like the rest of the whorl, sculptured with close, unequal, spiral threads. There are 3 threads upon the band, 8 below it. There are 14 high, rather narrow, longitudinal ribs on each whorl, the threads obsolete on their summits. The imperfect shell figured measures, length, 9; diameter, 2.8 millimeters, of 6⅓ whorls.—Brown and Pilsbry, 1911.

Figured specimen: U. S. Nat. Mus. No. 371054-from locality 3856, 5 to 6 miles northwest of Mossy, head, Walton County, Fla.

Type locality: Gatun Locks, Canal Zone.

The columella is obscurely biplicate. The anterior fold is marginal within the aperture, but just before reaching the opening it cuts across the pillar at a low angle. The posterior plication is rudely parallel to it and even more feeble. This small species is remarkable for the sharp definition of the suture and of the axial sculpture and the nodular sutural band. It is obviously one of the highly ornamented end members of the *T. bipartita* group.

A few somewhat imperfect individuals that may prove to be subspecific differentiates of *T. gausapata* are found associated with the normal species. They are larger than the ordinary *T. gausapata* and exhibit no trace of spiral sculpture upon the sutural band. The number of spirals in front of the sulcus is 6 rather than 8, and these are consequently broader but rather low; the sulcus is narrow and less conspicuously channeled than in the normal *T. gausapata*. The spirals in Brown and Pilsbry's species are more regular, more numerous, and more crowded than in *T. bipartita* Sowerby or any other described member of the group.

Occurrence: Shoal River formation, localities 3856^{r}, ?3742^{r}.

Terebra (Strioterebrum) bipartita Sowerby

Plate XXXVIII, figure 5

1850. *Terebra bipartita* Sowerby, Geol. Soc. London Quart. Jour., p. 47.

1873. *Terebra bipartita* Gabb, Am. Philos. Soc. Trans., new ser., vol. 15, p. 225.

1896. *Terebra* (*Acus*) *bipartita* Sowerby. Dall, U. S. Nat. Mus. Proc., p. 38.

Testa turrito-subulata, acuminata, anfractibus planulatis, longitrorsum plicato-costellatis, postice linea impressa costellis decussata cinctis, costellis posticis subevanidis, anticis subarcuatis; anfractu ultimo antice rotundato, columella antice laevi.—Sowerby, 1850.

Type locality: Near San Jago, Dominican Republic.

Shell acute, with the sutural sulcus prominent and set off by a deep sulcus, which cuts ribs and all, from the rest of the whorl, where the spiral threading is remarkably clear-cut, uniform, and elegant, not overriding the narrow, sharp-edged ribs. Santo Domingo and Chipola. Longitude, 23; maximum diameter, 5.5 millimeters.

The pillar of this form seems to be simple and smooth in all the specimens I have seen.—Dall, 1896.

Figured specimen: U. S. Nat. Mus. No. 371055, from locality 3856, 5 to 6 miles northwest of Mossyhead, Walton County, Fla.

All the individuals from the Chipola formation which have been referred to this species have proved to be *Terebra langdoni* Dall, a rather more slender, less sharply sculptured form, most readily separable by the absence of any plication upon the columella. A single young and two imperfect individuals from the Shoal River seem to differ in no essential detail from the typical *T. bipartita* of Sowerby. In *Terebra spirifera* Dall the spirals are dominant and override the costals with undiminished vigor. In *Terebra waltonensis*, as in *T. bipartita*, the spirals are more or less obsolete at the intersection with the axials, but *T. waltonensis* offers specific differences in the larger size, less sharply defined sculpture, both axial and spiral, and more obtuse and obscure columellar folds.

Occurrence: Shoal River formation, localities 3856^{r}, ?3748^{p}, ?7264^{r}.

Terebra (Strioterebrum) spirifera Dall

Plate XXXVIII, figures 6, 7

1896. *Terebra* (*Acus*) *bipartita* Sowerby var. *spirifera* Dall, U. S. Nat. Mus. Proc., vol. 18, p. 38.

1903. *Terebra (Oxymeris) bipartita* Sowerby var. *spirifera* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, pl. 59, fig. 13.

1909. *Terebra wolfgangi* Toula, K.-k. geol. Reichsanstalt Jahrb., Band 58, Heft 4, p. 705, pl. 28, figs. 7a, 7b.

1911. *Terebra wolfgangi* Toula. Brown and Pilsbry, Acad. Nat. Sci. Philadelphia Proc., p. 340, pl. 22, figs. 1, 3, 4, 5, 6.

Shell with the ribs feeble, the spiral sculpture more prominent than the ribs, especially two rather narrow spirals just in front of the sutural band, and overriding the ribs with close-set, even, distinct, coarse, rounded threads, which fail on the canal; pillar distinctly grooved or biplicate. Longitude, 30; maximum diameter, 8 millimeters. Ponton, Santo Domingo.

This form is larger, and the shell increases in diameter more rapidly than in the type. It may prove to be worthy of specific rank with more material, in which case the varietal may be used as a specific name. No. 113654, U. S. Nat. Mus.

It recalls, in its relation to the type, the relation of *T. indenta* Conrad to *T. dislocata* Say.—Dall, 1896.

Holotype: U. S. Nat. Mus. No. 113654.

The Dominican form seems to agree in all essential details with that described by Toula from the excavation at Gatun. There is rather a wide variation in the detail and relative prominence of the axials and spirals, but no more than is usual in the reticulately sculptured Terebras.

The typical form is present in the Oak Grove sand and the Shoal River formation, but it is not very common. *T. waltonensis*, a closely allied species, is abundant in the marls of Walton County. It differs from Dall's *T. spirifera* in the less numerous and less sharply defined spirals and the more obtuse and obscure columellar folds.

Occurrence: Oak Grove sand, localities 2646^{p}, ?5632^{p}, ?7054^{r}. Shoal River formation, localities 3856^{c}, 3731^{r}, 5079^{r}.

Terebra (Strioterebrum) waltonensis Gardner, n. sp.

Plate XXXVIII, figures 8, 9, 10

Shell very friable, moderately large. Whorls numerous, probably as many as 15 in a perfect adult, flattened laterally, increasing a little more rapidly in size toward the apex, the angle of convergence ranging from 5° to 10°. Body whorl rather abruptly rounded at the base. Nuclear characters obscured by the decortication of the apex in all available material; nucleus small, elevated, acute, probably thrice coiled. Sculpture uniform in general character over the entire surface of the conch. Presutural sulcus distinct and persistent, the posterior band thus differentiated being approximately one-third the width of the entire whorl. Axials varying in number and prominence (24 upon the final whorl of the type), somewhat irregular in size and spacing, feebly arcuate and asymmetric, inclined, commonly sharply toward the left, relatively prominent upon the sutural band, where the rivalry with the spiral sculpture is almost or altogether absent. Spiral sculpture exceedingly variable both relatively and absolutely, not developed upon the sutural band in the type nor in the majority of individuals; spirals 3 or 4 on the later whorls, overriding the costals but with diminished vigor, flattened and very slightly elevated, unequal in size and spacing; traces of microscopically fine spiral striae also present. Suture lines deeply impressed. Aperture narrow, sinuous. Outer lip broken in all adult material but doubtless, like the body whorl, approximately straight medially and rather sharply constricted at the base. Inner lip deeply excavated. Pillar rather long for the genus, bearing within the aperture two low, rounded folds which evanesce before reaching the opening and can be observed only in broken specimens. Fasciole oblique, incrementally striated, very sharply keeled posteriorly, and cut off from the base of the body by a smoothly rounded depression. Parietal wall glazed; anterior canal very short and sharply recurved. Terminal notch shallow.

Dimensions: Height, 44.0± millimeters; maximum diameter, 9.0± millimeters.

Holotype: U. S. Nat. Mus. No. 351074.

Type locality: No. 3732, Dave Adams Mill Creek, sec. 2, T. 3 N., R. 21 W., Walton County, Fla.

Figured specimens: U. S. Nat. Mus. No. 351075, from locality 3856, 5 to 6 miles northwest of Mossyhead, Walton County, Fla.

Terebra waltonensis exhibits a series of variations which suggest *Terebra dislocata* Say. One of the forms which has been figured (pl. XXXVIII, fig. 10) is much nearer to the closely allied but more sharply sculptured *T. spirifera* than most of the individuals assembled under the name. The general proportions and outline of the shell are fairly constant. The number of the axial costals may run as low as 16, but it seldom rises above 26. The axials are, however, one of the best diagnostic features of the species, for they are invariably a little arched and inclined toward the left. Their wide range in relative prominence is due less to their range in elevation than to the conspicuously variable spiral sculpture. The 3 to 5 spirals may be fairly sharp and regular as in the figured specimens; more commonly they are low, unequal, irregular, broad, and ill-defined, in some specimens reduced to indistinct striations that can not be seen except with a lens and on an unweathered surface. Occasionally the sutural band is striated, but this is rare. Generally there is a secondary band in front of the sulcus cut off by an impressed line. The sulcus is invariably well marked and persistent, but it does not dissect the costae as in *Terebra bipartita* Sowerby. The young are much more sharply sculptured, both axially and spirally, than the adults.

Terebra waltonensis s. s. occupies an intermediate position between the sharply sculptured *T. spirifera* Dall and the end members of the subspecies *T tribaka*, in which the spiral sculpture is almost entirely obsolete.

It is by far the most abundant representative of the genus in the Shoal River formation, to which it is apparently restricted. It runs larger than *T. bipartita* Sowerby and is less sharply sculptured and more obscurely plicated upon the pillar.

Occurrence: Shoal River formation, localities 3856^{pr}, 2645^{r}, 3732^{r}, 3742^{c}, 3731^{r}, 5080^{r}, 5184^{p}, 5195^{p}, 2238^{r}, 5618^{r}.

Terebra (Strioterebrum) waltonensis tribaka Gardner, n. subsp.

Plate XXXVIII, figures 11, 12

Shell tall but rather slender, probably as many as 19 whorls in a perfect adult. Nucleus small but elevated, including apparently 4 complete volutions. Whorls of conch flattened laterally, coverging with approximate uniformity at an angle between 5° and 10°. Presutural sulcus moderately broad and deep, isolating a prominent band more than one-third the width of the entire whorl. Axial sculpture dominant; axials numerous (24 in the type), rather broad and rather sharply pinched as a rule, especially in the young, slightly arcuate, inclined toward the left, not completely dissected by the sulcus, persistent from suture to suture and well down upon the base of the body; intercostal areas broadly rounded or obtusely V-shaped. Spiral sculpture variable; 3 or 4 very low, broad, ill-defined fillets developed upon the anterior portion of the later whorls of the spire in the type; body sculptured with 7 less feeble spirals with a few additional striae upon the base. Sutures deeply impressed. Body sharply rounded in front of the periphery. Aperture rather narrow, sinuous, acutely angulated posteriorly, constricted anteriorly into a very short, obliquely recurved canal. Outer lip sharp, very feebly expanded. Labium loosely sigmoidal, obscurely plicated within the aperture at the margin of the pillar, with an occasional trace of a second fold behind the first. Siphonal fasciole clearly differentiated, incrementally striated, cut off from the depression at the base of the body whorl by the sharply elevated posterior margin. Parietal wall glazed. Anterior canal short, recurved. Terminal emargination broad and rather deep.

Dimensions: Height of broken specimen, 32.0± millimeters; maximum diameter, 6.4± millimeters.

Holotype: U. S. Nat. Mus. No. 351084.

Figured specimen: U. S. Nat. Mus. No. 351085, from locality 3731, 5 to 6 miles northwest of Mossyhead, Walton County, Fla.

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

Terebra waltonensis tribaka is very closely allied to the normal *waltonensis*, and it would hardly be recognized by a distinct name except that the group is so large and so variable that it seems easier to hold it by two handles instead of one. The subspecies includes the smaller, more slender members in which the axials are rather sharply pinched but the spirals, except in the young, are feeble or even obsolete. The labial plications, especially the posterior, are rather more obscure than in the normal race. The subspecies, like the typical *T. waltonensis*, is restricted to the Shoal River formation.

Occurrence: Shoal River formation, localities 3856^{a} 3732^{p}, 3742^{c}, 3731^{r}, 5184^{p}, 5195^{r}, 3748^{p}.

Terebra (Strioterebrum?) eskata Gardner, n. sp.

Plate XXXVIII, figure 13

Shell moderately tall and slender; apical angle not far from 7°. Whorls numerous, probably 11 or 12 in the perfect adult, regularly increasing in diameter; body whorl abruptly constricted at the base. Nucleus lost in all available material. Sculpture dominantly axial. Presutural sulcus feeble, overriding the costals but only faintly depressing them, thus defining a sutural band of about one-third the width of the entire whorl; other macroscopic spiral sculpture absent except for occasional ill-defined striae or lirae upon the base of the body. Axials broad at the base, acute or acutely rounded upon their summits, feebly arcuate upon the whorls of the spire, sinuous upon the ultima, persistent from suture to suture and well down to the base of the body, feebly depressed but not indented at the sulcus, 14 in the type but running as high as 18; intercostal areas broadly concave, microscopically reticulated by the incrementals and still finer spiral striae. Suture lines deeply impressed. Aperture rather narrow, imperfect in all available material. Labrum probably thin and sharp and very feebly arcuate. Labium loosely sigmoidal, sharply excavated at the base of the body. Pillar straight medially. Parietal wall heavily glazed and apparently free from plications, although broken individuals reveal a single, obtuse fold upon the columella which evanesces at some distance within the aperture. Siphonal fasciole clearly defined, corrugated; sharply elevated at the posterior margin, cut off from the base of the body by a concave area in which traces of the axials still persist. Anterior canal short, sharply recurved. Terminal notch shallow, ill defined.

Dimensions: Height, 23.0± millimeters; maximum diameter, 6.0± millimeters.

Holotype: U. S. Nat. Mus. No. 351094.

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

Terebra eskata is probably an extreme end member of the *T. waltonensis* group, in which the outline is less slender, the spiral sculpture is almost or entirely obsolete, even upon the base of the body, and the sulcus has become much enfeebled. It differs from *T. rapta* in that the sulcus overrides the axials instead of being restricted to the intercostal areas.

T. eskata has been tentatively referred to *Strioterebrum* because of its general resemblance to the end members of *T. waltonensis*. It differs from the normal representatives of the subgenus in the absence of spiral sculpture and in the nonplicate or obscurely monoplicate columella.

The species is not uncommon at the type locality, but it has not been definitely recognized elsewhere.

Occurrence: Shoal River formation, locality 3856[c].

Terebra (Strioterebrum) rabdota Gardner, n. sp.

Plate XXXVIII, figure 14

Shell moderately elevated, slender, acutely tapering, slightly pupiform. Whorls flattened laterally, probably as many as 15 in a perfect adult. Nucleus broken away in all available specimens. Presutural sulcus rather broad but shallow, gouging the intercostals but only feebly impressing the costals. Sutural band a little less than half as wide as the entire whorl. Axial sculpture dominating the spiral costae, 18 in the final whorl of the type, feebly arcuate, rising from a broad base to an acutely rounded summit, depressed at the sulcus but not dissected, persistent from suture to suture and well down toward the base of the body; intercostal areas broadly and obtusely V-shaped. Spirals feeble, a single faint striation upon the sutural band of the type and 4 broad but exceedingly low fillets in front of the sulcus upon the later whorls, with 3 additional fillets in the peripheral region of the ultima. Suture line impressed. Aperture rather narrow, angulated posteriorly. Outer lip feebly arcuate. Inner wall sharply constricted at the base of the body. Pillar short, smooth, its margin sharply rounded but not definitely plicate. Parietal wall heavily glazed. Siphonal fasciole very short, oblique, corrugated, sharply elevated at the posterior margin, cut off from the base of the body by a smoothly concave depression. Anterior canal very short, recurved, terminating in a broad and deep emargination.

Dimensions: Height, 18.5± millimeters; maximum diameter, 4.5 millimeters.

Holotype: U. S. Nat. Mus. No. 351096.

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

Terebra rabdota, probably another end member of the protean *T. waltonensis*, differs from the typical members of the subgenus in the nearly smooth columella. It varies to a certain extent in the degree of development of the spiral sculpture and in the impression of the sulcus. The number of costae may run as low as 14.

The description of *T. rabdota* suggests *T. langdoni* Dall much more strongly than the shell itself. It is less elevated than *T. langdoni*, relatively stouter, and inclined to be pupiform. The sulcus is wider and more squarely channeled and, as a rule, cuts more deeply into the costals. The costals are broader at the base but rather less acute upon the summits. The spirals are less regular, less sharply defined, and for the most part lower and broader. The body whorl is stouter, the constriction at the base more abrupt, the pillar shorter, and the parietal glaze heavier.

T. rabdota is rather rare, even in the Shoal River formation, the only horizon at which it has been recognized.

Occurrence: Shoal River formation, localities 3856[c], 3742[r], 7264[r].

Terebra (Strioterebrum) langdoni Dall

Plate XXXVIII, figure 15

1896. *Terebra (Acus) langdoni* Dall, U. S. Nat. Mus. Proc., vol. 18, p. 39.

1903. *Terebra (Oxymeris) langdoni* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, pl. 59, fig. 27.

Shell small, slender, of 13 whorls besides the nucleus, which is small, conical, and of 3 whorls; sculpture reticulated transversely by 16 low, narrow, rounded, slightly flexuous ribs, with wider interspaces, the posterior ends of the ribs not cut off by the deep sulcus which defines the sutural band in front; transverse sculpture of this sulcus visible between the ribs, and 4 flattish spirals, separated by narrower grooves, between the sulcus and the next suture, and 7 or 8 narrower spirals on the base; aperture longer than wide; pillar simple, smooth; canal rather long, twisted and recurved. Longitude, 20; maximum diameter, 4 millimeters.

Habitat: Chipola beds (2211, 2212, 2213), Calhoun County, Fla., Burns.

Type [holotype]: No. 113913, U. S. Nat. Mus.—Dall, 1896.

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

Terebra langdoni Dall is no less variable than most of the other members of this mutable genus. The young, as a rule, are relatively stout, but the general proportions of the adults are fairly constant. The axial sculpture dominates the spiral to a greater or less degree, but in number and character both the axials and the spirals show a bewildering variation. The axials range from about 14 to 20, and though usually narrow with rounded summits they may, as in the representatives from Alum Bluff, be broad at the base with sharply pinched summits. The spirals may appear as equisized and equispaced fillets separated by sharply incised channels, usually 4, or they may be reduced to very faint striations, as in the subspecies *perpunctata* Dall.

All the forms from the Chipola formation which have been referred to *T. bipartita* Sowerby are probably mutants of this species. Although the costals in *T. langdoni* are commonly depressed at the sulcus, they are not dissected as in the true *T. bipartita*. A more valuable and more sharply defined diagnostic is the absence of any plication upon the pillar in *T. langdoni*, in contrast to the biplicate pillar of *T. bipartita*. The

Chipola species is more slender and more evenly acuminate than *T. rabdota* from the Shoal River formation. The sculpture, particularly the spiral, is more sharply defined in *T. langdoni*, and the costals are less widely channeled by the presutural sulcus.

Terebra chipolana Dall, described from a unique type, seems to be nothing more than a young *T. langdoni* so badly worn that the ribs and all other raised sculpture have almost completely disappeared, leaving only the sutural band and presutural sulcus.

Occurrence: Chipola formation, localities ?7893^{r}, 2213^{c}, 2564^{p}, 3419^{c}, 7151^{r}, 2211^{c}, ?7468^{r}. Oak Grove sand, localities ?2646^{p}, ?5632^{p}.

Terebra (Strioterebrum) chipolana Dall

Plate XXXVIII, figure 16

1896. *Terebra (Acus) chipolana* Dall, U. S. Nat. Mus. Proc., vol. 18, p. 39.

1903. *Terebra chipolana* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, pl. 59, fig. 2.

Shell small, slender, obsoletely sculptured, with a pupoid nucleus of 4 whorls and about a dozen subsequent whorls, the earlier of which are slightly smaller than the last two nuclear turns; sides flattish, suture distinct; sutural band conspicuous, set off by a deep sulcus; the band is without nodules or marked sculpture, except on the last whorl; the whorls are feebly transversely wrinkled by obsolete riblets, which on the last whorl in the type specimen take a more definite shape but fade out on the periphery; spiral sculpture of obsolete grooves on the anterior half of the whorl, two of which on the base are more distinct than the others; aperture longer than wide; pillar simple, smooth, twisted, little recurved; siphonal fasciole with a sharp posterior keel. Longitude, 12; maximum diameter. 2.5 [2.8] millimeters.

Habitat: Chipola beds (2213). A single specimen (no. 113912) in the National Museum.

This little species is sufficiently unlike the others to require but little in the way of comparison. A dwarf *T. langdoni* var. *perpunctata*, with the ribs almost wholly obsolete and the sulcus continuous instead of broken into punctures, would be something like it.—Dall, 1896.

This unique type is apparently a young *T. langdoni* with the ribs, of which faint vestiges remain, planed off to the suture line.

Occurrence: Chipola formation, locality 2213^{r}.

Terebra (Strioterebrum) langdoni subsp. perpunctata Dall

Plate XXXVIII, figure 17

1896. *Terebra (Acus) langdoni* var. *perpunctata* Dall, U. S. Nat. Mus. Proc., vol. 18, p. 39.

Shell with the spiral sculpture replaced by fine spiral striae, obsolete or irregular, except the sulcus in front of the sutural band, which is represented between the ends of each pair of ribs near the suture by a deep, generally rounded puncture or pit. Found with the type in the Chipola beds.—Dall, 1896.

Holotype: U. S. Nat. Mus. No. 113911.

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

Shell small, slender, acuminate, of not far from 13 volutions. Protoconch apparently coiled four times, the initial whorl rounded and largely submerged, the succeeding volutions elevated and increasingly flattened laterally. Whorls of conch flattened, converging at an angle of 5° to 10° toward the acute apex. Body whorl smoothly but rather abruptly rounded at the base. Axial sculpture dominating the spiral; costals 16 in the type, rather broad at the base, sharply rounded upon the summit and little or not at all affected by the spirals or even by the presutural sulcus but, for the most part, uniform in strength from suture to suture and persistent upon the body to the posterior margin of the fasciole. Spiral sculpture very much subdued and in the apical region absent altogether. Sulcus reduced to a series of small but rather deep gouges in each of the intercostal areas upon the medial and posterior portion of the shell; spirals in front of the suture appearing as feebly incised grooves, usually 3 or 4. Aperture rudely lenticular, angulated posteriorly. Outer lip broadly and feebly arcuate, slightly constricted at the sulcus. Inner lip obliquely constricted at the base of the body. Pillar rather heavy but nonplicate, recurved anteriorly. Fasciole clearly defined, margined posteriorly by a sharply elevated keel, cut off from the base of the body by a smoothly concave depression upon which traces of the axial sculpture and fortuitous spirals occasionally persist. Parietal wall glazed. Terminal notch rather deep.

Dimensions: Height, 11.0 millimeters; maximum diameter, 2.7 millimeters. Dimensions of an imperfect adult, height, 17.5 millimeters; maximum diameter, 4.0 millimeters.

Occurrence: Chipola formation, locality 2213^{c}. Oak Grove sand, locality ?5632^{r}.

Terebra (Strioterebrum) rapta Gardner, n. sp.

Plate XXXVIII, figures 18, 19

Shell moderately large and slender, apical angle between 5° and 10°. Whorls probably 14 or 15 in the fully adult, increasing in size with approximate uniformity, less flattened laterally than in many members of the genus. Body whorl abruptly constricted at the base. Sculpture, with the exception of the sulcus, exclusively axial; costae narrow and sharply pinched, persisting from suture to suture with uniform strength and well down to the base of the body, very feebly arcuate, arranged for the most part in continuous series which perform a little less than half a volution around the axis of the shell; number of costae ranging from 14 to 24 (18 in the type); intercostal areas broadly concave on the later whorls, more sharply depressed on the earlier. Presutural sulcus reduced to a series of gouges in the intercostal areas, which macroscopically suggest a narrow threading directly in front of the suture. Entire surface covered with a microscopic crisscross of incrementals and spiral striae. Sutures impressed, undulated by the costae of the preceding

volution. Aperture narrow, sinuous. Outer lip slightly expanded medially, abruptly constricted anteriorly, angulated posteriorly. Labium excavated at the base of the body, reflected over the parietal wall and the short recurved pillar. Columella bearing a single obtuse fold, which evanesces before reaching the aperture. Siphonal fasciole short and narrow but clearly defined, rugose, keeled posteriorly and cut off from the base of the body by a smoothly concave area. Anterior canal short, recurved. Anterior emargination broad but not very deep.

Dimensions: Height, 18.5 millimeters; maximum diameter, 4.8 millimeters.

Holotype: U. S. Nat. Mus. No. 351099.

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

Terebra rapta is characterized by the tendency toward a feeble medial inflation of the later volutions, the absence of spiral sculpture other than the sulcus, and the restriction of even that to the intercostal areas.

Terebra rapta exhibits many of the subgeneric characters of *Fusoterebra*, but it has so much in common with *T. eskata*, which in turn is closely related to the typical *Strioterebrum waltonense*, that in spite of the absence of any macroscopic spiral sculpture, *T. rapta* has been assigned to the subgenus *Strioterebrum*.

From *Spineoterebra psilis* and all other members of the genus it differs in that the axials are uniform in strength between the sutures and are not raised anteriorly into more or less prominent knobs.

Occurrence: Shoal River formation, localities 3742[c], 3856[r].

Genus SPINEOTEREBRA Sacco

1891. I molluschi dei terreni terziarii del Piemonte e della Liguria, pt. 10, p. 58.

Monotype: *Terebra spinulosa* Doderlein. (A guide fossil of the Tortonian (middle Miocene) of the Piedmont).

Shell rather small, fusoid or subscalariform; sculpture dominantly axial, costae elevated into more or less prominent nodes in front of the suture, commonly simulating an obtuse shouldering; presutural sulcus greatly reduced or altogether absent; spiral sculpture absent or inconspicuous; columella nonplicate; siphonal fasciole together with the posterior keel commonly obscure.

This well-characterized genus has a meager representation in the Tertiary and Recent faunas.

Spineoterebra psilis (Dall)

Plate XXXVIII, figure 20

1900. *Terebra psilis* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 5, p. 1197, pl. 41, fig. 11. (No description.)

Shell rather small, slender, turriculate, probably, when perfect, of 13 or 14 volutions, which increase regularly in size. Axial costals slightly knobbed about one-third of the distance from the posterior to the anterior suture, thus simulating an oblique and obtuse tabulation. Ultima rudely trapezoidal behind the abrupt basal constriction. Axial sculpture dominating even the presutural sulcus; axials broadly /\-shaped, 11 on each of the later whorls of the spire, feebly arcuate, most evenly elevated in the apical region, on the medial and anterior portion, most prominent at the sulcus but not overridden by it; intercostals broadly concave, the maximum depression emphasized by a half obsolete groove. Sulcus visible only as a series of deep gouges in the intercostal areas, interrupted by the rounded eminence of the costae. Entire surface from apex to canal covered by a closely crowded, irregular striation and lineation which appears in the form of well-defined, flattened lirae only toward and upon the base of the pillar. Aperture narrow, the outer margin broken in all available specimens but probably symmetrically arcuate; inner margin abruptly constricted at the base of the body. Pillar short, recurved, the inner edge twisted but not raised into a definite fold. Fasciole clearly defined, incrementally wrinkled, cut off from the base of the body by a smoothly rounded concavity which is sculptured only by the growth lines and very rarely by exceedingly fine spiral striae. Parietal wall thinly glazed, posterior margin of fasciole sharply elevated, its extremity notched in harmony with the growth lines.

Dimensions: Height, 16.5 [17.2] millimeters; maximum diameter, 4.3 millimeters.

Holotype: U. S. Nat. Mus. No. 107389.

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

Spineoterebra psilis (Dall) is the only member of this well-characterized group that has been noted in the Alum Bluff.

Occurrence: Oak Groves and, localities 2646[p], 5632[r].

POSITION UNCERTAIN

Group of Terebra aulakoessa Gardner, n. sp.

Shell small, acuminate, uniformly tapering, not constricted at the suture; axial costae uniform in character over the entire surface; spiral sculpture altogether absent upon the earlier whorls, manifested in a feeble presutural depression upon the later; columella short, simple, feebly recurved, twisted but not definitely plicate.

The small imperfect specimen described below under the name *Terebra aulakoessa* is the only representative of an apparently undescribed group. It has much in common with *Diplomeriza* Dall,[6] typified by *Terebra duplicata* Lamarck from the Indo-Pacific, but the Recent species is very much larger, with a pronounced and sharply defined columellar plication and a decidedly longer anterior canal. No superspecific name can be founded on material so inadequate.

[6] Dall, W. H., Nautilus, vol. 33, p. 32, 1919.=*Duplicaria* Dall, Nautilus, vol. 21, pp. 124, 125, 1908; not *Duplicaria* Rafinesque, Atlantic Jour., 1833, p. 165.

Terebra aulakoessa Gardner, n. sp.

Plate XXXVIII, figures 21, 22

Shell small, slender, polished, regular in profile. Whorls probably 10 in the perfect adult, flattened trapezoidal, increasing uniformly in size. Body whorl smoothly rounded at the base. Spiral sculpture absent except for an impressed sulcus, which is exceedingly faint on the early whorls of the conch and which only very feebly depresses the costae upon the medial portion but broadens somewhat and obtusely dissects them on the later whorls. Costae 17 or 18 on the ultima and penult, narrow, pinched, feebly protractive, uniform in strength, continuous in direction between the sutures, offset at the sutures on the later whorls but not on the earlier, abruptly evanescent at the periphery of the body; intercostal areas smoothly concave. Sutures closely appressed. Aperture narrow, the outer margin imperfect. Inner lip sigmoidal, constricted at the base of the body, recurved anteriorly. A twist but no trace of any plication on the pillar. Parietal wall apparently free from glaze. Siphonal fasciole very feebly defined by the raised posterior margin and the shallow depression behind it.

Dimensions: Height, 8.7 millimeters; maximum diameter, 2.2 millimeters.

Holotype: U. S. Nat. Mus. No. 135962.

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

This small but very well characterized species is tentatively referred to *Terebra* until its affinities can be determined with more assurance. It is remarkable in that the sulcus is merely suggested until the third or fourth volution and becomes increasingly stronger toward the aperture.

Occurrence: Oak Grove sand, locality 2646[r].

Family TURRITIDAE

The family Turritidae has the well-merited reputation of being the most difficult of all the marine gastropods. Wide-ranging in time and space, interesting and decorative in form and color, they attracted the attention of the early mariners and collectors and were received into the literature in large numbers before the importance of adequate descriptions and exact localities was recognized. The successful treatments of the family are all limited to small areas and a relatively brief time, and it is not easy to correlate satisfactorily the superspecific groups in these distinct faunas.

The most promising investigation of the east-coast turritids from shallow and moderate depths was that of John B. Henderson. His major groupings were based upon the nuclear whorls. He studied and grouped with great care and with intelligence the specimens in the east-coast collections in the National Museum and in his own large collections. A remarkable correlation between the character of the nucleus and the nature of the environment, particularly the depth of the water, was taking shape when to the lasting misfortune of the malacological world Mr. Henderson died in January 1925.

The new turritids of the Puerto Rican deep recovered by the Johnson-Smithsonian Deep Sea Expedition have been described by the leader of the expedition, Dr. Paul Bartsch,[7] curator of the division of mollusks and Cenozoic invertebrates in the U. S. National Museum, and a forthcoming exhaustive study of the family by the same author has been announced. In the meantime, while awaiting the appearance of this monographic study, in the discussion and description of the Alum Bluff faunas, the old generalized names have been retained.

Genus POLYSTIRA Woodring

1928. *Polystira* Woodring, Miocene mollusks of Bowden, Jamaica, pt. 2: Carnegie Inst. Washington Pub. 385, p. 145.

1934. *Polystira* Bartsch, Smithsonian Misc. Coll., vol. 91, No. 2, p. 8.

Type (by original designation): *Pleurotoma albida* Woodring, not Perry = *Murex virgo* Wood. (Recent in the West Indies and off the coast of Florida.)

Shell relatively large, fusoid. Nucleus stout, cylindrical, consisting of almost two whorls, the last quarter whorl bearing a few axial riblets. Aperture narrow. Anterior canal long, narrow, unemarginate. Siphonal fasciole slightly or rather strongly inflated. Between it and the inner lip lies a narrow umbilical groove or a relatively wide umbilical opening. Anal sinus moderately deep, shaped like a V with a rounded apex, which lies on the peripheral keel. Interior of outer lip bearing far within aperture fine ridges or fluting. Sculpture consisting of spiral keels and threads, the peripheral keel strongest, and of strong growth threads.

This genus is the American tropical representative of the Indo-Pacific *Turris* ("Bolten") Roeding (Mus. Bolt., pt. 2, p. 123, 1798); type, by subsequent designation, Dall, U. S. Geol. Survey Prof. Paper 59, p. 24, end of first paragraph, 1909, *Murex babylonus* Gmelin (error for *babylonius*) = *Murex babylonius* Linné, Recent, Indo-Pacific), which also has the interior of the body whorl fluted. The sinus of *Turris* is deep and narrow and lies behind the peripheral keel on a flat band.

Polystira apparently does not extend back farther than lower Miocene time.—Woodring, 1928.

Polystira albidoides Gardner, n. sp.

Plate XXXVIII, figure 24

?1904. *Pleuroliria barretti* Casey, Acad. Sci. St. Louis Trans., vol. 14, No. 5, p. 132.

Not *Pleurotoma barretti* Guppy, Geol. Soc. London Quart. Jour., vol. 22, p. 290, pl. 17, fig. 6, 1866.

Shell slender, fusiform, the maximum diameter approximating the median horizontal. Whorls probably as many as 20 in all in a perfect adult, increasing regularly but rather slowly. Protoconch sharply differentiated, equaling in diameter the initial whorl of the conch; nucleus of about 1⅔ turns, the first whorl somewhat bulbous and immersed at the tip, rapidly

[7] Bartsch, Paul, New mollusks, of the family Turritidae: Smithsonian Misc. Coll., vol. 91, No. 2, pp. 1–29, pl. 1–8, 1934.

increasing in altitude; axial sculpture introduced within the last half turn, the striae 10, increasingly less feeble toward the conch. Line of demarcation between the conch and protoconch marked by the abrupt cessation of the axial ribbing and the equally abrupt initiation of 3 symmetrically spaced spiral lirae, the medial the strongest and the anterior a little more feeble than the posterior. Medial spiral growing increasingly prominent toward the aperture both absolutely and relatively, while the anterior becomes almost or quite as strong as the posterior primary upon the later turns; medial and anterior spirals becoming farther and farther removed from the anterior suture, so that in the adult a fourth primary is commonly introduced directly behind the suture; interspiral areas strongly concave and obliquely lineated, with strong incrementals, which are retractive behind the periphery and protractive in front of it; intercalaries rather feeble and irregular upon the later whorls, usually a rather strongly and finely nodulated thread between the suture and the posterior spiral, with a fortuitous finer threadlet in front of it; none to 5 lirae between the posterior and the peripheral spiral, none to 4 between the periphery and the primary in front of it, and a similar number between the third and fourth primaries or between the third primary and the suture; primaries upon the body 5 or 6, gradually decreasing in prominence in front of the periphery; 3 or 4 sharply defined secondaries usually developed at the base of the body, and upon the pillar 9 to 12 lirae with finer intercalaries which grow increasingly finer anteriorly. Anterior fasciole threaded with 6 obscure lirae. Suture lines concealed by the sculpture. Aperture narrow, a little less than half as high as the entire shell. Outer lip expanded and flaring incrementally from the suture to the base of the body. Posterior commissure rather sharp, the outer lip angulated at the posterior spiral. Siphonal notch profound, V-shaped, coincident with the peripheral spiral. Throat strongly lirate in harmony with the external sculpture. Parietal wall thinly glazed. Canal long, straight, with proximate parallel margins.

Dimensions: Height, 10.6 millimeters; height of aperture, 5.1 millimeters; maximum diameter, 3.5 millimeters.

Holotype: U. S. Nat. Mus. No. 113990. The holotype is, unfortunately, a juvenile, selected because it exhibits better than any of the adults the diagnostic characters of the protoconch.

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

Polystira albidoides has been confused with *Polystira virgo*, of the Recent fauna, a species which attains a higher altitude. (See pl. 38, fig. 23.) The general type of ornamentation is the same in both, but in the Miocene form the primary spirals are sharper and more clearly differentiated, and the secondaries are much less numerous and more feeble. In consequence the oblique striations of the interspiral areas are much more obvious in the earlier species. The differences in the conchs are, however, much less radical than in the protoconchs. In the Chipola form the protoconch is almost or quite as great in diameter as the initial whorl of the conch, and the axial sculpture is restricted to the last half turn. The protoconch of the Recent species is smaller, higher, and more tapering. The number of smooth turns is approximately the same in both species, but in *P. virgo* the axial ribbing is introduced before the beginning of the last complete volution instead of within the last half turn.

The species is abundant throughout the Chipola formation. The Alum Bluff forms run stouter than those from the Chipola River, but they agree in the characters of the protoconch and the details of the sculpture of the conch. The Bowden analog is much closer in nuclear characters to the Chipola form than to the Recent.

Occurrence: Chipola formation, localities, 2212[a], 2213[a], 2564[c], 3419[a], 2211[c].

Subgenus PLEUROLIRIA De Gregorio

1890. *Pleuroliria* De Gregorio, Monographie de la faune éocénique de l'Alabama, p. 38.

Type (by original designation): *Pleurotoma* (*Pleuroliria*) *supramirifica* De Gregorio = *P. cochlearis* Conrad pars. (Vicksburg Oligocene of Mississippi.)

The subgenus is characterized by the absence of axial sculpture, except for laminar incrementals, and by the presence of spiral carinae. The nuclear whorls are more numerous than in *Polystira* s. s. and the anterior canal shorter. Unlike *Polystira*, *Pleuroliria* is represented in the lower Tertiary. Possibly the rank of subgenus is excessive for this group.

Polystira (Pleuroliria) tenagos Gardner, n. sp.

Plate XXXVIII, figures 25, 26

Shell rather large and rather slender. Whorls probably about 18 in a complete adult. Nucleus small, acutely tapering, made up of 4 to 4¼ volutions; surface somewhat decorticated and sculpture obscured; earliest turn minute but broadly inflated, immersed at the tip; succeeding nuclear turns gradually increasing in diameter and flattening laterally; axial sculpture probably introduced near the beginning of the second volution, the axial riblets 17 or 18 upon the final nuclear whorl, feebly arcuate and persistent from suture to suture. Line of demarcation between the conch and protoconch marked by the abrupt disappearance of the axial sculpture and the equally abrupt appearance of a single prominent spiral liration slightly in front of the median line, which rapidly increases in prominence and becomes the periphery in the adult shell; a second less prominent spiral, appearing directly in front of the suture within the first half turn, gradually becoming

stronger and assuming a position about midway between the posterior suture and the peripheral spiral, which, however, it does not closely approach in prominence; a third spiral appearing directly behind the anterior suture near the end of the initial turn of the conch, gradually becoming stronger and retreating to a position midway between the periphery and the suture; intercalaries first introduced both in front of and behind the periphery upon the fourth whorl of the conch. Adult spiral sculpture consisting of a prominently elevated peripheral spiral a little behind the median line, flattened upon its summit, and commonly with two very fine threads upon the outer margins; the posterior primary a little more than halfway from the periphery to the posterior suture; primary in front of the periphery a little more remote and not quite so strong as the posterior primary; anterior suture revolving directly upon or directly in front of a primary similar in character to that behind it; interspiral areas quite strongly concave, threaded with 3 to 5 rather sharp secondary lirae, the one at the base of the depression usually stronger than those on either side; rarely more than 1 or 2 lirae between the posterior spiral and the suture. Incrementals very strong upon the early whorls of the conch but more feeble toward the aperture, developed only between the primaries and overridden by the secondaries, retractive in direction behind the periphery, protractive in front of it. Body sculpture of five primaries with intercalated secondaries; base of the body lirated with a thread similar in character to the primaries but less elevated and, in front of it, finer lirae, usually 3 or 4; pillar wound with 9 to 12 moderately elevated threads with finer threadlets intercalated. Anterior fasciole apparently smooth except for incrementals. Suture line distinct but very inconspicuous. Aperture very narrow, slightly expanded posteriorly. Outer lip also flaring incrementally, thin and feebly crenate at the margin and lirate within in harmony with the external sculpture, the lirae evanescing, however, before reaching the edge. Siphonal notch coincident with the periphery, moderately deep, broadly V-shaped. Parietal wall heavily glazed. Canal long, straight, with proximate parallel margins.

Dimensions: Height, 39.0± millimeters; altitude of aperture, 18.0± millimeters; maximum diameter, 12.0 millimeters. Perfect adults probably attained an altitude of approximately 70 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 351134.

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

Polystira (*Pleuroliria*) *tenagos* differs from the somewhat similarly sculptured *Polystira virgo* of the Recent fauna in the smaller, relatively higher, more acutely tapering, and more numerously coiled protoconch, the smaller conch, the tendency toward a relatively more elevated peripheral spiral, the more sharply differentiated primary and secondary sculpture, and the shorter anterior canal. From *P. albidoides* of the Chipola fauna it is separated by the nuclear characters, the relatively stronger peripheral spiral, which commonly carries two secondary lirae upon its margins, the finer and more numerous secondaries, the less prominent incrementals, and the shorter and more finely sculptured anterior canal.

Pleuroliria tenagos is the most abundant representative of the family at Shoal River.

Occurrence: Shoal River formation, localities 3856^{pr}, 2645^{p}, 3732^{r}, 3742^{a}, 3731^{c}, 5080^{r}, 3748^{r}, 5618^{r}.

Polystira (Pleuroliria) sp. aff. P. tenagos Gardner

The group is represented in the available material from Oak Grove by only four individuals. On one of them the nucleus is preserved, though in a badly mutilated condition. It suggests that of *P. tenagos* in outline and sculpture, though apparently it contains only 3 complete volutions. The Oak Grove conchs are all immature. They are more slender than *P. tenagos* of the same size, the peripheral spiral is less prominent, both absolutely and relatively, the posterior and anterior spirals are introduced earlier and are relatively more prominent, and the incremental furrows are deeper. It is probable that the species will prove closely allied to *P. tenagos* in the protoconchal characters, though more suggestive of *Polystira albidoides* in the characters of the conch.

A single indeterminable individual from the Chipola fauna is very close to the Oak Grove forms, although it is more slender and much less strongly sculptured incrementally.

Occurrence: Oak Grove sand, localities 5632^{r}, 5633^{r}

Genus HEMIPLEUROTOMA Cossmann

1889. *Hemipleurotoma* Cossmann, Catalogue illustré des coquilles fossiles de l' Éocène des environs de Paris, vol. 4, p. 264.

1896. *Hemipleurotoma* Cossmann, Essais de paléoconchologie comparée, pt. 2, p. 78.

Type (by original designation): *Pleurotoma archimedes* Bellardi. (Miocene of southern Europe.)

Shell small or of moderate dimensions, not very slender, the spire elevated, turreted, acutely tapering; protoconch small, acute, multispiral, the first whorl or two smooth, the two or three succeeding volutions axially ribbed; peripheral carina prominent, flattened, simple, duplex or complex, nodose; body whorl abruptly constricted into a long, rather straight, and rather slender canal; aperture pyriform; posterior sinus deep, coincident with the peripheral keel.

Hemipleurotoma may very well take subgeneric rank under *Gemmula* Weinkauff [8] or may even prove to be identical with it. The diagnostics of *Hemipleurotoma* have, however, been established with certainty from topotypic material, whereas the characters of the typical *Gemmula* are less assured.

[8] Weinkauff, H. C. von, Deutsche malakozool. Gesell. Jahrb., vol. 2, p. 287, 1875.

Peripheral nodules not exceeding 32; area between the posterior primary and the posterior suture smooth or feebly lirate. *Hemipleurotoma eileta* Gardner, n. sp.

Peripheral nodules exceeding 32; area between the posterior primary and the posterior suture bearing a single, sharply elevated secondary---*Hemipleurotoma bitropis* Gardner, n. sp.

Hemipleurotoma eileta Gardner, n. sp.

Plate XXXVIII, figures 27, 28

Shell of moderate size for the genus, not very slender, the maximum diameter falling well in front of the median line. Whorls probably about 14 in all in the perfect adult. Nucleus small, acutely tapering, of 4 component volutions; initial turn smooth and rather low, broadly rounded; second turn higher, the convexity symmetrical and increasingly strong toward the conch, so that the final whorl of the protoconch suggests an *Epitonium* volution in outline as well as in the axial sculpture of very narrow, sharply pinched axial riblets. Line of demarcation between conch and protoconch less sharp than in many of the group, indicated by the abrupt disappearance of the axials from the posterior portion of the whorl and their gradual evanescence from the anterior and by the gradual initiation of a peripheral band which later is differentiated into two equal lirations separated by an interspiral of approximately the same width; band becoming increasingly prominent and crowning the periphery of the adult whorls; marginal lirae broadening and more or less completely fusing on the later volutions. Axials manifested in the adult stage only in the sharp peripheral nodulations, 25 to 30 in the later turns. Posterior spiral introduced within the first turn of the conch and becoming increasingly sharp and more elevated, not affected by the axial sculpture, not even by the incrementals; a very much less prominent thread intercalated midway between the periphery and the forward suture; 3 fine, secondary threadlets with a few tertiaries gradually introduced—the anterior the earliest—between the periphery and the posterior primary. Body sculptured in front of the periphery with 3 primaries separated by much wider and very finely lirate interspirals, with a less elevated spiral upon the base. Pillar threaded with about 10 lirae and in places intercalaries and 6 additional threadlets upon the siphonal fasciole. Aperture expanded posteriorly. Outer lip flaring both incrementally and away from the axis. Posterior siphonal notch coincident with the periphery, profound, broadly U-shaped. Throat sharply lirate in harmony with the external sculpture, the lirae abruptly evanescent, however, at some distance from the outer margin. Parietal wall heavily glazed. Canal rather short, straight, with parallel proximate margins.

Dimensions: Height, 25.0± millimeters; length of aperture, 10.0± millimeters; maximum diameter, 8.6 millimeters.

Holotype: U. S. Nat. Mus. No. 351142.

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

Hemipleurotoma eileta is readily separable from *Pleuroliria tenagos*, the only other species which exceeds it in abundance in the Shoal River fauna, by the smaller size, shorter anterior canal, and nodular periphery. It is larger than *H. bitropis*, less compact, and more obtusely sculptured. The posterior spiral is relatively less prominent and more remote from the periphery. The periphery is less sharply and less closely nodulated, and the marginal lirae upon it are commonly completely fused on the adult shell. The secondaries are much less sharp, and threadlike tertiaries are commonly present, but there is no threadlet developed behind the posterior spiral as in *H. bitropis*. The incremental sculpture of *H. eileta* is much finer and does not sharply sulcate the surface behind the periphery.

Hemipleurotoma eileta is closely related to *H. pontonensis* (Dall), from the Dominican Republic, a somewhat more slender species with a longer anterior canal, rather less numerous and more elevated peripheral nodes, and more prominent spiral lirae behind the periphery. *H. pontonensis* has also been reported from the Panama region.

Pleurotoma (Gemmula) vaningeni Brown and Pilsbry, from the Gatun formation of the Panama Canal Zone, differs only in sculpture detail. The peripheral axials are more conspicuously tuberculate, especially on the earlier whorls, and rather more numerous, and the spiral lirae are coarser and sharper. These differences are most obvious upon the whorls of the spire where the sculpture of *H. eileta* is characteristically lacking in uniformity.

Another species, obviously related closely to *H. eileta*, is *Turris brassoensis* Mansfield, a middle Miocene form from Trinidad. The distribution of these three species, one characteristic of the Shoal River, another from Ponton, Dominican Republic, and the third from the Brasso beds of Trinidad, is not without stratigraphic significance.

Occurrence: Shoal River formation, localities 3856[a], 3732[r], 3742[e], 3731[r], 5080[r], 5618[p].

Hemipleurotoma bitropis Gardner, n. sp.

Plate XXXVIII, figure 29

Shell rather small for the group but rather solid. Whorls probably about 12 in a perfect adult, regularly increasing in size. Nucleus decorticated but apparently similar in general characters to that of *H. eileta*, small, acutely tapering, of about 4 volutions, the last 2 or more ribbed with very narrow, pinched axials. Spiral sculpture initiated in much the same manner as in *H. eileta;* adult sculpture similar in general characters but distinct in details; peripheral band broad, located about two-thirds the distance from the posterior to the anterior suture; margins of band outlined by two well-defined spiral lirae which rarely fuse even in the adult;

nodules from 35 to 40, fine and crowded; posterior spiral as elevated as the keel, though much narrower and simple; anterior spiral very low and directly behind the suture line; one and on the later whorls two sharp lirae developed on the oblique shoulder between the posterior primary and the suture; area between the periphery and the posterior primary sharply concave; a single secondary developed on the posterior slope and two upon the anterior; a similar threadlet directly in front of the base of the peripheral band and separated from the spiral which outlines the suture by a smoothly concave area in which the incremental sculpture is very feeble. Incrementals very prominent and retractive behind the periphery, minutely crenulating the secondary threadlets but not affecting the posterior primary, much less prominent and protractive in front of the periphery. Body in front of the periphery sculptured with four simple spirals, which decrease gradually in prominence anteriorly. Pillar lirate, the lirae increasingly fine and crowded toward the anterior extremity. Aperture less than half as high as the entire shell, rather narrow, expanding posteriorly. Outer lip thin, sharp, flaring incrementally; broadly and deeply sinuate. Posterior siphonal notch deep following the peripheral band; peripheral lirae developed well within the margin of the outer lip. Parietal wall smooth, thinly glazed. Canal straight, moderately long, with proximate parallel margins.

Dimensions: Height, 19.0± millimeters; length of aperture, 8.0 millimeters; maximum diameter, 6.0± millimeters.

Holotype: U. S. Nat. Mus. No. 371056.

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

Hemipleurotoma bitropis suggests a very finely and closely sculptured *H. eileta*. They both possess a broad, nodose, peripheral band; a prominent posterior spiral; a rather prominent anterior spiral with intercalated secondaries; and incremental sculpture of more or less consequence. *H. bitropis* is smaller, however, and more closely and elaborately sculptured. The peripheral band is more finely and more sharply nodulated; the marginal lirae are rarely fused completely, even in the adult; the posterior primary is almost or quite as elevated as the periphery in front of it; the secondaries are fine but very sharp and are developed behind the posterior primary as well as in front of it. The incremental sulci are rather irregular but sharply incised.

The species has been recognized only at the type locality, but it is not uncommon there. Its resemblance to *Turris brassoensis* Mansfield from the Brasso clays of Trinidad is sufficiently close to be of stratigraphic significance.

Occurrence: Shoal River formation, locality 3856[p].

The four succeeding species were formerly included under *Surcula*, a group differing from the old *Turris* by the placing of the posterior siphonal notch upon the fasciole rather than upon the peripheral keel and from the old *Drillia* by the longer anterior canal.

Genus FUSITURRICULA Woodring

1928. *Fusiturricula* Woodring, Miocene mollusks from Bowden, Jamaica, pt. 2; Carnegie Inst. Washington Pub. 385, pp. 165–166.

Type (by original designation): *Turris* (*Surcula*) *fusinella* Dall. (Recent in the Gulf of Panama.)

Shell small or medium-sized, slender, "*Fusus*"-like. Nucleus smooth, consisting of a few whorls, slender or stout, in the type species slender and consisting of almost 3 uniformly enlarging whorls. Aperture narrow. Anterior canal long, narrow, slightly curved, expanded at base, unemarginate. Anal sinus wide, moderately deep, adjoining suture. Outer lip extending far forward. Sculpture consisting of swollen axial ribs, overridden by spiral threads. Anal fasciole flat or concave.

The aperture of the only specimen of the type species is imperfect, and the above description is based partly on "*Turris* (*Surcula*)" *armilda* Dall, a living species from the Pacific coast of Mexico, which would have been taken as the type, but no specimens have a perfect nucleus.

The "*Fusus*"-like shape and sculpture are striking features of this genus. All the fossil specimens examined have imperfect apertures, but the growth lines show that the outer lip extends far forward. * * *

Fusiturricula is represented by Miocene species in the West Indian region but now is no longer found there. In company with many other West Indian Miocene genera it is now living in the Panamic and Mazatlanic regions. In the Eocene and Oligocene deposits of southeastern United States it is replaced by *Pleurofusia* De Gregorio (Mon. Faune éoc. l'Alabama, pp. 33–34, 1890; type, by original designation, *Pleurotoma* (*Pleurofusia*) *longirostropis* De Gregorio, Eocene, Alabama). No specimens of *longirostropis* are in the collections of the United States National Museum from Claiborne, specimens so labeled representing a short-canaled "*Drillia*"-like turrid with fusoid sculpture. De Gregorio's figure shows that *longirostropis* is quite small and has a canal of moderate length. It seems probable that *Pleurotoma servata* Conrad, a larger species from the upper Oligocene Byram marl of Mississippi, represents *Pleurofusia*. This species has a conical nucleus of more than 4 whorls that enlarge very rapidly from the minute apical whorl. It is assumed that this nucleus represents the nucleus of *Pleurofusia*, and, although *servata* in other features can hardly be distinguished from the species of *Fusiturricula*, the difference in nuclear characters seems to be fundamental enough to assign generic rank to it.—Woodring, 1928.

Altitude of adult shell exceeding 18 millimeters; axials not exceeding 12 on the later whorls; spirals not uniform in size in front of the fasciole.. *Fusiturricula paraservata* Gardner, n.sp.

Altitude of adult shell not exceeding 18 millimeters; axials exceeding 12 on the later whorls; spirals uniform in size and spacing in front of the fasciole.

Fusiturricula glaphura Gardner, n. sp.

Fusiturricula paraservata Gardner, n. sp.

Plate XXXVIII, figures 30, 31

Shell moderately large, slender, *Fusus*-like in outline and in general aspect. Whorls approximately 10. Nucleus large and well elevated, coiled between 2½ and 2¾ times; first half of three-quarter turn largely submerged, the two succeeding volutions erect, ele-

vated, the earlier the more inflated but of approximately the same diameter as the later turn. Line of demarcation between conch and protoconch sinuous, rather obscure; a couple of feeble and irregular axial wrinkles on the last quarter turn of the protoconch; spiral sculpture initiated at the beginning of the conch in the form of exceedingly faint sulci, 2 or 3 on the posterior portion of the whorl, that directly in front of the suture line the least feeble; true axials introduced within the first quarter turn of the conch, rather broad, rounded, slightly protractive, strongest medially, evanescent posteriorly; a low, broad peripheral cord gradually established within the last half of the first conchal turn and another, similar to it, halfway between the periphery and the anterior suture. General features of adult form and sculpture established within the first 4 whorls. Outline of adult whorls modified by very prominent undulatory axial ribs, most elevated peripherally, evanescent posteriorly but persistent to the anterior suture and well down upon the base of the body, 10 upon the later adult turns. Spiral sculpture absent for the most part upon the fasciole but well developed in front of it; primaries cordate, equally prominent upon the costal and intercostal areas, 2 or 3 upon the medial whorls, 4 or even 5 upon the later, and 7 upon the body, separated by wider interspaces in which fortuitous secondaries are in places introduced upon the spire and regularly upon the body of the adult; pillar evenly lirate, the anterior fasciole closely threaded with much finer and sharper lirae; posterior fasciole between one-third and one-half as wide as the whorl, obscurely undulated by the axials, smooth or with 3 or 4 very fine and faint lirae on the anterior portion. Incremental sculpture unusually feeble. Margin raised directly in front of the suture, very closely appressed and undulated by the axials of the preceding volution in a manner common among some of the Fusidae and the Muricidae but extremely rare among the turritids. Aperture narrowly pyriform, rather abruptly constricted at the base of the body; outer lip expanded, simple within. Siphonal notch broad, moderately deep, symmetrically placed between the periphery and the suture. Inner margin of aperture gently concave, nonplicate. Parietal wall smoothly glazed. Anterior canal rather long, slender, almost straight, with parallel proximate margins.

Dimensions of immature individual: Height, 27.8 millimeters; maximum diameter, 9.6 millimeters. The adults are all in such bad shape that an immature form has been selected for figuring.

Holotype: U. S. Nat. Mus. No. 328487.

Paratype (protoconch): U. S. Nat. Mus. No. 328488.

Type locality: No. 3419, McClelland farm, 1 mile below Baileys Ferry, Calhoun County, Fla.

The Vicksburg *servata* with which this species has been confused in the synonymies is smaller, with distinct nuclear characters, less elevated and less undulatory axials, and a very fine and regular spiral threading upon the posterior fasciole and the spaces between the primaries. The Ballast Point specimens are probably distinct from both the Vicksburg and the Chipola. It is very difficult at first or even second glance to believe that this species is not a *Fusinus*. In outline, in the close appression of the whorls, and in the elevated, broadly undulating axials it is readily duplicated among the Fusidae, notably in *Fusinus*, but rarely among the Turritidae. The diagnostic character—the deep posterior sinus—is usually inconspicuous. The margin of the outer lip is rarely preserved intact, and the traces of the former extension of the sinus left in the incremental sculpture are unusually feeble.

The species is restricted in its known distribution to the Chipola fauna.

Occurrence: Chipola formation, localities 2213^{c}, 2564^{p}, 3419^{p}.

Fusiturricula? glaphura Gardner, n. sp.

Plate XXXVIII, figures 32, 33

Shell, small, highly polished, fusiform, acutely tapering posteriorly, the body whorl abruptly constricted and terminating in a moderately long anterior canal. Protoconch small but elevated, smooth, highly polished; initial whorl largely submerged; second turn inflated near its beginning, becoming increasingly flattened laterally. Line of demarcation between conch and protoconch more or less irregular, as a rule marked by an abrupt change in the texture and color of the shell and by the gradual introduction of protractive axial costae, evanescent posteriorly, and by the elevation of the margin of the whorl directly in front of the suture. General characters of adult sculpture established within the first three turns of the conch; whorl becoming obliquely shouldered or feebly concave on the posterior third or half, closely appressed in front of the suture. Axials broad, rounded, undulatory, feebly protractive, separated by intercostals of equal width or a little narrower, 11 to 13 on the earlier whorls, increasing to 15 or 16 on the later, persisting from the periphery to the anterior suture but almost or entirely obsolete behind the periphery and upon the base of the body. Spiral sculpture less prominent than the axial; spirals very low and straplike, restricted like the axials to the area between the periphery and the anterior suture, normally 4 upon the medial and later volutions, commonly with secondaries regularly intercalated upon the final whorls of the adult, which may approximate the primaries in width and elevation; base of body whorl and pillar closely and evenly lirated; area behind the periphery usually grooved with 4 incised lines, those in the maximum area of depression broadest and deepest; growth lines distinct upon the fasciole but obscured elsewhere by the heavier

sculpture. Suture lines impressed, well defined. Aperture narrowly pyriform, almost half as high as the entire shell. Outer lip thin, sharp, not lirate within. Inner margin of the aperture smoothly excavated at the base of the pillar, nonplicate. Parietal wall evenly glazed. Posterior siphonal notch deep, broadly U-shaped, symmetrically placed between the periphery and the suture. Anterior canal rather long, not very narrow, slightly flexed near its extremity.

Dimensions: Height of figured conch with tip, 12.0 millimeters; maximum diameter, 4.4 millimeters.

Cotypes (two): U. S. Nat. Mus. No. 351154.

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

All the specimens examined are rather dark gray and highly polished. These features, due possibly to the chemical composition, together with the closely appressed whorls, the short oblique ribs, and low flattened spirals, seem to isolate the species. The greatest variation is in the spiral sculpture upon the fasciole. In some individuals it is entirely absent; usually there are about 3 shallow sulci, least shallow a little in front of the suture but in some shells so deep and so wide that the interareas appear as moderately elevated, flat-topped lirae. The species is fairly common at and near the type locality.

The assignment of this species to *Fusiturricula* is made without conviction. The protoconch is smaller and more acute than that of *F. paraservata*, the conch is much smaller, and the axials, both nuclear and conchal, are more numerous and much more oblique and do not intrude upon the fasciole.

Occurence: Shoal River formation, localities, 3856[c], 3742[c].

Genus KNEFASTIA Dall

1919. *Knefastia* Dall, U. S. Nat. Mus. Proc., vol. 56, no. 2288, p. 3, a subgenus of *Turricula*.

Type (by original designation): *Pleurotoma olivacea* Sowerby, 1833; not Reeve, 1843. (Recent on the west coast from the Gulf of California to Panama.)

Shell slender, biconic, of moderate dimensions; protoconch large, obtuse, paucispiral, the axial sculpture little or not at all developed and restricted to the final nuclear turn; sculpture dominantly spiral, the peripheral cords strong and carinating the whorl; periphery fluted in the typical species by axial depressions, indicated on the early whorls of the conch by a crenulation of the peripheral spiral; body rather sharply constricted into a slender canal; aperture narrow, pyriform; posterior siphonal notch very deep and narrow, U-shaped, with parallel margins, placed midway between the periphery and the suture.

The pie-crust fluting of the periphery in this group is very characteristic. The genus is rather widely though not abundantly represented in the West Indian Miocene and is another bond between the Caribbean and Floridian faunas.

Axial costae feebly developed on the early whorls of the conch, evanescent upon the later--- *Knefastia glypta* Gardner, n. sp.
Axial costae not developed on any part of the shell.
Knefastia? waltonia Gardner, n. sp.

Knefastia glypta Gardner, n. sp.

Plate XXXVIII, figure 34

Shell of moderate size, slender, fusiform. Aperture a little less than half as high as the entire shell. Whorls approximately 11 in the adult, increasing regularly in size. Protoconch obtuse and rather elevated, thrice coiled; initial volution smooth, polished, largely submerged; succeeding turn inflated but gradually flattening away from the apex; final turn of the protoconch compressed laterally, sculptured with crowded asymmetrically arcuate axial riblets, about 20 to the whorl, extending from the posterior suture to the periphery, which is cut off from the anterior suture by a rather deep linear channel. Beginning of conch marked by the initiation of 5 spiral lirae, the posterior of which is the broadest, and the anterior, which outlines the periphery, the most elevated. Sculpture modified on the later volutions by the increasing prominence of the peripheral spiral and that directly behind it, the intercalation of secondaries, and the development of undulatory axials 8 to 10 to the whorl, which are indicated chiefly in the crenulation of the peripheral spirals; periphery of antepenult situated a little more than one-third of the distance across from the anterior to the posterior suture, outlined by a simple elevated spiral cord; a second spiral of similar character and almost equal elevation a short distance behind it, the two separated from one another by a shallow interspace in which a medial secondary and two microscopically fine tertiaries are symmetrically intercalated; both of the peripheral spirals broadly and regularly scalloped by the axial undulations; area between the posterior peripheral primary and the posterior suture feebly concave, lirated with a strongly elevated primary directly in front of the suture and 3 equal and closely spaced secondaries between the posterior primary and the posterior peripheral spiral; a microscopically fine tertiary in some specimens introduced directly behind the periphery; a strong secondary and two or more tertiaries usually developed between the anterior peripheral spiral and the spiral upon which the suture revolves. Body whorl in front of the periphery lirated to the anterior siphonal fasciole with about 12 elevated cords, regular in size and spacing, becoming increasingly less prominent and less distant anteriorly, with 2 to 4 threadlets intercalated between each pair, the medial thread usually the least feeble. Anterior fasciole also obscurely threaded. Suture line very inconspicuous. Aperture mutilated in all available specimens, narrowly pyriform, expanding slightly posteriorly. Outer lip widely flaring incrementally, narrowly but deeply sinuated in front of the anterior primary, distantly lirated

within; the lirae not persistent to the margin. Parietal wall thinly glazed, not entirely concealing the lirae upon the base of the body and the pillar, which continue far within the aperture. Anterior canal short, recurved, with parallel proximate margins.

Dimensions: Height, 25.3 millimeters; maximum diameter, 8.0 millimeters.

Holotype: U. S. Nat. Mus. No. 328484.

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

Knefastia glypta is certainly more suggestive in general aspect of *Fusinus* than of the genus to which it has been assigned. Not only the slender fusiform outline but the close though uneven spiral threading and the ill-defined, broadly undulatory character of the axial sculpture are more common to *Fusinus* than to the turritids. However, the diagnostic feature which allies it to the turritids—the deep sinus between the posterior suture and the periphery of the whorl—is unmistakably present.

Knefastia glypta has no near kin in the Alum Bluff faunas, but the resemblance in contour and sculpture to *"Drillia" fusinus* Brown and Pilsbry, of the Gatun beds, is very striking. The differences in the details of the sculpture, however, seem to be constant and of systematic value. A fragment of a *Knefastia* apparently allied to *K. glypta* occurs in the Alum Bluff deposits in Decatur County, Ga. It is larger and stouter, however, and differs in the details of the spiral sculpture, though the axial sculpture, as in *K. glypta*, is restricted to the early whorls.

Occurrence: Chipola formation, localities 2564[r], 3419[r].

Knefastia? waltonia Gardner, n. sp.

Plate XXXVIII, figures 35, 36, 37

Shell of moderate size for the genus, fusiform, the maximum diameter in front of the median horizontal. Aperture approximately half the total altitude. Whorls about 11. Nucleus small but rather high, twice coiled; initial turn erect, submerged only at the extreme tip, slightly bulbous; succeeding volution high, increasingly compressed laterally. Line of demarcation between conch and protoconch defined by the initiation of a faint peripheral ridge a little in front of the median line of the whorl—a ridge which becomes increasingly prominent and near the end of the first whorl of the conch is defined by a faint sulcus and threadlet behind it· a feeble spiral also introduced near the end of the first whorl directly behind the anterior suture line and within half a turn, another directly in front of the posterior suture, neither one of them attaining any prominence. Adult whorls bicarinate, the spiral directly behind the periphery increasing in strength until it is almost or quite as elevated as the peripheral keel, from which it is separated by a rather narrow, concave interspiral area, sculptured with protractive incrementals and in places a fortuitous spiral threadlet; area between the suture and the posterior keel strongly concave, sculptured with 2 faint spirals, both of them introduced near the beginning of the conch, the one a little in front of the suture, the other at an equal distance behind the posterior carina, and between them a smoothly concave interspace striated with strongly and symmetrically arcuate incrementals and a few very faint spiral lirae; microscopic spirals also present directly in front of the posterior suture and on the concave space between the anterior keel and the anterior suture; two additional primaries equal in prominence and spacing to the carinal spirals, upon the body, and about 12 similar primaries, regularly spaced and gradually decreasing in size anteriorly, upon the very base of the body and the pillar; secondaries intercalated on the pillar, in some specimens as many as 3 between a single pair of primaries, and a very fine threading upon the fasciole. Suture line distinct but inconspicuous, overhung by the periphery. Aperture pyriform, abruptly expanding posteriorly. Siphonal notch placed midway between the posterior carina and the suture line, U-shaped, with parallel sides, the anterior limb more produced than the posterior. Parietal wall thinly glazed. Anterior canal long, very slightly curved, with proximate parallel margins.

Dimensions: Height, 38.0± millimeters; maximum diameter, 11.4 millimeters.

Holotype: U. S. Nat. Mus. No. 351151; paratype (protoconch), U. S. Nat. Mus. No. 351153.

Type locality: Holotype No. 3732, Adams Mill Creek, Walton County, Fla. Paratype, No. 3856, 5 to 6 miles northwest of Mossyhead, Walton County, Fla.

Specimen figured to show posterior siphonal notch, U. S. Nat. Mus. No. 135939, from No. 2645, Shell Bluff, Shoal River, Walton County, Fla.

The most conspicuous character of the genus—the peripheral fluting—may be faintly suggested in this species, but it certainly is not obvious. The similarity in the protoconchs and the fasciole, however, indicates a rather close relationship to *K. glypta*, and for that reason *waltonia* has been tentatively placed under *Knefastia*.

No species similar to *Knefastia? waltonia* is known in the Alum Bluff faunas. Its most diagnostic characters are perhaps the smoothly concave outline of the posterior portion of the whorl, the absence of any conspicuous sculpture upon the spire except the carinal spirals, the strongly but distantly lirated body, and the profound siphonal sinus.

The species is rare at the few localities at which it occurs.

Occurrence: Shoal River formation, localities 3856[r], 2645[r], 3732[r], 3742[r].

"DRILLIA"

Though the necessity and desirability of large numbers of new generic names for the conglomerate collection formerly included under "*Drillia*" are recognized, some concession may be made to those who think in terms of the old and long-familiar classifications. Certainly the "drill-shells" of popular parlance possessed common characters—a solid, small but not minute, generally rather stout operculate shell with a large body whorl, short, broad anterior canal, well-developed sculpture, usually both axial and spiral, a posterior fasciole usually well defined with the sinus on the fasciole and not on the keel as it is in *Turris*. The protoconchs show considerable variation, and these are doubtless fundamental differences.

The old name *Drillia* would cover 39 species of the Alum Bluff fauna. These fall into three well-defined groups. In the first group the protoconch is smooth and the conch both axially and spirally sculptured. In the second group also the protoconch is smooth and an axial sculpture is developed, but the spiral sculpture is very feeble or absent altogether. In the third group either an axial or an axial and spiral sculpture is developed upon the protoconch and both an axial and a spiral sculpture upon the conch. Variations in the characters of the aperture are correlative with those of the protoconch and the adult sculpture. The best representation is in the Chipola and Shoal River faunas, the number of species running higher in the Chipola, the number of individuals higher in the Shoal River. The relatively meager representation in the Oak Grove fauna is rather marked. The first group is best developed in the Chipola fauna. Out of the 24 species in this group 16 are present at that horizon, and all of them are peculiar to it; 6 of the remaining 8 are peculiar to the Oak Grove fauna; and only 2—both of them rather abundant—have been reported from the Shoal River fauna. Of the 6 species in the second group, characterized by a smooth protoconch and the absence of a well-developed spiral sculpture upon the conch, 3 are restricted to the Chipola fauna, 1 to the Oak Grove, and the other 2 to the Shoal River, where *D. rabdotacona* is very abundant. The third group, characterized by the sculptured protoconch, is peculiarly characteristic of the Shoal River fauna. Of the 9 species in this group 6 are restricted to it, and all but one of them are more or less common. The Chipola fauna contains only 2 and the Oak Grove a single representative. None of the 39 species has been reported from more than one horizon.

Protoconch entirely smooth:[9]
- External surface sculptured with more or less elevated axials and raised spirals:
  - Outline rudely biconic, posterior fasciole very wide, more than half the altitude of the entire whorl, steeply sloping or feebly concave ..... *Crassispira boadicea* (Dall).
  - Spire more or less conspicuously elevated, posterior fasciole less than half the altitude of the entire whorl:
    - Altitude of adult shell exceeding 30 millimeters ..... *Crassispira meunieri* (Maury).
    - Altitude of adult shell not exceeding 30 millimeters:
      - Axial costae narrow, more or less acute, and flexuous upon the body:
        - Final volution regularly coiled:
          - Axials exceeding 18 upon the later volutions:
            - Axials exceeding 21 upon the body whorl:
              - Shell relatively stout ..... *Crassispira calligona* (Maury).
              - Shell slender ..... *Crassispira calligona paraconsors* Gardner, n. subsp.?
            - Axials not exceeding 21 upon the body whorl ..... *Crassispira calligonoides* Gardner, n. sp.
          - Axials not exceeding 18 upon the later volutions:
            - Axials most prominent at the periphery:
              - Axials usually 13 to 15 upon the later volutions; primary spirals usually 5 or 6 upon the penult ..... *Clavatula panopla* Gardner, n. sp.
              - Axials approximately 12 upon the later volutions; primary spirals usually 3 or 4 upon the penult ..... *Clavatula kalliglypta* Gardner, n. sp.
            - Axials uniform in prominence between the periphery and the anterior suture:
              - Spiral sculpture of low, flattened cords or fillets:
                - Shell usually rather stout, the spire relatively low, as a rule, and not sharply constricted at the fasciole:
                  - Posterior fasciole obscurely delimited, lirate:
                    - Spirals fine, approximately 7 in front of the fasciole of the penult. *Clavatula grabaui* (Maury).
                    - Spirals coarse, approximately 4 in front of the fasciole of the penult. *Clavatula apoia* Gardner, n. sp.
                  - Posterior fasciole sharply delimited, smooth ..... *Clavatula polyploka* Gardner, n. sp.
                - Spire elevated, sharply constricted at the fasciole:
                  - Spirals in front of the posterior fasciole exceeding 4 ..... *Clavatula vandenbroecki* (Maury).

[9] Protoconch not definitely known in "*Drillia*" *meunieri*, "*D.*" *grabaui*, and "*D.*" *proebenina*.

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Protoconch entirely smooth—Continued.
External surface sculptured with more or less elevated axials and raised spirals—Continued.
Spire more or less conspicuously elevated, posterior fasciole less than half the altitude of the entire whorl—Continued.
Altitude of adult shell not exceeding 30 milimeters—Continued.
Axial costae narrow, more or less acute, and flexuous upon the body—Continued.
Final volution regularly coiled—Continued.
Axials not exceeding 18 upon later volutions—Continued.
Axials uniform in prominence between the periphery and the anterior suture—Continued.
Spiral sculpture of low, flattened cords or fillets—Continued
Spire elevated, sharply constricted at the fasciole—Continued.
Spirals in front of the posterior fasciole not exceeding 4:
Shell small, slender, altitude not exceeding13.5 millimeters.
Clavatula habra Gardner, n. sp.
Shell moderately stout, altitude of adult exceeding 13.5 millimeters·
Protoconch twice coiled, axials usually 14 upon the penult.
Clavatula eleutheria Gardner, n. sp.
Protoconch thrice coiled, axials usually 13 upon the penult.
Clavatula compsa Gardner, n. sp
Spiral sculpture of more or less elevated lirae:
Spirals in front of the posterior fasciole of the penult not exceeding 4:
Axials exceeding 9:
Axials persistent to the posterior suture:
Axials usually exceeding 10; spiral sculpture faint but constant.
"Drillia" coryphodes Gardner, n. sp.
Axials rarely exceeding 10; spiral sculpture inconstant.
"Drillia" prion paraprion Gardner, n. subsp.
Axials evanescent at the posterior fasciole:
Protoconch twice coiled; axials usually 14 upon the penult.
Clavatula eleutheria Gardner, n. sp.
Protoconch thrice coiled; axials usually 13 upon the penult.
Clavatula compsa Gardner, n. sp.
Axials not exceeding 9——*Clavatula elatocompsa* Gardner, n. sp.
Spirals in front of the posterior fasciole of the penult exceeding 4:
Posterior fasciole obscurely defined——*"Drillia" coryphodes* Gardner, n. sp.
Posterior fasciole clearly defined, axials more than 10 upon the penult:
Protoconch twice coiled, posterior cord sharply defined:
Axials usually less than 14 upon the penult, spirals usually more than 7.
Clavatula euparypha Gardner, n. sp.
Axials usually more than 14 upon the penult; spirals rarely more than 7.
Clavatula anthera Gardner, n. sp.
Protoconch more than twice coiled, posterior cord not sharply defined.
Clavatula libertalis Gardner, n. sp
Final volution irregularly coiled; shell unduly constricted at the base of the penult; ultima produced backward near the aperture——*Clavatula proebenina* Gardner, n. sp.
Axial costae broadly undulatory, usually 6 or 7 upon the later volutions——*Carinodrillia cymatoides* Gardner, n. sp.
External surface sculptured with more or less elevated axials and spiral sulci:
Whorls convex; axials not varicose upon the spire, persistent across the fasciole——*Agladrillia aulakoessa* Gardner, n. sp.
Whorls more or less flattened laterally; axials not persistent across the fasciole:
No varices developed on the later volutions; subsutural band spirally sulcate——*Agladrillia dryados* (Maury).
One or more varices developed on each of the later volutions; subsutural band not spirally sulcate:
Posterior fasciole delimited by impressed sulci——*Agladrillia subvaricosa* Gardner, n. sp.
Spire scalariform, posterior fasciole not delimited by impressed sulci——*Agladrillia empera* Gardner, n. sp.
External surface sculptured with more or less elevated axials; spirals usually absent altogether; if present, developed as elevated lirae only on those forms in which the axials are persistent to the posterior suture:
Spiral sculpture absent altogether:
Axials obsolete upon the posterior fasciole of the later whorls or reduced to a series of feeble protractive riblets:
Altitude of adult usually exceeding 20 millimeters; axials usually more than 10.
Eumetadrillia rabdotacona Gardner, n. sp.
Altitude of adult not exceeding 20 millimeters; axials usually less than 10.
Eumetadrillia dodona Gardner, n. sp.
Axials acute, persisting with approximate uniformity in elevation and direction between the sutures.
"Drillia" prion Gardner, n. sp.
Spiral sculpture developed over the whole or a part of the conch:
Outer lip not varicose, axials usually exceeding 9:
Axials rarely exceeding 10; spiral sculpture inconstant, commonly restricted to the body.
"Drillia" prion paraprion Gardner, n. subsp.
Axials usually exceeding 10; spiral sculpture faint but regularly developed upon both the body and the spire.
"Drillia" coryphodes Gardner, n. sp.
Outer lip varicose, axials not exceeding 9——*"Drillia" eurysoma* Gardner, n. sp.

Protoconch sculptured:
Spirals conspicuously elevated, usually 3 on the later whorls of the spire; posterior fasciole sharply defined.
"Drillia" trimitrodita Gardner, n. sp.
Spirals not conspicuously elevated, usually more than 3 on the later whorls of the spire; posterior fasciole commonly obscurely defined:
Spiral sculpture regular over the entire conch; primaries equal, usually 5 or more in front of the posterior fasciole; secondaries absent or fortuitous; posterior fasciole regularly lirate with spirals similar in character to the primaries but narrower:
Spirals usually exceeding 8 in front of the posterior fasciole; axials persistent to the posterior suture.
"Drillia" microneta Gardner, n. sp.
Spirals rarely exceeding 7 in front of the posterior fasciole, axials not persistent to the posterior suture:
Spirals very low and broad, rarely exceeding 5 in front of the posterior fasciole---*"Drillia" zosta* Gardner, n. sp.
Spirals narrow and rounded, usually exceeding 6 in front of the posterior fasciole.
"Drillia" pycnoklosta Gardner, n. sp.
Spiral sculpture commonly more or less irregular; primaries rarely exceeding 5 in front of the posterior fasciole; secondaries commonly developed; posterior fasciole usually smooth or more or less irregularly lirate:
Primaries very low, broad, irregular, and ill defined, usually 2 or 3 in front of the posterior fasciole; secondaries not developed, fasciole usually smooth----------*"Drillia" centrodes* Gardner, n. sp.
Primaries more or less elevated lirae, usually with regularly intercalated secondaries; posterior fasciole smooth or lirate:
Axials normally 8 or 9 on the later whorls of the spire, not more than 1 secondary developed between each pair of primaries:
Primaries normally 3 in front of the posterior fasciole; posterior cord usually prominent.
"Drillia" trypanion Gardner, n. sp.
Primaries usually 4 or 5 in front of the posterior fasciole; posterior cord ill defined or undeveloped.
"Drillia" waltoniana Gardner, n. sp.
Axials normally 7 on the later whorls of the spire, 2 or 3 secondaries usually developed between each pair of primaries----------*"Drillia" pachycheila* Gardner, n.sp.

Genus CRASSISPIRA Swainson

1840. *Crassispira* Swainson, Treatise on malacology, p. 313.
1928. *Crassispira* Woodring, Miocene mollusks from Bowden, Jamaica, pt. 2, Carnegie Inst. Washington Pub. 385, p. 147.

Type: *Pleurotoma bottae* Valenciennes (*Pleurotoma bottae* auct., Swainson). (Recent on the west coast of Mexico.)

Small, subclavate, tuberculated; spire thick, lengthened; outer lip with a slight sinus above and thickened internally at the top and bottom; top of the inner lip with a thick pad; basal channnel but slightly defined.—Swainson, 1840.

Shell medium-sized. Aperture moderately long and wide, scarcely contracted at the base, forming a suggestion of a canal, moderately emarginate at base. Siphonal fasciole slightly bulging. Body whorl varicose near outer lip. Anal sinus deep, narrow, the apex semicircular and lying some distance from the suture below thread on anal fasciole. Base of outer lip bearing a very shallow, broad sinus, or stromboid notch. Inner lip detached. Parietal callus thickened adjoining anal sinus. Sculpture consisting of narrow axial ribs, between which lie spiral threads or grooves. Anal fasciole bearing a strong spiral cord. (Based on original figures, Kiener, Coquilles vivantes, *Pleurotoma*, pp. 33–34, pl. 15, fig. 2, 1839.)

It is very doubtful whether *Crassispira* can be considered a valid name for this genus of turrids. Swainson clearly had something else in mind, and the descriptions on both pages 152 and 313 fit *Crassispira fasciata* Swainson, which is figured on page 151 (fig. 17d; 17a on p. 313 is an error). Apparently this species has not certainly been identified. Swainson places it in the Columbellidae; at all events it apparently is not a turrid, and it may be a melanid. "*Pleurotoma bottae* auct." is the only other name cited by Swainson under *Crassispira*. By inference this method of citation excludes *Pleurotoma bottae* of Valenciennes, a view that is in harmony with Sherborn's citation of *Crassispira bottae* as a name of Swainson's (Index animalium, 1801–1850, p. 841, 1924). Under this interpretation "*Pleurotoma bottae* auct." is a nude name, and *Crassispira fasciata* Swainson becomes the monotype of *Crassispira*, which agrees with Gray's type designation (Proc. Zool. Soc. London, pt. 15, p. 134, 1847). The other interpretation is that inasmuch as Swainson did not cite "*Pleurotoma bottae* auct. non Valenciennes", the *Pleurotoma bottae* of Valenciennes is not excluded, and therefore Herrmannsen's designation is valid. I consider this a doubtful interpretation, but so long as there is room for a difference of opinion, and so long as *Crassispira* is more or less in use for this genus, it may be advisable to take refuge in Opinion 93 of the International Commission on Zoological Nomenclature, which states that "where a reasonable argument on both sides exists, it seems better to give current nomenclature the preference."—Woodring, 1928.

In the present uncertain state of the turritid nomenclature *Crassispira* is retained for the compact group of fairly large asymmetrically biconic "*Drillia*" rather elegantly sculptured both axially and spirally.

Crassispira boadicea (Dall)

Plate XXXIX, figure 1

1900. *Pleurotoma boadicea* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 5, p. 1197, pl. 41, fig. 4. (No description.)
1910. *Pleurotoma kempi* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 6, pl. 1, fig. 8.

Shell rather large, rudely biconic. Body angular, the basal curvature very slight. Whorls probably 10 in the conch of the perfect adult. Protoconch smooth, not perfectly preserved in any of the available material. Anal fasciole very wide, usually more than half the altitude of the volution, broadly concave, devoid of axial sculpture. Area in front of the fasciole undulated by the axials, which number 14 on the body of the type but which run as low as 11; axials most promi-

nent upon the periphery, which they crenulate, rapidly evanescent behind the periphery, persistent to the anterior suture but with constantly diminishing strength, obsolete upon the base of the body. Spirals low, flattened, and rather obscure, usually 3 upon the antepenult, 15 upon the ultima, the 6 upon the pillar slightly more elevated than those upon the body; secondaries fortuitously introduced upon the base of the body. Fasciole exhibiting an obscure spiral liration anteriorly; posterior margin of whorl closely appressed against the preceding volution but not conspicuously elevated. Suture line feeble, undulatory. Aperture narrow, widening a little behind by reason of the feeble expansion of the outer lip and the slightly less feeble constriction on the inner. Siphonal notch broad, shallow, placed perceptibly nearer to the periphery than to the posterior suture. Parietal wall smoothly but not very heavily glazed. Anterior canal long for the genus and rather broad. Anterior siphonal fasciole rather short, spirally lirate, incrementally rugose, obscurely marginate at its extremity.

Dimensions: Height, 25.0 millimeters; length of aperture, 12.5 millimeters; maximum diameter, 9.7 millimeters.

Holotype: U. S. Nat. Mus. No. 135965.

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

Crassispira boadicea seems to be peculiarly susceptible to the forces of weathering. The shell is thick and apparently solid, but in all the individuals available—a moderately large number—the tips of the protoconchs have been lost and the surface of the conch badly decorticated. The species is conspicuously biconic in outline and is further characterized by its very broad, concave fasciole and its crenulated and commonly obscurely nodulated periphery.

Possibly Miss Maury's species may be distinct, but it seems to be young and shows certain variations that may be duplicated in the young of *C. boadicea*.

Occurrence: Oak Grove sand, localities 2646^{c}, 5632^{r}, 5631^{r}, 7054^{r}.

Crassispira meunieri (Maury)

Plate XXXIX, figure 2

1910. *Drillia meunieri* Maury, Bull. Am. Paleontology, vol. 4 no. 21, p. 9, pl. 2, fig. 5.

Shell resembling *Drillia grabaui* but much larger and stronger. Whorls without the nucleus, which is eroded in the single specimen found, 8; spiral sculpture of subequal, shallow, narrow grooves extending from the notch to the base of the whorls; subsutural band very slightly nodular; transverse sculpture of fairly distinct ribs (13 on the last whorl) which become weaker and tend to fade out on the last whorl. The ribs extend from the notch to the succeeding suture and to about the center of the body whorl. Notch distinct, broadly U-shaped; canal short, wide; aperture rather narrow; outer lip not lirate within; pillar with a rather thick callus. Length of shell 41; of aperture 18; greatest width 21 millimeters.

Chipola marls, Baileys Ferry, Fla.

Cornell University collection.

Named in honor of Prof. Stanislaus-Meunier, of the Jardin des Plantes, Paris.—Maury, 1910.

Figured specimen: U. S. Nat. Mus. No. 113993, from locality 2213, Chipola formation, 1 mile below Baileys Ferry, Chipola River, Calhoun County, Fla.

The shell is unusually heavy and rude both in outline and in ornamentation, and the two individuals in the later collections are almost as badly worn as the type. The axials are rather broad and rounded upon their summits and tend to be slightly nodose at the periphery. The spiral sculpture is least feeble upon the base of the body and the pillar. The posterior fasciole is apparently devoid of both axials and spirals. The aperture is narrowly clavate. The posterior siphonal fasciole notch is a little closer to the periphery than to the posterior suture. The constriction of the base of the body is very slight, and the anterior canal is short and wide. The anterior fasciole is closely lirate, incrementally rugose, and rather deeply emarginate. In one of the individuals at hand there is a distinct umbilical chink behind the reverted inner margin of the canal, and in the other there is a decided depression but no chink. In rudeness of outline and sculpture *C. meunieri* distantly recalls *C. boadicea* Dall, of the Oak Grove fauna. It is, however, relatively higher and less stout. The anal fasciole is lower relatively and the axial costae more broadly undulatory.

The species is apparently very rare, and no well-preserved individuals have been found.

Occurrence: Chipola formation, locality, 2213^{r}, and Cornell University collections.

Crassispira calligona (Maury)

Plate XXXIX, figure 5

1910. *Drillia calligona* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 7, pl. 2, fig. 1.

Shell elongated, resembling in form the recent *Drillia ostrearum* Stearns. Spire acute, nuclear whorls 2, subsequent whorls 7, of which the 2 earlier show well-marked transverse ribs but little or no spiral sculpture; spirals on the later whorls stronger, consisting of primaries with alternating finer, secondary threads in pairs; transverse ribs stronger and more numerous on the later whorls (25 on the last) and more sharply defined; the intersecting ribs and spirals form a beautiful cancellation ornamenting the whorls up to the margin of the groove, where the ribs end abruptly; in the groove, lines of growth and fine, subequal spirals form the only sculpture; upper margin of the groove marked by a sharp carination sloping steeply to the suture; aperture narrow with a smooth callus.

Length of shell, 19; of last whorl, 11; of aperture, 8; greatest width, 6 millimeters.

This very beautiful species is characterized by the delicacy and elegance of its sculpture.

Chipola Oligocene, Baileys Ferry, Fla.

Cornell University collection.—Maury, 1910.

Figured specimen: U. S. Nat. Mus. No. 371057, from locality 3419, 1 mile below Baileys Ferry, Calhoun County, Fla.

The specimen figured in this report is an immature individual in which the diameter is relatively greater and the body more abruptly constricted at the base than in the normal adult. The whorls of the protoconch are probably 3 in the adult; those of the conch 10. The nucleus is smooth, highly polished, and somewhat papillate, the initial turn for the most part submerged, the succeeding volution rather low and broadly inflated, the final whorl of the protoconch flattened laterally and relatively high. The line of demarcation between the conch and protoconch is initiated by a protractive thickening of the shell and the introduction of 10 to 12 undulatory protractive riblets on the earlier whorls of the spire, persistent from the appressed posterior margin to the anterior suture. The spiral sculpture first appears near the beginning of the second whorl in the shape of 5 or 6 very faintly impressed sulci. The sculpture is modified with the growth of the shell, so that on the later whorls of the adult the axials increase to as many as 25 and are very sharply pinched, equal and regular in size and spacing, even near the aperture and persistent with uniform strength from the anterior margin of the fasciole to the anterior suture and on the body whorl almost to the base of the pillar. They are separated by slightly concave intercostals of more than double their width; the anal fasciole is smoothly concave, more than one-third the width of the whorl in the adult, margined posteriorly by a well-defined sutural cord lirated with 2 or 3 low threads but devoid of any axial ribbing or undulations; the primary spirals in front of the periphery are low, broad, equal, and regular in size and spacing both upon the costal and intercostal areas numbering 4 to 6 on the later whorls of the spire, and separated by shallow channels in which two or three microscopically fine secondaries are usually intercalated. The suture lines are inconspicuous and minutely undulated by the costals of the preceding volution. The aperture is narrowly clavate; the constriction at the base of the body feeble. The outer lip is thin and sharp and expands incrementally. The notch at the posterior fasciole is broadly and symmetrically U-shaped and not very deep; the anterior canal is long for the genus, broad, and very feebly recurved. The anterior fasciole is well defined, closely lirate, incrementally striate, and broadly emarginate at its extremity.

Dimensions: Height, 21.0± millimeters; height of aperture, 10.0 millimeters; maximum diameter, 7.5 millimeters.

Crassispira calligonoides, of the Shoal River fauna, is more slender, with only about 20 axial costae, lower than those of *C. calligona*, and with a more diffuse and less elevated spiral ornamentation.

The Recent *"Drillia" ostrearum* Stearns is a smaller and more slender species with broader and less acute axials and more elevated spirals, obscurely tuberculate at their intersection with the costals. It has been recorded from Hatteras to Grenada and is most abundantly represented in waters less than 25 feet in depth.

Young individuals similar in general character to the young of *C. calligona* but with a more sharply elevated sutural cord were collected in the Oak Grove.

Crassispira consors (Sowerby), the Dominican species with which this form has been confused in the collections, is similar in general characters but runs larger and is more closely sculptured axially. The spirals are also narrower and more distant and usually only 4 on the final whorl of the spire instead of 5 or 6 as in the Chipola species. The posterior fasciole is rather more finely sculptured, and the area between the posterior cord and the suture line is invariably finely lineated—a fortuitous character in *C. calligona*. *C. abundans* and the subspecies *perrugata*, less strongly sculptured and more deeply insinuated at the fasciole, are possibly descendants. The much more slender *"Drillia" alesidota* Dall of the Recent fauna is also a member of this group.

Occurrence: Chipola formation, localities 2213[e], 3419[r], ?2564[r], and Cornell University collections.

Crassispira calligona paraconsors Gardner, n. subsp.?

Plate XXXIX, figure 3

Shell rather large for the group, slender, turreted; body whorl and spire almost equal in altitude. Whorls of conch, 10. Protoconch broken but small and smooth, probably paucispiral. Adult sculpture reticulate. Axials 15 on the early whorls of the spire, increasing to 24 on the body, narrow, sharp, uniformly elevated from the posterior fasciole to the anterior suture and well down upon the base of the body. Spirals low, regularly spaced fillets overriding the costals, 4 on the medial whorls, a fifth appearing directly behind the anterior suture near the body, 15 upon the body; secondaries regularly intercalated and, on the body, fortuitous tertiaries; anterior fasciole very finely threaded. Posterior fasciole broad, concave, sharply delimited both by its concavity and the abrupt disappearance of the axials; a prominent cord in front of the suture; 3 or 4 sharp spirals between the cord and the anterior margin of the fasciole and a few irregular filaments between the cord and the closely appressed posterior margin. Suture line undulated in harmony with the axials. Aperture narrow, lanceolate. Outer lip imperfect, not thickened within. Sinus moderately deep, placed midway between the sutural cord and the anterior margin of the fasciole. Labium obliquely constricted at the base of the body. Parietal wash thin. Anterior canal relatively long and slender.

Dimensions: Height, 30.0 millimeters; height of aperture, 13.4 millimeters; maximum diameter, 9.0 millimeters.

Holotype: U. S. Nat. Mus. No. 114001.

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

Crassispira paraconsors is the Chipola member of a race widespread in the middle Miocene of the Floridian and Caribbean region. *Crassispira consors* (Sowerby), from the Gurabo of the Dominican Republic, is a larger, coarser shell with a slightly longer canal, more elevated spirals, which are rounded cords rather than flattened bands and which nodulate the axials at their intersection. Secondary spirals are not developed upon the Gurabo *C. consors* and are inconspicuous upon the smaller *C. consors bullbrooki* Mansfield, from the middle Miocene of Trinidad. In the Gatun subspecies *C. consors hobsoni* (Hanna), however, the primaries are relatively very narrow, with as many as seven wavy and irregular filaments on some of the interspiral areas.

This may be nothing more than a slender variety of Miss Maury's *Crassispira calligona*. In *C. calligonoides*, from the Shoal River, the spiral fillets are less elevated than in the Chipola species and the secondaries reduced to mere filaments.

Occurrence: Chipola formation, localities 2213^{r}, 3419^{r}.

Crassispira calligonoides Gardner, n. sp.

Plate XXXIX, figures 4, 9

Shell slender, spire elevated, acute, the aperture only a little more than one-third as high as the entire shell. Whorls numerous, 11 or 12 in the conch of the adult. Protoconch smooth, polished, papillate, thrice coiled; initial turn coiled in a single plane, largely submerged; succeeding whorl becoming increasingly less depressed, broadly elevated; final turn moderately high and evenly convex. Line of demarcation between conch and protoconch indicated by the protractive thickening of the shell and by the introduction of the axial sculpture. Axials 12 to each of the earlier whorls, feebly protractive, strongly elevated, undulatory in character, persistent from the area near the appressed posterior margin of the whorl to the anterior suture line. Fasciole indicated on the first volution of the conch; faintly impressed spirals appearing either at the close of the first or the beginning of the second whorl. Sculpture when well established similar in general characters to that of *C. calligona* Maury; axials 20 upon the body of the type, rather low, sharply pinched, restricted entirely to the area in front of the fasciole, on the body persistent to the base of the pillar, equal and uniform in strength throughout their extent and separated from one another by wide, concave intercostals. Spiral sculpture rather subdued; primaries in front of the fasciole normally 5 on the penult, 12 to 15 on the body and pillar, very low, broad, overriding the axials, separated by interspirals of approximately the same width in which are intercalated 2, 3, or even 4 microscopically fine secondaries; spirals narrower and more threadlike upon the base of the body and the pillar, gradually becoming feeble anteriorly and on the anterior fasciole replaced by a fine, close threading. Posterior fasciole broad, sharply defined, smoothly concave, free from axial sculpture except for conspicuous incrementals, very finely lirated spirally, the 3 or 4 threadlets upon the anterior and medial portions the least fine, those behind them mere microscopic striae, commonly obscure; a similar striation generally developed behind the sutural carina, which is sharply elevated but not crowned by a well-defined cord. Suture line slightly impressed, inconspicuous. Aperture narrowly clavate. Outer lip broadly but not strongly arcuate, slightly expanded incrementally. Posterior siphonal notch broad but rather shallow, symmetrically disposed upon the fasciole. Inner margin of aperture constricted at the base of the body, smoothly and rather heavily glazed. Anterior canal a little long for the genus, rather broad, very feebly recurved. Anterior siphonal fasciole lirate and incrementally corrugated, broadly emarginate anteriorly.

Dimensions: Height, 32.0 ± millimeters; altitude of aperture, 12.0 millimeters; maximum diameter, 8.5 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 351158.

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

Crassispira calligonoides is the analog in the Shoal River fauna of *C. calligona* of the Chipola fauna. It is more slender than *C. calligona*, though similar in the general contour of the whorls. The sculpture has the same general characters in the two forms, but that of the Shoal River species is more subdued, the costals lower and not so numerous, the spirals lower and less sharply delimited.

Pleurotoma consors Sowerby of the Gurabo of the Dominican Republic is similar in outline and is decorated with a rather similar though more elaborate sculpture.

A closely related species or subspecies of *Crassispira consors* has been cited from the Gatun formation.

Crassispira calligonoides is abundant at the type locality but is not well represented elsewhere.

This and the two preceding species are typical *Crassispira*.

Occurrence: Shoal River formation, localities 3732^{r}, 3742^{a} 5184^{r}, 3748^{r}, 5618^{r}.

Genus CLAVATULA Lamarck

1801. *Clavatula* Lamarck, Système des animaux sans vertèbres, p. 84. Type: *Murex* (*Turris*) *coronata* Chemnitz. (Recent on the Guinea coast.)

Coq. . subturriculée, scabre, ayant l'ouverture terminée inférieurement par un canal court ou par une échancrure. Un sinus au bord droit près de son sommet.—Lamarck, 1801.

Clavatula is used to cover a large group of shells prominent in the Alum Bluff faunas. They are shells of medium size, with a short, rather stout body whorl, and in many species, irregularly coiled at the final turn. The protoconch is small, smooth, and usually paucispiral. The adult sculpture is reticulate, the axials, as a rule, dominating the spirals. The posterior fasciole and the sutural cord are well defined, the aperture rather narrow, obliquely clavate, and heavily calloused along both the outer and inner margins. The posterior siphonal notch is usually emphasized by the heavy callus at the entrance on both the apertural and the labral wall. There is no sharp constriction at the base of the body, and the anterior canal is very short and broad.

Clavatula is a shorter, stouter group than *Crassispira* with fewer, less turreted whorls, a less elegant sculpture, and a shorter, broader canal.

The development of the group in the Alum Bluff faunas is the more remarkable, because it is comparatively rare in the middle Miocene faunas of the Caribbean.

Clavatula panopla Gardner, n. sp.

Plate XXXIX, figures 15, 16

Shell rather large for the genus, vigorously sculptured. Spire approximately the height of the aperture, scalariform. Whorls probably 9 in the conch and 3 in the protoconch. Protoconch small, smooth, and highly polished, the initial turn for the most part submerged, the succeeding volutions increasing regularly in diameter and elevation and decreasing in convexity. Beginning of conch marked by the appression of the posterior portion of the whorl and the introduction on the medial and anterior portions of short, broadly rounded, and prominently elevated axials, 10 on each of the earlier volutions; spiral sculpture and posterior fasciole first indicated on about the third turn of the conch; adult whorls sharply constricted at the anal fasciole, which is not more than one-third the width of the whorl. Axial sculpture dominant; axials rather narrow, conspicuously elevated, rounded upon their summits, most prominent at the periphery but persistent to the anterior suture and on the body, almost to the base of the pillar, 15 on the final whorl of the type but 13 or 14 on other individuals. Spiral sculpture developed over the entire conch; primaries very low and flattened, 6 on the later whorls of the spire, that outlining the periphery usually a little less depressed than those in front of it; primaries approximately 15 upon the body, becoming increasingly more elevated toward the base, equally strong upon the costal and intercostal areas; secondaries intercalated fortuitously upon the medial portion of the whorls of the spire and regularly upon the body. Fasciole closely threaded with 4 or 5 fine, sharp lirae; posterior margin of fasciole outlined by a rather heavy cord which follows the feebly impressed undulatory suture. Aperture narrowly lobate, slightly oblique. Outer lip very feebly expanded and thickened without and in some shells within. Posterior siphonal notch broad and very shallow. Posterior commissure feebly sulcated, with a small deposit of callus directly in front of the sulcus. Parietal wall smooth, very heavily glazed; anterior canal short and broad. Anterior siphonal fasciole rather broad, very closely lirate, deeply emarginate at its extremity.

Dimensions: Height, 23.5± millimeters; height of aperture, 11.0 millimeters; maximum diameter, 8.4 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 113998.

Type locality: No. 2211, Alum Bluff, Liberty County, Fla.

Clavatula panopla is a larger and in many specimens a decidedly stouter shell than *C. kalliglypta*, its closest analog along the Chipola River. The axials are much more prominently elevated, and a secondary system of spirals is regularly present upon the body. It varies widely in relative proportions. The young are as a rule stouter than the adults.

The species has not been recognized except at the type locality, where it is abundant.

Occurrence: Chipola formation, localities 2211[a], 7183[r], Aldrich collection, Johns Hopkins University.

Clavatula eleutheria Gardner, n. sp.

Plate XXXIX, figure 17

Shell slender and of moderate size; whorls regularly increasing in diameter, flattened laterally except in the apical region, constricted at the fasciole, the body whorl more rounded than those of the spire and smoothly contracted at the base. Nucleus small, smooth, highly polished, twice coiled, the initial turn immersed at the tip, feebly inflated; the succeeding volution flattened and relatively elevated. Line of demarcation between conch and protoconch rather obscure. Postnuclear whorls 8, first 2 or 3 volutions sculptured with 9 or 10 rounded axial riblets, undulatory, evanescent posteriorly; faint spiral striations introduced near the end of the second turn; posterior margin of whorl closely appressed even at the beginning of the first, the posterior cord and fasciole developing on the second and third. Axial sculpture on later volutions increased to 14 rather sharp, acute costals separated by broadly concave intercostals, uniform in prominence from the fasciole to the anterior suture and persistent on the body well down to the base of the pillar but more or less irregular in size and spacing upon the final half turn. Spiral lirae very feeble but overriding the costae, 4 equal and equally spaced upon the later whorls of the spire, 12 upon the body and pillar, more elevated and distant toward the base; 6 additional lirae upon the anterior fasciole. Posterior fasciole sharply

defined by the abrupt constriction of the whorl and the evanescence of the axial sculpture; a very fine threadlet upon its anterior margin and a similar thread directly behind it; posterior cord moderately strong, rather distant from the impressed suture and, like the suture, undulated by the costae of the preceding volution. Aperture narrowly and obliquely lobate. Outer lip very feebly expanded medially, subvaricose near the margin, sharp-edged, and smooth within. Inner lip constricted at the base of the body. Pillar straight, nonplicate. Parietal wall very heavily glazed, the callus localized at the posterior commissure. Posterior siphonal notch broad and very shallow. Anterior canal of moderate length for the genus, broad and open. Anterior fasciole short, broad, emarginate at its extremity.

Dimensions: Height, 16.6 millimeters; length of aperture, 7.2 millimeters; maximum diameter, 6.0 millimeters.

Holotype: U. S. Nat. Mus. No. 113995.

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

Clavatula anthera is relatively stouter than *C. eleutheria;* the spiral lirae are a little more numerous; the posterior cord is more sharply defined and more elevated; and the fasciole is devoid of spiral threading. *C. compsa,* also from the Chipola, is perhaps an even closer analog. The Alum Bluff species runs a little higher than the other; the axial costae are more numerous and more prominent, and the spiral threading is a little sharper.

C. eleutheria is very common at the type locality but has not been recognized elsewhere.

Occurrence: Chipola formation, locality 2211[e], Aldrich collection, Johns Hopkins University.

Clavatula kalliglypta Gardner, n. sp.

Plate XXXIX, figure 6

Shell of moderate dimensions. The spire rather slender and scalariform ornately sculptured. Whorls increasing rather rapidly in size, constricted at the suture except in the apical region, the body rather sharply contracted at the base; whorls 10½ in all. Protoconch very small but elevated, smooth, and highly polished, thrice coiled; initial turn rather low, broadly inflated and immersed at the tip, the succeeding volutions becoming increasingly higher and more flattened laterally. Line of demarcation between the conch and protoconch indicated by an irregular thickening, a slight change in the texture of the shell, the appression of the posterior margin, and the initiation of the axial sculpture. Axials on the early whorls short and rounded, persistent from the fasciole to the anterior suture but more prominent at the periphery, 10 on the earlier whorls; intercostal areas broadly concave; axials increasing to 12 on the later volutions, irregular in size and spacing on the final turn but for the most part persisting on the body almost to the margin of the anterior fasciole. Spiral sculpture dominated by the axial and barely perceptible upon the summits of the costae; primary lirae low and flattened, 3 upon the later whorls of the spire and about 12 upon the body; finer secondaries intercalated upon the spire and between the two posterior and the two anterior pairs of primaries upon the body; primaries upon the medial portion of the body more elevated, more sharply defined, and more closely spaced than on the anterior portion, most elevated and most distantly spaced upon the base of the body and the pillar. Anterior fasciole rather coarsely threaded with 8 rounded lirae. Posterior fasciole rather wide, defined by the constriction of the whorl and the evanescence of the axial sculpture, which still persists, however, in the form of obscure undulations; 2 rather strong subequal lirae symmetrically disposed upon it; posterior cord also rather strong but not sharply delimited, rather distant from the impressed suture, and like it strongly undulated by the costae of the preceding volution. Aperture narrowly clavate, widening posteriorly with the constriction of the inner lip and the very feeble expansion of the outer. Labrum sharp edged but thickened a little behind the margin, smooth within. Parietal wall heavily and brilliantly glazed, the callus localized near the posterior commissure, sulcated at the commissure. Posterior siphonal notch very broad and shallow, placed a little nearer to the periphery of the whorl than to the posterior suture. Anterior canal rather short, broad, and open. Anterior fasciole short but rather wide, broadly and deeply emarginate at its extremity.

Dimensions: Height, 16.0 millimeters; length of aperture, 7.0 millimeters; maximum diameter, 6.0 millimeters.

Holotype: U. S. Nat. Mus. No. 328503.

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

Clavatula kalliglypta is characterized by the relative prominence of the axials at the periphery of the whorl and by the wide and strongly lirate posterior fasciole. *Clavatula panopla,* from Alum Bluff, is larger and coarser, with more numerous and decidedly more prominent axials and more numerous spirals.

Occurrence: Chipola formation, locality 3419[r], Aldrich collection, Johns Hopkins University.

Clavatula grabaui (Maury)

1910. *Drillia grabaui* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 8, pl. 2, fig. 3.

Shell of moderate size, strong, with about 7 whorls in addition to the nucleus, which is eroded in both specimens in the collection. Spiral sculpture of close, equal grooves with slightly wider interspaces, the spirals continuing without interruption over the transverse ribs and covering the surface of the shell except the earlier whorls and the region just beneath the suture; subsutural band nodular; transverse sculpture of rather sharply defined

ribs (17 on the last whorl) which extend over the whorls from the nodular, subsutural band to the succeeding suture and over three-quarters of the body whorl; notch only slightly indented; aperture rather narrow; canal short, wide; outer lip thickened externally, not lirate within; pillar with a moderate callus. Length of shell, 26; of aperture, 11; greatest width, 9 millimeters.

Chipola marls, Baileys Ferry, Fla.

Cornell University collection.

Named in honor of Professor Grabau, of Columbia University.—Maury, 1910.

This rather rare shell is the largest and most closely sculptured representative of a mutable and prolific group. There are three individuals in the National Museum collections, but none of them retains the nucleus, and on all the surface is rather badly decorticated. The lirae are very fine and crowded, as many as 20 upon the body and pillar and 7 or 8 upon the later volutions of the spire, excluding the 2 or 3 very fine threadlets upon the posterior fasciole and the posterior cord. The sutures are very closely appressed and undulated by the costae of the preceding whorl. The anterior siphonal fasciole is rather short and wide, threaded with about a dozen lirae and deeply emarginate at its extremity.

Clavatula polyploka approaches *C. grabaui* most closely in general dimensions and contour but is somewhat stouter, with a less elevated spire. The posterior fasciole of *C. grabaui* is ill defined and spirally lirate, whereas that of *C. polyploka* is clean cut and devoid of sculpture either axial or spiral. The species has not been recognized except from the type formation.

Occurrence: Chipola formation, localities 2213^{r}, 3419^{r}, 2211^{r}, Cornell University collections.

Clavatula apoia Gardner, n. sp.

Plate XXXIX, figure 19

Shell rather small, slender, biconic, tapering gradually toward either extremity; length of aperture more than half the entire altitude. Whorls of the conch 6½. Protoconch thrice coiled, buccinoid in outline, polished, smooth; initial turn for the most part submerged, succeeding volutions very feebly inflated, becoming increasingly higher and more flattened laterally; beginning of conch marked by a slight thickening and change in the texture of the shell, the increasing posterior appression, and the introduction of very faint axial riblets broadly rounded upon their summits, evanescent posteriorly, 10 on the earlier whorls; spiral sculpture faintly discernible a little behind the middle of the second whorl of the conch, the spirals gradually increasing in number and prominence. Adult whorls feebly inflated medially, closely appressed posteriorly. Posterior fasciole very obscure. Axials narrower, less obtuse, and more numerous upon the later whorls than upon the earlier, 14 upon the penult, evanescent posteriorly and on the final half turn less prominent, crowded and irregular but uniform in strength from the fasciole to the anterior suture and well down to the base of the body whorl, opposite and slightly protractive, the series performing a little less than half a revolution around the axis of the shell. Spiral sculpture dominating the axial upon the later volutions; spirals low and broad, overrunning the costals, separated by linear channels except for the posterior channel, which is slightly wider than those in front of it; fillets 3 upon the later whorls of the spire, 12 upon the body, with an additional sharp thread and a narrow cord behind it at the anterior margin of the obscure posterior fasciole. Axial sculpture obsolete upon the fasciole except for the rather strong incrementals; posterior cord prominent, undulated, and feebly nodulated by the costae of the preceding whorl. Suture line wavy, very closely appressed. Aperture narrow, somewhat oblique, slightly wider posteriorly by reason of the constriction at the base of the body. Outer lip oblique, with an almost imperceptible medial expansion, subvaricose near the margin, simple within. Labium thickened, reverted. Posterior siphonal fasciole very broad and shallow, symmetrically disposed between the shoulder and the suture. Anterior canal broad, the anterior fasciole very finely lirate, broadly emarginate at its extremity.

Dimensions: Height, 13.5 millimeters; height of body whorl, 7.3 millimeters; maximum diameter, 5.4 millimeters.

Holotype: U. S. Nat. Mus. No. 328507.

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

Clavatula apoia is smaller than other members of the group; the posterior fasciole is less strongly defined and the spiral sculpture is more prominent. *C. grabaui* Maury has much the same general contour and the same vague definition of the posterior fasciole, but it is much larger, the axials are more numerous, the spirals are very much finer, and there are twice as many of them upon the later whorls of the spire.

Occurrence: Chipola formation, localities 2564^{p}, 3419^{p}.

Clavatula polyploka Gardner, n. sp.

Plate XXXIX, figure 23

Shell rather large and commonly stout, somewhat bucciniform. Whorls between 9 and 10 in all, those of the conch 7. Nucleus small, very smooth and shining, probably thrice coiled, although the very tip is slightly decorticated, so that the exact number is not determinable. Whorls of conch rudely trapezoidal, increasing rather rapidly in size; body whorl gently contracted at the base; both axial and spiral ornamentation developed, the former dominant. Axials on early whorls more or less undulatory, 10 or 12, increasing to 15 on the later and much narrower relatively and more acute, persisting with uniform strength from the fasciole to the anterior suture and well down to the base of the body but more or less irregular in size

and spacing on the final half turn. Spiral sculpture very obscure upon the spire and restricted to the intercostal areas; 4 exceedingly obscure fillets upon the later whorls of the spire and 12 upon the body, those upon the anterior and medial portions very vague; spirals much stronger toward the base. Anterior fasciole closely threaded with about 6 lirae. Posterior fasciole appearing as a rather broad, shallow channel, sharply delimited behind by the posterior cord and in front by the abrupt terminations of the axial ribs, devoid of any sculpture except feeble incrementals; posterior cord rather low and ill defined, feebly nodulated by the costae of the preceding volution. Suture line impressed, undulated. Aperture rather broad and a little oblique. Outer lip expanding incrementally only, more or less varicose behind the margin, acute and commonly feebly crenulated at the margin itself, smooth within. Parietal wall heavily glazed, a feeble sulcus developed at the posterior commissure. Posterior siphonal notch rather deep, symmetrically disposed between the suture and the outer margin of the fasciole. Anterior canal moderately long for the genus, broad and open. Anterior fasciole short but rather wide and rather deeply emarginate.

Dimensions: Height, 16.6 millimeters; length of aperture, 8.0 millimeters; maximum diameter, 6.8 millimeters. A larger but less perfect form attains a height of 24.0 millimeters.

Holotype: U. S. Nat. Mus. No. 328510.

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

Clavatula polyploka suggests a stout and coarsely sculptured *C. grabaui* Maury. There are, however, differences in the details of the sculpture which readily separate the two species. The axials of the former are broader, more elevated, less numerous, and much more abruptly evanescent posteriorly; the spirals on the later whorls are only about half as many. The fasciole of *C. polyploka* is sharply defined and smooth except for incremental striae; that of *C. grabaui* is obscurely delimited and finely lirate.

The species is rare even within the small area in which it has been recognized.

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

Clavatula euparypha Gardner, n. sp.

Plate XXXIX, figure 22

Shell of moderate size, slender; spire elevated, acutely tapering, the body relatively short and broad. Whorls numerous, 10 or 11 in all. Nucleus small but relatively elevated, a little more than twice coiled, the initial whorl feebly inflated and immersed at the very tip, the succeeding volution flattened laterally. Line of demarcation between conch and protoconch obscure. Axial sculpture initiated near the beginning of the first whorl of the conch; axials 9 or 10 on the early volutions, increasing to 13 upon the body, inclined to be irregular in size and spacing near the aperture, rather broadly rounded and undulatory on the early whorls, acutely rounded upon the summits in the later, persistent, with uniform strength from the fasciole to the anterior suture and, on the body, well down to the base of the pillar, feebly protractive upon the spire and flexuous upon the body; intercostal areas broadly concave, not quite double the width of the costal. Spiral sculpture dominated by the axial, not overrunning the summits of the costae, initiated in the form of exceedingly faint lineations which gradually become stronger and on the later whorls appear as low, flattened lirae, 7 or 8 upon the penult and 20 to 25 upon the body; spirals upon the later whorls of the spire and the anterior and medial portion of the body separated by wider interspiral areas but in the type much more crowded upon the base and separated only by linear interspaces. Anterior fasciole also closely threaded, cut off from the base by a rather wide, unsculptured band. Posterior fasciole not very strongly depressed but sharply defined by the abrupt evanescence of the axial sculpture, devoid of spiral sculpture, except here and there a fortuitous lira; posterior cord sharply defined and elevated, rather distant from the impressed suture but, like it, undulated by the costae of the preceding volution. Aperture slightly oblique, of approximately the same width throughout its extent, though widening slightly at the basal constriction of the body. Outer lip not expanded, varicose externally, sharp-edged and smooth within. Parietal wall smooth and very heavily glazed, the callus localized at the posterior commissure. Posterior siphonal notch broadly and somewhat obliquely U-shaped, placed nearer to the shoulder than to the suture. Anterior canal very short and broad. Anterior siphonal fasciole emarginate at its extremity.

Dimensions: Height, 15.0 millimeters; length of aperture, 6.5 millimeters; maximum diameter, 5.8 millimeters.

Holotype: U. S. Nat. Mus. No. 328533.

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

Clavatula anthera, C. compsa, C. libertalis, and *C. euparypha* possess in common a rather short body whorl and an acutely tapering spire, rather sharp axials restricted to the area in front of the fasciole, feebly protractive upon the spire, flexuous upon the body, and more or less irregular upon the final half turn, and a linear spiral sculpture. *Clavatula euparypha* is generally not quite so stout as *C. anthera,* and it is stouter than either *C. compsa* or *C. libertalis.* There are about 15 costals on each of the later volutions in *C. anthera,* 11 to 14 in *C. libertalis,* 13 in *C. euparypha,* and only 13 in *C. compsa.* In *C. euparypha* the number of spirals runs a little higher than in *C. anthera* and much higher than in *C. compsa.* The posterior cord is slightly more prominent than in either of the two

Chipola species and much more prominent than in that from Alum Bluff. *C. eleutheria*, from Alum Bluff, is more slender and exhibits a sharper, more distant axial sculpture, less numerous spirals, and, as a rule, a spirally lineated posterior fasciole.

Occurrence: Chipola formation, localities ?2213^{r}, 2564^{r}, 3419^{r}, ?7151^{p}.

Clavatula anthera Gardner, n. sp.

Plate XXXIX, figure 21

Shell small, rather slender; whorls closely appressed behind, very feebly inflated medially, the body whorl gently constricted at the base. Nucleus small, smooth, highly polished, twice coiled, the initial turn immersed at the tip, broadly inflated and rather high away from the tip, the succeeding volution becoming more and more flattened laterally. Line between conch and protoconch marked by a change in the texture of the shell, an irregular thickening, and the initiation of the axial sculpture. Axials on the early volutions approximately 10, rather broad, rounded upon their summits, evanescent posteriorly but uniform in strength throughout their medial and anterior extent, feebly protractive, gradually increasing to 15 on the later volutions, sharper and narrower upon the medial and anterior portion of the shell, persistent from the fasciole to the anterior suture and well down to the base of the body; intercostal areas broadly concave, usually more than twice as wide as the costals. Spiral sculpture barely perceptible, manifested on the second whorl of the conch by lineations, which increase slightly in elevation, appearing on the later whorls as fine, rather feeble lirae, 5 on the antepenult, 7 on the penult, and 13 on the body and pillar, not overriding the costals and restricted to the area in front of the fasciole. Posterior fasciole indicated even on the first whorl of the conch by the evanescence of the axials and the appression of the posterior margin of the whorl; rapidly increasing in sharpness of definition, faintly lirate on the early whorls but smooth upon the later except for the arcuate incrementals and the heavy cord directly in front of the suture and, like it, undulated by the costae of the preceding whorl. Aperture narrow, oblique, widening a little posteriorly by reason of the feeble constriction of the inner lip. Outer lip oblique, varicose a little behind the margin, sharp-edged, simple within. Inner lip simple, reverted, the parietal glaze very heavy especially near the posterior commissure. Posterior siphonal notch broad, open, and rather shallow, U-shaped. Anterior canal short, broad, ill-defined; a marked depression behind the callus of the pillar, thus simulating an umbilical chink. Anterior fasciole short, closely lirate, emarginate at its extremity.

Dimensions: Height, 14.7 millimeters; length of aperture, 6.0 millimeters; maximum diameter, 5.7 millimeters.

Holotype: U. S. Nat. Mus. No. 328536.

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

Clavatula anthera is a little stouter as a rule than *C. euparphya*, the species which it most closely resembles. The axials are rather more numerous, the spirals less numerous, and the depression behind the pillar glaze less conspicuous. *Clavatula libertalis*, from Alum Bluff, is only about two-thirds as large, the protoconch has 2¼ component volutions instead of 2, the spirals are rather more numerous, and the posterior cord less sharply defined.

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

Clavatula proebenina Gardner, n. sp.

Plate XXXIX, figure 20

Shell small but very solid, somewhat pupiform, unduly constricted at the base of the penult; body whorl smoothly rounded at the base, more than half as high as the entire shell. Whorls closely appressed, probably 10 in all. Apical region very much worn, the characters of the protoconch and the early whorls of the conch obscure; nucleus apparently small, paucispiral, and rather obtuse; medial and later volutions very closely appressed behind, flattened laterally. Both axial and spiral sculpture developed, the axial dominant. Costae angular, acutely rounded upon the summits, slightly flexuous, restricted to the area in front of the posterior fasciole, slightly more prominent posteriorly, though persistent to the anterior suture and almost to the anterior fasciole, less elevated upon the ultima than upon the penult and tending to become irregular in size and spacing upon the last half turn; intercostals wider than the costals, broadly concave. Primary spirals low, flattened fillets, equisized and equispaced, 7 or 8 upon the final whorl of the spire, approximately 20 upon the body, evanescent upon the summits of the costals, separated for the most part by channels of approximately the same width as the fillets; linear secondaries in some shells intercalated upon the medial and anterior portions of the whorl. Posterior fasciole wide, sharply defined by the slight constriction of the whorl and by the abrupt disappearance of the axials, threaded with 2 exceedingly fine spiral lirae and striated by the incrementals; posterior cord rather prominently elevated and rather distant from the suture. Suture very closely appressed, undulated by the costae of the preceding volution. Aperture oblique, narrowly clavate, widening slightly with the expansion of the outer lip and the constriction of the inner. Labrum subvaricose externally, the margin sharp and expanded both axially and incrementally; a single obscure denticle developed directly in front of the posterior fasciole. Parietal wall heavily glazed, a localized deposit of callus near

the commissure. Posterior siphonal notch U-shaped, moderately wide, and very deep, placed nearer to the outer margin of the fasciole than to the suture. Anterior canal short, broad, and open. Anterior siphonal fasciole short but wide, incrementally striated and lirated with 10 or 12 crowded spirals.

Dimensions: Height, 14.5± millimeters; length of aperture, 6.5± millimeters; maximum diameter, 5.4 millimeters.

Holotype: U. S. Nat. Mus. No. 351163.

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

Clavatula proebenina is the probable precursor of *C. ebenina* (Dall), described from the Caloosahatchee marl and reported from the Recent. The Pliocene form is larger than the Miocene, the spiral sculpture slightly coarser, the fasciole relatively narrower and more strongly lirate, and the posterior cord more elevated. It is possible that the Recent species, which is a shallow-water form ranging from the Tortugas to Vera Cruz, is specifically distinct from the Pliocene—certainly from the Miocene.

None of the congeners of *C. proebenina* resemble it closely. It is well characterized by the irregularity in the coiling of the final volution, which lends to the shell a pupiform aspect.

Occurrence: Shoal River formation, locality 5079[r].

Clavatula libertalis Gardner, n. sp.

Plate XXXIX, figures 13, 14

Shell small, compact, fusiform, the whorls closely appressed, the early volutions trapezoidal, the later turns bulging a little behind the anterior suture; the body more than half as high as the entire shell, obliquely tapering but not rounded; whorls of conch 6. Protoconch small, smooth, highly polished, a trifle more than twice coiled; initial turn broadly and rather strongly inflated, immersed at the tip; succeeding volution less tumid but more elevated. Line of demarcation between conch and protoconch irregular, indicated by a change in the texture of the shell, by the posterior appression of the whorl, and by the gradual initiation of the axials and of exceedingly faint spiral lirations. Axials narrow, rather prominent, acute, a little stronger medially than anteriorly and obsolete posteriorly, feebly protractive, somewhat flexuous upon the base of the body, 11 upon the penult of the type but running as high as 14, equal, equispaced except upon the final half turn. Intercostals concave and finely cross-barred by very low, flattened, and obscure threadlets, 6 to 9 in front of the fasciole of the later whorls of the spire and about twice as many upon the body; lirae overriding the costals in fresh specimens but usually worn off. Posterior fasciole distinct but inconspicuous, defined by the appression of the whorl, by the evanescence of the axials, and by a microscopically fine and crowded spiral striation; posterior margin elevated, the cord ill defined and a little in front of the impressed suture. Aperture very narrow, approximately uniform in width throughout its extent. Outer lip oblique, varicose; 2 obscure lirae developed upon the inner surface, one medial in position, the other more elevated and about halfway between the first and the posterior commissure. Posterior sinus broad, U-shaped, not very deep. Inner margin of aperture broadly concave. Parietal wall heavily glazed, especially at the posterior commissure; pillar straight, simple, heavily reinforced. Anterior canal short, broad, open. Anterior fasciole rather wide, finely lirate, obliquely truncate at its extremity.

Dimensions: Height, 9.6 millimeters; length of aperture, 4.5 millimeters; maximum diameter, 3.7 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 114014.

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

Clavatula libertalis is smaller than either *C. euparypha* or *C. anthera*, the protoconch is coiled 2¼ times instead of only twice, and the posterior cord is very much less sharply defined.

Occurrence: Chipola formation, locality 2211[p], 7183[r].

Clavatula vandenbroecki (Maury)

Plate XXXIX, figure 18

1910. *Drillia vandenbroecki* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 10, pl. 2, fig. 8.

Shell slender, acute, with 10 whorls, of which the 3 nuclear are smooth and shining; spiral sculpture of fine, subequal threads with wider interspaces. The threads extend over the subsutural grooves and thus cover the entire surface of the shell except the 3 nuclear whorls; transverse sculpture of well-marked riblets which extend from the base of the subsutural groove to the succeeding suture and down over more than one-half the body-whorl; aperture rather narrow; outer lip somewhat thickened near the edge; notch deep, distinct, U-shaped; pillar with a moderate callus; canal very short, open. Length of shell, 13; of aperture, 5; greatest width, 4.5 millimeters.

Chipola marls, Baileys Ferry, Fla.

Cornell University collection.

Named in honor of Professor Van den Broeck, Director of the Geological Survey of Belgium.—Maury, 1910.

Shell of moderate size, with a rather short body whorl and a slender, elevated spire. Nucleus small, smooth, highly polished, acutely tapering, of 3½ volutions; initial whorl largely submerged, the succeeding turns becoming increasingly elevated and more flattened laterally. Line of demarcation between conch and protoconch marked by a change in the texture of the shell, the appression of the posterior margin of the whorl, and the initiation of rounded axial riblets, 10 to 12 to the whorl, persisting from the appressed posterior portion to the anterior suture; a microscopically faint spiral lineation introduced upon the

second volution. Adult whorls rather angular in outline, although the profile is somewhat obscured by the heavy axial ribbing. Posterior fasciole rather narrow, about one-third the width of the whorl, moderately concave; rounded, the extremities of the axials forming a crenulated shoulder at the margin of the fasciole. Sides of whorls approximately vertical in the adult except the body, which is gently constricted toward the base. Axial sculpture dominant, the costae, 12 to 14 upon the final whorl, very narrow but rounded upon their summits, persisting with uniform strength from the fasciole to the anterior suture and well down upon the base of the body, equal and regular in size and spacing except upon the final half turn, separated by convex intercostals of slightly greater width. Spiral sculpture close and crowded over the entire conch, equally strong upon the costal and intercostal areas, separated by narrower channels. Primaries low but rather broad, usually 6 upon the penult and 13 to 15 upon the body and pillar; secondaries intercalated upon the medial portion of the body; posterior fasciole threaded with 3 or 4 very fine, rather sharp lirations and, in its anterior portion, obscurely undulated by the axials. A single heavy cord placed at the posterior margin of the fasciole a little in front of the impressed suture. Aperture narrow, slightly oblique. Outer lip very broadly arcuate, somewhat thickened but not lirate within. Posterior siphonal notch broad and rather shallow. Parietal glaze very heavy, especially near the posterior commissure, where there is a localized deposit. Anterior canal short, broad, open. Anterior siphonal fasciole closely threaded, deeply emarginate at its extremity.

Dimensions of figured specimen: Height, 22.5 millimeters; maximum diameter, 8.0 millimeters.

Figured specimen: U. S. Nat. Mus. No. 371058, from locality 2564, McClelland farm, 1 mile below Baileys Ferry, Chipola River, Calhoun County, Fla.

C. vandenbroecki (Maury) is characterized by the threading of the posterior fasciole.

Occurrence: Chipola formation, localities 7893^{r}, 2213^{c}, 2564^{r}, Cornell University collections.

Clavatula habra Gardner, n. sp.

Plate XXXIX, figure 10

Shell slender, the spire elevated and acutely tapering, the body rather abruptly contracted at the base. Whorls feebly convex, not very strongly constricted at the fasciole, 10 to 10¼. Nucleus very small, smooth and shining, a trifle more than twice coiled; initial whorl rather tumid, immersed at the tip; final whorl flattened laterally. Line of demarcation between conch and protoconch obscure, indicated by a slight change in the texture of the shell and by the gradual initiation of the axial sculpture. Axials approximately 10 on the earlier whorls, increasing to 14 on the later, irregular in size and spacing upon the final half turn; intercostals broadly concave, approximately double the width of the costals. Spirals very feeble and restricted entirely to the intercostal area, very low and flat, 4 upon the later whorls of the spire, 8 upon the posterior and medial portions of the body, and 3 or 4 rather more elevated and more distantly spaced lirae upon the base; interspirals, except upon the base of the body, narrower than the spirals. Posterior siphonal fasciole rather narrow and sharply delimited in the later whorls by a feeble linear sulcus; the margin of the posterior of the primary spirals more or less obsolete on the costal but very distinct on the intercostal areas; fasciole usually devoid of spiral sculpture but in some shells, as in the type, obscurely lirate. Suture closely appressed, posterior cord rather distant from it and, like the suture, strongly undulated by the costae of the preceding volution. Aperture narrowly clavate, acutely angulated posteriorly, widening slightly with the feeble expansion of the outer lip and the constriction at the base of the body. Labrum commonly more or less thickened externally, wedging to a sharp edge, smooth within. Parietal wall very heavily glazed. Posterior siphonal notch broad but rather shallow, symmetrically disposed between the periphery and the suture. Anterior canal short, broad, and open. Anterior fasciole short but rather wide, broadly emarginate at its extremity.

Dimensions: Height, 12.3 millimeters; length of aperture, 5.2 millimeters; maximum diameter, 4.3 millimeters.

Holotype: U. S. Nat. Mus. No. 328517.

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

Clavatula habra is more slender than *C. vandenbroecki* Maury, with a wider and more closely spaced spiral sculpture and a less constantly lirate posterior fasciole. It is, in fact, the smallest and most delicate of all the similarly sculptured members of the genus.

Occurrence: Chipola formation, localities 2213^{c}, 2564^{c}.

Clavatula compsa Gardner, n. sp.

Plate XXXIX, figures 7, 8

Shell of moderate size, the spire somewhat scalariform in outline, acutely tapering, the body very gently constricted at the base; whorls 10 in all. Protoconch small but rather high, smooth, and highly polished, the initial turn minute, feebly inflated, immersed at the extreme tip, the two succeeding volutions broadly convex, regularly increasing in diameter. Line of demarcation between the conch and protoconch rather obscure, indicated by an irregular break in the texture of the shell and by the gradual initiation of the axial sculpture. Axials very broadly rounded, somewhat undulatory in character on the early volutions, 8 or 9, becoming a little narrower on the later volutions and increasing to 13, persisting with uniform strength from

the posterior fasciole to the anterior suture and on the ultima almost to the anterior fasciole. Spiral sculpture relatively feeble, much stronger on the adolescent forms than on the fully adult; spirals broad, flattened cords, usually 4 on the later whorls of the spire and 10 to 12 on the body, for the most part equal in size and spacing but perceptibly stronger and more distantly spaced upon the base of the body. Anterior fasciole closely threaded with an additional half dozen lirae. Posterior fasciole sharply defined by the constriction of the whorl and the abrupt evanescence of the axials, for the most part smooth as in the type but in some shells developing a feeble and fortuitous spiral; posterior cord strong, rather distant from the impressed suture and, like it, strongly undulated by the costae of the preceding volution. Aperture oblique, narrowly clavate, angulated posteriorly, widening with the feeble expansion of the labrum and the slight constriction of the labium. Outer lip subvaricose externally, though wedging out to a thin margin, smooth within. Parietal wall heavily glazed, the callus localized directly in front of the posterior commissure, which is feebly sulcate. Posterior siphonal notch very broad and very shallow. Anterior canal very short and very broad. Anterior fasciole short and rather wide, deeply marginate.

Dimensions: Height, 15.7 millimeters; length of aperture, 8.0 millimeters; maximum diameter, 5.7 millimeters.

Holotype: U. S. Nat. Mus. No. 328526.

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

Clavatula compsa is a somewhat larger and decidedly coarser shell than *C. elatocompsa*. The axials are narrower, less undulatory, and more numerous, the normal number being 13 instead of 9 or 10; the spirals are broader but more obscure, and the posterior fasciole is more sharply constricted and less affected by the costae.

Clavatula eleutheria, of the Alum Bluff fauna, is slightly larger, with somewhat more numerous and more prominent axials and a more obscure but usually coarser spiral sculpture.

Occurrence: Chipola formation, localities, 2564^c, 3419^c, 2211^r, Aldrich collection, Johns Hopkins University.

Clavatula elatocompsa Gardner, n. sp.

Plate XXXIX, figures 11, 12

Shell small, daintily formed, rather slender; constriction at the base of the body rather abrupt; whorls of conch 6. Protoconch small, smooth, and highly polished, a trifle more than thrice coiled; volutions increasing regularly and rather rapidly in size; the initial turn broadly inflated, immersed at the very tip, the succeeding volutions also a little convex medially. Line of demarcation between conch and protoconch irregular, marked by a decided change in the texture of the shell and by the initiation of the axial sculpture. Axials on early whorls broadly rounded, protractive, 8, increasing to 9 on the later volutions, more feebly protractive and somewhat flexuous upon the body, becoming more acutely rounded and persistent from the fasciole well down to the base of the body but more or less irregular in size and spacing upon the final half turn; intercostal areas broadly and symmetrically concave. Spiral lirae very fine and faint and, upon the summits of the costals, barely perceptible, 4 upon the whorls of the spire and about 12 upon the body, those upon the spire and the anterior portion of the body equal in size and separated by equal interspaces about three times as wide as the spirals; lirae upon the medial portion of the body a little more closely spaced as a rule and those upon the base and pillar more prominent and more distant. Posterior siphonal fasciole not very sharply delimited, obscurely undulated by the axial sculpture and bearing 1 or 2 very fine spiral lirae; posterior cord ill defined, rather distant from the impressed suture and, like it, undulated by the costae of the preceding volution. Aperture narrow, obliquely oblanceolate. Outer lip expanded incrementally but not axially, commonly thickened behind the margin, sharp-edged and smooth within. Parietal wall smoothly and rather heavily glazed, the callus localized in front of the posterior commissure. Posterior siphonal notch broad and moderately deep. Anterior canal short, broad, and open, not sharply differentiated. Anterior siphonal fasciole short but broad and deeply emarginate at its extremity.

Dimensions: Height, 11.1 millimeters; length of aperture, 5.6 millimeters; maximum diameter, 4.3 millimeters.

Holotype: U. S. Nat. Mus. No. 328520.

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

Clavatula elatocompsa suggests a *Glyphostoma* in its general contour and proportions. The relative dimensions are variable; the number of axial costae may be perceptibly increased or diminished, and the spiral lirae are commonly decidedly wider than in the type. The most characteristic features of the shell are the fusiform outline, the smoothly rounded body, the narrow but undulatory axial costae, which are for the most part opposite and perform about half a revolution around the axis of the shell, and the subdued spiral sculpture.

Clavatula elatocompsa is very closely related to *C. compsa*, but *C. Compsa* runs a little larger, is more sharply constricted at the fasciole, has more numerous and less undulatory costals, and a more obscure but less delicate spiral sculpture.

Occurrence: Chipola formation, localities 2213^r, 2564^c, 3419^c, Aldrich collection, Johns Hopkins University.

"Drillia" stonemani Maury

1910. *Drillia stonemani* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 10, pl. 2, fig. 7.

Shell small, short fusiform, whorls about 7, of which the nuclear are smooth; spiral sculpture of raised threads which are absent only from the subsutural bands; transverse sculpture of fine riblets (10 on the body whorl) with narrower interspaces; outer lip thickened near the edge which is crenulate on the inside margin; notch very marked and prominent; nearly O-shaped; aperture narrow; pillar with a slight callus. Length of shell, 10; greatest width, 4 millimeters.

Chipola marls, Baileys Ferry, Fla.

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

Cornell University collection.—Maury, 1910.

It has not been possible to discover this or the following species in the material under observation.

Occurrence: Chipola formation, Cornell University collection.

"Drillia" nemoralis Maury

1910. *Drillia nemoralis* Maury, Bull. Am. Paleontology, vol. 4, p. 9, pl. 2, fig. 6.

Shell small, rather solid, about 8-whorled, nuclear whorls eroded in the specimen found; spiral sculpture of raised threads covering the whorls except on the subsutural grooves, which are smooth; transverse sculpture of riblets (7 on the body whorl), which are strongest at the periphery of the volutions and do not cross the subsutural grooves; aperture oval-elliptical; notch slight and inconspicuous; pillar with a moderate callus. Length of decollate shell, 10; greatest width, 4.5 millimeters.

Oak Grove, Santa Rosa County, Fla.

Cornell University collection

This species resembles in size and sculpture *D. stonemani*, from Baileys Ferry, but in the latter shell the transverse ribs are more numerous and the notch is very conspicuous, while in this species it is only slightly indented.—Maury, 1910.

The species has not been recognized in the later collections. Occurrence: Oak Grove sand, Cornell University collection.

Genus CARINODRILLIA Dall

1919. *Carinodrillia* Dall, U. S. Nat. Mus. Proc., vol. 56, no. 2288, p. 17.

1928. *Carinodrillia* Woodring, Miocene mollusks from Bowden, Jamaica, pt. 2: Carnegie Inst. Washington Pub. 385, p. 153.

Type (by original designation): *Clathrodrillia* (*Carinodrillia*) *halis* Dall. (Recent in the Gulf of California.)

For the species in which the spiral sculpture predominates and in which there is a tendency for the peripheral cord to form a carina, the name *Carinodrillia* is proposed, with *Clathrodrillia halis* Dall as the type. This forms a very natural group containing a large number of species, mostly unicolor, whitish or brownish.—Dall, 1919.

Woodring raised Dall's section to generic rank in 1928.

Shell medium-sized, moderately slender. Nucleus (of type species) slender, consisting of about 2½ whorls, the last three-quarters whorl sculptured with axial riblets. Aperture narrow, anterior canal short, strongly constricted. Siphonal notch shallow, siphonal fasciole slightly inflated. Base of outer lip bearing a shallow sinus. Anal sinus deep, the apex rounded, lying some distance from suture. Edge of inner lip detached. Parietal wall heavily calloused adjoining anal sinus. Sculpture "*Fusus*"-like, consisting of swollen axial ribs, overridden by spiral threads. Anal fasciole concave, bearing a spiral cord or swelling above the sinus.

Carinodrillia was proposed as a section of *Clathrodrillia* on account of the "tendency for the peripheral cord to form a carina." The definitely formed anterior canal, shallow siphonal notch and "*Fusus*"-like sculpture seem to justify generic recognition. The presence or absence of a peripheral carina is not considered of any great significance. The holotype of *Clathrodrillia* (*Carinodrillia*) *halis* is an immature shell. Larger specimens show a more maturely formed aperture.

Carinodrillia has the sculpture of *Fusiturricula*, but the anterior canal is much shorter, wider, and emarginate.—Woodring, 1928.

The group is not conspicuous, but it is widespread in the middle Miocene of Florida and the Caribbean.

Carinodrillia cymatoides Gardner, n. sp.

Plate XL, figure 1

Shell small, slender, acutely tapering, constriction at the base of the body rather abrupt. Whorls of adult conch probably 8. Protoconch small, smooth, and highly polished, coiled 3½ times; initial whorl of protoconch coiled in a single plane and for the most part submerged, succeeding volution increasing rapidly in altitude; the final turns increasing regularly and rather rapidly both in diameter and elevation. Boundary line between the conch and protoconch indicated by the thickening and change in the texture of the shell, the initiation of the axial sculpture, and the appression of the posterior margin of the whorl; costals on the first whorl of the conch so broadly rounded in proportion to their length that they have the aspect of somewhat elongated peripheral nodes, 10 on the first whorl but reduced to 8 upon the second; 2 feeble spirals introduced within the first half turn, one near the medial horizontal and the other halfway between that and the anterior suture; a third primary introduced directly behind the suture line upon the third turn of the conch; posterior fasciole developed between the posterior cord and the posterior primary, gradually increasing in width and, on the third volution, showing traces of a faint spiral lineation; adult sculpture unusually well characterized. Axials 6 or 7 upon the later volutions, prominently elevated and very broadly rounded, separated by narrower concave intercostals, opposite and slightly protractive, so that the series performs a little less than half a revolution around the axis of the shell; most prominent medially but persistent to the anterior suture, evanescent posteriorly but sufficiently strong to undulate the fasciole feebly. Primary spiral sculpture of rather narrow, conspicuously elevated cords, 3 upon the later whorls of the spire, symmetrically disposed between the anterior margin of the fasciole and the anterior suture, the 3 primaries upon the anterior and medial portions of the body supplemented by 5 slightly less elevated cords upon the base, 5 lirae upon the

pillar, and 3 or 4 very fine threadlets upon the anterior fasciole; very fine, fortuitous secondaries in some shells introduced upon the medial and basal portions of the body and upon the pillar; posterior cord defined on the first whorl of the conch and attaining an equal or greater elevation than any of the primaries, broadly and smoothly undulated by the costae of the preceding volution. Posterior fasciole gradually developed between the posterior cord and the peripheral primary; on the later volutions, one-third as high as the entire whorl, strongly undulated by the costae of the same volution and feebly by the costae of the preceding, lirated by 5 rather sharp threadlets, the 2 anterior a little stronger and not quite so closely spaced as those behind them. Suture line impressed, broadly undulated, the margin in front of it obliquely sloping to the summit of the posterior cord. Aperture narrowly clavate, widening behind by reason of the expansion of the outer lip and the rather abrupt constriction of the inner. Labrum broadly arcuate, not varicose in the immature type, smooth within. Parietal wall glazed, the callus localized directly in front of the posterior commissure. Posterior siphonal notch very deep, symmetrically U-shaped, placed a little nearer to the posterior cord than to the periphery. Anterior canal of moderate length for the genus, rather narrow, open, very slightly recurved. Anterior fasciole short, broadly emarginate at its extremity.

Dimensions: Height, 16.0 millimeters; length of aperture, 5.8 millimeters; maximum diameter, 5.5 millimeters.

Holotype: U. S. Nat. Mus. No. 114025.

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

Carinodrillia cymatoides is very similar in general aspect to *C. elocata* (Pilsbry and Johnson), from the Gurabo of the Dominican Republic, and its subspecies *meta* from Bowden. The West Indian race runs larger, the anterior canal is usually longer, and the sculpture upon the posterior fasciole is not the sharp regular threading that it is upon the Chipola species.

Drillia zooki Brown and Pilsbry is a more delicate and slender shell with a similar primary sculpture but with only 1 or 2 faint secondary threadlets visible upon the posterior fasciole.

Carinodrillia cymatoides is the possible precursor of *C. eucosmia* (Dall) of the Recent fauna. The axials of the Miocene species are broader and less numerous, the posterior cord much more prominent, and the secondary spiral sculpture much less constant and more restricted. The type of *C. cymatoides* is immature and differs probably from the adult in the sharper basal constriction, the absence of a terminal varix, and the thinner parietal glaze.

A fragment of a form similar to *C. cymatoides* but larger, more sharply undulated, and more strongly and distantly lirate upon the posterior fasciole was collected in the Shoal River formation. The species is fairly common at the type locality but has not been recognized elsewhere.

Occurrence: Chipola formation, locality 2213[c].

Genus AGLADRILLIA Woodring

1928. *Agladrillia* Woodring, Miocene mollusks from Bowden, Jamaica, pt. 2: Carnegie Inst. Washington Pub. 385, p. 157.

Type (by original designation): *Agladrillia callothyra* Woodring. (Miocene of Bowden, Jamaica.)

Shell small, moderately slender, body whorl bearing a varix some distance from outer lip. Nucleus rather stout, consisting of about 2 smooth whorls. Aperture long and narrow. Anterior canal strongly constricted. Siphonal notch moderately deep, asymmetrical, siphonal fasciole hardly inflated. Base of outer lip bearing a relatively deep notch. Inner lip detached. Anal sinus deep, adjoining suture, apex rounded. Parietal wall heavily calloused adjoining suture. Sculpture consisting of narrow axial ribs and of spiral threads or grooves. Anal fasciole bearing a swelling across which obscure prolongations of the axials extend.

This genus is proposed for small "Drillias" that have a narrow aperture, definitely formed anterior canal, rather deep stromboid notch on the outer lip, and an asymmetrical siphonal notch.—Woodring, 1928.

The high polish is a conspicuous feature of the members of this group throughout the Floridian and Caribbean middle Miocene.

Subgenus AGLADRILLIA s. s.

1928. *Agladrillia* Woodring, Miocene mollusks from Bowden, Jamaica, pt. 2: Carnegie Inst. Washington Pub. 385, p. 157.

Type (by original designation): *Agladrillia callothyra* Woodring. (Miocene of Bowden, Jamaica.)

The sculpture of *Agladrillia* s. s. consists of axials and spirals, and the anal fasciole is set off by discrepant sculpture.—Woodring, 1928.

The group includes the type species *A. callothyra* Woodring; the relatively large, coarse, and usually warped *A. gatunensis* (Toula), from the Gatun Lock site; and a much smaller species, *A. pennyi* (Mansfield), from the Brasso beds of Trinidad. In all the West Indian forms the posterior fasciole is defined earlier than in the Floridian. The tendency toward a warped and irregular growth habit is very marked both in *A. gatunensis* and in the Shoal River species *A. empera,* which it strongly resembles.

Agladrillia aulakoessa Gardner, n. sp.

Plate XL, figures 2–4

Shell highly polished, moderately large and heavy, sharply constricted at the base of the body. Whorls convex, acutely tapering, of 13 component volutions, the first 2½ included in the smooth polished protoconch. Initial half turn of protoconch for the most part submerged; succeeding volutions erect, broadly inflated,

and strongly constricted at the suture; the final nuclear whorl gradually flattening and usually of smaller diameter than the whorl behind it. Line of demarcation between conch and protoconch obscure and irregular, indicated by the introduction of the axial sculpture in the form of narrow riblets, 10 to 12 to the whorl, persistent from suture to suture, sharply pinched posteriorly, broader and more obtuse medially, and separated anteriorly by wider, concave intercostals, most deeply depressed a little in front of the suture line. Spirals not introduced, as a rule, until the third volution and not perceptibly impressed until the fourth; anal fasciole developed upon the fifth or sixth. Adult whorls strongly convex for the genus, constricted both at the posterior and the anterior suture; posterior margin elevated and closely appressed, forming a rather narrow sutural band. Axials numerous, 17 or 18 upon the later whorls but irregular and, for the most part, obsolete upon the final half turn, normally assuming the form of acute, elevated ridges, fairly uniform in prominence from the anterior suture to the fasciole, which they cross, though with diminished strength, even appearing as obscure nodes upon the posterior sutural band, and persisting on the body whorl almost to the base of the pillar; intercostal areas obtusely V-shaped, a little wider than the costal, somewhat pitted at the fasciole. Spirals manifested as impressed linear sulci, equal and regular in size and spacing, 4 upon the antepenult of the type and 5 upon the penult, 10 to 12 upon the body and pillar, in some shells as many as 6 upon the penult, with a corresponding increase on the other whorls; sulci restricted almost entirely to the intercostal areas. Anal fasciole smooth, very narrow, not very sharply defined, indicated by the weakening of the costals and the more strongly depressed intercostals. Suture line distinct, impressed. Aperture rather wide. Outer lip standing apart, the margin thin, sharp, flaring incrementally but only slightly expanded. Constriction of the inner lip at the base of the body rather sharp. Labium smooth, heavily glazed, most heavily near the posterior commissure and along the pillar wall. Posterior siphonal notch very deep, broadly V-shaped, symmetrically disposed between the suture and the anterior margin of the fasciole. Anterior canal short, straight, rather wide. Anterior fasciole short, spirally lirate, incrementally rugose, deeply emarginate at its extremity.

Dimensions: Height, 25.0 millimeters; altitude of aperture, 9.0 millimeters; maximum diameter, 8.0 millimeters.

Holotype and 2 paratypes: U. S. Nat. Mus. No. 113999.

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

The form varies decidedly in relative proportion and in the relative inflation of the nuclear whorls. In some specimens the fasciole is delimited by sulci, much as in *A. subvaricosa*, thus giving to the whorl the effect of being regularly striated from the sutural band to the anterior suture. These variations are apparently individual and of no systematic significance.

Agladrillia aulakoessa is the Chipola representative of the group of *A. subvaricosa*, from the Oak Grove fauna, and *A. empera*, from the Shoal River fauna. The forms have in common an elevated spire, a closely appressed sutural band with a narrow fasciole in front of it, numerous more or less /\-shaped axials, and an impressed spiral sculpture, restricted for the most part to the intercostal areas in front of the fasciole and consisting of 4 to 6 sulci upon the later whorls of the spire.

The characters that separate the Chipola species from the other members of the group are the convex whorls, the ill-defined posterior fasciole, the more regular and more acute axials, which persist across the fasciole, and the somewhat more numerous and more deeply impressed spirals.

All three members have been unaccountably assigned to *"Drillia" jamaicensis* Guppy, of the Bowden fauna, a rather small, heavy *Crassispira*, somewhat pupiform, not constricted at the base of the body, with distinct nuclear characters, a spirally lirate fasciole with a rather broad, elevated sutural cord behind it and 6 or 7 primary lirations with intercalated secondaries in front of it.

Occurrence: Chipola formation, localities, 2213[a], 2564[p], 3419[c], 7151[r].

Agladrillia dryados (Maury)

1910. *Drillia dryados* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 7, pl. 2, fig. 2.

Shell of moderate size, rather strong, resembling *D. grabaui*, with 11 whorls, of which the 2 nuclear are smooth; spiral sculpture of close equally interspaced grooves, which extend over the entire surface of the shell except the nucleus and the crests of the transverse ribs which interrupt the grooves; transverse sculpture of numerous, rather sharply defined ribs (16 on the next to the last whorl) which tend to become fainter and obsolete on the body whorl; subsutural band slightly nodular, undulated; aperture narrow; canal short; outer lip not lirate within; pillar with a moderate callus. Length of shell, 21.5; of aperture, 4; greatest width, 7 millimeters. One specimen only.

Oak Grove, Santa Rosa County, Fla.

Cornell University collection—Maury, 1910.

Agladrillia dryados is apparently very close to *A. subvaricosa* but more slender and more closely sulcate. The sutural band is wider in the former, obscurely nodose, and spirally lirate, whereas in the latter it is rather narrow, strongly corrugated incrementally but devoid of spiral sculpture.

Occurrence: Oak Grove sand, Cornell University collection.

867196 O—50——5 (142-F)

Agladrillia subvaricosa Gardner, n. sp.

Plate XL, figures 5, 6

Shell rather large, moderately heavy, sharply constricted at the base of the body. Whorls 14 in all, including the smooth, small but relatively high, thrice-coiled nucleus. Initial whorl partly submerged; succeeding nuclear turns broadly inflated, smoothly polished, well elevated. Initiation of conch indicated by an exaggerated incremental and by the introduction of the axial sculpture in the form of sharp peripheral nodes, 10 to 12 to the whorl, which persist for a short distance behind the periphery as narrow, obscure ridges and in front of the periphery as broad axial undulations; spiral sculpture indicated on the second whorl of the conch by a low thread joining the nodes and on the third whorl by 5 faintly impressed lines upon the medial and anterior portions; posterior portion of whorl becoming increasingly appressed with the increasing development of the fasciole. Adult whorls irregular in outline; posterior margin of the shell elevated and closely appressed, forming a rather broad sutural band cut off from the periphery by a rather broad and well-defined siphonal channel. Adult axial sculpture of sharply pinched riblets, 18 on the later whorls but irregular and more or less obsolete on the last half turn, persisting with uniform strength from the fasciole to the anterior suture, equal in size except for a few broadly rounded varices, separated from one another by concave intercostals slightly wider than the costals. Spiral sculpture restricted to linear sulci, 3 or 4 on the later whorls of the spire, not including the sulci that usually define the siphonal channel, 5 on the medial portion of the body, 3 on the base of the body, and 4 somewhat wider and deeper on the pillar; sulci confined for the most part to the intercostal areas, though in some specimens faintly discernible upon the summits of the costals, especially on the anterior portion of the whorl. Sutures impressed. Aperture narrowly pyriform, the outer lip mutilated in all available material, probably thin and feebly expanded. Siphonal notch broad and rather shallow, symmetrically placed between the suture and the periphery. Parietal glaze very heavy, its outer margin discrete along the pillar and anterior fasciole. Anterior canal short and straight; siphonal fasciole short, sharply defined, rugose, emarginate.

Dimensions: Height, 26.6 millimeters; height of aperture, 10.0 millimeters; maximum diameter, 8.5 millimeters.

Holotype: U. S. Nat. Mus. No. 351166; paratype, U. S. Nat. Mus. No. 135966.

Type locality: Holotype, No. 5079, half a mile below Shell Bluff, Shoal River, Walton County, Fla.; paratype, No. 2646, Oak Grove, Okaloosa County, Fla.

Agladrillia subvaricosa is closely related to *A. empera* but the whorls are less sharply constricted at the fasciole, so that the spire does not possess the angular scalariform aspect of the Shoal River species. The nucleus is higher, the initial whorl less submerged, and the number of component volutions slightly greater. The axials are somewhat less elevated, the varices less pronounced and less numerous, and the sulci linear instead of almost the width of the spaces between them. From *Agladrillia aulakoessa*, the Chipola analog, it is separated by its somewhat larger, ruder shell, less convex whorls, more sharply defined anal fasciole, more obtuse and irregular axial sculpture, and more distinct spiral sulci.

Occurrence: Oak Grove sand, locality 2646[r]. Shoal River formation, locality 5079[r].

Agladrillia empera Gardner, n. sp.

Plate XL, figures 7, 8

Shell rather large for the genus, heavy, sharply constricted at the base of the body, the spire approximately two-thirds the altitude of the entire shell, scalariform. Whorls probably 15 in all in a perfect adult. Nucleus small, smooth, highly polished, obtuse, performing between 2½ and 2¾ volutions; earliest half or three-quarters turn almost entirely submerged; succeeding whorl broadly inflated, becoming increasingly elevated; final turn of the protoconch very feebly convex. Line of demarcation between conch and protoconch inconspicuous, indicated by a slight change in texture and by the initiation of the axial sculpture in the form of 10 to 12 peripheral nodes which flatten abruptly behind the periphery but which persist as undulatory costals in front of it; spiral sculpture initiated by a faint medial sulcus connecting the nodes, augmented within the second conchal volution by 2 or 3 additional sulci in front of the periphery and others even fainter behind it; posterior margin of the whorl becoming increasingly appressed with the development of the anal fasciole. Adult whorls straight-sided, abruptly compressed at the fasciole, thus giving to the spire a conspicuously scalar outline. Axial sculpture dominant, restricted, with the exception of the incrementals, to the area before the fasciole; axials 16 to 18, for the most part narrow and pinched, irregular on the last half turn, and with 1 to 3 broadly rounded varices, upon the later whorls; axials uniform in strength from the fasciole to the anterior suture and persistent on the ultima almost to the base of the pillar. Spiral sculpture also restricted to the medial and anterior portions of the whorl, taking the form of rather broad, impressed sulci equal in size and regularly spaced, overriding the axials but with diminished prominence, separated by low interareas of slightly greater width. Base of the body and the pillar grooved with slightly narrower and relatively deeper sulci, which give the effect of a raised rather than an impressed sculpture. Fasciole narrow, about one-third the width of the whorl; somewhat con-

cave, closely appressed posteriorly, destitute on the later whorls of all sculpture except heavy growth lines. Suture distinct, impressed, undulated by the costae of the preceding whorl. Aperture narrowly pyriform, the body whorl smoothly rounded at the base. Outer lip thin, sharp, gently expanded incrementally. Posterior siphonal notch broad, rather shallow, symmetrically disposed between the suture and the periphery. Labium smoothly concave, nonplicate. Parietal wash heavy. Anterior canal short, straight, rather wide. Anterior siphonal fasciole well defined, incrementally corrugated, deeply emarginate at its extremity.

Dimensions: Height, 28.0± millimeters; height of aperture, 10.0 millimeters; maximum diameter, 8.4 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 351168.

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

These forms seem to be peculiarly prone to deformation. The varices are pathologic in aspect, and yet all of a large number of adult individuals exhibit them to a greater or less degree upon the later whorls. This tendency is also shared to a certain extent by the Oak Grove analog, *Agladrillia subvaricosa*, although the varices are less numerous and less conspicuous upon that species. The abrupt constriction at the fasciole and the consequent scalar outline, together with the relatively wide spiral sulci, are characters which separate the Shoal River form not only from *A. subvaricosa* but also from *A. aulakoessa*, the Chipola representative. The axial sculpture is less regular than in either of the other two species and the costals rather more elevated, though not more acute than in *A. aulakoessa*.

The *"Drillia" gatunensis* of Toula is another link between the Gatun and Shoal River faunas. It is a larger shell than *A. empera*, the axials are more acute and more numerous, and the posterior fasciole is more clearly defined upon the early whorls. The two species share the crude, bulging outline of the whorls, the strong tendency toward deformation, and the high polish on a gray shell surface.

Agladrillia empera is abundant in the environs of the type locality.

Occurrence: Shoal River formation, localities 3856[a], 3742[a], 5184[r], 2238[r].

Genus EUMETADRILLIA Woodring

1928. *Eumetadrillia* Woodring, Miocene mollusks from Bowden, Jamaica, pt. 2: Carnegie Inst. Washington Pub. 385, p. 159.

Type (by original designation): *Agladrillia* (*Eumetadrillia*) *serra* Woodring. (Miocene of Bowden, Jamaica.)

Shell small, slender. Nucleus rather slender, consisting of about 1½ smooth whorls. Aperture as in *Agladrillia* s. s., but the stromboid notch is shallower, and the siphonal notch is a little deeper and not so asymmetrical. Sculpture consisting of rounded swollen axial ribs, across which growth lines extend diagonally, and of microscopic filelike spirals. Anal fasciole shallow, unsculptured except for growth lines.

The aperture of *Eumetadrillia* is essentially the same as in *Agladrillia* s. s., with the exceptions given above. *Cymatosyrinx* Dall (Bull. Mus. Comp. Zoology Harvard College, vol. 18, p. 95, 1889; type, by original designation, *Pleurotoma lunata* Lea, Miocene, Virginia), which has been used for almost all "Drillias" that have no spiral sculpture, has a wide aperture, very deep narrow siphonal notch, swollen and definitely limited siphonal fasciole, and deep narrow stromboid notch that leaves its trace across the body whorl, and narrow anal sinus.—Woodring, 1928.

The two smooth or nearly smooth turritids in the Floridian Miocene differ so markedly in general aspect from the Alum Bluff members of *Agladrillia* that the subgenus has been raised to generic rank. The characters that separate the group from *Cymatosyrinx* Dall seem less fundamental and of doubtful generic value.

Eumetadrillia dodona Gardner, n. sp.

Plate XL, figure 31

Shell rather small for the genus, slender and lustrous; body whorl short relatively and abruptly constricted at the base. Conch of a little less than 8 volutions, the protoconch of a little more than 2. Initial whorl of protoconch inflated, immersed at the tip, the succeeding volution also inflated at its beginning, though flattening toward its close. Line of demarcation between the conch and protoconch indicated by a slight change in the texture of the shell and the gradual initiation of the axial sculpture. Whorls of conch closely appressed posteriorly, sharply rippled anteriorly. Costae prominently elevated, rather narrowly rounded, more or less obsolete posteriorly, tending to expand anteriorly, persistent to the base of the body but irregular upon the final half turn, usually 9 upon the later volutions of the spire, separated by concave intercostals, most deeply depressed a little behind the posterior suture; incrementals prominent, flexuous. Posterior fasciole not sharply defined, indicated by the weakening though not by the complete disappearance of the axials. Spiral sculpture absent over the entire shell. Suture very closely appressed. Aperture rather wide. Outer lip feebly arcuate, very thin and sharp at the edge, not denticulate within, broadly varicated at some distance back from the margin, nicked by the "stromboid notch". Posterior siphonal notch very deep and symmetrically U-shaped. Inner wall of the aperture excavated, smoothly and heavily glazed. Base of the body cut off from the anterior fasciole by a broad and shallow sulcus which terminates at the aperture in a feeble notch. Anterior canal short, broad, open. Anterior fasciole short, profoundly emarginate at its extremity.

Dimensions: Height, 16.0 millimeters; length of aperture, 6.5 millimeters; maximum diameter, 6.0 millimeters.

Holotype: U. S. Nat. Mus. No. 135968.

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

Eumetadrillia dodona is a much smaller and more delicate shell than *E. rabdotacona*, its probable analog in the Shoal River fauna. The axials are usually less numerous than in either *E. rabdotacona* or *"Drillia" prion* of the Chipola and also less acute than in *"D." prion* and more expanded in front of the periphery and less persistent behind it.

Occurrence: Oak Grove sand, localities 2646[c], 5632[p].

Eumetadrillia rabdotacona Gardner, n. sp.

Plate XL, figures 23, 27

Shell of moderate dimensions, rather stout, conic, the length of the aperture not much more than a third of the total altitude; body whorl short for the genus, rather sharply constricted at the base; whorls of the spire very closely appressed, decreasing regularly and rather rapidly in diameter. Protoconch large, smooth, shining, a trifle more than twice coiled, the initial turn for the most part immersed, the succeeding volution tumid and of approximately the same diameter as the first whorl of the conch. Beginning of conch indicated by a change in the texture of the shell, the appression of the posterior portion of the whorl, and the initiation of a feeble axial sculpture. Axials on early whorls 10 to 12 to the turn, decreasing to 10 or 11 upon the medial and anterior portions of the shell; axials obtusely rounded, a little more prominent at the periphery than upon the anterior portion of the shell, evanescent posteriorly on the later whorls though not on the earlier, opposite for the most part and almost vertical, thus regularly fluting the cone from the apex to the base of the body; interaxials concave, of approximately the same width as the axials except upon the final half turn, where they are irregular in size and spacing. Spiral sculpture absent over the entire surface, even upon the anterior fasciole. Posterior fasciole defined only by the close appression of the whorl and the more or less complete evanescence of the costae. Suture line distinct, crenulated by the axials of the preceding volution. Aperture rather short, widening posteriorly with the excavation at the base of the body. Outer lip very thin and sharp, almost vertical but widely expanded incrementally, the area included between the fascioles forming a subquadrate alate expansion. Posterior sinus profound, broadly U-shaped, symmetrically disposed between the periphery and the posterior suture. Labrum also finely but distinctly emarginate at the base. Labium sharply concave. Parietal wall heavily glazed, the callus especially thick directly in front of the posterior commissure. Pillar straight, simple, heavily reinforced. Canal very short, broad, open. Anterior fasciole heavily corrugated, very short, broadly and deeply emarginate.

Dimensions: Height, 24.0± millimeters; length of aperture, 9.5 millimeters; maximum diameter, 9.0 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 351176.

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

Less perfect individuals attain a maximum altitude of 30.0 millimeters.

Eumetadrillia rabdotacona is very abundant in the Shoal River fauna. It varies widely in relative dimensions. The young are decidedly stouter than the adults, but the variation in outline in the adults is so great that it is only after considerable hesitation that the differences have been judged not to merit taxonomic recognition. The axials also exhibit variations in number and prominence. They seldom fall below 10, but they may run up as high as 14 upon the later volutions. In some individuals they are rather acutely rounded, and they may even persist with greatly diminished strength across the fasciole, appearing in front of the suture as a series of inconspicuous retractive riblets.

This species is the representative in the Shoal River fauna of the group of *Cymatosyrinx lunata* Lea of the later Tertiary deposits. The Shoal River species is not constricted nor excavated at the fasciole, like the later Miocene form, nor do the axial costae evanesce so abruptly posteriorly and so completely. The axials are also less numerous and much less acute in *E. rabdotacona* and form a more obviously continuous series. The irregularity in the body ribbing is also much more marked in the earlier form, for there is commonly only a single normal rib and one abnormally broad and elevated protuberance upon the final half turn.

Eumetadrillia dodona is similar in the general characters both of the conch and protoconch but is much smaller and more delicate and usually has fewer ribs. *"Drillia" prion*, of the Chipola fauna, is usually smaller and much more slender, with more acute and usually less numerous axials, which are less expanded anteriorly and more persistent posteriorly.

Occurrence: Shoal River formation, localities 3856[pr], 2645[r], 3732[p], 3742[pr], 5080[r], ?5184[r], 5195[r], 3748[p].

There is a small group of two species and one subspecies in the Alum Bluff for which there is apparently no name among the restricted genera of the present nomenclature. They are slender shells of small size with elevated spires, 2 to 2½ smooth, nuclear turns, axials on the conch that persist from suture to suture, a spiral sculpture that ranges from faint to obsolete, a posterior fasciole that is clearly defined in *"Drillia" coryphodes* only, and apertural characters similar to those of *Eumetadrillia*. The group differs from *Eumetadrillia* in the persistence of the axials to the posterior suture even upon the earliest turns of the conch, in the development in some forms of a feeble

spiral sculpture, and in the tendency toward a vaguely defined posterior fasciole.

"Drillia inadrina" Mansfield, from the Brasso beds of Trinidad, is not far removed.

"Drillia" prion Gardner, n. sp.

Plate XL, figures 29, 30

Shell large, rather slender; spire elevated but slightly interrupted at the sutures, acutely tapering; body whorl rather abruptly constricted into the slender pillar. Whorls 10 to 11, the first 2 included in the protoconch, which is smooth and shining and rather obtuse. Initial whorl for the most part submerged, the succeeding volution large and broadly inflated at its beginning, flattening and slightly decreasing in size toward its end. Dividing line between conch and protoconch indicated by a slight thickening of the shell and the introduction of the axial sculpture. Axials similar in general character over the entire surface of the conch, narrow but rounded upon their summits, persistent from suture to suture and almost to the anterior fasciole, though weakening posteriorly and upon the base of the body and the final half turn, 11 upon the penultima of the type, feebly protractive and for the most part opposite, inclined to be slightly flexed at the posterior fasciole, separated by slightly wider concave intercostals. Spiral sculpture absent altogether, even upon the anterior fasciole. Posterior fasciole indicated only by the feeble flexure of the costals and the slightly greater depression of the intercostals; posterior margin of whorl very closely appressed. Sutures inconspicuous. Aperture clavate. Outer lip little or not at all thickened, although there is usually a rather broad varix developed within the final half turn; edge of outer lip thin and sharp and very slightly incurved, broadly and deeply insinuated at the posterior fasciole. Inner wall of aperture smoothly excavated, heavily glazed, the callus being especially thick directly in front of the posterior commissure. Anterior canal moderately long, broad, and open. Anterior fasciole clearly defined by the raised posterior margin and by the incremental corrugations, rather short and obscurely emarginate at the extremity.

Dimensions: Height, 20.0 millimeters; length of aperture, 8.0 millimeters; maximum diameter, 6.4 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 114045.

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

This is possibly the form that has appeared in the check lists under the name *Drillia lunata* Lea. Perhaps the most obvious of the many differences between the two shells is the persistence of the axial sculpture of *"D." prion* to the posterior suture. The species suggests *"Drillia" lunata*, however, in the range of variation in outline and in the number of costals. The individuals from Alum Bluff are constantly stouter than those from the Chipola River, and it is probable that more perfect material may warrant their separation. The type is larger than most of the forms and more closely sculptured. Commonly 9 rather than 11 ribs are developed upon the penult. Both the Shoal River and the Oak Grove analogs, *Eumetadrillia rabdotacona* and *E. dodona*, are relatively stouter. The axial costae are also more acute in the Chipola species than in either of the others and more uniform in prominence throughout their extent, being less expanded in front of the periphery and less prone to evanesce behind it. *"Drillia" prion paraprion* is usually more slender and is feebly sculptured spirally.

"D." prion is not rare along the Chipola River, and at Alum Bluff it is one of the most common representatives of the family.

Occurrence: Chipola formation, localities 2213[c], 2564[p], 3419[c], 2211[c], 7183[r]. Aldrich collection, Johns Hopkins University.

"Drillia" prion paraprion Gardner, n. subsp.

Plate XL, figures 24, 25

Shell of moderate size, spire elevated, whorls constricted at the sutures and increasing rather rapidly in diameter, body rounded and rather abruptly constricted at the base. Protoconch low but obtuse, coiled 2 times; initial half turn almost entirely immersed, succeeding volution tumid, broadly rounded posteriorly; final whorl of protoconch flattening and of approximately the same diameter as the whorl behind it. Dividing line between conch and protoconch defined by a slight thickening of the shell and the initiation of the axial sculpture. Whorls of conch 7, the early volutions trapezoidal in outline, the later broadly inflated a little in front of the median horizontal. Axials similar in general character over the entire conch except upon the final half turn, where they are for the most part obsolete, 10 upon the penult of the type, rather sharply elevated, acutely rounded upon their summits, feebly protractive medially and anteriorly, lower and slightly flexed posteriorly, persistent, however, from suture to suture and on the body well down to the base; intercostal areas broadly concave and approximately double the width of the costals, most depressed at the posterior fasciole. Spiral sculpture developed in the form of very obscure lirations, least faint upon the body, usually 3 on the later whorls, symmetrically disposed between the periphery and the anterior suture, and about 12 on the ultima, including those upon the pillar; spirals also faintly suggested upon the anterior fasciole. Posterior fasciole defined only upon the later whorls by the weakening and flexure of the axials and the greater depression of the interaxials. Suture lines distinct, impressed. Aperture less than half as high as the entire shell but rather wide. Outer lip thin, sharp, simple, only slightly expanded axially but widely flaring incrementally, the edge recurved over

the opening. Posterior siphonal notch U-shaped, very broad and deep. Inner lip excavated at the base of the body, smoothly and heavily glazed, the callus most heavy directly in front of the posterior commissure; the edge of the reverted pillar cut off from the anterior fasciole by a very shallow depression. Anterior fasciole rather wide, broadly arched, sinuous at its extremity.

Dimensions: Height, 12.8 millimeters; length of aperture, 5.8 millimeters; maximum diameter, 5.0 millimeters.

Holotype: U. S. Nat. Mus. No. 371059.

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

"Drillia" prion paraprion differs from *"D." prion* s. s. in the more slender outline and the consequent closer spacing of the axials and in the development of an obscure spiral liration.

"Drillia" coryphodes is very closely allied, so closely that it is difficult to separate the peripheral members, although the extremes seem much too far apart to be included under a single name. *"Drillia" coryphodes* runs smaller than *"D." prion paraprion,* is more closely and regularly lirate and more numerously costate, and usually has a shorter anterior canal. The posterior sinus is also a little deeper, the posterior band more sharply defined, and the costals are rather more sharply elevated, but all these characters vary within certain limits.

Occurrence: Chipola formation, localities 2564[c], 3419[c]. Aldrich collection, Johns Hopkins University

"Drillia" coryphodes Gardner, n. sp.

Plate XL, figures 26, 28

Shell rather small for the group and rather slender. body whorl relatively short; spire elevated not far from two-thirds of the altitude of the entire shell; whorls of the spire closely appressed, feebly inflated a little in front of the median horizontal; body rounded and rather strongly constricted at the base. Whorls 10 in all. Protoconch smooth, polished, obtuse, coiled 2½ times; conch 7½; initial half turn almost entirely immersed, the succeeding volution of the protoconch rather tumid; final whorl flattened laterally. Boundary line between the conch and protoconch indicated by a slight thickening of the shell and by the introduction of the axial sculpture. Axials similar in general character over the entire conch except upon the final half turn, where they tend to be irregular and commonly obsolete; 12 in the type, in some specimens as many as 14 on the final whorl of the spire, persistent from suture to suture and well down to the base of the body, rather sharply elevated, acutely rounded upon their summits, usually opposite, most prominent medially and anteriorly, lower and slightly flexuous posteriorly and upon the base of the body. Intercostal areas broadly concave, approximately double the width of the costals, very feebly lirated, with low and more or less obscure threadlets, which are for the most part obsolete upon the summits of the costals; 5 or 6 in front of the fasciole of the later whorls of the spire, more or less irregular upon the body; 3 or 4 less feeble lirae girding the base of the body directly behind the anterior fasciole, which is incrementally but not spirally striated. Posterior fasciole defined by the diminished strength of the axials, the flexure in the axials and incrementals, the greater depression of the interaxials, and on some individuals, but not in the type, by 2 or 3 microscopic spiral striae. Suture bordered by a low, ill-defined band overridden by the axials and by vigorous incrementals. Suture line distinct, impressed. Aperture oblique, lobate. Outer lip widely flaring incrementally, not varicated, the outer edge thin and sharp, simple within, broadly and deeply insinuated at the posterior sinus, feebly emarginate at the base of the body, possibly for the extension of the eye stalks. Labium smoothly excavated, heavily glazed, callus most heavy at the posterior commissure. Pillar simple, strongly reinforced. Anterior canal very short, broad, open, feebly recurved. Anterior fasciole cuneate, deeply emarginate at its extremity.

Dimensions: Height, 10.4 millimeters; length of aperture, 3.9 millimeters; maximum diameter, 3.8 millimeters.

Holotype: U. S. Nat. Mus. No. 328551.

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

"Drillia" coryphodes is more strongly and more regularly lirated than *"D." prion paraprion;* the costae in the former usually run 11 and 12 to the whorl; in the latter there are most commonly 9 or 10.

Occurrence: Chipola formation, localities 2213[c], 2564[r], 3419[p]. Aldrich collection, Johns Hopkins University.

"Drillia" eurysoma Gardner, n. sp.

Plate XL, figure 10

Shell small, ovate conic, the spire moderately elevated, acutely and rapidly tapering, the body broad relatively, its apparent breadth increased by the prominence of the terminal varix. Whorls of conch 6. Protoconch rather large, smooth, polished, elevated, the whorls probably 4, although the apex is slightly macerated so that the exact number cannot be determined with assurance; the initial turn for the most part immersed, the succeeding volutions increasing regularly and rather rapidly in diameter. Beginning of conch marked by the appression of the posterior margin of the whorl and by the introduction of the axial sculpture. Axials prominently elevated, 8 on the later whorls of the spire, persistent from suture to suture and well down to the base of the body, lower and more sharply pinched behind, expanding somewhat medially

and anteriorly, equal and regular in size and spacing except upon the final half turn, usually opposite and a little protractive, feebly flexed posteriorly upon the penult and both posteriorly and anteriorly upon the ultima; intercostals smoothly concave and a little wider than the costals. Spiral sculpture restricted to microscopically fine lineations upon the medial and anterior portion of the whorl, about 6 upon the penult and twice as many upon the body exclusive of the half dozen less feeble threadlets upon the anterior fasciole. Posterior fasciole obscurely indicated by the weakening of the axials, the slightly increased depression of the interaxials, the flexing of the incremental striae, and the entire absence of spiral lirae. Suture lines distinct, undulated by the costae of the preceding volution. Aperture oblique, rather narrow. Outer lip conspicuously varicose, the margin feebly arcuate, slightly thickened within directly in front of the posterior fasciole and at the entrance and parallel with the anterior canal. Posterior sinus broad and shallow, rather distant from the suture. Inner margin of aperture excavated at the base of the body. Parietal wall heavily glazed, especially near the posterior commissure. Pillar straight, simple, heavily reinforced. Anterior canal short, broad, open. Anterior fasciole wide, probably obliquely truncate at its extremity.

Dimensions: Height (tip decollate), 9.2 millimeters; length of aperture, 4.0 millimeters; maximum diameter, 4.0 millimeters.

Holotype: U. S. Nat. Mus. No. 351188.

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

This species should be included under the group of *"Drillia" riogurabonis* to which Woodring[10] referred when he said:

> It apparently represents an unnamed group of small stout "Drillias" that have a very short canal, no anal fasciole, and heavy ribs extending from suture to suture.

The Gurabo species is a smaller, stouter form than *"Drillia" eurysoma* with sharper, less flexuous axials. *"Drillia" riogurabonis* is apparently restricted to the Gurabo of the Dominican Republic; the closely related *"Drillia" eurysoma* to the Shoal River of Florida.

Occurrence: Shoal River formation, locality 3856[r].

"Drillia" microneta Gardner, n. sp.

Plate XL, figures 9, 21

Shell of only moderate size, rather slender; spire elevated and almost two-thirds as high as the entire shell; body short, rounded, and abruptly constricted at the base. Whorls of the adult conch 7. Protoconch rather large, polished, acutely tapering, coiled 4½ times; initial turn for the most part immersed, the 3 succeeding volutions smooth, broadly convex, increasing regularly and rather rapidly in diameter; final half turn of protoconch sculptured with 6 arcuate axials which persist to the posterior suture but wedge out rather abruptly anteriorly. Line of demarcation between the conch and protoconch rather obscure, indicated chiefly by a feeble, irregular thickening of the shell, the appression of the posterior margin of the whorl, the evanescence of the costae behind, and their persistence in front to the suture line. Axials similar in general character over the entire surface of the shell, increasing regularly in prominence to the ultima, 8 upon the later whorls of the spire, rather broad and obtusely angulated, the summits axially arcuate; costae most elevated medially, obsolete posteriorly, regular in size and spacing except upon the final half turn, where they are more prominent and less numerous, for the most part vertical but flexing a little posteriorly, and wedging out at the base of the body; intercostals broadly concave, wider than the costals. Spiral sculpture exceedingly faint on the earlier whorls but uniform in character over the entire surface of the conch except upon the fascioles and the pillar; spirals developed in the form of low, broad fillets separated by linear sulci, overriding the costals but commonly worn away from their summits, usually 9 or 10 in front of the fasciole of the later volutions of the spire, merging gradually into the narrower, closer threading of the posterior fasciole; pillar girded with 3 (in some individuals 4) coarser threads and the anterior fasciole with 6 more rounded lirae, which are shagreened by the incrementals. Posterior fasciole defined by the appression of the whorl, the more or less complete evanescence of the axials, and the closer spiral threading; posterior margin not elevated. Suture lines distinct, impressed. Aperture slightly oblique, oblanceolate. Labrum broadly and feebly arcuate, the margin thin and sharp and expanded incrementally, broadly but not deeply insinuated posteriorly. Labium smoothly concave. Parietal wall glazed, the callus heaviest at the posterior commissure. Pillar straight, simple, reinforced. Anterior canal short, broad, open. Anterior fasciole cuneate, obliquely emarginate at its extremity.

Dimensions: Height, 14.0 millimeters; length of aperture, 5.0 millimeters; maximum diameter, 4.7 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 351172.

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

This species is another *"Drillia"* or possibly *"Mangelia"* that does not conform to any of the restricted groups. It is characterized by the small shell, the large nucleus of 4½ coils, the pinched axials similar to those of *"D." prion*, the very fine and uniform spiral grooving, which covers the rounded whorls from suture to suture, and the low, close banding of the entire surface. The character of the spiral sculpture is somewhat similar to that of *"D." zosta*, but there are twice as many fillets upon each of the later whorls of the spire

[10] Woodring, W. P., Miocene mollusks from Bowden, Jamaica, pt. 2: Carnegie Inst. Washington Pub. 385, p. 162, 1928.

in "*D.*" *microneta*; furthermore, the nucleus is entirely different, the body whorl is relatively stouter, and the axials are more acute and not quite so numerous.

Occurrence: Shoal River formation, localities 3856[r], 3742[r].

"Drillia" trimitrodita Gardner, n. sp.

Plate XLI, figures 2, 3

Shell small, very slender, the profile broken by the constriction at the posterior fasciole and by the prominent spirals; spire elevated, tapering slowly to an acute apex. Whorls of conch probably between 6 and 7. Protoconch rather large and elevated, for the most part smooth and polished, of 3½ volutions; initial turn feebly inflated, submerged at the tip, the succeeding volution low, flattened laterally and also upon the summit; third turn of protoconch broadly and smoothly convex, moderately elevated; axial sculpture initiated on the last half, in some individuals not till the last quarter whorl of the nucleus, in the form of a few obtuse, more or less irregular protractive riblets. Beginning of conch indicated by a change in the texture of the shell and the character of the axial sculpture, the abrupt appression of the posterior margin, and the appearance of the posterior cord. Axials similar in general character over the entire conch, though shorter, sharper, and more closely spaced upon the early volutions; in their typical development broadly rounded, abruptly evanescent posteriorly, a little less elevated anteriorly than medially, persistent almost to the base of the body, equal in size except for the subvaricose terminal rib, and regularly spaced by narrow, sharply concave intercostals that broaden anteriorly, the number of ribs usually remaining constant (8 in the type) from the apical region to the body. Spirals sharply elevated, flattened cords that override the costals and intercostals with uniform strength, normally 3 upon the later whorls of the spire, with a fourth in some shells intercalated directly behind the suture line upon the penult; body primaries 6, with 3 slightly broader and more distant upon the pillar and with about 6 additional lirae upon the anterior fasciole; posterior of the primaries upon each whorl bordering the posterior fasciole, those in front symmetrically disposed between it and the anterior suture; interspiral areas smooth except for fine incremental striae. Posterior fasciole constricted, delimited in front by the posterior primary, behind by the acute and sharply elevated posterior cord; anterior portion of fasciole undulated by the remnants of the axials; spirals usually developed to the number of 5. Suture line obscure. Aperture rather narrow, obliquely oblanceolate. Outer lip subvaricose, expanded incrementally, smooth within; posterior sinus U-shaped, symmetrically disposed upon the fasciole. Inner margin of aperture excavated at the base of the body; parietal wall glazed; pillar straight, reinforced. Anterior canal moderately long and straight, the margins parallel. Anterior fasciole rather wide, obliquely truncate at its extremity.

Dimensions: Height, 10.0± millimeters; length of aperture, 3.5 millimeters; maximum diameter, 3.5 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 114024.

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

"*Drillia*" *trimitrodita*, another species apparently without restricted relationships, is suggested by some of the *Compsodrillia* of Woodring, but the nucleus of "*D.*" *trimitrodita* is larger and the sutural cord is a conspicuous feature not shared by the Bowden forms. The species is so well characterized that it seems worth while to give it a name. In the general features of both the conch and protoconch the shell suggests *Carinodrillia cymatoides*, a larger and more acutely tapering species. From individuals of the same size "*D.*" *trimitrodita* may be separated by its more gradually tapering spire, less strongly constricted body, more numerous and less nodular axials, the absence of secondary spiral striae between the primaries, and the much more feeble liration of the posterior fasciole.

Drillia stonemani Maury is apparently stouter and fewer whorled but with the same general ornamentation.

Occurrence: Chipola formation, localities 2213[p], 3419[r].

One group of "*Drillia*" which is well developed in the Alum Bluff is apparently without representation in the middle Miocene of the Caribbean and can not be included in any of the restricted genera. It is further remarkable in that five of the six species are known only from the Shoal River formation. The sixth, "*Drillia*" *pachycheila*, is an Oak Grove species. The cancellate later whorls of the protoconch form the most significant characteristic of the group. Other common features include a small shell with elevated spire, an axial and spiral sculpture, neither one of them conspicuously strong, and a moderately deep U-shaped siphonal notch.

"Drillia" centrodes Gardner, n. sp.

Plate XL, figures 11, 12

Shell small, slender, fusiform, spire elevated and acutely tapering, body whorl attenuated and smoothly constricted at the base. Whorls of conch a trifle more than 6. Protoconch of 2½ volutions; initial half turn obtuse, almost entirely immersed; succeeding volution broadly inflated, inclined to be flattened posteriorly, in some individuals axially puckered; final turn of protoconch axially sculptured and the final half turn sculptured with spiral lirations as well; axials very narrow, flexuous, inclined to evanesce anteriorly, 10 on the last half turn of the nucleus;

spirals flattened, usually 4 excluding the 2 more or less obsolete anterior lirae. Beginning of conch indicated by a slight change in the texture of the shell, the disappearance of the nuclear axials, the appression of the posterior portion of the whorl, and the gradual establishment of the postnuclear sculpture. Axials rather narrow, oblique, and strongly protractive upon the first turn of the conch but rapidly assuming their adult characters on the medial and anterior portions of the shell, less strongly protractive, approximately 9 to the whorl, short, subnodose, on the later volutions restricted entirely to the area in front of the fasciole and to the medial portion of the ultima, evanescent upon the base and the final half turn; spiral sculpture very low and inconspicuous but showing a considerable range in the degree of obscurity. Spirals, like the axials, largely restricted to the area in front of the fasciole, equally low and flattened on the costal and intercostal areas, usually 3 on the later volutions and more than twice as many on the body exclusive of the half dozen sharper, more closely spaced lirae upon the pillar and anterior fasciole. Posterior fasciole irregularly concave, more than half as wide as the entire whorl, sharply undulated on the earlier volutions by the remnants of the axial costae but on the later smooth except for an obscure spiral threading, rather strong incrementals, and feeble undulations along the anterior margin; posterior margin very slightly raised. Suture lines distinct, impressed, crenulated in harmony with the axials of the preceding volution. Aperture obliquely lobate, the outer lip feebly arcuate, the inner smoothly but rather feebly excavated. Labrum obscurely varicose a little behind the margin, the edge thin and sharp, commonly somewhat thickened within directly in front of the posterior fasciole and directly behind the entrance to the anterior canal. Posterior sinus profound, rather broadly U-shaped, symmetrically disposed between the suture and the periphery; deposit of callus at the posterior entrance to the sinus very heavy. Parietal wall smoothly washed. Pillar straight, simple, reinforced. Canal short, broad, open. Anterior fasciole cuneate, obliquely emarginate at its extremity.

Dimensions: Height, 9.3 millimeters; length of aperture, 4.0 millimeters; maximum diameter, 3.7 millimeters.

Holotype: U. S. Nat. Mus. No. 371061.

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

"Drillia" centrodes varies rather widely in the strength of the spiral sculpture on both the nuclear and the postnuclear whorls. It is unusually strong on the nucleus figured. In many individuals, indeed, only the two anterior lirae are discernible. The spirals upon the conch are invariably very low and flattened upon their summits and are usually wider than the interspiral channels.

The relatively low axials, the low spirals, relatively few, and the more sharply defined posterior fasciole readily separate the species from other forms of similar outline and nuclear characters, such as *"D." trypanion* and *"D." waltoniana*.

Occurrence: Shoal River formation, locality 3742[c].

"Drillia" zosta Gardner, n. sp.

Plate XL, figures 13, 14

Shell small, slender, acutely tapering, spire elevated, body whorl rather short relatively—only a little more than half as high as the entire shell—and rather sharply constricted at the base. Whorls 8½ in all, only the first 2¼ turns included in the protoconch. Initial half turn almost entirely submerged; the succeeding volution for the most part smooth and highly polished, becoming increasingly more elevated and more flattened laterally. Axial sculpture introduced just after the beginning of the final whorl of the protoconch, at first very feeble and irregular, but gradually gaining in strength and uniformity; spirals initiated within the next quarter turn as 3 or 4 low, flattened cords upon the medial and anterior portions of the whorl; sculpture upon the final half turn of the protoconch evenly reticulated, the axials numerous, 10 to 12 to the half turn, narrow and feebly arcuate; spirals rather broad, evanescent posteriorly, separated by linear channels. Line of demarcation between conch and protoconch indicated by a thickening and change in texture in the shell substance and by the abrupt disappearance of the protoconchal sculpture and the equally abrupt appearance of the conch ornamentation, both axial and spiral. Axials similar in general character over the entire surface of the conch, though narrower, more strongly protractive, and more persistent posteriorly upon the early turns, 9 upon each of the later whorls of the spire, equal and regularly spaced except upon the final half turn, obsolete posteriorly, expanded and obtusely rounded medially and anteriorly, persistent with but slightly diminished strength to the anterior suture and well down to the base of the body, separated by broadly concave and slightly wider intercostals. Spiral sculpture of low, broad fillets, uniform in character upon the costal and intercostal areas, 4 in front of the posterior fasciole of the earlier volutions, 5 on the later, and 9 upon the body exclusive of the 3 narrower, sharper threadlets which gird the extreme base of the body and the pillar and the 6 to 12 crowded lirae upon the anterior fasciole. Posterior fasciole indicated on the earliest turn of the conch by the appression of the posterior border, on the later volutions of the spire almost half as wide as the entire whorl, defined by the constriction of the whorl, the more or less complete evanescence of the axials, and the crowded spiral threading, the 5 fasciolar lirae being only about half as wide as the fillets upon the medial and anterior portions of the

whorl; posterior margin elevated, in some specimens cordate. Suture line impressed, undulated by the costae of the preceding volution. Aperture oblique, not very wide; a broad varicose fillet developed a short distance behind the outer margin, but no terminal varix. Outer lip very feebly arched, expanded incrementally, simple within, deeply insinuated posteriorly, the sinus subcircular in outline, symmetrically disposed between the suture and the periphery, strongly constricted at the entrance. Inner margin of aperture smoothly excavated. Parietal wall heavily glazed. Pillar straight, simple, reinforced. Anterior canal short, very broad, and open. Anterior fasciole wide threaded in the type with about 12 sharp lirae, deeply emarginate at its extremity; umbilicus suggested by the depression behind the anterior portion of the reverted pillar lip.

Dimensions: Height, 10.7 millimeters; length of aperture, 4.2 millimeters; maximum diameter, 4.0 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 351194.

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

"Drillia" zosta is well characterized by the close, even banding of the spirals. None of its congeners, such as *"D." trypanion* and *"D." waltoniana*, which have a similar outline and spiral sculpture, approach it in the regularity of the spiral sculpture, particularly upon the posterior fasciole.

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

"Drillia" trypanion Gardner, n. sp.

Plate XL, figures 15, 16

Shell small, slender, evenly tapering; body whorl rather short, only a little more than half as high as the entire shell, rather strongly constricted at the base. Whorls of conch 6, of the protoconch 2 to 2½. Initial turn smooth, broadly rounded, immersed at the tip. Sculpture introduced near the beginning of the last full nuclear coil in the form of feeble, flexuous axial riblets, most prominent a little behind the suture line; an obscure anterior carina developed concomitant with the axials; spirals initiated near the beginning of the last half turn, usually 3, the anterior directly behind the suture, the medial spiral outlining the obscure keel, and the posterior about midway between the anterior and posterior sutures. Dividing line between conch and protoconch indicated by an irregular break and by the abrupt assumption of the conchal characters. Axial sculpture dominating the spiral, the axials rather low, broadly rounded, feebly protractive, 8 on the final whorl of the spire, narrower, sharper, and more produced posteriorly on the earlier whorls, almost entirely obsolete on the posterior fasciole on the later volutions, the axials obsolete also upon the base of the body and very irregular and ill defined upon the final half turn; intercostals smoothly concave and of approximately the same width as the costals. Spiral sculpture low and worn in appearance, uniform in strength upon the axial and interaxial areas; primaries low, flattened cords, 2 on the early turns, increasing to 3 or rarely 4 on the penult and ultima, the posterior primary outlining the periphery and the others symmetrically disposed between it and the anterior suture; very fine secondary threadlets in some shells, as in the type, intercalated between the primaries; basal spirals narrower, sharper, and more distantly spaced than those upon the medial portion of the body; anterior fasciole closely and sharply threaded with 8 or 9 lirae. Posterior fasciole almost half as wide as the entire whorl, defined by the feeble constriction of the whorl, the evanescence of the axial sculpture, and the very much finer and more distant, commonly obsolete spiral sculpture; anterior spiral upon the fasciole in some specimens rather coarse, 3 or 4 filamentary spirals usually developed between it and the rather sharp but not very heavy posterior cord; incremental striae rather well defined. Suture line distinct, impressed. Aperture minutely pyriform. Outer lip subvaricose externally, widely flaring incrementally, the edge thin and recurved over the apertural opening. Posterior sinus broad and U-shaped, posteriorly directed. Labium excavated at the base of the body. Parietal wall heavily glazed, especially at the entrance to the posterior sinus; pillar straight, simple, reinforced. Anterior canal short, broad, feebly recurved. Anterior fasciole deeply emarginate at its anterior extremity.

Dimensions: Height, 11.0 millimeters; length of aperture, 4.5 millimeters; maximum diameter, 3.8 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 371060.

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

"Drillia" trypanion varies widely in the development of the spiral sculpture, particularly upon the posterior fasciole, which in some specimens is entirely smooth between the posterior cord and the posterior primary, except for the incrementals, and in some specimens is coarsely threaded. In general dimensions and outline, in the nuclear features, and in the general character of the sculpture the species suggests *"Drillia" waltoniana*, but it is more slender, the whorls are less constricted at the sutures, the axials decidedly less elevated and more irregular upon the body, the primary spirals broader and less numerous, the sculpture upon the posterior fasciole more constantly developed, and the posterior cord much more sharply defined.

"D." trypanion is not rare at Shell Bluff, but it is very much less abundant than *"D." waltoniana*. *"Drillia" zosta* is very similar in dimensions, contour, and the character of the axial sculpture, but the spirals are much broader and are separated only by linear sulci,

the posterior fasciole is invariably lirate, and the posterior cord conspicuously developed.

Occurrence: Shoal River formation, localities 3856[r], 3742[c].

"Drillia" pycnoklosta Gardner, n. sp.

Plate XL, figures 17, 18

Shell rather small for the genus; spire moderately elevated; whorls constricted at the suture and increasing in diameter with moderate rapidity; body whorl relatively large, broadly rounded, constricted at the base, aperture not far from half of the entire altitude. Whorls 8 in the type, 2½ of these included in the protoconch. First 1½ whorls smooth and polished, the initial half turn largely submerged, the succeeding whorl broadly rounded and increasing rapidly in elevation; sculpture initiated near the beginning of the last full turn of the nucleus in the form of narrow, somewhat arcuate riblets, about 9 to half a whorl; introduction of the spiral sculpture following closely that of the axial, the two medial spirals first appearing as obscure lirae, gradually gaining in prominence; one or two posterior and one or two anterior spirals developed later, the sculpture upon the last quarter turn of the nucleus evenly cancellate. Line of division between the conch and protoconch indicated by an irregular thickening of the shell, the abrupt disappearance of the nuclear sculpture, and the establishment of the postnuclear; spirals carried across with much reduced strength; axial costae uniform in general character over the entire surface of the conch, though narrower, sharper, and more produced posteriorly upon the earlier turns. Axials 9 upon each of the later whorls, including the body, rather sharply elevated, obtusely rounded, a little more prominent at the periphery, obscure upon the posterior fasciole, obsolete upon the base of the body and irregular in size and spacing upon the final half turn; intercostals sharply concave, narrower than the costals. Spiral sculpture covering the entire surface from the protoconch to the anterior extremity, equally developed upon the axial and the interaxial areas; spirals simple, broadly rounded, equal in size, 7 in front of the posterior fasciole of the penult and upon the medial portion of the ultima, closely spaced, separated only by linear sulci; 2 or 3, rarely 4, narrow, less elevated, and more distant spirals developed upon the fasciole; base and pillar girded with narrower but somewhat sharper lirae, more distantly spaced, with secondary filaments intercalated upon the base of the body; anterior fasciole very finely and closely threaded with about half a dozen lirae, which are minutely corrugated by the incrementals. Posterior fasciole wide, only a little less than half the entire width of the whorl, defined by the constriction of the whorl, the reduced axial sculpture, and the finer and more distant spirals; posterior cord feeble; posterior margin closely appressed. Sutures impressed and crenulated in harmony with the axials of the preceding volution. Aperture rather narrow, obliquely lobate. Outer lip varicose a little behind the margin, the edge thin, sharp, and recurved, conspicuously arched incrementally. Posterior sinus profound, U-shaped, posteriorly directed, the maximum insinuation halfway between the suture and the periphery. Labrum smooth within, though thickened directly in front of the sinus. Labium excavated at the base of the body; parietal wall glazed, the callus especially heavy at the entrance to the posterior sinus. Pillar straight, simple, reinforced. Anterior canal rather short and very broad, feebly recurved. Anterior fasciole wide, obliquely emarginate.

Dimensions: Height, 9.8 millimeters; length of aperture, 4.7 millimeters; maximum diameter, 3.8 millimeters.

Holotype: U. S. Nat. Mus. No. 351201.

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

"Drillia" pycnoklosta is separated from *"D." waltoniana*, which it most resembles in general aspect, by the more rapidly tapering spire, the less elevated axials, their greater persistence posteriorly, and the coarser spiral sculpture. Secondaries, which are regularly intercalated in *"D." waltoniana*, are not developed in *"D." pycnoklosta* except upon the base of the body. The general character of the spiral sculpture suggests *"D." zosta*, but the spirals in that species are decidedly broader and flat upon their summits.

Occurrence: Shoal River formation, locality 3742[r].

"Drillia" waltoniana Gardner, n. sp.

Plate XL, figures 19, 20

Shell small, slender, acutely tapering; spire elevated, about half as high as the entire shell; body whorl rather strongly constricted at the base. Conch of 6½ volutions. Protoconch of 2½, initial half turn almost entirely submerged, the succeeding volution also smooth and very broadly and smoothly rounded; sculpture introduced within the first quarter of the last whorl of the protoconch in the form of very fine, feebly arcuate axial riblets which persist from suture to suture and number about a dozen to half a turn; spiral sculpture usually introduced within the final half whorl of the protoconch, in some specimens a little before, the anterior lira the first to appear, medial and posterior lirae quickly following; a fourth and fifth spiral introduced in some shells, the one directly in front of the posterior suture, the other directly behind the anterior, all of them subequal and symmetrically disposed between the sutures. Line of demarcation between the conch and protoconch indicated by a thickening of the

shell, the disappearance of the nuclear sculpture, and the establishment of the postnuclear, the two anterior spirals, however, carried across to the conch; axials similar in general character over the entire postnuclear surface, though narrower, more strongly protractive, and more persistent posteriorly upon the earlier volutions. Axials 9 on each of the later whorls, including the body, evanescent upon the wide posterior fasciole but prominently elevated, broadly rounded, and uniform in strength from the fasciole to the anterior suture, obsolete upon the base of the body and unequal though regularly spaced upon the final half turn; intercostals broadly concave and of approximately the same width as the costals. Spiral sculpture fine, close, and regular over the entire surface of the conch except the posterior fasciole, where it is usually absent altogether; primary spirals low, flattened; lirae uniform in prominence upon the costal and intercostal areas, 2 upon the earliest turns of the conch, increasing to 4 or 5 upon the penult, less regular in size and spacing upon the body; linear secondaries regularly intercalated between each pair of primaries upon the medial and anterior portions of the spire and the medial portion of the body, not differentiated upon the base; pillar spirals slightly sharper and less crowded than those behind them; anterior fasciole closely threaded with about a dozen fine lirae. Incrementals strong enough to shagreen the spirals and arcuately striate the posterior fasciole. Posterior fasciole defined on the early volutions by the appression of the whorl; on the later by the broad, concave constriction almost half as wide as the entire whorl, by the more or less complete evanescence of the axial sculpture, and by the absence of all but very faint fortuitous spirals, which are developed in some shells, especially upon the posterior portion; posterior margin of whorl elevated but not cordate. Suture line distinct, impressed, undulated, in harmony with the axials of the preceding volution. Aperture oblique, widening a little behind by reason of the feeble expansion of the outer lip and the constriction at the base of the inner. Outer lip subvaricose a little behind the margin, smooth within, the edge thin, sharp, expanded incrementally, profoundly but rather narrowly insinuated posteriorly, the sinus symmetrically disposed midway between the posterior suture and the periphery. Labrum also feebly emarginate at the base of the body, possibly for the extension of the eye stalks. Labium smooth, excavated. Parietal wall evenly glazed. Pillar straight, simple, reinforced, the reverted margin discrete anteriorly and cut off from the anterior fasciole by a narrow groove. Canal short, very broad, open. Anterior fasciole wide, strongly arched, deeply insinuated at its extremity.

Dimensions: Height, 10.7 millimeters; length of aperture, 4.7 millimeters; maximum diameter, 4.2 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 351203.

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

"Drillia" waltoniana may be recognized by the fine, close spiral threading and the unequal, alternating lirae. This character, together with the more slender and elevated spire and the more prominent axials, readily separates it from the rather rare *"D." pycnoklosta*. *"D." pachycheila*, the possible analog in the Oak Grove fauna, differs in having only 7 instead of 9 axials upon the later whorls of the spire, as well as in the more subdued spiral threading and the less sharply constricted body.

Occurrence: Shoal River formation, localities 3856[c], 3732[r], 3742[a].

"Drillia" pachycheila Gardner, n. sp.

Plate XL, figure 22

Shell rather small, spire elevated and acutely tapering, feebly constricted at the sutures; body whorl rather slender, not sharply constricted at the base, attenuated anteriorly in the apertural view, its breadth perceptibly increased by the terminal varix. Whorls 6 in the conch, 2½ in the protoconch. Initial turn broad, flattened, and almost entirely immersed; succeeding half turn also smooth, evenly inflated; sculpture introduced near the beginning of the final whorl of the protoconch in the form of narrow but obtuse axial riblets, persisting with uniform elevation from suture to suture, about 10 to the half whorl, overridden upon the last half turn of the nucleus by 3 to 5 low spirals. Dividing line between conch and protoconch indicated by an irregular break in the shell and an abrupt change in the character of the sculpture. Axials upon the conch broadly rounded, most prominent at the periphery, though persistent to the anterior suture and, on the body, well down to the base, evanescent, however, upon the posterior fasciole, feebly protractive and usually opposite, 7 upon the later whorls, equal and separated by equal, concave intercostals except upon the final half turn, where they are unequal and inequispaced; terminal varix very heavy, persistent from the posterior to the anterior fasciole, usually set back a little from the margin. Spiral sculpture inconspicuous but equally developed upon the costals and intercostals; primaries 4 or 5 in front of the fasciole of the later whorls of the spire, approximately twice as many upon the body, narrow and little elevated, with 2 or 3 or even 4 secondary filaments crowded between each pair of primaries; basal spirals a little more sharply elevated than those behind them; anterior fasciole finely and closely threaded, the lirae equal and about 8. Posterior fasciole sculptured with a dozen or so obscure, subequal, microscopic lirae; fasciole defined also by the constriction of the whorl and the evanescence of the axial sculpture, undulated anteriorly by the axials of the same volution and posteriorly by the axials of the preceding;

posterior margin closely appressed; posterior cord ill defined. Sutures impressed, undulated. Aperture obliquely lenticular. Outer lip varicose a little back from the margin, the edge thin and sharp, not denticulate within, although thickened directly in front of the sinus. Posterior sinus very deep, symmetrically rounded, feebly inclined posteriorly, slightly constricted at the entrance. Labrum also feebly emarginate at the base of the body, possibly for the extension of the eye stalks. Inner margin of aperture strongly excavated. Parietal wall heavily glazed, the glaze continuous with the lining of the posterior sinus. Pillar straight, simple, heavily reinforced. Canal moderately long for the group, broad, open. Anterior fasciole rather wide, obliquely emarginate at its extremity.

Dimensions: Height, 11.0 millimeters; length of aperture, 5.0 millimeters; maximum diameter, 4.2 millimeters.

Holotype: U. S. Nat. Mus. No. 349882.

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

The body whorl of *"Drillia" waltoniana*, a possible analog in the Shoal River fauna, is relatively larger and more sharply constricted at the base, the axials are more numerous and more conspicuously elevated, the primary spirals also more numerous, with only a single secondary intercalated between each pair, and the posterior sinus is broader and less constricted at its entrance.

Occurrence: Oak Grove sand, localities 2646[p], 5632[p].

Genus MANGELIA Risso

1826. *Mangelia* Risso, Histoire naturelle des principales productions de l'Europe méridionale, vol. 4, p. 219.

The name was discarded by Woodring [11] because of the uncertainty in the designation of the type.

The name was given in honor of the Italian naturalist Mangili but was written *"Mangelia."* The genus as defined by Fischer included all the Pleurotomidae that do not possess opercula. It has been commonly divided into a number of subgenera, mainly on the characters of the outer and inner lips and the ornamentation of the whorls. *Mangelia* s. s. was formerly used to cover the small, slender nonoperculates, usually with an elevated spire, with or without sculpture, a siphonal fasciole, a shallow siphonal notch, and a narrow, obliquely clavate unarmored aperture.

The old *Mangelia* s. s. is represented in the Alum Bluff by 22 species, none of which has been reported from more than one horizon. Of this number, 14, or approximately 63 percent, are restricted to the Chipola formation; 8, or about 36 percent, to the Oak Grove; and only 3, or a little less than 14 percent, to the Shoal River formation. Perhaps the most striking feature in the distribution of the Alum Bluff Mangelias, especially among the more strongly sculptured forms, is the marked differentiation, the large number of species, and, as a rule, the very small number of individuals.

[11] Woodring, W. P., Miocene mollusks from Bowden, Jamaica, pt. 2: Carnegie Inst. Washington Pub. 385, p. 177, 1928.

CONCH

Spiral sculpture not restricted to the pillar and anterior fasciole:
Outline slender; spire elevated; axials rarely exceeding 10 upon the penult:
Entire surface of conch spirally sculptured:
Spiral sculpture of fine, sharp, commonly granose spirals tending to alternate in size:
Primary spirals not exceeding 6 upon the penult:
Whorls more or less angulated at the periphery but not conspicuously tabulated:
Axials usually 8 upon the penult:
Axials not persistent to the posterior suture; posterior cord not developed.
Kurtziella prionata Gardner, n. sp.
Axials persistent to the posterior suture or at least to the posterior cord:
Maximum diameter more than one-third the altitude; spirals simple; primary spirals 3 or 4 upon the penult *Kurtziella websteri* (Maury).
Maximum diameter approximately one-third the altitude; spirals granose; primary spirals 4 to 5 upon the penult *Saccharoturris centrodes* Gardner, n. sp.
Axials usually more than 8 upon the penult *Kurtziella stephanophora* Gardner, n. sp.
Whorls acutely angulated at the periphery, conspicuously and almost horizontally tabulated.
"Mangelia" pyrgota Gardner, n. sp.

Spiral sculpture not restricted to the pillar and anterior fasciole—Continued.
Outline slender; spire elevated; axials rarely exceeding 10 upon the penult—Continued.
Entire surface of conch spirally sculptured—Continued.
Spiral sculpture of fine, sharp, commonly granose spirals tending to alternate in size—Continued.
Primary spirals exceeding 6 upon the penult:
Axials persistent to the posterior suture:
Axials not arranged in continuous series from the protoconch to the anterior fasciole, usually exceeding 7 upon the penult:
Axials more or less obtuse, usually 9 or 10 upon the penult:
Maximum diameter rarely exceeding the length of the aperture; axials usually 9 upon the penult; evanescent upon the base of the body; spirals exceedingly fine and obtusely granose.
Kurtziella ramondi (Maury).
Maximum diameter usually exceeding the length of the aperture; axials usually 10 or 11 upon the penult, sharply defined upon the base of the body; spirals very fine and acutely granose.
Cryoturris daidalea Gardner, n. sp.
Axials acute, usually 8 upon the penult——*Kurtziella thektapleura* Gardner, n. sp.
Axials arranged in continuous series from the protoconch to the anterior fasciole, usually 7 upon the penult; spirals exceedingly fine and sharply granose——*"Mangelia" asteria* Gardner, n. sp.
Axials not persistent to the posterior suture:
Altitude not exceeding 10 millimeters; axials may be persistent to the posterior suture, at least on the early whorls; posterior fasciole not creeping up upon the preceding volution.
Kurtziella ramondi (Maury).
Altitude usually exceeding 10 millimeters in the adult, axials not persistent to the posterior suture even on the early whorls; posterior fasciole creeping up upon the preceding volution.
"Mangelia" anthetika Gardner, n. sp.
Spiral sculpture of low, flattened primaries, usually 4 to 6, with intercalated secondaries.
Kurtziella prionota Gardner, n. sp.
Entire surface of conch not spirally sculptured:
Spiral sculpture usually absent from the entire posterior fasciole, developed in front of the fasciole in the form of exceedingly low, flat, ill-defined fillets, narrower and sharper upon the base of the body and the pillar.
"Mangelia" teirata Gardner, n. sp.
Spiral sculpture absent except upon the base of the body, there developed in the form of fine lirae.
"Mangelia" clarae Maury.
Outline squat; spire low; axials usually exceeding 10 upon the penult:
Axials rarely exceeding 12 upon the penult, primary spirals exceeding 3 upon the penult:
Primary spirals exceeding 6 upon the penult——*"Mangelia" klimakota* Gardner, n. sp.
Primary spirals usually 4 or 5 upon the penult——*"Mangelia "sextoni* Gardner, n. sp.
Axials usually 13 to 15 upon the penult, primary spirals usually 3 upon the penult—*"Mangelia" stypteria* Gardner, n. sp.
Spiral sculpture restricted to the pillar and anterior fasciole, reduced to a microscopic shagreening or lineation or absent altogether:
Spiral sculpture restricted to the pillar and anterior fasciole:
Base of pillar and anterior fasciole lirate:
Axials acute, usually 8 to the whorl——*"Mangelia" teirata* Gardner, n. sp.
Axials rounded, usually 10 to the whorl——*"Mangelia" phrixae* Gardner, n. sp.
Base of pillar sulcate——*"Mangelia" louisae* Maury.
Spiral sculpture reduced to a microscopic shagreening or lineation or absent altogether:
Spiral sculpture reduced to a microscopic lineation or absent altogether; protoconch smooth; altitude of adult exceeding 7.0 millimeters:
Spiral sculpture reduced to a microscopic lineation, axials usually 6 on the later whorls.
Ithycythara? radinos Gardner, n. sp.
Spiral sculpture absent altogether, axials usually 7 or 8 on the later whorls——*"Mangelia" lissa* Gardner, n. sp.
Spiral sculpture reduced to a microscopic shagreening, last half turn of protoconch carinate and axially costate:
Axials usually 6:
Outline conspicuously hexagonal, axials very narrow, acute, opposite, arranged in continuous series which persist the entire length of the conch——*Ithycythara defuniak* Gardner, n. sp.
Outline not conspicuously hexagonal; axials narrow and rather acute, not arranged in continuous series which persist the entire length of the conch——*Ithycythara tarri* (Maury).
Axials usually 7, relatively obtuse——*Ithycythara compsacosta* Gardner, n. sp.

PROTOCONCH

Protoconch sculptured:
Sculpture cancellate:
Entire last whorl of protoconch reticulate; axial sculpture developed on 1½ of the 4± or 5± whorls.
Kurtziella prionota Gardner, n. sp; *Kurtziella stephanophora* Gardner, n. sp.
Last half whorl of protoconch reticulate:
Axial sculpture developed on 2 of the whorls of the protoconch——*Kurtziella websteri* (Maury).

Protoconch sculptured—Continued.
Sculpture cancellate—Continued.
Last half whorl of protoconch reticulate—Continued.
Axial sculpture not well developed before the final half turn; spiral sculpture exceedingly feeble:
Whorls of protoconch about 4½—*Kurtziella thektapleura* Gardner, n. sp.
Whorls of protoconch 3 to 3½—*Kurtziella ramondi* (Maury); *Saccharoturris centrodes* Gardner, n. sp.
Whorls of protoconch 2 to 2½—"*Mangelia*" *stypteria* Gardner, n. sp.
Last quarter turn of protoconch reticulate, axial sculpture developed on 1 of the 3½ whorls.
"*Mangelia*" *teirata* Gardner, n. sp.
Sculpture costate:
Whorls of protoconch 3½ to 4 in all, last half turn carinate.
Ithycythara tarri (Maury); *Ithycythara compsacosta* Gardner, n. sp.
Whorls of protoconch 3½ in all:
Axial sculpture developed on a little more than half a turn—*Ithycythara defuniak* Gardner, n. sp.
Axial sculpture developed only on the last half turn; last half turn carinate.
Cryoturris daidalea Gardner, n. sp.; "*Mangelia*" *asteria* Gardner, n. sp.
Whorls of protoconch 3 in all—"*Mangelia*" *pyrgota* Gardner, n. sp.; "*Mangelia*" *sextoni* Gardner, n. sp.
Whorls of protoconch 2½ in all—"*Mangelia*" *anthetika* Gardner, n. sp.
Protoconch not sculptured:
Last half turn of the 4 carinate—"*Mangelia*" *phrixae* Gardner, n. sp.
Last half turn not carinate:
Whorls of protoconch 3 in all—*Ithycythara? radinos* Gardner, n. sp.
Whorls of protoconch 2½ in all—"*Mangelia*" *louisae* Maury; "*Mangelia*" *lissa* Gardner, n. sp.
Whorls of protoconch 2 in all—"*Mangelia*" *klimakota* Gardner, n. sp.; "*Mangelia*" *clarae* Maury.

"Mangelia" anthetika Gardner, n. sp.

Plate XLI, figures 38, 39

Shell large for the group, slender; the spire elevated; whorls constricted at the suture; body whorl rather abruptly contracted at the base; aperture less than half the entire altitude. Whorls of conch 6¼ in the type, of the protoconch 2½. Apex of protoconch broadly rounded, the initial half turn flattened and almost entirely submerged; succeeding volution broadly inflated, increasing rapidly in altitude anteriorly; axial sculpture introduced shortly after the opening of the last turn; the riblets narrow, rounded, uniform in elevation between the sutures, about 10 upon the final half turn, the later a little more prominent and less closely spaced; a very close and fine spiral striation developed concomitant with the axials. Dividing line between conch and protoconch indicated by a slight break, the appression of the posterior margin, the abrupt disappearance of the nuclear axials, and the establishment of the postnuclear; spiral sculpture carried across. Axials on the first whorl of the conch 8 in the type, narrow, rounded, protractive, persisting almost to the posterior suture, separated by intercostals of approximately the same width; costals on the later volutions prominently elevated, feebly protractive, for the most part opposite, sharply rounded, inclined to be nodose at the periphery, less elevated anteriorly, evanescent posteriorly and upon the base of the body, 8 on the later whorls, including the body; terminal axial varicose, the one directly behind it relatively feeble; intercostal areas broadly concave and a little wider than the costals. Entire surface of conch crowded with microscopic lirae, the threadlets flattened and tending to alternate in size in front of the fasciole and upon the medial portion of the body, a little less feeble upon the base of the body and the pillar; anterior fasciole closely and evenly lirate, the posterior crowded with minute, flattened threadlets separated by linear interspaces. Posterior fasciole defined by the constriction of the whorl, the weakening of the axials, the finer and more uniform spiral threading, and the faint, arcuate incrementals; posterior margin closely appressed, slightly elevated and beveled. Sutures impressed, undulated in harmony with the axials of the preceding volution. Aperture rather wide, only slightly contracted at the extremities. Outer lip strengthened by a heavy, subvaricose costal a little behind the margin, the edge thin, sharp, and incrementally expanded. Inner surface of labrum smooth. Posterior siphonal notch broad, U-shaped, symmetrically disposed between the posterior suture and the periphery. Inner wall of aperture smoothly excavated; parietal glaze rather thin except at the entrance to the posterior sinus, which is heavily reinforced. Pillar straight, simple, the narrowly reverted inner margin not entirely concealing the umbilical chink. Anterior canal short, broad, open. Anterior fasciole wide, deeply and obliquely emarginate at its extremity.

Dimensions: Height, 12.4 millimeters; length of aperture, 5.0 millimeters; maximum diameter, 4.8 millimeters.

Holotype: U. S. Nat. Mus. No. 328586.

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

"*Mangelia*" *anthetika* is characterized by the obtuse, paucispiral nucleus, the smoothly rounded, subnodose axial sculpture, the microscopically fine, evenly flattened spiral ornamentation, the closely appressed and

undulated posterior fasciole, and a sutural cord, an unusual sculpture detail in "*Mangelia.*" It has no obvious affinities with any of the restricted groups. The type is about 3.5 millimeters higher than any other representative of the species in the collection.

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

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.)

Shell small, slender, with an elevated spire and short body; protoconch of 3 to 5 slender but rather rapidly increasing whorls, the final turn reticulately sculptured; outer surface crowded with spiral filaments shagreened by the incrementals and rippled by the axials; posterior fasciole rarely conspicuous; aperture narrow, obliquely clavate, feebly notched at the posterior sinus; anterior canal rather short.

In the Alum Bluff faunas, *Kurtziella* is the best represented of all the slender elaborately sculptured Mangelias. The final nuclear whorl of *Saccharoturris* is conspicuously keeled, and the protoconch of *Cryoturris* is smaller and more acute.

Kurtziella prionota Gardner, n. sp.

Plate XLI, figures 10, 11

Shell small; spire elevated, whorls acutely angulated at the periphery; body abruptly constricted into the slender pillar; aperture a little less than half the entire altitude. Whorls between 8 and 9 in all, only 4 of them included in the conch. Protoconch multispiral, acutely tapering, the very tip broken away in all the many individuals, probably of nearly 5 volutions, 3½ of which have been preserved; sculpture introduced on the next to the last whorl of the protoconch; the preceding volutions smooth, polished, moderately inflated, and increasing rapidly in diameter; axials initiated near the beginning of the nuclear penult, at first very feeble, arcuately protractive, evanescing a little short of the anterior suture; an obtuse anterior carina developed concomitant with the axials, the surface in front of the keel strongly undercut; spirals introduced near the beginning of the last half turn of the penult, the anterior crowning the anterior carina, the other two directly behind, separated from one another by linear sulci only; two exceedingly fine lirae behind them, one set directly in front of the posterior suture, the other about midway between it and the posterior primary; both the primaries and the secondaries beaded by the intersecting axials; moniliform sculpture merging on the final nuclear turn into a fine cancellation and with the increasing prominence of the axials into a dominantly axial sculpture, with the spirals for the most part restricted to the interaxials. Beginning of conch indicated by the abrupt angulation of the periphery and the equally abrupt disappearance of the axials upon the posterior portion of the whorl. Sculpture similar in general character over the entire surface of the conch. Axials 8 on each of the 4 postnuclear whorls of the type, sharper and more persistent posteriorly on the early volutions, most prominent and commonly subnodose at the periphery, broadly rounded and feebly protractive in front of it, more or less completely evanescent and retractive behind it; body axials less prominent upon the final half turn, obsolete upon the base. Spiral sculpture very fine and crowded, covering the entire surface of the conch from the protoconch to the anterior extremity; area in front of the posterior fasciole of the whorls of the spire and of the medial portion of the body covered with 4 to 6 low but sharply defined flattened lirae, with a very fine, sharp threadlet intercalated in each of the narrow interspaces; sculpture upon the base of the body and the pillar less regular, the primaries lower and commonly broader, with 1 to 3 intercalated secondaries, the pillar threading sharper than that upon the base of the body, merging with the absence of the secondaries into the half dozen lirae of the anterior fasciole. Posterior fasciole half or more than half as wide as the entire whorl, very sharply defined both by the abrupt constriction of the whorl and by the sculpture; peripheral margin broadly and regularly crenulated by the axials, which persist in the form of obscure undulations upon the posterior portion; fasciole closely threaded with about a dozen subequal lirae, separated by linear interspaces; incremental striae feeble, sinuous; posterior margin of the whorl closely appressed but not cordate. Suture distinct, impressed, crenulated in harmony with the axials of the preceding volution. Aperture oblanceolate, acutely angulated at the posterior commissure. Outer lip thin, sharp, obtusely angulated at the periphery, broadly and feebly emarginate posteriorly, expanding slightly incrementally. Labrum feebly excavated at the base of the body. Parietal wall thinly and evenly glazed. Pillar straight, simple. Anterior canal moderately long, straight, open. Anterior fasciole obscurely differentiated, obliquely truncate at its extremity.

Dimensions: Height, 7.2 millimeters; length of aperture, 3.4 millimeters; maximum diameter, 3.0 millimeters.

Holotype: U. S. Nat. Mus. No. 351219.

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

Kurtziella prionota is well characterized by the granulose and cancellate nuclear turns, the strongly angulated postnuclear volutions, the evenly crenate periphery, the wide, closely lirate posterior fasciole, and the low, uniform spiral sculpture in front of the periphery. No other species approaches it very closely

Occurrence: Shoal River formation, localities 3856[r], 3742[c], 3748[p], 5618[c].

Kurtziella thektapleura Gardner, n. sp.

Plate XLI, figure 1

Shell very small, slender and delicate; spire elevated, the component whorls strongly angulated at the periphery and increasing slowly in diameter; body attenuated anteriorly, smoothly tapering. Whorls of conch 5¼, of the protoconch probably 4½; extreme tip macerated so that the exact number is indeterminate. Initial whorl low, rounded, for the most part submerged; sculpture initiated near the beginning of the last half turn of the penult; the preceding volutions smooth, polished, moderately inflated; axials at first low and obscure though closely and regularly spaced, on the final whorl of the protoconch acute, arcuate, most elevated upon the obtuse medial carina, which is developed within the last half turn; intercostal areas obscurely striated spirally. Dividing line between conch and protoconch acutely arcuate, defined by the thickening of the shell substance, a change in the character of the axial sculpture, and the abrupt initiation of spiral lirae. Axials similar in general character over the entire surface of the conch, 8 upon each of the later whorls, including the body, elevated and conspicuously acute upon the spire, though relatively obtuse upon the body, feebly protractive in front of the periphery, retractive behind it, flexuous upon the base of the body, only a little less elevated anteriorly than medially, though greatly diminished in strength upon the posterior fasciole and obsolete upon the appressed posterior margin, persistent on the ultima to the anterior fasciole; costals equal except for the terminal varix and equally spaced by wider, deeply concave intercostals. Entire surface of the conch crowded with microlirae, most of them cut up by the incrementals into exceedingly fine beads; primaries 7 in front of the periphery of the penult, with 1 or 2 microscopically moniliform lirae intercalated between each pair; sculpture upon the medial portion of the body similar in character to that in front of the periphery on the whorls of the spire, the primaries upon the base and pillar a little more elevated and not quite so crowded; threadlets upon the anterior fasciole simple, about 8. Posterior fasciole defined by the constriction of the whorl, the diminished axial sculpture, and the dozen crowded, closely granulated subequal spirals, broadly undulated in harmony with the axials of the same volution except those upon the appressed posterior margin, which are a little coarser and follow the axials of the preceding volution. Sutures impressed, undulated. Aperture narrow, obliquely lanceolate, acutely angulated at the posterior commissure. Outer lip varicose, thin edged, smooth within, broadly but not very deeply insinuated a little more than halfway from the suture to the periphery. Inner margin of aperture feebly excavated at the base of the body; parietal wall smoothly glazed. Pillar long, straight, simple, feebly reinforced. Anterior canal moderately long, the margins parallel. Anterior fasciole wide, obliquely truncate at its extremity.

Dimensions: Height, 6.4 millimeters; length of aperture, 2.7 millimeters; maximum diameter, 2.0 millimeters.

Holotype: U. S. Nat. Mus. No. 349896.

Type locality: No. 5633, Oak Grove, Yellow River, Okaloosa County, Fla.

Kurtziella thektapleura is perhaps most closely related to *K. ramondi* (Maury), a form which differs from it, however, in the much less acutely angulated whorls, much more obtuse and rather more numerous axials, and less sharply granose spirals.

No species in the Chipola fauna approaches it very closely except perhaps *Cryoturris daidalea*, a form with distinct nuclear characters and much more obtusely costate.

The type of this unusually dainty and crenate little species is perhaps unique. A single other individual from Oak Grove has been doubtfully included under this name.

Occurrence: Oak Grove sand, localities ?2646[r], 5633[r].

Kurtziella websteri (Maury)

Plate XLI, figure 4

1910. *Mangilia websteri* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 11, pl. 3, fig. 2.

Shell very slender, with 7 whorls, of which the 2 nuclear are smooth; body whorl slightly less than half the length of the shell; transverse sculpture of nearly straight, elevated, prominent ribs, of which there are 8 on the body whorl (including the varix); spiral sculpture of close-set threads, tending to alternate in size, which cover the whole surface of the shell except the nuclear whorls.

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

Chipola Oligocene, Baileys Ferry, Fla.

Cornell University collection.

Dedicated to Dr. David Webster, of New York City.—Maury, 1910.

The spire is turreted, the whorls obtusely angulated at the periphery, the body rather abruptly constricted at the base. The whorls of the conch are a trifle more than 4 and of the protoconch approximately the same. The extreme tip is broken away in all of a rather large number of individuals, but it probably includes only the initial turn. The succeeding volutions are broadly inflated, increase rather rapidly in size, and are, near the end of the nucleus, strongly undercut behind the anterior suture. Axial sculpture is introduced near the beginning of the nuclear penult, at first exceedingly faint but becoming increasingly acute, protractive, a little less elevated posteriorly, and evanescent on the anterior undercut, the riblets

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approximately 24 on each of the last two nuclear turns. Exceedingly faint spiral lirae are discernible in the interaxial spaces of the final half turn. The line of demarcation between the conch and protoconch is indicated by an irregular thickening of the shell, the appression of the posterior margin of the whorl, the abrupt disappearance of the crowded nuclear axials, and the initiation of the broader, more rounded, and less closely spaced postnuclear axials. The spirals are carried across with an abrupt increase in definition. The postnuclear axials when typically developed are rather narrow, rounded, nearly vertical, and uniform in prominence from the periphery to the anterior fasciole but more or less evanescent and retractive upon the fasciole behind the periphery, very feeble and slightly flexed upon the base of the body, and inclined to be a little irregular upon the final half turn. The intercostal areas are a little wider than the costal and like them are overrun by low spiral lirae. The primaries are 3 or 4 upon the later whorls of the spire, with secondaries regularly intercalated between them. About half a dozen slightly narrower primaries without intercalated secondaries gird the base of the body, with 3 finer lirae upon the pillar which differ from the threadlets upon the anterior fasciole merely by the less crowded spacing. The posterior fasciole is a little less than half as wide as the later whorls, is feebly undulated axially, and is spirally lineated by about 5 subequal filaments. The posterior portion of the fasciole is closely appressed and creeps up a little upon the preceding whorl. The margin is raised and on the later turns there is in some specimens a low, ill-defined cord. The sutures are not very distinct. The aperture is narrow, oblique, and open at both extremities. The outer lip is thin and sharp, though there is usually rather a heavy costal a little behind the margin. The posterior insinuation is deep and placed a little nearer to the periphery than to the suture. The inner wall of the aperture is rather feebly excavated and thinly glazed, the pillar straight and rather long, the canal rather broad, and the anterior fasciole wide and obliquely truncate at its extremity.

Saccharoturris centrodes is smaller and much more slender, the sculpture upon the protoconch is not introduced so early, and the conch is crowded with beaded spirals, finer and more numerous than those of *K. websteri*. *"Mangelia" pyrgota* is conspicuously and almost horizontally tabulated. The axials are narrower and stand up from the surface of the conch like heavy cords, and the spirals are a little finer and more numerous. The spiral sculpture of *Cryoturris daidalea* is decidedly sharper, the threadlets are finer and more crowded in front of the periphery, but upon the posterior fasciole they are coarser and less numerous. The thread outlining the posterior suture is sharply beaded but not elevated as in *Kurtziella websteri*.

Kurtziella websteri is similar in general features to some of the more coarsely sculptured members of the type species of the genus, though the axials are not so numerous nor so acute as those of *K. cerina*.

Figured specimen: U. S. Nat. Mus. No. 371062, from locality 2213, 1 mile below Baileys Ferry, Chipola River, Calhoun County, Fla.

Occurrence: Chipola formation, localities 2213^{p}, 3419^{r}. Cornell University collections.

Kurtziella stephanophora Gardner, n. sp.

Plate XLI, figures 8, 9

Shell small, slender; spire elevated and acutely tapering; body whorl constricted at the base; aperture less than half as high as the entire shell in the adults, the young much lower relatively and decidedly stouter. Whorls of conch between 4½ and 5, of the protoconch about 4. Extreme tip broken off in all of a considerable number of individuals but probably not including more than the largely submerged initial whorl; sculpture not introduced until about the last half of the penult, the preceding whorls smooth, lustrous, broadly convex, increasing rapidly in diameter; last half turn of penult faintly costate; axials fine, close-set, feebly protractive, or arcuate, persisting with diminished strength to the posterior suture, abruptly evanescing on the anterior keel developed concomitant with the axials and overhanging the anterior suture; spirals introduced upon the final turn of the protoconch, which is obtusely bicarinate; peripheral keel near or a little in front of the median line, the anterior keel about halfway between the periphery and the suture, both of them outlined by low, flattened lirae which overrun the axials and are somewhat nodulated by them; area between the keels cut up by the axials into a series of squarish or rectangular pits; costals narrow, threadlike, numbering about 25 to the whorl; area behind the periphery broad, not very steeply sloping, traversed by the axials, which persist to the suture and are even impacted against the preceding volution; a third and fainter spiral also developed a little behind the peripheral keel, with still others regularly intercalated between it and the posterior suture toward the end of the whorl; area in front of the anterior keel smooth and strongly concave. Line between conch and protoconch obscure because of the elaborate sculpture at the close of the protoconch, indicated by the projection of the axials across the anterior undercut, the introduction of spirals upon it, and the granulation of the spirals over the entire whorl; conchal sculpture ornate. Axials usually 10 upon the later whorls of the spire, 9 upon the body, narrow, acute, feebly retractive behind the periphery, less narrow, obtusely rounded, uniform in elevation in front of it, flexuous, broader, and not quite so regular upon the body, obsolete upon the pillar; intercostal areas broadly concave. Entire surface of conch crowded with linear

spirals; usually 3 or 4 more sharply elevated lirae in front of the periphery on the later whorls of the spire and about twice as many upon the body; 1 to 3 finely moniliform secondaries intercalated between each pair of primaries; spirals upon the extreme base of the body and pillar broader and more elevated, not so strongly dissected, usually about 6; anterior fasciole microlirate. Posterior fasciole crowded with another half dozen frosted lirae, with still another more elevated, strongly moniliform spiral close to the suture; posterior fasciole not quite half as wide as the entire whorl, defined by the obscure angulation of the whorl, the difference in character and direction of the axials, and the equal, sharply granulated spirals. Aperture narrow, oblanceolate, acutely angulated at the posterior commissure. Outer lip thin, sharp, broadly and very feebly insinuated posteriorly. Inner wall of aperture smoothly excavated. Parietal and pillar glaze thin. Anterior canal short, broad, open. Anterior fasciole rather narrow, obliquely truncate at its anterior extremity.

Dimensions: Height, 5.7± millimeters; length of aperture, 2.5 millimeters; maximum diameter, 2.0 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 351211.

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

Kurtziella stephanophora is similar in the general character of the external ornamentation to *Cryoturris daidalea*, from the Chipola. The spirals are perceptibly coarser, however, and the primaries and secondaries are much better differentiated. In this they resemble those of *K. websteri*, but the spirals of that species are simple or obtusely dissected. The protoconch of *K. stephanophora* is distinct from any of its congeners in that the entire final whorl is heavily reticulated, whereas in *K. websteri* only the last half turn is cancellate, and in *Cryoturris daidalea* the protoconchal sculpture is restricted to axials upon the last half turn.

Occurrence: Shoal River formation, locality 5079[p].

Kurtziella ramondi (Maury)

Plate XLI, figures 20, 21

1910. *Mangilia nemorensis* Maury, Bull. Am. Paleontology vol. 4, no. 21, p. 12, pl. 3, fig. 4.

1910. *Mangilia ramondi* Maury, Bull. Am. Paleontology, vol., 4, no. 21, p. 12, pl. 3, fig. 5.

Shell small, slender, with an acute spire; whorls 7, of which the first two are smooth, the third ornamented with spiral threads, and the remaining whorls with both spirals and longitudinal riblets (8 on the last whorl). Spirals very close and fine, not visible without a lens. Aperture narrow, elliptical; outer lip simple without internal lirae. Length of shell 5; greatest width 2 millimeters.

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

Oak Grove, Santa Rosa County, Fla.

Mr. Aldrich's collection.

This shell resembles in general form *M. tarri*, from which it differs in having no internal lirae and in the presence of spiral sculpture.—Maury, 1910.

Shell small and very slender; spire elevated, more than half of the entire altitude, the whorls angulated at the periphery and increasing slowly in diameter. Postnuclear whorls 4½, the nuclear 3½. Initial turn minute, inflated, submerged at the tip; sculpture introduced near the beginning of the final whorl of the protoconch, the preceding volutions smooth and polished, constricted at the sutures and increasing rapidly in diameter; axials the first to appear, and concomitant with them on some individuals an obtuse keel overhanging the anterior suture; the riblets at first exceedingly fine and irregular and little more than mere puckers in front of the posterior suture; spirals following the axials within a quarter of a turn, the anterior first, others intercalated behind it, the posterior the latest; final protoconchal sculpture of sharp, narrow axial riblets persisting from suture to suture with wider interspaces, finely lirated spirally. Dividing line between conch and protoconch sharply defined by the abrupt change in the character of the axials, those of the conch being relatively broad, obtusely rounded upon their summits, feebly flexuous, evanescent posteriorly, and less elevated anteriorly. Sculpture similar in general character over the entire surface of the conch. Axials 9 to the whorl except upon the body, which is more or less irregularly sculptured near the aperture, broad, obtusely rounded, feebly protractive on the early volutions, almost vertical upon the later, flexuous upon the base of the body, most prominent upon the periphery, weakening posteriorly, less elevated anteriorly and upon the base. Spiral sculpture of exceedingly fine lirae, 6 or 8 to half a millimeter, microscopically dissected by the incrementals, linearly spaced, irregular, and tending to alternate in width except upon the posterior fasciole, where they are equal and even finer and sharper than in front of the periphery, and upon the base of the ultima and the pillar, where they are less narrow and flattened, with a microscopic threadlet regularly intercalated; anterior fasciole closely lirate, the lirae equal and about 9. Posterior fasciole well differentiated by the obtuse angulation of the whorl, the reduced axial sculpture, and the microscopic spiral granulation. Incrementals strong and flexuous. Sutures distinct, impressed. Aperture oblique, lobate, acutely angulated at the posterior commissure. Outer lip thin, sharp, feebly arched axially and strongly incrementally, thickened neither without nor within, broadly but not very deeply insinuated halfway between the suture and the periphery. Inner margin of aperture feebly excavated at the base of the body. Parietal wall smoothly and thinly glazed. Pillar straight, simple, reinforced. Anterior canal rather long, open. Anterior fasciole wide, obliquely truncate at its extremity.

Figured specimens: U. S. Nat. Mus. No. 349890, from locality 2646, Oak Grove, Okaloosa County, Fla.

The young are relatively stouter than the adults, and even among the adults there is a very considerable range of variation. Individuals attaining an altitude of over 1 centimeter and a maximum diameter of only 3.5 millimeters exhibit the characteristic whorl contour and ornamentation of *K. ramondi* and have been admitted a little doubtfully under that name.

K. ramondi is smaller than its Chipola analog, *K. websteri* Maury, less sharply sculptured axially, and much more finely lirate spirally.

The species was repeated under another name in the same paper. *"Mangelia" nemorensis* immediately precedes *M. ramondi*, but as the type of the former is an immature and imperfect shell it has seemed justifiable to retain the name *ramondi* in its stead. *Kurtziella thektapleura*, also from the Oak Grove sand, is more slender, more acutely angulated at the periphery, and more sharply sculptured both axially and spirally.

Kurtziella cerina Kurtz and Stimpson of the Recent fauna is a closely allied member of this group.

Occurrence: Oak Grove sand, localities 2646[c], 5632[p], 5631[r], 5633[r], 7054[p]. Aldrich collection, Johns Hopkins University. Cornell University collection.

"Mangelia" teirata Gardner, n. sp.

Plate XLI, figures 22, 23

Shell small, moderately slender, fusiform; aperture less than half as high as the entire shell; spire elevated; whorls trapezoidal in outline, closely appressed, obtusely tapering. Whorls of conch 4, of protoconch 3½. Initial turn of protoconch minute, obtuse, for the most part submerged; succeeding 1½ volutions increasing rapidly in diameter, broadly convex, constricted at the sutures, smooth like the initial turn; sculpture introduced at the end of the nuclear penult; axials arcuate, at first very feeble and close set, becoming increasingly straight and more distant; spirals introduced very shortly after the axials but exceedingly faint until the last quarter of a turn, where they develop into rather strong fillets, usually 4 upon the medial and anterior portions of the whorl, more feeble and less regular posteriorly. Line between conch and protoconch defined by the final axial of the protoconch, further indicated by the posterior appression of the whorl, the disappearance of the well-defined spiral sculpture, and the change in the character of the axial sculpture. Axials upon the conch not very prominent, somewhat flexuous, sharply pinched, and feebly retractive posteriorly, persistent to the suture, broader, more elevated, and more obtuse between the fasciole and the anterior suture, evanescing well down upon the base of the body, numbering 8 to the whorl including the body, inclined to be opposite but not forming well-arranged series. Spiral sculpture ill defined and irregular, appearing, in the type, on the spire in the form of 3 exceedingly low, flat fillets with a single narrower secondary intercalated between each pair of primaries; primaries upon the body about four times as many as upon the spire, exceedingly feeble medially but sharpening a little upon the base; secondaries intercalated, similar in character to those upon the spire; spirals upon the pillar 4 in the type, narrower, less distant, and not so low and flat as those behind them; secondaries not intercalated; anterior fasciole finely and closely threaded with about half a dozen simple, rounded lirae. Posterior fasciole with a few ill-defined scratches but no regular sculpture; fasciole defined by the slightly greater depression of the intercostal areas, the acute, feebly retractive axials which traverse it, the faint arcuate incrementals, and the absence of any spiral sculpture other than irregular striations. Suture line distinct, impressed, undulated by the costals of the preceding volution. Aperture oblique, angulated at the posterior commissure, narrow and approximately uniform in width throughout its extent. Outer lip thin, sharp, broadly and, for the group, rather deeply insinuated posteriorly, expanding incrementally in front of the sinus. Labium feebly constricted at the base of the body. Parietal wall and pillar thinly glazed. Anterior canal rather short, broad, and open. Anterior fasciole obliquely truncate at its extremity.

Dimensions: Height, 5.5 millimeters; length of aperture, 2.3 millimeters; maximum diameter, 2.2 millimeters.

Holotype: U. S. Nat. Mus. No. 349898.

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

The most striking features in this worn little shell are the rather sharply pinched, persistent axials and the very low, obscure, and ill-defined spirals.

"Mangelia" teirata recalls *Kurtziella* in the final tesselated whorl of the nucleus, but the nucleus is more obtuse than in the members of that group, and the conch stouter and less elegantly sculptured.

Occurrence: Oak Grove sand, locality 2646[r].

Genus SACCHAROTURRIS Woodring

1928. *Saccharoturris* Woodring, Miocene mollusks from Bowden, Jamaica, pt. 2: Carnegie Inst. Washington Pub. 385, p. 182.

Type (by original designation): *Mangilia consentanea* Guppy. (Miocene of Bowden, Jamaica.)

Shell small, slender, whorls very strongly constricted. Nucleus consisting of three rapidly enlarging whorls, the apex rising abruptly, the last two whorls strongly keeled and bearing beads on the keel, from which fine axial riblets extend. Aperture wide, anterior canal short, but strongly constricted, unemarginate. Outer lip not varicose; anal notch very shallow and broad. Sculpture consisting of heavy varixlike ribs, overridden by strongly frosted spiral threads of several orders of magnitude.

Saccharoturris is a genus of "Mangilias" that has a beaded nucleus, unemarginate canal, very shallow anal notch, and strongly frosted sculpture.—Woodring, 1928.

The small keeled protoconch is one of the most characteristic features of the group.

Saccharoturris centrodes Gardner, n. sp.

Plate XLI, figure 7

Shell very small and exceedingly slender; spire elevated, serrated in profile by the rather acutely angulated periphery; body whorl smoothly constricted at the base. Conch performing 5 complete volutions, the protoconch between 3 and 3½. Initial turn minute, rounded, laterally compressed, slightly tilted and immersed at the tip, the 2½ succeeding volutions also smooth and polished, inflated, constricted at the sutures, and increasing rather rapidly in diameter within their narrow limits; anterior undercut and axial ribbing introduced within the last half turn; the axials microscopically fine, arcuate, and abruptly disappearing upon the keel, which migrates from its introduction behind the suture almost to the median horizontal; spiral striations visible under high magnification between the riblets. Line of demarcation between the conch and protoconch indicated by the abrupt disappearance of the nuclear axials and the introduction of broadly rounded axials which do not persist to the posterior suture; nuclear carina continued across as the peripheral keel. Adult axial sculpture of narrow, rather sharply rounded riblets, a little more prominent at the periphery than anteriorly, retractive behind the periphery, flexuous upon the body, evanescent near the posterior suture and the base of the body, somewhat irregular in number, 8 upon the penult of the type and 6 upon the ultima; intercostal areas rather flat and perceptibly wider than the costals. Both costal and intercostal areas over entire surface of conch crowded with sharp, minutely prickled threadlets, tending to alternate in size in front of the periphery, the least fine usually 4 or 5 on the later whorls of the spire; secondaries and tertiaries intercalated on the spire and the medial portion of the body, secondaries only on the base of the body. Pillar and fasciole threading uniform. Posterior fasciole almost half as wide as the entire whorl, gently sloping, slightly undulated by the axials and evenly threaded with 9 equal filaments; posterior margin not elevated but closely appressed against the preceding volution and undulated in harmony with the axials. Sutures indistinct. Aperture sublinear, acutely angulated at the posterior commissure. Outer lip thin, sharp, expanded incrementally but not axially, thickened neither without nor within. Posterior sinus a spreading U, running nearer to the periphery than to the posterior suture. Inner margin of aperture scarcely excavated. Parietal wall thinly and evenly glazed. Anterior canal rather long and narrow. Anterior fasciole rather wide, obliquely terminated at the extremity.

Dimensions: Height, 4.8 millimeters; length of aperture, 1.8 millimeters; maximum diameter, 1.6 millimeters.

Holotype: U. S. Nat. Mus. No. 328570.

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

Saccharoturris centrodes is much the most slender member of the group. In general build and character of ornamentation it resembles *Kurtziella websteri* (Maury), but it is smaller and very much more slender both in conch and protoconch; the protoconchal sculpture is not introduced so early, and the conch is more finely and sharply sculptured with frosted instead of simple spirals.

Chipola formation, localities, 2213[p], 2564[r], 3419[r].

Genus CRYOTURRIS Woodring

1928. *Cryoturris* Woodring, Miocene mollusks from Bowden, Jamaica, pt. 2: Carnegie Inst. Washington Pub. 385, p. 178.

Type (by original designation): *Cryoturris engonia* Woodring. (Miocene of Bowden, Jamaica.)

Shell small or medium-sized, slender or moderately slender, whorls angulated at periphery or rounded. Nucleus slender or moderately slender, apex generally rising abruptly, consisting of about 2½ or 3 whorls, the last whorl or half whorl bearing curved, protractive axial riblets and generally bulging at periphery. Aperture moderately narrow, anterior canal very short or hardly differentiated, slightly emarginate. Outer lip simple, except at intervals corresponding to position of varixlike ribs. Anal notch wide, shallow, or moderately deep. Sculpture consisting of axial ribs, overridden by fine spiral threads and by microscopic frosted spiral threads.

Cryoturris is a genus of "Mangilias" that seems to be the tropical representative of the temperate genus *Kurtziella* Dall (Proc. Biol. Soc. Washington, vol. 31, p. 137, 1918; type, by original designation *Pleurotoma cerina* Kurtz and Stimpson, Recent, east coast of United States), which has a similar aperture and sculpture, though the frosted effect is not so pronounced. The last nuclear whorl, or perhaps the first postnuclear whorl, of *Kurtziella* bears, however, reticulate sculpture. * * *

All the species referred to *Cryoturris* have the same general features, but they differ greatly in size. All have an axially sculptured nucleus, short canal or virtually no canal, simple outer lip, shallow or moderately deep anal notch, and minutely roughened or frosted sculpture.—Woodring, 1928.

Cryoturris daidalea Gardner, n. sp.

Plate XLI, figure 24

Shell small and slender; spire elevated and turreted, the aperture decidedly less than half as high as the entire shell; whorls of spire moderately inflated, constricted at the suture, acutely tapering; body sharply contracted. Whorls of conch 4½ in the type. Protoconch rather elevated, highly polished, coiled 3½ times; initial turn rounded, strongly tilted, and immersed at the tip; next 1½ turns broadly convex, constricted at the sutures, increasing rather rapidly in diameter; axial sculpture introduced near the end of the first half of the final nuclear whorl in the shape of microscopically

fine, arcuate riblets about a dozen to the half turn, persistent to the suture posteriorly but evanescing anteriorly in front of the obtuse carina, which is developed concomitant with the axial riblets and is continued across to the conch as the peripheral keel. Dividing line between conch and protoconch arcuate, indicated by a slight break in the shell, the disappearance of the nuclear axials, and the initiation of the postnuclear sculpture both axial and spiral; axials similar in general character over the entire surface of the conch, though narrower and more persistent posteriorly on the earlier whorls and more widely spaced upon the body. Axials normally rather narrow but well rounded upon their summits, of approximately the same width or a little narrower than the concave intercostals that separate them, nearly vertical, approximately uniform in prominence from the periphery to the anterior suture, retractive behind the periphery and persisting, though with greatly diminished strength, to the posterior suture, flexuous upon the body, evanescent upon the pillar, 11 upon the final whorl of the spire but only 8 upon the body; these, however, spaced with approximate regularity upon the whorl, as prominent upon the last half turn as upon the first. Spirals crowding the entire surface of the conch alternating in size in front of the periphery, the primaries 7 or 8 upon the later whorls of the spire and about three times as many upon the body, not including the half dozen primaries that gird the pillar; both the primaries and the regularly intercalated secondaries and tertiaries very finely and daintily frosted; beading upon the pillar much less sharp than upon the rest of the primaries; fasciole very finely threaded with somewhat crinkled lirae. Posterior fasciole crowded with about a dozen equal finely prickled spirals; fasciole not quite half as wide as the entire whorl, defined by the obtuse angulation at the periphery, the weakening of the axial sculpture, and the uniformity of the spiral; posterior margin closely appressed but not elevated. Sutures impressed but not at all conspicuous. Aperture somewhat oblique, narrowly oblanceolate, acutely angulated at the posterior commissure. Outer lip broadly and very feebly arcuated, strengthened a little behind the margin by the terminal rib; posterior insinuation very broad and shallow. Inner wall of aperture smoothly excavated at the base of the body. Parietal and pillar wash rather thin. Anterior canal moderately long and rather narrow. Anterior fasciole rather narrow, obliquely truncated at its extremity.

Dimensions: Height, 6.0 millimeters; length of aperture, 2.5 millimeters; maximum diameter, 2.4 millimeters.

Holotype: U. S. Nat. Mus. 328578.

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

In *Kurtziella websteri, Saccharoturris centrodes, K. ramondi,* and *K. thektapleura,* a cancellate sculpture is developed upon the final half turn of the protoconch, but in *Cryoturris daidalea* only the axial is present. There are also diagnostic differences in the conch. The axials are more numerous in *C. daidalea* than in any of the four other species. *K. websteri* is more coarsely sculptured spirally, and the spirals are not sharply beaded as in *C. daidalea.*

S. centrodes is more slender. *K. ramondi* is smaller and more obtusely sculptured axially. In *K. thektapleura* the axials are much more acute. *"M." pyrgota* has similar nuclear characters, but the whorls are more strongly tabulated, and the axials less numerous and more strongly cordate.

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

"Mangelia" pyrgota Gardner, n. sp.

Plate XLI, figures 5, 6

Shell rather small and slender, the whorls strongly tabulated behind, rather acutely angulated at the periphery, and constricted a little at the anterior suture; body smoothly contracted at the base. Whorls of conch between 5 and 5½. Protoconch low, highly polished, thrice coiled; initial turn minute, inflated, a little tilted and immersed at the tip, the succeeding turn broadly and smoothly rounded and like the final nuclear whorl increasing rapidly in diameter; a feeble axial sculpture introduced upon the final half turn of the nucleus, the riblets sublinear, strongly arcuate, obsolete near the anterior suture. Line of demarcation between the conch and protoconch indicated by an irregular thickening of the shell, the abrupt disappearance of the nuclear sculpture, and the equally abrupt appearance of the post-nuclear, both axial and spiral. Axials very narrow, elevated, rounded upon their summits, approximately vertical and uniform in prominence from the periphery to the anterior suture, sharply pinched, retractive but persistent from the periphery across the fasciole to the posterior suture, flexuous and not quite so prominent upon the base of the body though well defined even to the anterior fasciole; costals 8 upon the body, including the terminal varix, and approximately the same upon the whorls of the spire, with a consequent increasingly closer spacing toward the apex; intercostals on the later whorls rather flattened and decidedly wider than the costals. Spiral sculpture uniformly developed upon the axial and interaxial areas, the spirals unequal in front of the periphery; the primaries low and flattened, 4 or 5 upon the later whorls of the spire and about twice as many upon the body, with 3 to 5 secondaries and tertiaries crowded into each of the interspaces; the pillar girded with 3 somewhat broader and more distant primaries with intercalated secondaries; the anterior fasciole more feebly lirate, the threadlets becoming increasingly finer and closer anteriorly. Posterior fasciole crowded with linear lirae, 15 upon the body of the

type; all the spirals overrun and more or less dissected by exceedingly fine and close-set incrementals, which microscopically granulate the finer spirals and shagreen the coarser; posterior fasciole not quite half as wide as the entire whorl, very sharply differentiated by the contour of the whorl, the pinching and flexure of the axials, and the very abrupt change in the character of the spirals; posterior margin closely appressed. Sutures impressed and rather sharply undulated by the costae of the preceding volution. Aperture oblique, narrowly lobate, obtusely angulated. Outer lip broadly and very gently arcuate, varicated a little behind the thin, sharp margin, smooth within. Curvature of inner wall of aperture even lower than that of the outer. Parietal and pillar surfaces smoothly and lightly glazed. Anterior canal rather short, broad, open. Anterior fasciole moderately wide, truncate at its extremity.

Dimensions: Height, 6.9 millimeters; length of aperture, 2.9 millimeters; maximum diameter, 2.6 millimeters.

Holotype: U. S. Nat. Mus. No. 328574.

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

"Mangelia" pyrgota is most conspicuously characterized by the strongly tabulated shoulder, the almost straight-sided outline in front of the shoulder, and the heavy, cordate axials. No other species approaches it very closely.

The larger protoconch and the obtuse but very pronounced shouldering of the whorl of the conch prevent its inclusion under *Cryoturris*.

Occurrence: Chipola formation, localities 7893[r], 2213[r], 3419[r].

Genus ITHYCYTHARA Woodring

1928. *Ithycythara* Woodring, Miocene mollusks from Bowden, Jamaica, pt. 2: Carnegie Inst. Washington Pub. 385, p. 168.

Type (by original designation): *Mangilia psila* Bush. (Recent off the southeast coast of the United States.)

Shell small, slender. Nucleus consisting of 2½ to 3 rapidly enlarging whorls, the last whorl [more] or less keeled or not keeled and bearing weak protractive axial riblets. Aperture long, narrow, anterior canal generally not differentiated, siphonal notch shallow. Anal notch moderately deep, the apex rounded and lying some distance from suture. Outer lip varicose, interior bearing crude elongate denticles. Inner lip bearing a deeply set inflated denticle lying above middle, from which very obscure small denticles may extend downward. Sculpture consisting of narrow widely spaced axial ribs, generally arranged in continuous series on later whorls, angulated at periphery by an obscure spiral. Minute spirals present or absent.—Woodring, 1928.

The genus includes slender forms of the *"Cythara"* type, with small nuclei and a few strong axials, which commonly give to the shell a more or less polygonal outline.

Ithycythara defuniak Gardner, n. sp.

Plate XLI, figures 31, 32

Shell very small and very slender, hexagonal; axials narrow, acute, and opposite, arranged in 6 continuous series; interaxials smoothly concave, not interrupted at the sutures nor macroscopically sculptured spirally. Whorls of conch 4½, of protoconch 3½. Initial whorl of protoconch low, broadly inflated, partly immersed; succeeding 1½ volutions also low and broadly convex, the maximum diameter not far behind the anterior suture. Axial sculpture introduced within the last full turn of the protoconch; axials at first very feeble, arcuate, most prominent medially, persistent to the posterior suture but obsolete a little behind the anterior, which is slightly overhung by the obtuse peripheral keel; axials becoming increasingly prominent and more distantly spaced toward the close of the nucleus; exceedingly obscure spiral striae developed in some specimens on the last quarter turn. Line of division between conch and protoconch not very sharp, indicated by the closer appression of the posterior margin, the abrupt disappearance of the nuclear axials, and the establishment of the more elevated and more distant postnuclear axials. Postnuclear axials 6 to the whorl, very narrow, opposite and continuous, a little more sharply pinched posteriorly, acutely rounded medially and anteriorly, bowing out a little at the periphery, persistent on the body to the anterior fasciole; intercostal areas symmetrically but not deeply concave, most depressed posteriorly; incremental striae faint, sinuous. Spiral sculpture absent except for microscopically fine striae discernible only on fresh surfaces, least faint upon the summits of the costae, approximately uniform in their vertical development. Posterior fasciole indicated only by the more acute and slightly lower axials and the more depressed interaxials; posterior margin appressed. Suture line distinct but not conspicuous. Body whorl slender and evenly attenuate; aperture oblique, sublinear, and approximately uniform in width throughout its extent. Outer lip oblique, thin, and sharp, reinforced a little behind the margin by the rather heavy terminal rib, further reinforced within, in the type, by 3 broad, heavy ridges running normal to the margin, the broadest and heaviest directly in front of the posterior sinus, the 2 in front equal and separated from one another and from the posterior ridge by rather narrow sulci, in other individuals denticulated all the way to the anterior canal. Posterior sinus semicircular, symmetrically disposed upon the fasciole. Inner wall of aperture very feebly excavated, heavily glazed, an amorphous denticle developed at the entrance to the sinus directly across from the posterior ridge of the labrum. Anterior canal rather long, moderately broad, the margins parallel. Anterior fasciole wide, obliquely truncate at its extremity.

Dimensions: Height, 5.8 millimeters; length of aperture, 2.5 millimeters; maximum diameter, 1.9 millimeters.

Holotype: U. S. Nat. Mus. No. 352137.

Type locality: No. 7264, probably in sec. 8 or 17, T. 2 N., R. 19 W., *Cardium* beds, Walton County, Fla.

Ithycythara defuniak is exceedingly close to *"Mangelia" elongata* Gabb, but the differences, though slight, are apparently constant. *"M." defuniak* is the smaller of the two by about 25 percent. It is a little the more slender and includes one or two more whorls. The tendency toward peripheral nodes, so marked in *Ithycythara psila* (Bush), usually is perceptible in all the earlier whorls of *"M." elongata* but only on the first of *I. defuniak*. The spiral sculpture is also a little less faint in the Jamaica form and the terminal varix not quite so pronounced. In *Ithycythara? tarri*, perhaps the closest analog within the Alum Bluff, the axials are less acute and their opposition much less constant and accurate.

Occurrence: Shoal River formation, locality 7264[p].

Ithycythara compsacosta Gardner, n. sp.

Plate XLI, figures 33, 34

Shell minute, slender, the aperture less than half the altitude of the entire shell; spire elevated, acutely tapering; the body attenuated anteriorly; conch of 5 volutions, the protoconch of 3½ to 4. Initial whorl minute and partly submerged; the 2 succeeding volutions moderately elevated, constricted at the sutures, and increasing rather rapidly in diameter; final whorl of the protoconch obscurely carinate near its close, the keel placed a little behind the anterior suture, which it overhangs; faint arcuate riblets developed behind the keel and concomitant with it, restricted for the most part to the final half turn of the nucleus. Line of demarcation between the conch and protoconch most clearly indicated by the wedging out of the nuclear keel and the establishment of the true axial sculpture. Axials prominent, arcuate on the early whorls and more or less flexuous upon the later, persistent from suture to suture and on the body to the anterior fasciole but more sharply pinched and less elevated posteriorly, expanding slightly anteriorly, separated by wider, smoothly concave intercostal areas, usually 7 upon the body whorl, which is, except in rare individuals, as regularly sculptured as those of the spire. Spiral sculpture similar to that of *Ithycythara tarri* (Maury), a close shagreening covering the entire shell but visible only under very high magnification. Posterior margin of whorls closely appressed, the sutures distinct and undulated by the axials of the preceding volution. Aperture narrow, widening but very slightly posteriorly. Outer lip subvaricose, the edge thin, sharp, and recurved, a single rather large amorphous denticle placed directly in front of the siphonal notch. Posterior sinus a spreading U, moderately deep, distant from the posterior suture. Posterior commissure filled with callus. Columella feebly excavated, the wall thinly glazed. Pillar straight, simple. Anterior fasciole short, obscurely defined, obliquely truncate at its extremity.

Dimensions: Height, 5.8 millimeters; length of aperture, 2.5 millimeters; maximum diameter, 2.0 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 114056.

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

Ithycythara compsacosta is the analog in the Chipola fauna of *I. tarri* (Maury) in the Oak Grove. The axial costae of the former are more prominent and more obtusely rounded and usually number 7 instead of 6 upon the later whorls. Furthermore, there is, as a rule, only 1 denticle on the inner surface of the labrum instead of 3, as normally in *I. tarri*. The difference in outline is sufficient to separate a large series, for in such small forms even the slightest variation in the ratio of altitude and diameter or in the relative altitudes of spire and body whorl strikes the eye. *Ithycythara tarri* is a little more slender than the Chipola species, the body whorl is a little higher relatively, and the basal constriction a trifle more pronounced. The spire is consequently relatively more elevated, and its component whorls are more strongly flattened laterally.

Occurrence: Chipola formation, localities 7893[r], 2213[c], 2564[p], 7151[r].

Ithycythara tarri (Maury)

Plate XLI, figures 35, 36

1910. *Mangilia strabonis* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 12, pl. 3, fig. 6.

1910. *Mangilia tarri* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 13, pl. 3, fig. 7.

Shell small, slender, acute, 6-whorled exclusive of the eroded nucleus, body whorl slightly more than half the length of the shell; suture distinct, somewhat wavy; sculpture consisting only of longitudinal flexuous riblets or waves, of which there are 6 on the last whorl; aperture narrow; outer lip with internal lirae; callus moderate. Length of shell 6; greatest width 2 millimeters.

Named in honor of Professor Tarr, of Cornell University.

Oak Grove, Santa Rosa County, Fla.

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

Figured specimens (2) from Oak Grove sand, Oak Grove, Okaloosa County, Fla., Aldrich collection (Johns Hopkins University).

The shell is very slender, the conch of a little less than 5 volutions, the protoconch relatively large and coiled 3½ to 4 times. The initial turn is erect, slightly tilted, and immersed at the tip. The two succeeding volutions are moderately inflated, constricted at the sutures, and increase rather rapidly in diameter. Very fine axial riblets are introduced within the last half turn of the protoconch. These are somewhat irregular and arcuate and become feeble near the

posterior suture, abruptly disappearing at about two-thirds of the distance to the anterior suture. The keel thus formed wedges out at the dividing line between the conch and the protoconch. The axials are rather narrow and obtusely rounded upon their summits, tending to expand anteriorly. They are separated by broader, concave interaxials, which are slightly protractive and usually opposite upon the later whorls. There is also visible under high magnification a spiral shagreening, too faint to be called a sculpture, of exceedingly fine threadlets, 10 or 12 to the millimeter over the entire shell but least faint upon the early volutions and the anterior portion of the adult whorls. The axial sculpture in some individuals is regular upon the body whorl; in others it is irregular on the last half turn, and a varix is developed a little behind the outer lip; there are usually 3 denticles upon the inner surface of the labrum, the posterior one near the entrance to the siphonal sinus more prominent than the two in front of it, which occupy a medial position. The sinus is very shallow and placed at some distance from the posterior suture. There is no thickening around the margin. In some individuals a small denticle is developed on the parietal wall at the base of the body, but this is commonly absent, even in forms apparently mature. This species is probably the most abundant member of the group in the Oak Grove sand.

The type of *"Mangelia" strabonis* Maury has been examined. It is nothing more than a well-preserved young individual of *Ithycythara tarri*. The young of *I. tarri* are relatively stouter than the adults, the axials are sharper and rather more numerous, and the spiral shagreening is not quite so faint. It has seemed justifiable to retain the name *I. tarri*, although the description of the juvenile precedes it by a page.

The closest analog is *Ithycythara compsacosta*, of the Chipola fauna, which differs from *I. tarri* in the slightly less slender outline, in the broader and more elevated axials, and in the presence of only 1 instead of 3 denticles upon the inner surface of the labrum. *"Mangelia" elongata* Gabb is a member of the same well-defined group, but it is larger, and the axials are more acute, especially upon the anterior portion of the whorl, and are arranged in continuous series, which persist the length of the conch.

In *"Mangelia" psila* Bush the obtuse angulation of the whorls is emphasized by feeble peripheral nodes developed upon the axials and in some individuals connected by a faint spiral cord. The axials are also much more acute and arranged in more sharply defined series. *"Mangelia" muricoides* C. B. Adams is larger, the ribs are more acute and more elevated and more constantly opposite.

Occurrence: Oak Grove sand, localities 2646^{c}, 5632^{c}, 5631^{p}, 5630^{r}, 5633^{r}, 7054^{p}. Aldrich collection, Johns Hopkins University; Cornell University collections.

Ithycythara? radinos Gardner, n. sp.

Plate XLI, figures 12, 13

Shell very slender, body whorl rather high relatively, attenuated anteriorly; spire elevated, tapering very gradually to the acute apex. Whorls less than 10 in all, the protoconch of a little more than 3, the conch of a little less than 7 volutions. Protoconch smooth and shiny, moderately large and elevated, the initial turn immersed at the tip, the two succeeding volutions broadly inflated, increasing regularly in diameter, flattening slightly toward the end of the protoconch. Line of demarcation between the conch and protoconch indicated by the introduction of the axial sculpture and by the appression of the posterior margin of the whorl. Whorls of conch very closely appressed, almost imperceptibly constricted at the posterior fasciole, with an even more feeble compression at the anterior suture; body whorl obliquely tapering at the base but not sharply constricted. Axial sculpture undulatory in character, the axials 6 on each of the later whorls, including the ultima, broadly rounded, not sharply defined, evanescent posteriorly but persistent to the anterior suture and to the base of the body, feebly protractive for the most part, opposite and constituting a continuous series which performs a little less than half a revolution around the axis. Spiral sculpture exceedingly faint but developed over the entire surface, most feeble posteriorly, least so upon the anterior fasciole, taking the form of obscure microscopic threadlets, 6 to 8 upon the later whorls of the spire in front of the fasciole. Posterior fasciole defined, though not at all sharply, by the feeble constriction of the whorl and by the evanescence of the axials; posterior margin of the whorl raised and closely appressed but not elevated as a distinct cord. Sutures undulated in harmony with the axials. Aperture somewhat oblique, very narrow both in front and behind. Outer lip subvaricose a little behind the margin, very feebly arched medially, smooth within. Posterior sinus broad but shallow, placed more than half way from the posterior suture to the outer margin of the fasciole. Inner wall of the aperture feebly excavated at the base of the body, rather heavily glazed, especially just in front of the posterior commissure and along the pillar, where the edge of the callus is cut off from the anterior fasciole by a shallow depression. Anterior fasciole rather wide, defined by the relatively coarse and crowded lirae, squarely truncate at the outer extremity.

Dimensions: Height, 9.6 millimeters; length of aperture, 4.0 millimeters; maximum diameter, 3.0 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 371063.

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

This species is set apart from the other members of *Ithycythara* by the larger number of smooth nuclear turns and their more gradual enlargement and by the development of a posterior fasciole. These differences may prove to be generic.

The species suggests the adult *"Mangelia" clarae* Maury, the type of which I have been unable to examine. Even the young of *I. radinos*, however, are more slender than Miss Maury's species and less constricted at the base of the body. The costals are also more numerous by one in *"M." clarae*, and the difference in the number of whorls is rather too great to be eliminated by the personal equation.

"Mangelia" lissa is very similar in outline but exhibits no trace of spiral sculpture.

Occurrence: Chipola formation, localities 7257^{r}, 2213^{r}, 2564^{p}, 3419^{p}.

"Mangelia" clarae Maury

1910. *Mangilia clarae* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 11, pl. 3, fig. 1.

Shell small, slender, acute, 7-whorled, the 2 nuclear smooth and full; spiral sculpture consisting only of a few fine threads extending over the lower half of the body whorl; transverse sculpture of slightly oblique ribs (7 on the last whorl), most prominent at the periphery of the whorls. Length of shell, 6.5; greatest width, 2.5 millimeters.

Chipola marls, Baileys Ferry, Fla.

Cornell University collection.—Maury, 1910.

The species is not represented in the later collections.

Occurrence: Chipola formation, Cornell University collection.

"Mangelia" asteria Gardner, n. sp.

Plate XLI, figures 29, 30

Shell very small, fusiform, the maximum diameter in front of the median horizontal; spire elevated, the component whorls evenly convex, constricted at the sutures, decreasing regularly in diameter toward the acute apex; body whorl rather abruptly contracted at the base in the unique type, which is not fully mature. Whorls of the conch 5, of the protoconch 3½. Protoconch slender but high, the early whorls smooth and lustrous; initial turn slightly tilted, moderately inflated, immersed at the tip; the two succeeding volutions also inflated, sharply constricted at the sutures, increasing regularly in diameter and altitude; axial sculpture introduced within the last half turn of the protoconch along with the obtuse peripheral keel, which runs a little in front of the median horizontal; axials arcuate, about a dozen, persisting from the posterior suture to the periphery, where they flatten and evanesce. Division line between the conch and protoconch indicated by a slight change in the texture of the shell, the disappearance of the peripheral keel, and the establishment of the spirals and the true axials; both the axial and the spiral sculpture uniform in general character over the entire surface of the conch. Axials 7 to a whorl except on the earliest turn of the conch, where they run up to 11, very sharply pinched and acutely rounded upon their summits, abruptly rising to an elevation of probably half a millimeter above the surface of the body, a little more elevated medially but persisting to the sutures and to the anterior fasciole, arranged in continuous, slightly retractive series which perform about a quarter of a revolution about the axis of the shell; separated by broadly and deeply concave intercostals of more than double their own width. Entire surface of the conch except the anterior fasciole covered with exceedingly fine, sharp, roughened threadlets about a dozen to half a millimeter, for the most part equal upon the body but tending to alternate in size upon the earlier volutions, uniform in strength upon the costal and the intercostal areas; anterior fasciole microscopically lirate, with threadlets less sharp and more smooth than upon the rest of the surface. Posterior fasciole defined only by the lesser elevation of the axials and the finer, closer spiral lineation. Suture lines distinct but inconspicuous. Aperture narrow, broadening but slightly behind, angulated at the posterior commissure. Outer lip varicated by the terminal costal, feebly arcuate, smooth within. Siphonal notch very broad and shallow and barely perceptible, set nearer to the periphery than to the posterior suture. Inner lip excavated at the base of the body. Parietal wall and pillar rather thinly glazed. Anterior canal long, feebly recurved. Anterior fasciole rather wide, obliquely truncate at the extremity.

Dimensions: Height, 6.2 millimeters; length of aperture, 2.8 millimeters; maximum diameter, 2.4 millimeters.

Holotype: U. S. Nat. Mus. 328584.

Type locality: No. 2564, 1 mile below Baileys Ferry, Calhoun County, Fla.

"Mangelia" asteria is strikingly well characterized. In cross section the form is stellate; the profile is daintily scalloped, the scallops symmetrical and decreasing regularly in diameter toward the apex. There is no form either in the coexistent or the later faunas that approaches it very closely.

"Mangelia" asteria has many characters that ally it to *Ithycythara*, but the differences in the nuclei and the apertures are so marked that it can scarely be admitted to so restricted a group.

Occurrence: Chipola formation, locality 2564^{r}.

"MANGELIA"

A small group of polished nonlirate species may be referable to the operculates rather than to the nonoperculates. They have many of the characters of *Eumetadrillia*, but the nucleus is more slender, more acute, and of 2½ to 4 volutions instead of 1½. The characters of the aperture, however, are much more

suggestive of the Mangelias. The group includes 2 Chipola species and 1 from the Shoal River.

"Mangelia" lissa Gardner, n. sp.

Plate XLI, figures 27, 28

Shell small and slender; body whorl short; spire elevated and acutely tapering. Whorls between 9 and 10 in all, between 6½ and 7 in the conch, 2½ in the protoconch. Protoconch smooth, highly polished, relatively rather large; initial turn almost entirely immersed; the succeeding whorls broadly inflated, flattening toward the close of the nucleus. Dividing line between conch and protoconch indicated by a slight change in the texture of the shell and by the initiation of the axial sculpture. Whorls of the spire very closely appressed posteriorly but not constricted at the posterior fasciole and very slightly at the anterior suture; body whorl obliquely contracted at the base. Axials narrow, persistent from suture to suture, but very narrow and pinched posteriorly, broadest, most obtuse, and most elevated a little in front of the median line, irregular upon the body, 7 upon the later whorls of the spire, feebly protractive and tending to arrange themselves in series which perform less than a quarter of a revolution around the axis of the shell; body axials persistent to the base, a single, broad varix usually developed within the last half turn but no other axials between it and the terminal varix. Spiral sculpture absent altogether, even upon the anterior fasciole. Posterior fasciole indicated only by the weakening of the axials and the very obscure incrementals. Aperture short and wide throughout its extent. Outer lip varicose but thin edged, smooth within, widely flaring, incrementally forming a quadrate flange, deeply and broadly insinuated at the posterior fasciole, very feebly notched at the base of the body, possibly for the extension of the eye stalks. Inner margin of the aperture concave. Parietal wall and pillar heavily glazed, an amorphous deposit of callus at the entrance to the posterior sinus. Reverted pillar margin cut off from the anterior fasciole by a shallow depression. Anterior fasciole ill defined, incrementally wrinkled, broadly emarginate at its extremity.

Dimensions: Height, 8.1 millimeters; length of aperture, 3.0 millimeters; maximum diameter, 3.0 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 328560.

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

"Mangelia" lissa is macroscopically very similar to *Ithycythara? radinos*. However, the spiral sculpture of *I. radinos*, though very faint, is a constant character of which there is no trace whatever on *"M." lissa*. There is also a constant difference in the protoconch. The posterior fasciole of *I. radinos* is constricted, that of *"M." lissa* is not. There are 6 costals on the later whorls of the spire in the former, 7 in the latter; and in *I. radinos* the axial sculpture is almost invariably regular upon the body. *"Mangelia" lissa* is the only member of the genus in the Alum Bluff faunas that does not develop either a macroscopic or a microscopic spiral sculpture on some part of the shell.

Occurrence: Chipola formation, localities 2213^c, 2564^c, 3419^c. Aldrich collection, Johns Hopkins University.

"Mangelia" phrixae Gardner, n. sp.

Plate XLI, figures 25, 26

Shell very small, slender, highly polished; spire elevated and acutely tapering; body whorl rather abruptly constricted into the slender pillar. Whorls 9½ in all, the first 4 of them nuclear. Protoconch large and rather obtuse; initial volution for the most part submerged; the 2½ succeeding volutions very broadly convex and increasing slowly but regularly in diameter; final half turn of the protoconch acutely carinated a little behind the anterior suture, the keel wedging into the suture line at the end of the nucleus. Beginning of conch indicated by the abrupt initiation of the axial sculpture. Whorls of the conch closely appressed at the posterior margin but not constricted at the fasciole. Axials 10 to the whorl, sharply rounded, weakening but not entirely disappearing posteriorly, slightly protractive, opposite, the series performing about one-fourth of a revolution around the axis of the shell; intercostal areas broadly concave and wider than the costals; body axials persistent to the base but irregular upon the last half turn; usually a single broad varix at some distance back from the margin with a minor corrugation between it and the outer lip. Spiral sculpture restricted to an obscure liration upon the base of the pillar and the anterior fasciole. Posterior fasciole defined only by the weakening of the axials and the almost imperceptible incremental striae. Aperture clavate. Outer lip broadly arcuate, simple within; labral edge thin and recurved over the opening, broadly and rather deeply insinuated at the posterior fasciole. Inner wall of aperture smoothly excavated, rather heavily glazed. Anterior canal short, broad, open. Anterior fasciole rather short, obliquely truncate at its extremity.

Dimensions: Height, 6.9 millimeters; length of aperture, 2.8 millimeters; maximum diameter, 2.7 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 351214.

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

"Mangelia" phrixae is the possible Shoal River analog of *"M." lissa* of the Chipola fauna. It is less slender, however, and heavier than *"M." lissa*, the axials are more numerous and more expanded peripherally, and the pillar and anterior fasciole are not smooth, as in *"M." lissa*, but feebly lirate. The young of *Eumetadrillia rabdotacona* are much stouter and are not

lirate toward the anterior extremity. *"Mangelia" teirata* is not polished, nor is it so sharply constricted at the base of the body. The axials are sharply pinched and usually run 8 to the whorl. There is a very obscure spiral banding in front of the posterior fasciole, but the fillets are so low that they are not perceptible except under high magnification.

"Mangelia" phrixae bears a striking resemblance to *Drillia inadrina* Mansfield, from the Brasso beds of Trinidad, a series probably contemporaneous with the upper Alum Bluff. The Trinidad species, however, has the *Eumetadrillia* nucleus and less sharply pinched axials.

Occurrence: Shoal River formation, 3856[p], 3742[c], 3748[r].

"Mangelia" louisae (Maury)

1910. *Drillia louisae* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 8, pl. 2, fig. 4.

Shell small, slender, acute, with 8 whorls, of which the nuclear are smooth; spiral sculpture consisting only of about 8 fine, impressed lines at the base of the shell; transverse sculpture of slightly flexuous riblets which become obsolete on the last third of the body whorl, their termination being marked by a more pronounced varixlike riblet; space between this terminal rib and the outer lip showing strong, transverse lines of growth. Ribs on the body whorl 7. Notch U-shaped, distinct; outer lip thickened near the edge; pillar with a moderate callus. Length of shell, 9.5; greatest width, 3.75 millimeters.

Chipola marls, Baileys Ferry, Fla.

Cornell University collection.—Maury, 1910.

The conch is coiled 6½ times, the protoconch 2½. The initial turn of the protoconch is bulbous, the succeeding volution also highly inflated at its beginning but less convex toward the end. The whorls of the conch are flattened laterally and not perceptibly constricted at the sutures. The axials are sharply pinched, weakening a little posteriorly, feebly protractive, opposite, and arranged in continuous series, which perform almost half a revolution around the axis of the shell. The number ranges from 7 to 10 upon the penult. The spirals, though normally restricted to the base of the body and the pillar, may appear upon the medial portion or even upon the spire in the form of microscopic striae. The sutures are closely appressed and little or not at all undulated by the costals of the preceding volution. The aperture is rather narrow, and the edge of the outer lip slightly recurved over it. The parietal callus is especially heavy near the posterior commissure and along the pillar. The margin of the callus is cut off from the anterior fasciole by a shallow depression. The anterior fasciole is short, sharply defined, coarsely but obscurely lirate, and deeply emarginate at its extremity. A few battered individuals from Alum Bluff have been tentatively placed near this species, though they may prove distinct, at least subspecifically. They run a little longer and stouter than the Chipola form and are faintly sulcated over the entire surface. There are usually about half a dozen of the sulci in front of the fasciole and 3 even more feeble lineations upon it. This grooving is a fortuitous and a variable character in the *"M." louisae* from Chipola, but in the Alum Bluff representatives it is apparently constant. *"Mangelia" louisae* is well characterized by the acute axials and the sulcated pillar.

Occurrence: Chipola formation, localities 2213[p], ?2211[p]. Cornell University collections.

Genus BRACHYCYTHARA Woodring

1928. *Brachycythara* Woodring, Miocene mollusks from Bowden, Jamaica, pt. 2: Carnegie Inst. Washington Pub. 385, p. 175.

Type (by original designation): *Cythara gibba* Guppy. (Miocene of Bowden, Jamaica.)

Shell small, stout, biconic. Nucleus small-tipped, consisting of about 3 very rapidly enlarging whorls, about the last whorl sculptured with crowded, protractive, curved, axial riblets. Aperture long, narrow, base barely emarginate, anterior canal not differentiated. Outer lip not varicose, except at intervals corresponding to axial ribs. Anal notch shallow. Specimens with a perfectly formed outer lip show a low denticle below the notch well within the aperture. Parietal callus moderately thickened adjoining notch. Sculpture consisting of axial ribs, barely overridden by fine spiral threads, and of microscopic frosted spirals.

Brachycythara is a genus of small, biconic turrids having a very rapidly enlarging axially sculptured nucleus, nonvaricose outer lip, and no anterior canal.—Woodring, 1928.

Brachycythara dasa Gardner, n. sp.

Plate XLI, figures 14, 15

Shell very small, stout, fusiform, the maximum diameter falling a little in front of the median horizontal; height of aperture a little less than half the total altitude; whorls of spire broadly rounded, tapering rapidly to an acute apex; body rounded, strongly and rather abruptly constricted at the base. Whorls 7½ in all, 4 of them included in the lustrous, elevated protoconch. Initial turn of protoconch extremely minute but rounded and a little compressed laterally, immersed only at the tip, slightly tilted; the succeeding volutions of the protoconch very broadly and smoothly rounded and increasing rather rapidly in diameter; axial sculpture introduced upon the final half turn in the shape of faint protractive or slightly arcuate linear riblets, uniform in elevation from suture to suture but becoming increasingly stronger and a little more closely spaced toward the close of the protoconch. Dividing line between conch and protoconch indicated by a slight thickening and change in the texture of the shell and by the initiation of the conchal sculpture, both the axial and the spiral. Axials rather low, broadly rounded, uniform in prominence from the periphery to the anterior suture but

much lower, narrower, and sharply pinched behind the periphery, persisting, however, across the fasciole to the posterior suture, 9 upon each of the later whorls of the type, including the body, which is regularly costated even upon the final half turn, the costae evanescing, however, upon the base; intercostal areas shallow, usually a little wider than the costals; incremental striae faint but sharp. Spiral sculpture crowding the entire surface of the conch, the spirals low and very fine, tending to alternate in size, microscopically granulated by the incrementals, the primaries 7 or 8 in front of the periphery of the penult, least faint and least narrow upon the pillar. Spirals upon the posterior fasciole even finer and more crowded than those in front of the periphery, a little irregular in size but without intercalated secondaries; fasciole on the spire approximately half the width of the whorl, inconspicuously defined by the obscure and oblique shouldering of the whorl and the change in the character of the sculpture, both the axial and the spiral. Sutures deeply impressed, undulated by the costae of the preceding volution. Aperture narrow, obliquely lobate, acutely angulated at the posterior commissure. Outer lip thin, sharp, broadly insinuated posteriorly, slightly expanded incrementally but not axially. Posterior sinus rather shallow, symmetrically disposed upon the fasciole. Labium smoothly excavated at the base of the body. Parietal wash thin. Pillar long, approximately straight. Anterior canal moderately long and rather wide. Anterior fasciole rather narrow, defined only by the absence of spiral sculpture upon it; extremity obliquely truncate or very widely and obscurely emarginate.

Dimensions: Height, 4.6 millimeters; length of aperture, 2.6 millimeters; maximum diameter, 2.2 millimeters.

Holotype: U. S. Nat. Mus. No. 328608.

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

Brachycythara dasa is a stout little form similar in outline only to *M. cryptopleura*, a species from which it is readily separated by the less numerous axial costae, the sharper spiral lirae, and the 4-whorled instead of 2-whorled protoconch, the initial whorl of which is tilted and immersed only at the tip. This apical tilt is similar to that of *"Cythara" chariessa*, but the later protoconchal turns of *dasa* increase much more rapidly in diameter than those of *chariessa*.

Occurrence: Chipola formation, localities 2213^{p}, 2564^{p}, 3419^{p}. Aldrich collection, Johns Hopkins University.

"MANGELIA"

Two species of differing aspect but resembling one another in the small paucispiral nuclei have no obvious relationships to any restricted group. Both of them are from the Chipola formation.

"Mangelia" klimakota Gardner, n. sp.

Plate XLI, figures 16, 17

Shell minute, squat, biconic, the maximum diameter falling near the median horizontal; spire moderately elevated and angular; body whorl broadly conic. Whorls of conch 3½. Protoconch twice coiled, entirely smooth, small but high, obtusely angulated and flattened behind, the initial whorl largely submerged. Line between conch and protoconch very distinct, the first rib of the conch outlining the boundary. Whorls of conch sharply angulated at the periphery, the fasciole almost half as broad as the entire whorl; both axial and spiral ornamentation similar in general character over the entire conch. Axials narrow, acute, and commonly flexed slightly behind the periphery, persistent to the posterior suture, less narrow, obtuse, and slightly protractive in front of it, uniform in strength from the periphery to the anterior suture, from 10 to 12 in number on the later whorls, including the body, which is regularly though not quite so closely costate as the spire; body costals slightly flexuous upon the base, absent upon the pillar and anterior fasciole; intercostal areas broader than the costals, feebly concave; spiral sculpture faint but developed over the entire surface. Spirals in front of the periphery low, flattened threads, 8 upon the last whorl of the spire, equal in the type but commonly alternating in size and almost twice as many on other individuals; a broad, flat band following the periphery of the body and in front of it, in the type, about 15 flattened lirae with linear secondaries regularly intercalated; pillar girded with 3 or 4 slightly less feeble lirae, the anterior fasciole very finely and obscurely lineated. Posterior fasciole crowded with 9 or 10 linear threadlets, the area well defined not only by the diagnostic spiral sculpture but also by a change in the character and direction of the ribs and the acutely angulated periphery. Sutures distinct but inconspicuous. Aperture oblique, widening very slightly posteriorly, acutely angulated at the commissure. Outer lip thin, sharp, obtusely angulated at the periphery, slightly flaring incrementally, broadly but not deeply insinuated at the posterior fasciole, the sinus symmetrically disposed upon the shoulder. Inner wall of aperture feebly excavated. Parietal and pillar wash thin. Anterior canal very short, broad, and open. Anterior fasciole moderately wide, obliquely truncate at its extremity.

Dimensions: Height, 3.4 millimeters; length of aperture, 1.7 millimeters; maximum diameter, 1.6 millimeters.

Holotype: U. S. Nat. Mus. No. 371081.

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

"Mangelia" klimakota is well characterized by its small size and squat and angular outline. It is very

common at the type locality, but apparently it has no representatives and no very close analogs elsewhere.

"M." stypteria has a somewhat similar outline but is coarsely striated spirally, having as a rule only 3 primaries upon the penult and 6 or 7 upon the ultima. *"M." sextoni* is obtusely angulated at the periphery, the axials are heavier and less numerous than in *"M." klimakota*, and the spiral sculpture is not so fine and uniform.

Occurrence: Chipola formation, localities 2564[r], 3419[r], 2211[c], 7183[r].

"Mangelia" stypteria Gardner, n. sp.

Plate XLI, figures 18, 19

Shell small, thin, rather slender, turreted; spire rather elevated, more than half as high as the entire shell, the component whorls broadly shouldered and angulated at the periphery; body rather abruptly constricted at the base. Whorls of conch 4½. Protoconch performing between 2 and 2½ volutions; first 1½ turns flattened behind and obtusely angulated at the periphery; the initial half turn almost entirely immersed; first half of last nuclear whorl more or less flattened laterally, with a few microscopically fine, crowded axial riblets; the final half turn obtusely angulated medially and sculptured behind the periphery, with about half a dozen arcuate axials, which are sectioned at the periphery by the concave undercutting of the anterior half of the whorl; incremental striae rather vigorous in front of the periphery; obscure spiral lirae also faintly discernible. Dividing line between conch and protoconch defined by an almost imperceptible break, the persistence of the axials to the anterior suture, and the abrupt strengthening of the spirals. Axials similar in general character over the entire surface of the conch, narrow, rather sharply elevated, cordate, sharply rounded upon their summits, 13 to 15 upon each of the whorls of the type; intercostal areas wider than the costals except upon the earliest turns, broadly convex. Spiral sculpture overrunning the axial; primaries low, flattened, 3 upon the later whorls of the spire, twice as many upon the body; posterior primary crowning the periphery, the other two symmetrically spaced between it and the anterior suture, which follows and conceals a fourth primary; from 3 to 6 linear secondaries intercalated between each pair of primaries, the medial secondary commonly less fine than those on either side; pillar girded with 3 additional primaries, similar in character to those upon the body though more rounded and not clearly differentiated from them; anterior fasciole closely lirate. Posterior fasciole lineated with 6 to 8 microscopically fine filaments minutely crinkled by the incrementals; posterior fasciole not quite half as wide as the entire whorl, sharply defined by the contour, the pinching and retractive flexure of the axials, and the characteristic spiral sculpture; posterior margin of fasciole appressed. Sutures rather obscure. Aperture moderately wide for the group, only a little oblique, angulated at the posterior commissure. Outer lip reinforced by a strong terminal rib a little behind the margin, the edge thin, broadly and feebly arcuate; posterior sinus broad but not very deep, symmetrically disposed between the periphery and the suture. Labial margin feebly excavated at the base of the body. Parietal wall and pillar smoothly and thinly glazed. Canal short and broad. Anterior fasciole narrow, obliquely truncate at its extremity.

Dimensions: Height, 5.5 millimeters; length of aperture, 2.5 millimeters; maximum diameter, 2.3 millimeters.

Holotype: U. S. Nat. Mus. No. 113942.

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

"Mangelia" stypteria is readily separated from its congeners by the coarseness of its spiral sculpture. *"M." klimakota* is also low and angular, but the spiral sculpture is microscopically fine and uniform.

Occurrence: Chipola formation, locality 2211[r].

Two other "Mangelias" in the broad sense, described below, have found no place among the restricted genera. They have in common only group characters—a short, somewhat cythariform outline, short, obtusely shouldered whorls, and a smooth protoconch of 2 or 3 volutions. They are apparently adult, but there is no reinforcing callus around the margin of the aperture.

"Mangelia" sextoni Gardner, n. sp.

Plate XLII, figure 25

Shell minute, slender, the aperture approximately half as high as the entire shell; spire moderately elevated, scalariform, acutely tapering; body smoothly constricted at the base. Whorls between 6½ and 7 in all, 3½ of these closely appressed and included in the conch. Protoconch a little more than thrice coiled; initial whorl somewhat compressed, tilted, and submerged at the tip; the succeeding 1½ volutions more broadly convex, increasing rather rapidly in diameter, and like the first turn smooth and highly polished; axial sculpture introduced within the last half turn in the form of very fine and faint arcuate riblets. Line between conch and protoconch rather obscure, indicated by the initiation of the conchal sculpture, both axial and spiral. Axials narrow and abruptly elevated but evenly rounded, relatively acute upon the early whorls, sharply pinched and feebly retractive upon the shoulder, uniform in prominence from the periphery to the anterior suture, persistent on the ultima to the pillar, 12 upon the penult, reduced upon the body to 8 regularly but more distantly spaced costals; intercostal areas flattish, of approximately the same width as the costals upon the spire, a little wider upon the body. Spirals overriding the costals and intercostal areas with uni-

form prominence; primary spirals rather low, flattened, simple cords, 4 or 5 on the penult, symmetrically disposed between the periphery and the anterior suture, 9 upon the body; 1, 2, or 3 finely beaded secondaries intercalated between each pair of primaries, the medial secondary, where there are 3, stronger than those on the sides; pillar girded with 4 rather more closely spaced primaries with 1 or 2 intercalated secondaries; anterior fasciole very finely and closely threaded with simple lirae. Posterior fasciole crowded with approximately 9 very finely beaded, equal spirals; defined by the obtuse angulation of the whorl, the change in direction and character of the axial sculpture, and the crowded spiral threading. Sutures inconspicuous. Aperture rather narrow, obliquely lenticular, acutely angulated at the posterior commissure. Outer lip thin, sharp, flaring both axially and incrementally, the posterior insinuation broad but so shallow that it is scarcely perceptible; inner margin faintly sulcate, in harmony with the spirals. Inner margin of aperture feebly excavated at the base of the body. Parietal wall and pillar thinly glazed, simple. Anterior canal short, broad, open. Anterior fasciole rather wide, obscurely emarginate at its extremity.

Dimensions: Height, 3.8 millimeters; length of aperture, 1.9 millimeters; maximum diameter, 1.6 millimeters.

Holotype: U. S. Nat. Mus. No. 113932.

Type locality: No. 7257, Sexton's marl bed on Tenmile Creek, Calhoun County, Fla.

"Mangelia" sextoni has no very near kin. *"M." stypteria* and *"M." klimakota*, the only other species in the Alum Bluff which are so low, are acutely angulated at the periphery and are less heavily and, for the most part, more numerously costate.

Occurrence: Chipola formation, locality 7257r.

"Mangelia" cryptopleura Gardner, n. sp.

Plate XLII, figures 26, 27

Shell small, rather stout, fusiform, the maximum diameter falling a little in front of the median horizontal; spire moderately elevated for the group, the component whorls somewhat buccinoid in outline, increasing rather rapidly in size; body whorl almost two-thirds as high as the entire shell, smoothly tapering at the base. Volutions, 7½ in all, 2 of them included in the small, smooth, highly polished protoconch. Initial whorl flattened behind and almost entirely submerged, the succeeding volution becoming increasingly higher and more flattened toward the end of the nucleus. Dividing line between conch and protoconch obscure, indicated by the very gradual initiation of the obtuse peripheral keel and of the axial and spiral sculpture. Axials similar in general character over the entire surface of the conch, though narrower and more acute upon the earlier turns and relatively lower, broader, and a little irregular upon the body; for the most part, rather narrow, abruptly and rather conspicuously elevated, obtusely rounded upon the summits, feebly protractive and uniform in prominence from the periphery to the anterior suture, retractive and sharply pinched from the periphery to the posterior suture, flexuous upon the body, persistent almost or quite to the anterior fasciole; costals only 10 on the later whorls in the type, though commonly running up to 13 in other individuals; intercostal areas rather flat and of approximately the same width as the costals except upon the body, where they are perceptibly wider. Spirals exceedingly fine and delicate, uniformly developed upon the axial and interaxial areas; primary filaments 7 on the final whorl of the spire and probably twice as many upon the body, the spirals upon the base and pillar even lower and flatter than those behind them; 3 secondary filaments usually intercalated between each pair of primaries, the medial secondary commonly a little less fine than those on the sides, both the primaries and the secondaries frosted by the dissecting incrementals; anterior fasciole very finely and obscurely threaded. Posterior fasciole crowded with more than a dozen subequal, finely granulated threadlets; fasciole decidedly less than half as high as the entire whorl, defined by the contour, the flexure, and the change in character both of the axial and of the spiral sculpture. Posterior margin closely appressed, creeping up a little against the preceding volution. Sutures impressed, undulated in harmony with the axials of the preceding whorl, outlined by the very finely beaded spiral in front of them. Aperture oblique, acutely angulated at the commissure, very slightly expanded posteriorly by reason of the excavation at the base of the body. Outer lip thin, sharp, obtusely angulated at the shoulder feebly expanded incrementally but scarcely at all axially, the posterior insinuation very broad and ill defined. Labium slightly concave. Parietal wall thinly glazed. Pillar straight, simple, reinforced. Anterior canal moderately long, very broad and open. Anterior fasciole wide, obliquely truncate at its extremity.

Dimensions: Height, 7.1 millimeters; length of aperture, 3.7 millimeters; maximum diameter, 3.1 millimeters.

Holotype: U. S. Nat. Mus. No. 371065.

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

"Mangelia" cryptopleura is well characterized by its stout fusiform outline, small, only twice-coiled protoconch, and numerous axial costae. *Brachycythara dasa* is similar in outline but has 4 turns in the protoconch, the first of them slightly tilted, and as a rule only 9 axial costae to each of the later whorls of the conch.

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

"CYTHARA" Schumacher

Shell small, costulated longitudinally; aperture linear; canal short; both outer and columellar lips denticulate or wrinkled.

"Cythara" is no longer in favor, because it has not been found possible to fix the type, but the name has been retained for certain species which satisfy the common conception of the word and which do not conform to any of the restricted genera. These shells are characterized by a cythariform outline, a few narrow, elevated axials, a fine spiral chasing, and a narrow aperture more or less reinforced with varices and denticles.

The distribution of *"Cythara"* is remarkable in that four out of the five species reported from the Alum Bluff group are restricted to the Chipola formation. The fifth is rare in the Shoal River formation. Not even indeterminable members of the genus have been found in the Oak Grove sand.

Axials exceeding 8 upon the body of the adult:
- Labrum very finely lirate within.
  "Cythara" chariessa Gardner, n. sp.
- Labrum not lirate within:
  - Early whorls of conch angulated at the periphery:
    - Initial whorl of protoconch tilted and immersed only at the tip.
      "Cythara" chariessa Gardner, n. sp.
    - Initial whorl of protoconch little tilted, almost entirely immersed in the succeeding volution.
      "Cythara" barbadoides Gardner, n. sp.
  - Early whorls of conch smoothly rounded:
    - Initial whorl of protoconch tilted and immersed only at the tip.
      "Cythara" chariessa Gardner, n. sp.
    - Initial whorl of protoconch not tilted, almost entirely immersed in the succeeding volution.
      "Cythara" isabellae Maury.

Axials not exceeding 8 upon the body of the adult:
- Axials not uniform in number upon the later whorls and not forming continuous series:
  - Altitude of adult usually exceeding 5 millimeters, surface of conch not crowded with fine, sharp lirae; labrum usually lirate within.
    "Cythara" chariessa Gardner, n. sp.
  - Altitude of adult rarely exceeding 5 millimeters; surface of conch crowded with fine, sharp lirae; labrum not lirate within---*"Cythara" anthera* Gardner, n. sp.
- Axials uniform and usually 7 upon the later whorls, forming continuous series from the protoconch to the base.
  "Cythara" basilissa Gardner, n. sp.

"Cythara" chariessa Gardner, n. sp.

Plate XLII, figures 28, 29

Shell small, not conspicuously slender, fusiform, the maximum diameter falling near the median horizontal; aperture approximately half as high as the entire shell; spire moderately elevated, whorls increasing rapidly in size, their outline obscured by the heavy axial sculpture; body whorl cythariform, basally attenuated but not sharply constricted. Whorls of the conch 4½, of the protoconch 3½. Initial turn of protoconch smooth, polished, inflated, slightly tilted and immersed at the tip; the two succeeding volutions also smooth and polished, moderately elevated, strongly constricted at the sutures; axial sculpture introduced upon the final half turn in the shape of about a dozen arcuate riblets, which become increasingly less fine and less crowded toward the end of the nucleus; riblets persistent to the posterior suture, abruptly disappearing a little behind the anterior. Line between conch and protoconch indicated by the rapid development of a peripheral keel, the evanescence of the nuclear sculpture, and the establishment of the postnuclear. Two earliest turns of the conch sharply angulated a little behind the anterior suture and sculptured with 10 or 11 axial costae, which are sharply pinched and retractive behind the periphery though quite broadly rounded upon and in front of it. Peripheral carina obsolete on the later volutions. Axials 8 upon the penult of the type, 7 upon the ultima, moderately elevated and broadly rounded medially and anteriorly, flexuous and sharply pinched behind, persistent even to the posterior suture, flexuous upon the body and persistent almost to the anterior fasciole. Spiral sculpture reduced to exceedingly faint spirals almost or altogether obsolete upon the later whorls, usually visible upon the antepenult in the form of 4 to 6 faint lineations in front of the periphery, with 8 or more crowded filaments discernible upon the posterior fasciole; threading upon the anterior fasciole microscopically fine and very obscure. Posterior fasciole defined macroscopically on the early volutions by the contour of the whorl and the flexure and pinching of the axials; on the later merely by the change in the character of the axials. Sutures distinctly impressed, undulated by the costae of the preceding volution. Aperture very narrow, slightly oblique, only slightly expanded behind by the feeble constriction of the inner lip. Outer lip varicose a little behind the margin, the margin itself thin and sharp, finely denticulate within, the denticle at the anterior entrance to the anal sinus the most prominent. Sinus broad but rather shallow and distant from the posterior suture. Parietal wall and pillar smoothly glazed. Anterior canal long and straight, the margins proximate and parallel. Anterior fasciole wide, obliquely truncate at the extremity.

Dimensions: Height, 5.8± millimeters; length of aperture, 3.0 millimeters; maximum diameter, 2.5 millimeters.

Holotype and paratype: U. S. Nat. Mus. 114059.

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

When fully mature *"C." chariessa* is readily recognizable by the presence of fine lirae upon the inner surface of the labrum. The species is also very well characterized in its juvenile state. The protoconch is unusually slender, the later whorls increasing very slowly in diameter. The initial turn is minute, compressed laterally, slightly tilted, and immersed only at the tip

instead of being largely immersed in the succeeding volution, as in most of the other members of the group. There is a certain amount of variation in the other characters; the early whorls may be rather acutely angulated or they may be rounded, and the spiral lineation may be almost entirely obsolete or under sufficient magnification it may appear distinct.

Occurrence: Chipola formation, localities, 2213[r], 3419[p], 7151[r].

"Cythara" barbadoides Gardner, n. sp.

Plate XLII, figures 30, 31

Shell of moderate size for the group, highly polished, slender, fusiform; aperture almost half the altitude of the entire shell; whorls of spire constricted at the suture, obtusely angulated at the periphery; body smoothly but rather strongly contracted. Whorls of the conch a trifle more than 5, of the protoconch 3½. Initial turn of the protoconch inflated, slightly tilted, and immersed at the tip; the two succeeding volutions of the protoconch also highly inflated and increasing rather rapidly in diameter; axial sculpture introduced a little before the beginning of the final half turn in the form of very feeble, arcuate riblets, about 10 to the half whorl, which increase gradually in prominence and persist from suture to suture, though more feeble posteriorly in front of the obtuse keel, which like the axials is initiated upon the final half turn. Dividing line between the conch and protoconch indicated by the more acute angulation of the periphery, the establishment of a more prominent and more distant axial sculpture, and the introduction of faint spiral lirae, approximately 4 behind the periphery and 3 in front of it. Outline of whorl modified on the later volutions, the periphery much less acutely angulated and much less anterior in position and the fasciole decidedly less than half as wide as the entire whorl. Axials 9 on the later volutions including the body, which is regularly sculptured; the costae uniform and evenly spaced, separated by intercostals of double their own width, smoothly but rather sharply rounded and feebly protractive in front of the periphery, pinched and slightly retractive behind it, usually opposite and arranging themselves in continuous uninterrupted series from the protoconch to the base of the body. Spiral sculpture of very low, flattened lirae, unequal in width, linearly spaced, the pillar lirations not quite so feeble and the half dozen threads upon the anterior fasciole the coarsest and most elevated of all upon the shell. Posterior fasciole about half the width of the entire whorl, obliquely sloping, clearly defined by the angulation of the whorl, the pinching and flexure of the axials, the more feeble spiral sculpture, and the arcuate incrementals. Suture lines distinct, impressed, not perceptibly undulated. Aperture narrow, oblique. Outer lip subvaricose a little behind the sharp margin, simple within, broadly but not deeply insinuated posteriorly, the sinus symmetrically disposed between the suture and the periphery. Inner margin of the aperture slightly excavated, rather thinly glazed. Anterior canal long, moderately broad and open. Anterior fasciole rather wide, obliquely truncate at the extremity.

Dimensions: Height, 9.5 millimeters; length of aperture, 4.7 millimeters; maximum diameter, 3.4 millimeters.

Holotype: U. S. Nat. Mus. No. 114058.

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

The young are much stouter relatively and more angular in outline than the adults. *"Cythara" barbadoides* is similar in general aspect to its congener *"C." isabellae* Maury. It is as a rule more slender, the whorls of the conch are more angular, particularly in the apical region, the ribs are rather fewer in number, and the spiral ornamentation is very much flatter.

Occurrence: Chipola formation, localities 7257[r], 2213[c], 2564[p], 3419[p].

"Cythara" isabellae (Maury)

Plate XLII, figures 32, 33

1910. *Mangilia isabellae* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 11, pl. 3, fig. 3.

Shell short, fusiform, whorls 7, of which the 2 nuclear are smooth; body whorl more than half the length of the shell; transverse sculpture of prominent, somewhat flexuous ribs (8 on the last whorl, including the varix at the aperture); spiral sculpture of exceedingly fine raised threads, visible only with a lens; aperture narrow; interior smooth.

Length of shell, 5; of aperture, 2; of body whorl, 3.5; greatest width, 2 millimeters.

Oligocene of the Chipola marls, Baileys Ferry, Fla.

Cornell University collection.—Maury, 1910.

Shell of moderate dimensions for the group, well proportioned, the aperture almost half the entire altitude, the whorls of the spire constricted at the sutures and increasing rather rapidly in diameter. Conch of 5½ volutions. Protoconch brilliantly polished, thrice coiled; initial turn almost entirely submerged, the two succeeding volutions medially inflated and increasing rapidly in diameter; very faint but sharp, arcuate, axial riblets, which increase in prominence toward the end of the whorl, introduced upon the last half turn. Dividing line between conch and protoconch indicated by an irregular thickening, an abrupt change in the texture of the shell and in the character of the axial sculpture, and the introduction of microscopically fine spiral lirae. Axials similar in general features over the entire shell, though relatively wider and more closely spaced upon the earlier whorls, the number remaining approximately constant—9 in the type—on the body only 8; axials upon the spire narrow, obtusely rounded upon the summits, almost vertical and uniform in strength from the periphery to the anterior suture, slightly pinched and very feebly flexed behind the periphery; body axials relatively distant, flexuous,

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flattening somewhat upon the base, but persisting to the anterior fasciole; intercostal areas smoothly concave and wider than the costals. Spiral sculpture obscure and irregular, appearing in the form of very low, ill-defined lirae, for the most part unequal in size, linearly spaced, covering the entire surface of the shell from the protoconch to the anterior fasciole, most feeble upon the posterior fasciole. Posterior fasciole ill defined by the obscure flattening of the shell in front of the suture, the flexure of the axials, and the exceedingly feeble spirals; posterior margin closely appressed but not elevated. Suture line distinct, impressed, crenulated in harmony with the axial sculpture. Aperture rather wide for the group, lobate, obtusely angulated at the posterior commissure. Outer lip broadly arcuate, obscurely angulated at the periphery, subvaricose, the margin thin and sharply recurved, smooth within. Posterior sinus as broad as the fasciole and rather shallow. Inner wall of aperture smoothly constricted at the base of the body. Parietal wall thinly glazed. Pillar long, straight, reinforced. Anterior canal rather broad, open. Anterior fasciole rather narrow, feebly lirate, feebly emarginate at the extremity.

Dimensions of figured topotype: Height, 10.0 millimeters; length of aperture, 5.0 millimeters; maximum diameter, 4.0 millimeters.

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

Topotype: U. S. Nat. Mus. No. 371064, from locality 3419.

"Cythara" isabellae Maury is similar in outline to *"C." barbadoides*, but the whorls are more smoothly rounded, especially in the apical region. The whorls of the protoconch of *"C." isabellae* are not quite so numerous and the last half turn is not carinate, as in *"C." barbadoides;* the axials are more abruptly elevated, more obtuse upon their summits, and less sharply pinched posteriorly. The spiral sculpture, though very feeble, is less so than in *"C." barbadoides*.

Occurrence: Chipola formation, localities ?2213[p], 3419[e], 7151[r]. Cornell University collections.

"Cythara" basilissa Gardner, n. sp.

Plate XLII, figures 23, 24

Shell slender, lustrous, fusiform, exceedingly graceful, the maximum diameter falling near the median horizontal; both the body and the spire smoothly attenuated. Whorls of the conch 4½, those of the protoconch certainly more than 3. Tip of the protoconch broken away; a whorl and a half still remaining, smooth and evenly inflated, the final half turn arcuately costate, the costae evanescent on the obtuse keel that overhangs the anterior suture. Line of division between conch and protoconch distinct but inconspicuous, indicated by a slight change in the texture of the shell and by the initiation of the true axials. Whorls of conch very closely appressed, increasing rather rapidly in diameter. Axial sculpture of very narrow but rounded, abruptly elevated, flexuous costae, which persist from suture to suture and well down to the base of the body; costals more sharply pinched and flexed posteriorly, broadening slightly anteriorly, separated by intercostals of about three times their own width; axials 7 upon the later whorls, protractive, opposite, and arranged in series that perform more than half a complete revolution around the axis of the shell. Spiral sculpture restricted to microscopically fine linear sulci, least feeble upon the summits of the axials, most feeble upon the early volutions and upon the posterior portion of the whorl. Posterior fasciole indicated only by the weakening of the axials and by the flexure of the axials and incrementals. Aperture more than half as long as the entire shell, narrow, lanceolate, acutely angulated posteriorly. Outer lip subvaricose, flexuous, smooth within. Posterior sinus scarcely perceptible. Basal constriction of the inner lip very feeble. Pillar long, straight, simple. Parietal wash thin. Anterior canal long, broad, and open. Anterior fasciole very wide, finely lirate, obliquely truncate at its extremity.

Dimensions: Height, 10.0± millimeters; length of aperture, 5.4 millimeters; maximum diameter, 3.7 millimeters.

Holotype: U. S. Nat. Mus. No. 351224.

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

This species, the only Alum Bluff representative of the genus outside of the Chipola formation, is well characterized by the highly polished surface, the graceful fusiform outline, the relatively few, flexuous, macroscopically cordate costae arranged in continuous series, and the restriction of the spiral sculpture to microscopically fine sulci.

In the general contour and character of the sculpture *"C." basilissa* suggests the more numerously costate recent species *"C." cymella* Dall. Similar species are found in the middle Miocene of Trinidad and in the Gurabo of the Dominican Republic, but none of them so elegantly sculptured as *"C." basilissa*.

Occurrence: Shoal River formation, locality 3742[r].

"Cythara" anthera Gardner, n. sp.

Plate XLII, figures 17, 18

Shell minute, ovate; spire moderately elevated, a trifle more than half as high as the entire shell; body whorl ovate, flattening toward the aperture. Whorls of conch exactly 4; the protoconch a trifle more than twice coiled, highly polished, and entirely smooth; the initial whorl rather tumid, immersed at the tip; the succeeding volution flattening toward the end of the protoconch. Boundary line between the conch and protoconch indicated by the thickening of the shell, the even inflation of the whorl, and the initiation of the spiral sculpture in the form of about half a dozen equal threadlets, evenly and symmetrically spaced

between the sutures. Axial sculpture indicated on the first half turn only by faint and for the most part irregular wrinkles, which gradually become stronger and more regular; number of costae varying widely not only in different individuals but on the different whorls of the same individual, in the type 12 on the antepenult, 10 upon the penult, and only 7 upon the body, the space between the terminal rib and that behind it being unusually wide; costals feebly protractive and flexuous, continuous between the sutures and on the body persistent almost to the anterior fasciole, narrow and feebly reflexed posteriorly, broader and more elevated medially and anteriorly. Spiral sculpture exceedingly fine but rather elaborate, 6 or 8 very fine flattened lirations in front of the periphery of the penult, about 30 upon the ultima, with finer, minutely beaded threadlets regularly intercalated in the narrow interspaces. Posterior fasciole threaded with 6 or 7 beaded spirals, slightly coarser than the secondaries, which they resemble in general character; fasciole defined not only by the sculpture but also by the obscure angulation of the whorl. Suture lines deeply impressed, undulated in harmony with the axial sculpture of the preceding whorl. Aperture narrow and approximately uniform in width throughout its extent. Outer lip varicose, widely expanded incrementally but not axially, broadly but not very deeply insinuated at the posterior fasciole, smooth within except for a single amorphous denticle at the anterior entrance to the sinus. Inner margin of the aperture oblique, feebly excavated. Parietal wall glazed, the callus heaviest near the posterior commissure. Pillar simple. Anterior canal very broad, open, not differentiated. Anterior fasciole not defined by the outline but only by the absence of intercalated secondaries, obliquely emarginate at the extremity.

Dimensions: Height, 4.0 millimeters; length of aperture, 2.2 millimeters; maximum diameter, 2.0 millimeters.

Holotype: U. S. Nat. Mus. No. 328615.

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

"Cythara" anthera is well defined by the peculiar petaloid outline of the body when viewed from the rear, by the relatively strong spiral ornamentation, and by the wide spacing of the axials upon the final half turn.

Occurrence: Chipola formation, localities 2213[r], 2564[r], 3419[r].

Genus LIOGLYPHOSTOMA Woodring

1928. *Lioglyphostoma* Woodring, Miocene mollusks from Bowden, Jamaica, pt. 2: Carnegie Inst. Washington Pub. 385, p. 193.

Type by original designation: *Lioglyphostoma adematum* Woodring. (Miocene of the Bowden beds of Jamaica.)

Shell relatively small, moderately slender. Nucleus consisting of about 3½ rapidly enlarging whorls, about the last whorl bearing a moderately strong anterior keel. Aperture long, narrow. Anterior canal short, slightly emarginate, slightly curved backward. Outer lip varicose. Anal notch deep, apex broadly rounded. Interior of outer lip smooth, except for a slight thickening adjoining anal notch and at base of canal. Parietal callus heavily thickened adjoining anal notch. Inner lip bearing a few low denticles, the most conspicuous one lying far up on the lip. Sculpture consisting of broad axial ribs, overridden by spiral cords. Ribs subdued on anal fasciole but continuing across it.

Lioglyphostoma is like a small *Glyphostoma* that has lost the denticles on the outer lip, most of the denticles on the inner lip, and also the growth wrinkles on the anal fasciole.—Woodring 1928.

Lioglyphostoma tyro Gardner, n. sp.

Plate XLII, figure 7

Shell small, slender, smoothly rounded, fusiform in the apertural view, the maximum diameter falling in front of the median horizontal; aperture almost half as high as the entire shell; whorls of the spire strongly appressed posteriorly but scarcely constricted, increasing slowly in diameter; body whorl attenuated and gradually tapering to the rather broad anterior extremity. Whorls of conch 5. Protoconch entirely smooth, highly polished, a little more than thrice coiled; initial whorl minute, almost entirely submerged, the succeeding volutions feebly inflated, increasing rather rapidly in altitude and diameter. Dividing line between conch and protoconch indicated by an irregular thickening of the shell, the appression of the posterior portion of the whorl, and the initiation of the axial and spiral ornamentation. Axials narrow, more persistent posteriorly and more strongly protractive upon the early whorls, rather broadly rounded, continuing with scarcely diminished strength to the anterior suture and to the base of the body, obsolete upon the appressed posterior margin, 9 upon the later whorls of the spire, including the body, which is regularly costate except for the nearly terminal varix and the relatively feeble rib behind it; intercostal areas somewhat flattened and of approximately the same width as the costals. Spiral sculpture very low and inconspicuous, 6 extremely low, flattened lirae developed on the last whorl of the spire and about twice as many upon the body, not including the pillar; interspaces as wide or a little wider than the lirae, microscopically striated with 2 to 5 crowded spirals; pillar girded with about half a dozen less feeble lirae separated by narrow, striated interspaces. Anterior fasciole also threaded with 6 more rounded and more closely spaced lirae; posterior margin closely appressed, feebly elevated, beveled, and spirally striated like the rest of the fasciole. Suture distinct, feebly impressed. Aperture narrow, obliquely oblanceolate, open at both extremities. Outer lip feebly expanded axially, rather strongly incrementally, varicose behind the margin, the margin itself thin, sharp, and finely crenulated, smooth within. Posterior sinus very deep, contracted

at the entrance. Labrum feebly emarginate also at the base of the body, possibly for the extension of the eye stalks. Inner margin of aperture smoothly concave. Parietal wash thin except for a heavy local deposit at the posterior entrance to the sinus. Pillar rather long, straight, reinforced. Anterior canal short, flaring a little, contracted by the axial thickening on the inner surface of the labrum. Anterior fasciole rather narrow, broadly emarginate at its extremity.

Dimensions: Height, 8.0 millimeters; length of aperture, 4.0 millimeters; maximum diameter, 3.1 millimeters.

Holotype: U. S. Nat. Mus. No. 328532.

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

The type is unique and presents no striking characters, but it is well preserved and cannot be united with any described species.

Occurrence: Chipola formation, locality 3419[r].

Lioglyphostoma rusum Gardner, n. sp.

Plate XLII, figure 1

Shell of moderate size for the group; spire elevated and turreted; body rather sharply constricted into the long and slender pillar; aperture about half the entire altitude; maximum diameter a little less. Whorls of conch 7. Protoconch rather slender but elevated, thrice coiled; initial whorl tumid, tilted, and immersed at the tip; second whorl convex at its beginning, becoming increasingly angulated toward its close; area behind the periphery broadly and steeply sloping, the much narrower portion in front of it undercut; periphery a little less strongly anterior on the final turn and crowned with a flattened spiral, a second similar liration intercalated directly behind the anterior suture. Dividing line between conch and protoconch indicated by the introduction of the axial sculpture. Axials sharply rounded and persisting with diminished strength upon the early turns to the posterior suture, broader but abruptly elevated and strongly rounded upon the later, 10 upon the penult, irregular upon the last half of the ultima, a little more elevated medially than anteriorly, and more or less completely evanescent posteriorly and upon the base of the body; intercostal areas strongly concave and of approximately the same width as the costals. Spiral sculpture equally developed upon the axial and interaxial areas, the primaries carried across from the protoconch, 2 on the earliest whorl, increasing to 3 on the second or third volutions, and to 4 on the penult; secondaries commonly intercalated; 14 additional primaries without intercalated secondaries upon the body and pillar, the lirae a little more sharply defined and less closely spaced anteriorly; anterior fasciole closely threaded with about a dozen rounded lirae. Posterior fasciole lineated with sharp filaments, 8 in the type; fasciole defined by the constriction of the whorl, the abruptly diminished axials, and the equally abrupt change in the character of the spirals; incrementals strongly arcuate upon the fasciole and commonly rather vigorous; posterior margin very closely appressed against the preceding whorl and creeping up a little upon it, undulated in harmony with the axials of the preceding volution. Suture line distinct, impressed, undulatory. Aperture obliquely lenticular, open at both extremities. Outer lip arcuate, varicated a little behind the margin, the edge thin, sharp, and finely crenulated. Inner surface of labrum thickened directly in front of the posterior sinus, irregularly lirated, normal to the margin in the anterior third, feebly reinforced parallel to the anterior canal; posterior sinus very broad and deep, slightly constricted at the entrance, symmetrically disposed between the suture and the outer margin of the fasciole. Inner margin of aperture excavated at the base of the body. Parietal glaze for the most part so thin that the spiral sculpture may be traced through it but very heavy near the entrance to the sinus. Pillar also rather heavily reinforced and rudely denticulated. Anterior canal moderately long for the group and rather narrow, flaring at its extremity. Anterior fasciole wide, deeply emarginate.

Dimensions: Height, 14.7 millimeters; length of aperture, 7.5 millimeters; maximum diameter, 6.0 millimeters.

Holotype: U. S. Nat. Mus. No. 328620.

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

Lioglyphostoma rusum suggests both *Glyphostoma harrisi* Maury and *G. peri-eilema* Gardner in general outline and type of ornamentation. In both of these similar species, however, the protoconchs are relatively low and only twice coiled. In *L. rusum*, on the other hand, the protoconch is very slender for its diameter, elevated, and made up of 3 volutions, the last of which is acutely angulated at the periphery and crowned by a spiral lira. The axial costae are a little broader and feebler in *G. harrisi*, but the difference is not sufficiently great to be of much value except in a long series. *G. peri-eilema* is much more sharply sculptured spirally, secondaries are absent or fortuitous, and the anterior canal is larger and less deeply emarginate.

Occurrence: Chipola formation, localities 2564[p], 3419[p].

Genus GLYPHOSTOMA Gabb

1873. *Glyphostoma* Gabb, Acad. Nat. Sci. Philadelphia Proc. for 1872, p. 270.

Monotype: *Glyphostoma dentiferum* Gabb. (Miocene of the Dominican Republic.)

Shell fusiform; canal rather long; form characterized by a very heavy outer lip, which is strongly rugose within; inner lip more or less wrinkled.

It is quite possible that the differences in the protoconchs are of more than specific value.

Glyphostoma is represented in the Alum Bluff group by 10 species, 8 of which are restricted to the Chipola formation. None of these species are common, but most of them occur at more than one locality. *Glyphostoma aldrichi* Maury, the characteristic Oak Grove form, is widespread and far from rare at the single horizon. The diagnostic *Glyphostoma* of the Shoal River fauna, *G. xeston*, is also fairly common locally.

Primary spirals exceeding 3 on the later whorls of the spire:
- Axial sculpture upon the body restricted almost entirely to the periphery ---- *Glyphostoma aldrichi* Maury.
- Axial sculpture upon the body not restricted almost entirely to the periphery:
  - Primary spirals exceeding 5 upon the final whorl of the spire of the adult:
    - Maximum diameter more than one-third the total altitude:
      - Altitude of adult usually exceeding 10 millimeters; primary spirals fine, not sharply elevated, commonly with intercalated secondaries:
        - Protoconch twice coiled, altitude commonly exceeding 15 millimeters ---- *Glyphostoma harrisi* Maury.
        - Protoconch thrice coiled, altitude rarely exceeding 15 millimeters ---- *Lioglyphostoma rusum* Gardner, n. sp.
      - Altitude of adult not exceeding 10 millimeters; primary spirals relatively coarse and sharply elevated, secondaries fortuitous ---- *Glyphostoma peri-eilema* Gardner, n. sp.
    - Maximum diameter approximately one-third the total altitude ---- *Glyphostoma ischnon* Gardner, n. sp.
  - Primary spirals not exceeding 5 upon the final whorl of the spire:
    - Spire scalariform; axials conspicuously narrow and elevated, acutely rounded ---- *Glyphostoma tiarophoron* Gardner, n. sp.
    - Spire not conspicuously scalariform; axials rather low and usually rather broadly rounded:
      - Protoconch coiled three times; spirals fine and close, a single secondary usually intercalated between each pair of primaries; altitude exceeding 7 millimeters in the adult ---- *Lioglyphostoma rusum* Gardner, n. sp.
      - Protoconch coiled twice; spirals relatively coarse, sharply elevated, secondaries absent or fortuitous; altitude exceeding 7 millimeters in the adult ---- *Glyphostoma peri-eilema* Gardner, n. sp.
      - Protoconch coiled four times; spirals linear, faint, relatively distant, equisized; altitude rarely exceeding 7 millimeters in the adult ---- *Glyphostoma typhon* Gardner, n. sp.

Primary spirals not exceeding 3 on the later whorls of the spire:
- Axials rounded, not exceeding 14 to the whorl, spirals lirate:
  - Axials persistent upon the body well down to the base; posterior fasciole finely lineated spirally, as a rule, and usually more or less undulated by the axials:
    - Outline slender; axials rarely exceeding 8 upon the penultima; denticulations on inner surface of labrum not persisting to the margin ---- *Glyphostoma belonoides* Gardner, n. sp.
    - Outline squat; axials usually exceeding 8 upon the penultima; denticulations on inner surface of labrum persisting to the margin ---- *Glyphostoma nannophues* Gardner, n. sp.
  - Axials evanescent upon the body before reaching the base; posterior fasciole very wide, not regularly lineated spirally upon the later whorls and little and not at all affected by the axials:
    - Axials rarely exceeding 10 upon the penult; on the ultima almost entirely restricted to the periphery. *Glyphostoma aldrichi* Maury.
    - Axials usually exceeding 10 upon the penult; on the ultima restricted to the medial portion but not to the periphery ---- *Glyphostoma chipolanum* Gardner, n. sp.
- Axials rounded, spirals very low and broad, tending to become obsolete upon the ultima ---- *Glyphostoma xeston* Gardner, n. sp.
- Both axials and spirals lirate, the axials exceeding 14 ---- *Nannodiella nemorensis* (Maury).

Glyphostoma harrisi Maury

Plate XLII, figure 9

1910. *Glyphostoma harrisi* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 14, pl. 3, fig. 10.

Shell of moderate size, strong, 10-whorled; spiral sculpture of subequal threads with wider interspaces, which cover the whole surface of the shell except on the subsutural grooves, where the threads become so faint as to be seen only with the aid of a lens or are obsolete; transverse sculpture of well-marked ribs with slightly narrower interspaces. The ribs extend from the base of the subsutural groove to the succeeding suture and to about halfway down the body whorl. Notch very distinct, deeply cut, narrowly U-shaped; outer lip with a thick external varix near the edge; lirate within, especially anteriorly; aperture rather narrow; canal short; pillar with about 14 denticulate lirae, callus slight. Length of shell 20; of aperture 10.5; greatest width 9 millimeters.

Chipola marls, Baileys Ferry, Fla. Two specimens.
Cornell University collection.

Named in honor of Prof. G. D. Harris, by whom the Cornell collections of Tertiary fossils have been made.—Maury, 1910.

The nucleus is very small and smooth and only twice coiled. The initial whorl is bulbous, slightly tilted, and immersed at the tip, the succeeding volution becoming decreasingly convex. The line of demarcation between the conch and protoconch is sharp and indicated both by initiation of the axial and spiral sculpture and by a change in the texture of the shell. The axials are broadly rounded and undulatory, 10 upon the later whorls of the spire but more or less irregular upon the body. The primary spiral lirae run from 6 to 8 upon the later whorls of the spire, and a microscopically fine secondary may or may not be intercalated between each pair of primaries. The threadlets upon the posterior fasciole are almost as strong as the primaries upon the early volutions, but upon the later they become increasingly indistinct and distant. On the early whorls the posterior fasciole is very obscure, for there is no perceptible constriction of the whorls and the costals are carried across to the posterior suture. On the later volutions, however, it is very sharply defined by the abrupt constriction of the whorls and by the abrupt disappearance of the axial costae. The denticulations upon the inner surface of

the labrum are very irregular. Those upon the posterior half are little more than denticles, more or less irregularly arranged; anteriorly, however, they are produced into lirae, which extend almost to the margin of the lip. The anterior lira is placed at the entrance to the canal and is roughly parallel to it. The denticulations upon the inner wall of the aperture are also irregular. There is usually a cluster directly across from the siphonal notch and a more or less irregular series of 8 to 14 upon the pillar, the posterior as a rule the most feeble. The wash at the base of the body is conspicuously thin for a species so heavily reinforced around the margin of the aperture. The canal is moderately long for the group, the anterior fasciole rather wide, strongly arched, closely lirate, and very deeply emarginate at its extremity. The species is not uncommon in the environs of the type locality.

Glyphostoma harrisi greatly exceeds most of its congeners in dimensions. The young show as a rule such unmistakable characters of immaturity around the aperture that there is little danger of confusion with other species of similar outline except *Lioglyphostoma rusum*, a species usually less than three-fourths as large as *G. harrisi* but very similar in conchal characters. The protoconch, however, is much more slender than that of Miss Maury's species and contains a third volution, which is acutely angulated and which bears two spirals on the last half turn—one upon the periphery and one directly behind the anterior suture. Each form is represented by several individuals upon which the protoconchs are perfectly preserved, and no intermediate types have ever been noted. In *G. harrisi* the axials run a little broader and more elevated, and the spirals are rather more numerous, but these characters are merely relative. Fortunately the protoconchs, which furnish the most trustworthy diagnostics for separation, are commonly preserved.

Figured specimen: U. S. Nat. Mus. No. 113944, from locality 2213, Chipola formation, 1 mile below Baileys Ferry, Calhoun County, Fla.

Glyphostoma peri-eilema has a similar protoconch, but the spirals are broader and more sharply elevated, the secondaries are absent or fortuitous, and the anterior canal is shorter and less deeply emarginate.

G. harrisi Maury is the most conspicuous representative of the group both by reason of its size and its comparative abundance.

Occurrence: Chipola formation, localities 2213[c], 2564[p], 3419[r], 7151[r].

Glyphostoma peri-eilema Gardner, n. sp.

Plate XLII, figure 2

Shell small for the group but heavy and rather slender; aperture about half as long as the entire shell; spire moderately elevated, constricted at the sutures; body whorl smoothly contracted at the base. Whorls of conch a trifle more than 6. Protoconch smooth, shiny, twice coiled; initial whorl large, bulbous, slightly tilted and immersed at the tip, the second whorl strongly inflated at its beginning, rapidly flattening laterally and, toward its end, obscurely carinated a little in front of the median horizontal. Dividing line between conch and protoconch indicated by a slight break and by the abrupt strengthening of the peripheral carina and the initiation of the sculpture, both axial and spiral. Axials relatively low, narrow, close-set, and persistent posteriorly upon the first whorl of the conch; on the later volutions prominently elevated, with broad, strongly rounded summits, uniform in strength in front of the periphery, more or less completely evanescent upon the posterior fasciole and the base of the body, 10 upon each of the later whorls of the spire, irregular in size and spacing upon the final half turn, separated by narrower, concave intercostals. Spirals sharply defined, flattened cords which overrun the costal and intercostal areas with equal prominence, the primaries 4 to 6 upon the later whorls of the spire and about 20 upon the body, the spirals upon the base and pillar a little more elevated and less closely spaced; fortuitous, linear secondaries in some specimens intercalated; 3 to 5 exceedingly feeble spiral filaments also disposed upon the posterior fasciole, more or less undulated in harmony with the axials; posterior fasciole less than half as wide as the entire whorl, defined by the constriction of the whorl, the evanescent axial sculpture, and the abrupt change in the character of the spirals. Posterior portion of whorl closely appressed, not elevated, creeping up a little upon the preceding volution. Sutures obscure. Aperture obliquely lenticular, open at both extremities. Outer lip very feebly arcuate, strongly varicose a little behind the margin, the margin itself thin, sharp, and finely crenulated by the spirals; inner surface of varix denticulate, the most prominent denticle set at the entrance to the posterior canal; 3 short, medial denticles and 2 anterior, elongated parallel to the anterior canal, one a little behind it and the other directly at the entrance. Posterior sinus very deep, constricted at the entrance by the thickening of the inner walls. Inner margin of aperture smoothly concave. Parietal wall thinly glazed except for a heavy deposit of callus at the entrance to the posterior sinus directly opposite the heavy labral denticle. Pillar rather long, straight, reinforced, bearing a few amorphous denticles upon the reverted lining. Anterior canal rather narrow, slightly recurved, and expanded at its extremity. Anterior fasciole rather wide, closely threaded with 8 or 9 rounded lirae, deeply emarginate in front.

Dimensions: Height, 8.0 millimeters; length of aperture, 4.0 millimeters; maximum diameter, 3.5 millimeters.

Holotype: U. S. Nat. Mus. No. 328623.

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

There is apparently a dwarf representation of this species. Three individuals similar in nuclear and postnuclear characters, even to the fully armed aperture, but attaining an altitude of only 5 millimeters, occur in the environs of the type locality.

The only species sufficiently similar to *G. peri-eilema* to cause confusion is *Lioglyphostoma rusum*, also from the Chipola. *G. peri-eilema* is a little more slender, the protoconchal characters are distinct, the primary spirals are, as a rule, coarser and decidedly more elevated and usually less numerous, especially upon the pillar, and the secondaries are absent or fortuitous. In *G. tiarophoron* the axials are narrower and much more sharply rounded. *G. harrisi* is much larger, the primary spirals are less elevated, and secondaries are commonly intercalated.

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

Glyphostoma tiarophoron Gardner, n. sp.

Plate XLII, figures 3, 10

Shell rather small for the group, the aperture approximately half as high as the entire shell and the maximum diameter a little less; spire elevated, turreted, acutely tapering. Whorls of conch 6. Protoconch small, smooth, polished, and twice coiled; initial whorl of the protoconch inflated, slightly tilted and immersed at the tip; succeeding whorl inflated at its beginning, the final half turn increasingly angulated a little in front of the periphery. Dividing line between conch and protoconch distinct, indicated by a slight change in the texture of the shell and by the abrupt initiation of the sculpture, both axial and spiral; carina carried across, outlining the periphery of the conch. Axials low and ill defined at their initiation, rapidly increasing in prominence and sharpness of definition; axials on the later volutions running 10 to the whorl but irregular upon the final half turn of the body, abruptly elevated on the spire, uniform in prominence from the periphery to the anterior suture except on the body, where they are most elevated peripherally, evanescent behind the periphery and upon the base of the body, the costae sharply rounded upon their summits, feebly protractive, separated by intercostals of approximately the same width. Spiral sculpture overrunning the axial, most prominent upon the summits of the costae; the primaries rather sharp lirae, 2 or 3 on the early volutions, 5 on the final turn of the spire and about 12 on the body, equal and regularly spaced except on the extreme base of the body and the pillar, where they are a little sharper and a little more distant; threads on the anterior fasciole about 12, linearly spaced. Posterior fasciole lirated with a relatively coarse thread directly behind the periphery and about 4 filamental threadlets between this and the posterior suture; posterior fasciole a little less than half as high as the entire whorl, defined by the abrupt constriction of the whorl, the more or less complete evanescence of the axials, and the absence of strong spiral sculpture; posterior portion very closely appressed against the preceding whorl. Sutures obscure, undulated in harmony with the axials. Aperture obliquely lenticular, open at both extremities. Outer lip feebly arcuated, strongly varicose. Inner surface thickened at the entrance to the posterior sinus, an elevated denticle also developed at the entrance to the anterior canal and parallel with it, with a couple of pairs of lirate denticles behind this and normal to the margin, the anterior pair the longer. Posterior sinus broad and deep, U-shaped, filling the entire space between the posterior suture and the periphery, the inner margin thickened and beveled. Inner wall of aperture strongly excavated at the base of the body. Parietal glaze rather thin except for the heavy deposit at the entrance to the posterior sinus. Pillar straight, glazed, the reverted inner lip irregularly denticulate. Anterior canal rather short and not very broad. Anterior fasciole wide, broadly and rather deeply emarginate at its extremity.

Dimensions: Height, 9.2 millimeters; length of aperture, 4.8 millimeters; maximum diameter, 4.3 millimeters.

Holotype: U. S. Nat. Mus. No. 113951.

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

Glyphostoma tiarophoron is remarkable for its very narrow and very sharply elevated ribs. *Lioglyphostoma rusum* has much the same general type of sculpture, but the axials are more broadly rounded, secondary spirals are regularly intercalated, the spirals are more prominent and more crowded, and the anterior emargination is more profound.

Occurrence: Chipola formation, locality 2211^{p}, Aldrich collection, Johns Hopkins University.

Glyphostoma ischnon Gardner, n. sp.

Plate XLII, figure 4

Shell of moderate size for the group, very slender and elevated; aperture less than half as high as the entire shell and the maximum diameter only about one-third; whorls of spire elevated, feebly constricted at the sutures, increasing slowly in diameter; body whorl constricted and attenuated at the base. Apex broken away so that nuclear characters and exact number of whorls are indeterminate; number in conch more than 8, probably not more than 10. Sculpture dominantly axial. Costae broadly and smoothly rounded, a little more prominent medially than anteriorly, evanescent a little in front of the posterior suture and at the base of the body, 10 upon each of the later whorls of the spire, irregular upon the last half turn of the ultima,

separated by narrower intercostals. Spiral sculpture equally developed upon the axial and the interaxial areas; lirae moderately elevated and rounded, the primaries increasing by intercalation at the anterior suture from 2 on the apical whorls to 6 on the penult and 10 on the body; pillar girded with 7 more sharply elevated and more closely spaced lirae, which grade without any sharp break into an equal number of finer threadlets upon the anterior fasciole; secondaries commonly intercalated upon the medial portion of the whorl; similar filaments also developed upon the posterior fasciole to the number of 4 or 5. Posterior fasciole decidedly less than half as high as the entire whorl, rather ill defined by a feeble flattening of the whorl in front of the suture, the evanescence of the axial sculpture, the abrupt change in the character of the spiral, and the arcuate incremental puckerings, most prominent posteriorly. Suture line distinct, impressed. Aperture narrow, lanceolate, open at both extremities. Outer lip strongly varicose, the margin thin, sharp, and finely crenulated; inner surface of varix armed with 7 denticles, the posterior the most prominent and set at the entrance to the posterior sinus, the anterior at the entrance to the anterior sinus; intermediate denticles symmetrically spaced. Anal sinus U-shaped, the margins thick and beveled. Inner lip feebly excavated at the base of the body. Parietal wash rather thin except for the heavy deposit at the posterior entrance to the sinus and directly opposite the posterior denticle. Pillar long, straight, reinforced, with half a dozen lirae developed upon the reverted labium at right angles to the margin. Anterior canal rather long for the group and narrow. Anterior fasciole well arched, slightly recurved, probably emarginate at its extremity.

Dimensions: Height, 15.0± millimeters; length of aperture, 6.3 millimeters; maximum diameter, 4.8 millimeters.

Holotype: U. S. Nat. Mus. No. 113945.

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

Glyphostoma ischnon is characterized by the slender, elevated spire and the relatively high altitude of the component whorls. No other species approaches it very closely. The type is unique.

Occurrence: Chipola formation, locality 2213[r].

Glyphostoma typhon Gardner, n. sp.

Plate XLII, figures 11, 12

Shell small but heavy and solid; aperture a little less than half as high as the entire shell; spire acutely tapering. Whorls of conch 4½. Protoconch slender but elevated, smooth polished, coiled a trifle more than four times; initial whorl of protoconch minute, tumid, slightly tilted and immersed at the tip; the two succeeding volutions flattened or very feebly convex, increasing slowly in diameter; a carina introduced at or just before the beginning of the last whorl a little in front of the median line, increasing rapidly in prominence and, near the end of the whorl, conspicuously elevated, the surface behind it concave, the surface in front strongly undercut. Dividing line between conch and protoconch sharply defined by the abrupt disappearance of the nuclear keel and by the initiation of the axial sculpture. Axials similar in general character over the entire surface of the conch, though narrower and more closely spaced upon the early volutions, 8 or 9 upon the later whorls of the spire, irregular upon the body, sharply rounded, more elevated medially than anteriorly and altogether obsolete in front of the posterior suture; intercostal areas usually narrower than the costals. Spirals low, flattened, and inconspicuous, equally developed upon the axials and interaxials but worn off from the summits of the ribs in all but fresh specimens; primary lirae for the most part equal and symmetrically disposed in front of the periphery, 2 upon the earliest whorl or whorl and a half of the spire, 3 upon the next, 4 upon the penult, and at least twice as many upon the body exclusive of the 1 to 3 more elevated and more distant cords that gird the pillar; fortuitous secondaries introduced upon the medial portion of the body; anterior fasciole threaded with about half a dozen well-rounded lirae; posterior fasciole obscured in almost every individual by incrusting bryozoa but probably threaded with at least 4 very fine, equal lirae. Posterior fasciole less than half as high as the entire whorl, defined by the feeble constriction of the whorl, the evanescent axial sculpture, and the absence of a primary spiral lination; posterior margin very closely appressed and creeping up upon the preceding whorl. Sutures obscure, undulated in harmony with the axial sculpture. Aperture narrow, oblique, open at both extremities and scarcely at all expanded medially, choked with the armature of both the outer and inner lips. Labrum very strongly varicose a little behind the margin, the margin itself thin and sharp edged, forming a narrow quadrate flange between the canals, almost imperceptibly emarginate at the base of the body, possibly for the extension of the eye stalks; inner edge of labrum very finely crenulated in harmony with the spirals; inner surface of the varix furnished with half a dozen denticles, the posterior the most prominent, placed at the entrance to the posterior sinus, the anterior at the entrance to the anterior canal and elongated parallel to it, the 4 medial denticles equal and regularly spaced. Posterior sinus U-shaped, profound, and symmetrically disposed between the suture and the periphery, the edge heavily reinforced and beveled. Outline of inner margin of aperture broken by the prominently elevated ridge of callus, which forms the posterior wall of the sinus; excavation at base of body rather abrupt. Parietal wash thin but widely spread. Pillar strengthened by 4 low but broad

protuberances, which are placed directly opposite the medial denticles of the outer lip. Anterior canal short and rather narrow, flaring and recurved at its extremity. Anterior fasciole wide, broadly and somewhat deeply emarginate.

Dimensions: Height of holotype, 5.5 millimeters; length of aperture, 2.5 millimeters; maximum diameter, 2.4 millimeters; height of paratype, 5.0 millimeters; maximum diameter, 2.2 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 113956.

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

Glyphostoma typhon is smaller than any of its congeners. The spire is rather conspicuously slender and acutely tapering, but the body whorl is relatively rather stout. It differs from *Lioglyphostoma rusum*, which perhaps resembles it more closely than any other species, not only in its lesser dimensions and more slender outline but also in the narrower, more acutely rounded axials, and especially in the much finer filamental spirals.

Occurrence: Chipola formation, locality 2213[p].

Glyphostoma belonoides Gardner, n. sp.

Plate XLII, figure 8

Shell small for the group, slender, acutely tapering; aperture a little less than half the total altitude; spire feebly constricted at the sutures; body attenuated. Whorls of conch 6. Protoconch only twice coiled; initial turn of protoconch smooth, well rounded, immersed at the extreme tip; succeeding volution high and tumid at its beginning, less inflated and obscurely carinate toward its close; a single flattened lira outlining the keel and initiated with it near the beginning of the final half turn; a second spiral introduced a little later directly behind the anterior suture. Dividing line between conch and protoconch indicated by an irregular thickening of the shell; the two nuclear spirals carried across to the postnuclear whorls, a third in some shells intercalated midway between them but not persisting; axial sculpture introduced within the first half turn of the conch in the form of feeble undulations, at first restricted entirely to the area in front of the periphery, rapidly increasing in prominence and regularity and feebly undulating the posterior fasciole. Axial sculpture when fully established consisting of broadly rounded, undulatory costae, 7 on the later whorls of the spire, irregular in size and spacing upon the final half turn, almost vertical, a little more prominent medially than anteriorly, evanescent but not obsolete upon the posterior fasciole and the base of the body, separated by rather deep intercostals of approximately the same width as the costals. Spiral sculpture equally developed upon the costal and intercostal areas; two primaries upon each of the whorls of the spire except the last half turn of the penult, the posterior outlining the periphery, the anterior about midway between it and the suture line, a third primary intercalated directly behind the suture near the close of the penult; body spirals 12, subequal in size and spacing, though a little more elevated and distant upon the base, in some specimens a fortuitous secondary introduced between the primaries on the later whorls of the spire; anterior fasciole threaded with 9 to 12 rather coarse and crowded lirae; 3 or 4 filamental spirals symmetrically disposed upon the posterior fasciole, undulating in harmony with the axial sculpture. Posterior fasciole almost half as high as the entire whorl, clearly defined by the outline of the whorl, the evanescent axials, and the character of the spiral sculpture; posterior margin very closely appressed and creeping up upon the preceding whorl. Sutures obscure. Aperture obliquely lenticular, open at both extremities. Outer lip strongly varicose, the margin thin and sharp, minutely crenulated; inner surface of varix denticulated, a single prominent elevation at the anterior entrance to the anal canal, 3 equal medial denticles and an irregular thickening at the entrance to and parallel with the anterior canal. Posterior sinus broad and deep, reinforced, slightly constricted at its entrance. Inner margin of aperture strongly excavated at the base of the body. Parietal wall rather thinly washed except at the mouth of the posterior canal, where the callus is fairly heavy. Pillar straight, reinforced, and bearing 3 feeble denticles near the outer margin of the wash. Anterior canal rather short, not very broad, feebly recurved. Anterior fasciole wide, obliquely marginate.

Dimensions: Height, 7.2 millimeters; length of aperture, 3.4 millimeters; maximum diameter, 2.9 millimeters.

Holotype: U. S. Nat. Mus. No. 328629.

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

G. belonoides differs from *G. peri-eilema* which it closely resembles in general outline, proportions, nuclear character and character of adult sculpture, in the less elevated and less numerous axials, the fewer spirals, and the broader and less profound siphonal notch. In *G. belonoides* there are 2 primaries on the medial portion of the spire, with a secondary intercalated in some individuals. In *G. peri-eilema* there are 3 or 4 narrower primaries, a little more closely spaced. The adult *G. harrisi* Maury is at least twice as large, and individuals of the same size exhibit unmistakable characters of immaturity, especially around the aperture.

Occurrence: Chipola formation, localities 2213[r], 3419[r].

Glyphostoma nannophues Gardner, n. sp.

Plate XLII, figures 5, 6

Shell dwarfish, squat when viewed from behind, biconic from the front, the maximum diameter falling very close to the median horizontal; whorls of conch broadly and obliquely shouldered, about 4 (a trifle more in the type, a trifle less in other individuals), increasing rapidly in diameter; body whorl broad, conic from the rear, the aperture more than half as high as the entire altitude. Protoconch small, smooth, polished, thrice coiled; the initial whorl full, minute, but strongly elevated and slightly tilted, immersed only at the extreme tip; succeeding turn much larger, obliquely flattened in front of the posterior suture, rounded anteriorly; final nuclear whorl rudely trapezoidal, obliquely sloping behind, strongly carinate about two-thirds of the way from the posterior to the anterior suture. Dividing line between conch and protoconch not conspicuous, indicated by the initiation of a feeble axial sculpture and of two faint spirals, the one crowning the peripheral keel, the continuation of the acute carina of the protoconch; the second spiral directly behind the anterior suture. Axials numerous, 10 on the last whorl of the spire, largely obsolete on the final half turn except for the heavy terminal varix, rounded, not strongly elevated, a little more prominent upon the periphery than in front of it, evanescent but rarely completely obsolete behind it; intercostal areas convex, of approximately the same width as the costals. Spirals equally developed upon the axial and interaxial areas, the 2 original primaries in some shells increased to 3 upon the last whorl of the spire, though the third primary rarely attains the prominence of the 2 in front of it; 2 or 3 relatively strong and distant spirals upon the body, with 12 to 15 more feeble and more closely spaced lirae upon the body and pillar not including the half dozen rounded threadlets upon the anterior fasciole. Posterior fasciole finely lineated with half a dozen evenly spaced filaments, the anterior commonly stronger than the other 5 and in some specimens approaching in prominence the spiral in front of it; posterior fasciole more than half as high as the entire whorl, sloping at an angle not far from 45° to the obtuse periphery; fasciole defined also by the abrupt weakening of the axial sculpture and the change in the character of the spiral; posterior margin closely appressed. Suture rather obscure. Aperture moderately wide for the size of the shell, lenticular, open at both extremities. Outer lip heavily varicated a little behind the edge, which is thin and sharp; inner margin corrugated with 9 short lirae, persistent along the inner surface of the varix to the edge; a heavy amorphous denticle also developed directly in front of the posterior sinus. Sinus very large and very deep for the size of the shell, constricted at the entrance by the prominent denticles on the apertural walls. Inner margin of aperture smoothly concave. Parietal wash rather thin except for the heavy toothlike deposit at the posterior entrance to the sinus. Reverted pillar lip strengthened with half a dozen dentate processes. Anterior canal short, rather narrow at its entrance, expanding at its extremity. Fasciole moderately wide, broadly emarginate.

Dimensions: Height, 5.9 millimeters; length of aperture, 3.2 millimeters; maximum diameter, 3.0 millimeters.

Holotype: U. S. Nat. Mus. No. 113947.

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

Glyphostoma nannophues is well characterized by its small size, squat outline, long, sloping shoulder, numerous axials, and, except upon the body, meager spirals. There is no species which shows a relationship sufficiently close to cause embarrassment. *Glyphostoma aldrichi*, from the Oak Grove, is perhaps as close as any other but is readily separable by the more elevated, more acutely tapering spire, the more angular body, the much more broadly rounded axials and their restriction on the final whorl to the periphery.

Glyphostoma nannophues has been recognized only in the environs of the type locality.

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

Glyphostoma aldrichi Maury

Plate XLII, figure 13

1910. *Pleurotoma boadiceoides* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 6, pl. 1, fig. 7.

1910. *Glyphostoma aldrichi* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 14, pl. 3, fig. 9.

This species [*P. boadiceoides*] is a miniature of *P. boadicea* Dall, for with an equal number of whorls it is but half the size of the specimen figured by Dr. Dall. Whorls 8, of which the first 2 are smooth, the third strongly carinated, and the remainder ornamented with riblets and spirals. Spiral sculpture of equal threads that can easily be seen without a lens; 18 or 20 are present on the last whorl, and 2 or 3 on the preceding whorls. Longitudinal sculpture of nodular riblets (7 on the last whorl), occurring immediately below the subsutural grooves. Aperture narrowly elliptical; notch broad, not deep; outer lip simple. Length of shell 7; greatest width 2.5 millimeters.

It is possible that this may prove to be a small variety of *boadicea* when more specimens are found.

Oak Grove, Fla. Mr. Aldrich's collection.—Maury, 1910.

Shell [of *G. aldrichi*] small, so closely resembling in size and sculpture *Pleurotoma boadiceoides* that, were it not for the characters of the mouth and for the strong terminal varix, it might be taken for that species. Whorls 7 or 8 of which all but the nuclear are sculptured. Spiral scuplture of equal threads (18 or 20 on the last whorl and 3 on the preceding whorls). Longitudinal sculpture of nodular riblets developed immediately below the subsutural grooves. Last whorl more than half the length of the shell; terminal varix strong, developed near the margin of the outer lip; aperture narrowly elliptical; notch U-shaped, profound; outer lip with internal lirae; columella denticulate. Length of shell 7; greatest width 3.5 millimeters.

Named in honor of Mr. Aldrich.

Oak Grove, Santa Rosa County, Fla.

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

The shell is conspicuously biconic, the spire rather slender and elevated, the body whorl attenuate basally but not rounded. The protoconch is rather high and coiled 4 times. The initial coil is minute, inflated, slightly inclined, and immersed at the tip. The 2 succeeding volutions are broadly inflated and increase rather rapidly in diameter. A peripheral carina is initiated near the beginning of the final nuclear turn, increasing rapidly in prominence, and is, toward the end of the volution, acutely angulated and sharply pinched. The line between the conch and protoconch is well defined by a change in the texture of the shell and the initiation of the axials and the shoulder spirals. The carina of the protoconch persists upon the conch as the peripheral spiral. The whorls of the conch are 6, broadly and closely appressed posteriorly. The axial sculpture is undulatory, the costae broadly nodose, more or less evanescent posteriorly, separated by narrower intercostals and usually 7 upon the later whorls of the spire. The axials are reduced upon the body to a peripheral crenulation and are very irregular upon the final half turn. The posterior fasciole occupies almost half of the entire whorl. On the early turns it is feebly undulated axially and closely threaded spirally, but on the later turns both the axial and the spiral sculpture disappear entirely, leaving the fasciole broadly convex and smooth except for faint incremental striae. The denticles upon the inner margin of the labrum range from 6 to 12; on the inner wall of the aperture they are more or less irregularly disposed from the commissure to the base of the pillar. The anterior fasciole is wide, threaded with about a dozen lirae, and broadly and rather deeply emarginate at its extremity.

Glyphostoma chipolanum is more slender than the Oak Grove species and more constricted at the base of the body. The axials are decidedly more numerous upon the later volutions, much narrower, and less abruptly evanescent posteriorly. Unlike those of *G. aldrichi* they are not restricted, on the first half turn of the body, entirely to the periphery but are continued over the entire medial portion of the whorl. The body spirals are more numerous in the Chipola form, and the posterior fasciole in place of being smooth or at most irregularly striated is regularly lineated.

"Pleurotoma" boadiceoides was described from a young and imperfect specimen in which the outer lip had been broken away. The types of both the *Pleurotoma* and *Glyphostoma aldrichi* have been examined, and there is no doubt of their identity. The name *aldrichi* has been retained for the species, although *boadiceoides* was described on an earlier page in the same paper. There is nothing to be gained and much to be lost by substituting another and in this case a very misleading name for a rather common form, especially when this involves the substitution of an immature and imperfect individual as the type of the species.

Occurrence: Oak Grove sand, localities 2646[c], 5632[p], 7054[r]. Aldrich collection, Johns Hopkins University, and Cornell University collections.

Glyphostoma chipolanum Gardner, n. sp.

Plate XLII, figure 21

Shell rather small and slender, biconic, the maximum diameter falling near the median horizontal; spire elevated, tapering to an acute apex; body whorl attenuated anteriorly. Whorls of protoconch between 3 and 4, those of the conch 5¼. Protoconch slender but elevated, broken at the very tip; earliest turn minute and probably immersed at the tip; peripheral carina initiated probably on the second volution, although it does not become acute and overhanging until the final turn of the protoconch. Line of demarcation between the conch and protoconch indicated by a change in the texture of the shell and by the abrupt initiation of rounded axials and the more gradual introduction of feeble spiral lirae; peripheral spiral continuous with the nuclear keel. Whorls of spire closely appressed posteriorly, the sloping posterior fasciole occupying more than half the volution. Axials broadly undulatory, inclined to be nodose, evanescent posteriorly except in the apical region, separated by slightly narrower interaxials equal in size and regularly spaced except upon the body, degenerating on the final half turn into irregular puckerings along the periphery. Spiral sculpture less prominent than the axial, restricted to a couple of low and rather obscure fillets on each of the whorls of the spire and the medial portion of the body, the one outlining the periphery, the other midway between the periphery and the anterior suture, overriding the costals but more or less obsolete in the intercostal areas; base of body, pillar, and anterior fasciole closely threaded with inconspicuous lirations that become increasingly sharp and more crowded anteriorly. Suture lines distinct, crenulated by the axials of the preceding volution. Aperture rather narrow, oblique. Outer lip strongly varicose a little behind the margin; inner surface of varix irregularly denticulated, the posterior denticle the most elevated, the anterior denticles elongated and produced almost to the margin of the shell, the one in front set parallel to the anterior canal. Posterior siphonal notch broad and very deep, its entrance partly closed by the posterior denticle of the outer lip and the sharp parietal denticle directly opposite. Base of the body rather thinly glazed. Pillar reinforced, irregularly denticulated. Anterior canal rather long, slightly recurved, partly closed near its initiation by the denticulations of the labrum and labium. Anterior fasciole broad, sinuated, obscurely emarginate at its extremity. The type is unique.

Dimensions: Height, 9.8 millimeters; length of aperture, 5.6 millimeters; maximum diameter, 4.0 millimeters.

Holotype: U. S. Nat. Mus. No. 328633.

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

Glyphostoma chipolanum is the analog in the Chipola fauna of *Glyphostoma aldrichi* in the Oak Grove. The Chipola species is more slender and more constricted basally, the axial costae more numerous, sharper, and decidedly narrower, the spirals finer and more numerous upon the body. The spiral sculpture on the posterior fasciole of the early whorls of *G. aldrichi* is perhaps a little less faint than on the corresponding whorls of *G. chipolanum*, but the later whorls of the Chipola species are much more regularly lineated than those of the Oak Grove.

Occurrence: Chipola formation, locality, 2564[r].

Glyphostoma xeston Gardner, n. sp.

Plate XLII, figures 19, 20

Shell small but thick and solid; spire elevated and tapering to an acute apex, body whorl rather abruptly constricted at the base. Protoconch small but high, not perfectly preserved in any individual but probably made up of about 3½ volutions; initial whorl minute; succeeding turn broadly and smoothly rounded; peripheral carina gradually established on the penult, becoming increasingly acute upon the ultima, set a little more than halfway from the posterior to the anterior suture; surface behind the carina feebly and that in front of the carina strongly concave; incremental striae vigorous, but true sculpture not introduced before the beginning of the conch; nuclear keel carried across to the conch as the peripheral keel and outlined by a flattened cord. Whorls of conch 5½; the earlier turns rather strongly angulated at the shoulder, the later volutions constricted at the fasciole, the body whorl rounded. Axial sculpture dominating the spiral, the axials rather sharply rounded, equal and equispaced upon the spire, evanescent posteriorly on the later whorls and a little less prominent anteriorly than medially, 10 on the penult, irregular and more or less obsolete upon the final half turn of the body. Spiral sculpture of low, flattened fillets which become increasingly low and inconspicuous toward the ultima, 2 upon the earlier volutions, one outlining the periphery, the other midway between it and the anterior suture, increasing rapidly in number upon the antepenult by intercalation between the primaries and also by introduction behind the suture; body spirals very inconspicuous and rather irregular in size and spacing upon the medial portion, the pillar spirals more regular and more elevated, merging without any marked break into the rather coarse threading of the anterior fasciole. Posterior fasciole sharply defined, gently sloping on the earlier turns and crenulated by the axial costae, closely appressed posteriorly, on the later volutions, broadly convex and devoid of both axial and spiral sculpture; incremental striae rather feeble. Suture lines distinct but not conspicuous. Aperture rather narrow and slightly oblique. Outer lip strongly varicose a little behind the margin, thinning abruptly into a narrow flange, which is bent over the opening; about half a dozen denticles developed on the inner surface of the varix, the posterior the most prominent, the anterior elongated more or less parallel to the anterior canal, the medial denticles usually equal and regularly spaced. Posterior siphonal notch profound, symmetrically U-shaped, heavily reinforced and beveled; callus very heavy and denticulate at the labial entrance to the sinus. Base of the body smooth and thinly washed. Pillar heavily glazed and irregularly dentate, the posterior denticles the most prominent. Anterior canal moderately long for the group, not very broad. Anterior fasciole wide, recurved, and deeply emarginate at its extremity.

Dimensions: Height, 10.7 millimeters; length of aperture, 5.2 millimeters; maximum diameter, 4.6 millimeters.

Holotype: U. S. Nat. Mus. No. 351227. Paratype: U. S. Nat. Mus. No. 371066.

Type locality: No. 3742, Shell Bluff, Shoal River, Walton County, Fla. Paratype from locality 3856, 5 to 6 miles northwest of Mossyhead, Walton County, Fla.

Glyphostoma xeston is a highly polished little shell without any striking diagnostics or any very close allies. The spiral sculpture, narrow and rather sharply lirate on the early whorls, broad and increasingly obscure on the later, is perhaps the most characteristic feature.

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

Genus NANNODIELLA Dall

1918. *Nannodiella* Dall, U. S. Nat. Mus. Proc., vol. 54, p. 329 (no description).
1919. *Nannodiella* Dall, U. S. Nat. Mus. Proc., vol. 56, p. 59.
1928. *Nannodiella* Woodring, Miocene Mollusks from Bowden, Jamaica, pt. 2: Carnegie Inst. Washington Pub. 385, p. 194.

Type (by original designation): *Philbertia* (*Nannodiella*) *nana* Dall. (Recent in the Gulf of California.)

Minute Turritidae with a glassy nucleus of several whorls finally developing spiral threads but otherwise smooth; the adult sculpture predominantly spiral, the anal sulcus large, with a projecting margin, the outer lip in front of it thin and much incurved over the aperture; the aperture unarmed, the canal short, the animal inoperculate.

Type: *Nannodiella nana*, n. sp.

This group is instituted for a number of minute species which are remarkable for their relatively enormous anal sulcus, often half as large as the aperture. Those so far recognized are inhabitants of the Gulf of California and its vicinity.—Dall, 1919.

Nannodiella, which was proposed as a section of *Philbertia*, may be regarded as related to *Glyphostoma*. The nuclei of the two genera are essentially the same. The very large spoutlike anal notch is a striking feature. Some of the Australian species

referred by Hedley to *Etrema* have a similar spoutlike anal notch, but they have denticles on the outer or inner lips or on both. How much significance is to be attached to this armature is open to question. The type of *Nannodiella* apparently has none. The Bowden species has obscure denticles on the inner lip and fine denticles on the outer lip far within the aperture. An undescribed recent species from Cape St. Lucas, Lower California, which otherwise resembles *Nannodiella nana*, has heavy denticles on both outer and inner lips. All these American species are regarded as representing *Nannodiella*.

This genus has been found at a number of Miocene localities in the West Indian region, where it generally goes under the name of "*Mangilia*" or "*Glyphostoma*." Living species are found in the West Indian and Floridian regions, in the Gulf of California, and probably in the Orient.—Woodring, 1928.

The genus is represented in the three formations of the Alum Bluff group.

Nannodiella nemorensis (Maury)

Plate XLII, figure 14

1910. *Clathurella nemorensis* Maury, Bull. Am. Paleontology, vol. 4, No. 21, p. 13, pl. 3, fig. 8.

Shell small, slender, spire acute, whorls 7, of which the first 2 are smooth, the third with a single carination near the base, and the remaining 4 cancellated by the intersections of numerous fine spiral threads with slightly more widely separated fine longitudinal riblets. Aperture slightly less than one-third the total length of the shell. Sinus profound, U-shaped. Outer lip bearing an external varix and 4 plications within. Columella with 3 denticles. Length of shell 4.5; greatest width 2 millimeters.

Oak Grove, Santa Rosa County, Fla.

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

The protoconch is made up of 4½ smooth and highly polished volutions. The initial turn is minute, slightly inclined, rather tumid, and immersed at the tip. The succeeding whorl is also very small and broadly but feebly inflated. Near the beginning of the third volution there is a rather abrupt increase in the diameter and a suggestion of a peripheral keel. The final 1½ whorls are acutely angulated a little more than halfway from the posterior to the anterior suture. Behind the carina the surface is broadly convex but rather deeply undercut in front of it. The delimiting line between the conch and protoconch is fairly sharp and is marked by a change in the texture of the shell and by the introduction of the axial sculpture. The nuclear carina persists as the shoulder angle and is outlined by a flattened cord. The adult whorls are less strongly angulated than the young and the body whorl is smoothly rounded at the base. The shoulders are very long and gently sloping and are more than half as wide as the entire whorl. The axials vary widely in prominence and sharpness of definition, but they are usually rather feeble and obtusely rounded. Although they persist across the whorl and well down to the base of the body they are more prominent medially. Their number runs from 16 to 20, and they are for the most part equal in size and spacing, although commonly more or less irregular upon the final half turn. The primary spirals are flattened fillets overriding the axials, usually 3 upon the penult, the posterior outlining the peripheral angle, the anterior very near the suture and sometimes concealed by it, the medial symmetrically placed between them. Secondaries are fortuitous and rather uncommon. The cancellation is usually very regular upon the anterior half of the whorl, the intersecting axials and spirals cutting the surface into a series of small, squarish pits. The base of the body is smoothly constricted and lirated with flattened threads, which become increasingly fine and close-set and commonly pass without any marked break into the threading of the anterior fasciole. The posterior fasciole is also lirated with 5 or 6 very fine, sharp threadlets. The outer lip is much thickened. In addition to the four plications on the inner surface of the labrum there is a single amorphous denticle on the parietal wall at the posterior entrance to the sinus. The denticles upon the columellar wall are merely localized deposits of callus and differ widely in number and arrangement. The anterior fasciole is rather wide, finely and closely threaded, and obliquely truncate at its extremity. The species has not been found in any abundance, but it has an unusually wide distribution for the group.

None of its congeners presents the wide and gently sloping shoulders and the very narrow and numerous axials, evenly cancellated by the intersecting spirals, which characterize *Nannodiella nemorensis*.

Occurrence: Chipola formation, locality 3419[r]. Oak Grove sand, localities 2646[p], 5632[r], 5631[r]. Aldrich collection, Johns Hopkins University, Cornell University collections. Shoal River formation, localities 3742[r], 3748[r].

Genus MICRODRILLIA Casey

1903. *Microdrillia* Casey, Acad. Nat. Sci. Philadelphia Proc., February 1903, p. 276.

Type (by subsequent designation, Cossmann, 1906, Essais de paléoconchologie comparée, pt. 7, p. 223): *Pleurotoma meyeri* Cossmann=*Pleurotoma cossmanni* Meyer, not De Raincourt. (Eocene of Jackson, Mississippi.)

A number of minute pleurotomids, including *infans* and *cossmanni* of Meyer and *harrisi* of Aldrich, have been referred to by Cossmann under the names *Asthenotoma* and *Scobinella*, by Harris under *Mangilia*, by Aldrich under *Glyphostoma*, and by Meyer, Vaughan, and others under *Pleurotoma* in its broad sense. They are all very small and characterized by a well-developed multispiral, closely coiled embryo, having 1 to 3 of its basal whorls costulate, few body whorls which are wholly devoid of costae but spirally carinate, the retral sinus relatively large, circularly rounded and close to the suture, the aperture oblique, columella callous, with or without plications, and the canal short or subobsolete.

The genus *Microdrillia* differs from *Asthenotoma*, to which *cossmanni* was referred by Cossmann, in the structure of the embryo and especially in the position of the retral sinus, which in *Asthenotoma* corresponds in its greatest depth with the

median line or periphery of the whorls. * * * *Microdrillia* is much more closely related to *Glyphostoma*, as suggested by Aldrich, but not at all allied to *Mangilia*. It appears to have become wholly extinct in the Oligocene or lower Miocene. The species were numerous and individually abundant, especially in the mid-Eocene of the lower Claiborne.—Casey, 1903.

The genus is restricted in its distribution in the Alum Bluff group to the horizon of the Chipola formation.

Microdrillia hebetika Gardner, n. sp.

Plate XLII, figures 15, 16

Shell minute, well rounded, tapering very gradually to an obtuse apex; body whorl short, smoothly but rather rapidly constricted at the base. Whorls 9½ in all, nearly half of them nuclear. Protoconch relatively large, though rather acutely tapering, highly polished, coiled 4½ times; initial turn minute, erect, rounded, immersed only at the very tip and preserved in only one out of a large number of individuals; succeeding 2½ turns smooth, trapezoidal in outline, increasing regularly and rapidly in diameter; final whorl of the protoconch sculptured with sharply elevated arcuate riblets, 16 to 18 in number. Boundary line between conch and protoconch sharply defined by the abrupt disappearance of the axials and by the equally abrupt initiation of two well-rounded, elevated lirae, one placed directly in front of the posterior suture, the other submedial in position; a third lira introduced within the first half turn directly behind the anterior suture. Later whorls of the spire flattened laterally, threaded with 3 conspicuously elevated cords, flattened upon their summits, the posterior a little less elevated than the 2 in front; a fourth primary coincident with the suture line and almost entirely concealed by the succeeding volution; body spirals increased to 8, those upon the base less elevated but similar in character and spacing to those upon the medial portion. Incrementals very strong between the spirals but not overriding them. Sutures obscure. Aperture short, oblique, widening only slightly posteriorly. Outer lip thin, sharp, oblique, widely expanded incrementally and curving somewhat over the opening, lirated internally with 4 feeble threads which evanesce at some distance from the outer margin but which extend far within the throat. Posterior siphonal fasciole included between the two posterior primaries, the notch profound, symmetrical, U-shaped. Inner wall of aperture smoothly and rather heavily glazed, bearing near the base of the body and almost midway between the extremities of the aperture two minute horizontal folds. Anterior canal very short, broad, open. Anterior fasciole unsculptured, strongly arched, feebly emarginate at its extremity.

Dimensions: Height, 4.3 millimeters; length of aperture, 1.7 millimeters; maximum diameter, 1.6 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 124981.

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

The species has been confused in the collections with *Microdrillia infans* Meyer. The Vicksburg form has an even larger nucleus of 5½ volutions, of which 3 are axially sculptured, whereas in *M. hebetika* the ribbing is restricted to the final whorl of the protoconch. The conch of *M. infans* has fewer whorls than that of the Chipola species, and they are much more strongly constricted at the sutures. There is no similar congenetic species, although the young of *Polystira albidoides* resemble *M. hebetika* in the strong and regular spiral cording. The species is moderately abundant at the type locality. The recent analog *Mangelia comatotropis* Dall is larger, the axial sculpture is introduced before the beginning of the nuclear ultima, and the medial spiral is relatively more prominent than in *M. hebetika*.

Occurrence: Chipola formation, localities 2213^{p}, 2564^{r}, 3419^{r}, 7151^{r}.

Genus BELA Leach

1847. *Bela* Leach, in Gray, Annals and Mag. Nat. History, vol. 20, p. 270.
1847. Gray, Zool. Soc. London Proc., p. 134.

Type (by subsequent designation, Gray, 1847): *Murex nebula* Montagu. (Recent in the North Atlantic.)

The shells of this group are, for the most part, thin, more or less biconic, and commonly turriculate in outline but exhibiting an unusual degree of individual and sex variations. Both axial and spiral sculpture are normally developed, the former dominant. The outline of the aperture varies with the contour of the shell. The outer lip is thin and sharp, the inner lip simple, the anterior extremity truncate.

The approximate or complete obsolescence of the posterior sinus is one of the characteristic features of the genus.

Bela has not been recognized in strata older than the Eocene. The Recent species are restricted to the northern waters, and it is rather remarkable that even a single species occurs in a fauna so warm as that of the Alum Bluff.

Bela nassoides Gardner, n. sp.

Plate XLII, figure 22

Shell small, ovate, nassoid in form and in character of ornamentation; spire short, the aperture more than

half as high as the entire shell. Whorls of conch 3½, narrowly tabulated posteriorly, trapezoidal. Protoconch smooth, polished, acutely tapering, coiled a little more than four times; initial volution for the most part submerged, the succeeding turns broadly convex and increasing rather rapidly both in diameter and altitude. Line of demarcation between conch and protoconch irregular but very distinct, indicated by a decided change in the texture of the shell and by the abrupt appearance of both the axial and the spiral sculpture. Ornamentation similar in general character over the entire spire. Axials numerous, 18 on the penult, sharply rounded, uniform in prominence throughout their extent from the posterior to the anterior suture and well down to the base of the body, equal and separated by equal intercostals of approximately their own width. Both axials and interaxials overrun by rather low spiral fillets, usually 5 on the later whorls of the spire and twice as many upon the body, for the most part equal in size and spacing, though narrower, sharper, and more closely spaced upon the base of the body. Pillar girded by 3 or 4 broader and more elevated cords, which are only a little coarser than the 3 to 6 crowded lirae upon the anterior fasciole. Posterior fasciole not defined away from the aperture. Suture line deeply impressed. Aperture not very wide, oblanceolate. Outer lip broadly and very feebly arcuate, slightly thickened externally, thin edged, denticulate within; the denticles elongated normal to the margin, symmetrically disposed between the canals, the posterior tooth the most prominent and placed directly in front of the sinus, the anterior tooth the least prominent and placed at the entrance to the anterior canal and parallel to it, the medial denticles equal and equispaced; posterior sinus very broad and shallow, distant from the suture. Inner margin of aperture strongly excavated at the base of the body. Parietal wall thinly glazed, commonly somewhat rugose. Inner edge of pillar acute but not distinctly plicate. Anterior canal short, broad, recurved. Anterior fasciole very short and narrow, obliquely and very deeply emarginate at its extremity.

Dimensions: Height, 5.5 millimeters; length of aperture, 2.8 millimeters; maximum diameter, 2.6 millimeters.

Holotype: U. S. Nat. Mus. No. 351234.

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

This small form is strikingly nassoid in general aspect.

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

Family CONIDAE

Genus CONUS Linnaeus

1758. *Conus* Linnaeus, Systema naturae, 10th ed., p. 712.

Type (by subsequent designation, Children, 1823): *Conus marmoreus* Linnaeus. (Recent in the Indo-Pacific.)

Shell heavy, porcellanous, inversely conical; spire short or depressed, simple, keeled, rarely tuberculate; body whorl generally smooth, in large measure embracing the spire. Aperture narrow, with parallel or subparallel margins. Outer lip simple, thin, acute, notched at the shoulder. Columella straight, smooth, truncate anteriorly.

A large genus, which has been in existence since Cretaceous times and now numbers about 400 species, most of which are inhabitants of the tropical seas.

The distribution of the cones in the Chipola, Oak Grove, and Shoal River faunas is remarkably local. Of the 14 species represented not one occurs in all the faunas, and only a single one is common to any two. Though clearly related to the mid-American cones none of the 14 has been recognized outside of the Alum Bluff of Florida. The Chipola fauna is characterized by *C. isomitratus* and the closely related *C. sulculus*, with the somewhat less abundant *C. demiurgus* of the larger, stouter type and, among the more slender races, *C. chipolanus* Dall, with a meager representation of the Oak Grove species *C. corrugatus*. The Oak Grove fauna is dominated by *Conus dodona*, a form that suggests *Conus proteus* Hwass of the late Tertiary and Recent seas, and the smaller *Conus corrugatus*. The Shoal River fauna is characterized by its isolated cone fauna of 3 species and 1 subspecies, none of which occur outside the Shoal River formation and two of which, *C. waltonensis* and its subspecies *anodosus*, greatly exceed in abundance any other member of the cones within the Alum Bluff group.

The Chipola and Oak Grove faunas are obviously much more closely related to each other than to the Shoal River. The Shoal River fauna is the most peculiar of the three, and through its dominant species, so extraordinarily prolific in Walton County, is related to other mid-Miocene faunas of the mid-American province.

The character of the cones as a whole indicates throughout the Alum Bluff warm and very shallow waters.

Most of the other species are members of groups widespread in the middle and later Tertiary in the warm temperate and tropical waters of eastern America, but in few of them is the specific likeness sufficiently close to argue strongly for stratigraphic contemporaneity.

Adult shell not exceeding 55 millimeters in altitude; no sculpture developed on body whorl except unequal and irregular lirations upon the anterior portion:
- Shoulder of whorls not spirally sculptured:
  - Shoulder flattened, approximately horizontal in the later volutions ..... *Conus demiurgus* Dall.
  - Shoulder concave between the appressed suture and the raised peripheral margin ..... *Conus dodona* Gardner, n. sp.
  - Shoulder turgid, in some specimens flattened on the ultima of the adult ..... *Conus isomitratus* Dall.
- Shoulder of whorls spirally sculptured ..... *Conus sulculus* Dall.

Adult shell not exceeding 40 millimeters in altitude; spiral sculpture developed over all or a part of the body whorl, either in the form of broad fillets, linear sulci, or moniliform spirals:
- Nonmoniliform spiral sculpture developed with approximate uniformity over the entire body:
  - Body whorl rather stout:
    - Spirals rarely exceeding 20; shoulder usually flattened behind the periphery; body whorl not constricted at the base ..... *Conus corrugatus* Gardner, n. sp.
    - Spirals usually exceeding 20; shoulder not flattened behind the periphery; body whorl constricted at the base. *Conus turbinopsis* Gardner, n. sp.
  - Body whorl very slender:
    - Spiral sculpture of approximately 20 sharp and narrow lirae ..... *Conus fusiformis* Gardner, n. sp.
    - Spiral sculpture of approximately 25 linear sulci ..... *Conus chipolanus* Dall.
- Spiral sculpture not uniformly developed over the entire body:
  - Body whorl sculptured with linear sulci, feebly or not at all moniliform:
    - Shell slender; spire high; sulci usually exceeding 7 ..... *Conus chipolanus* Dall.
    - Shell rather stout; spire of medium height; sulci rarely exceeding 7 .. *Conus waltonensis anodosus* Gardner, n. subsp.
  - Body sculpture more or less moniliform; shell rather stout; spire low or of only moderate height:
    - Pustular spirals developed over the medial or the medial and posterior portions of the body; shoulder not spirally lirate ..... *Conus waltonensis* Aldrich.
    - Pustular spirals very feebly developed over the medial portion of the body; shoulder spirally lirate. *Conus submoniliferus* Gardner, n. sp.

Adult shell exceeding 55 millimeters in altitude:
- Spiral sculpture not restricted to the base of the body ..... *Conus molis* Brown and Pilsbry.
- Spiral sculpture restricted to the base of the body:
  - Shoulder of body whorl subacute ..... *Conus draperi* Maury.
  - Shoulder of body whorl smoothly rounded ..... *Conus nemorideditus* Maury.
  - Shoulder of body whorl acute ..... *Conus demiurgus* Dall.

Conus demiurgus Dall

Plate XLIII, figure 1

1896. *Conus demiurgus* Dall, U. S. Nat. Mus. Proc., vol. 18, p. 43.
1903. *Conus demiurgus* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, pl. 60, fig. 22.

Shell large, elongate, with a large, somewhat bulbous nucleus, and about 10 subsequent whorls; spire low, in the young nearly flat, with a distinct but not channeled suture; shoulder of the whorl angular, the space between the sutures flattish or feebly excavated, sculptured with obvious lines of growth, crossed by few faint, obsolete spiral traces; sides of the whorl smooth, except for obsolete spiral lines, rather wide and irregularly spaced; in the anterior third they are stronger, but even there not very marked; some specimens seem to indicate a faded color pattern of continuous, narrow spiral lines, rather evenly and uniformly spaced; aperture narrow, of equal width or nearly so; the anal notch moderately deep, the pillar straight, with a narrow callous part not showing any ridge or plait. Longitude of spire, 5; of shell, 65; diameter, 35; width of aperture, 6 millimeters.

Habitat: Chipola beds (2211–2213), Florida.

Types: No. 113920, U. S. Nat. Mus.; and in the Aldrich collection.

This species is the largest yet found in these beds, and among recent species finds its nearest analog in *C. papilionaceus* Hwass. It is a more slender shell than the latter, with more flattened spire and larger nucleus. It is a shell without striking characteristics, yet which will not fit in with any of the other forms of this horizon.—Dall, 1896.

The type is No. 113920 in the collections of the U. S. National Museum from No. 2213, 1 mile below Baileys Ferry, Chipola River, Calhoun County, Fla. The specimen figured by Dall is U. S. Nat. Mus. No. 113923 from No. 2212, Tenmile Creek, 1 mile west of Baileys Ferry, Calhoun County, Fla.

No other species within the area combines the rather slender outline, the low spire planulated toward the periphery, the flattened nonplicate, nonlirate shoulder, and the sharply angulated periphery of the body whorl.

C. demiurgus Dall is restricted to the Chipola fauna but is rather common within those narrow limits.

Occurrence: Chipola formation, localities ?7893, 2212[p], 2213[p], 2564[c], 3419[a], 2211[p].

Conus isomitratus Dall

Plate XLIII, figure 2

1896. *Conus isomitratus* Dall, U. S. Nat. Mus. Proc., vol. 18, p. 43.
1903. *Conus isomitratus* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, pl. 60, fig. 26.

Shell small, solid, short, stout, with a rather low spire of 8 or 9 whorls beside the nucleus; a single elevated thread runs at the shoulder, on which the suture is laid; between the sutures, which are deep and distinct, the whorl is convex, turgid, with only incremental lines; in front of the shoulder the sides are slightly swollen, the posterior half obsoletely spirally striate or smooth, anteriorly with distinct spiral threads and equal interspaces crossed by conspicuous lines of growth; the siphonal fasciole distinct, swollen, showing as a rounded ridge; outer lip straight, thin, sharp; anal notch shallow, aperture narrow, siphonal notch

deep; pillar with the edge thickened and twisted, forming in well-developed specimens with the siphonal fasciole two obscure plaits; body with little or no callus. Longitude of shell, 28; of spire, 5; maximum diameter, 18 [17.5] millimeters.

Habitat: Chipola beds (2212, 2213), Chipola River, Fla., and Alum Bluff beds near De Funiak Springs (2238).

Types: No. 113980, U. S. Nat. Mus.; and in the collection of Mr. Aldrich.

The young of this species have 9 or 10 deep grooves, with narrower interspaces, covering a little more than the anterior half of the shell. These grooves during growth become gradually modified to the adult sculpture.—Dall, 1896.

The figured type is in the United States National Museum collection, No. 113980, from locality 2212, Tenmile Creek, 1 mile west of Baileys Ferry, Calhoun County, Fla.

The species is set apart from all the coexistent forms by the peripheral cord outlining the inflated shoulder. It is common within the Chipola formation.

Occurrence: Chipola formation, localities 2212[a], 2213[c], 2564[p], 7151[r], ?7468[r].

Conus sulculus Dall

Plate XLIII, figure 3

1896. *Conus isomitratus* var. *sulculus* Dall, U. S. Nat. Mus. Proc., vol. 18, p. 43.

1903. *Conus sulculus* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, pl. 60, fig. 27.

Shell resembling the type, except that the sutural border or shoulder of the shell is flattened or excavated with a few or numerous spiral grooves upon its surface. It is also larger. Longitude of spire, 5; of shell, 38 [39.0]; diameter, 24 [22.0] millimeters.

Habitat: Chipola beds (2212, 2213), Chipola River, Fla.

Types: No. 113924, U. S. Nat. Mus.

The transition from a concave to a turgid sutural border, from smooth to spirally grooved, is quite gradual, though the extremes have a very different aspect, and would, by some writers, be put in different sections of the genus. This species recalls *C. mus* of the recent fauna as much as any species. It is much shorter and stouter than the line which begins with *C. sauridens* et al., and is represented in the present fauna by *C. davcus*.—Dall, 1896.

Shell rather large and not very stout, moderately heavy in texture. Spire low, between one-sixth and one-fifth of the total altitude of the shell. Tip of nucleus broken away in all available material even in the holotype. Whorls of conch 8 or 9, closely embracing, so coiled that the spire is moderately steep in the apical region but flattens to a peneplain toward the periphery. Suture line following the periphery of the preceding volution. Shoulders of whorls of conch sculptured with 3 to 5 shallow linear sulci; shoulder of body whorl acutely rounded at the outer margin. Anterior third or more of the ultima sculptured with close-set, minutely sinuous spirals which tend to alternate in size, except near the canal, where they are uniform and much crowded. Labrum thin, sharp, deeply marginate at the shoulder. Inner lip simple, reinforced at the anterior canal; canal slightly flaring, terminated by a broad and shallow indentation.

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

Conus sulculus Dall is most certainly near of kin to *C. isomitratus* Dall, but it is so readily separable by reason of its larger size, more attenuated anterior portion, and sulcated shoulder and is connected with *C. isomitratus* by so few intermediate forms that it seems worth while to give it specific rank.

The species is fairly common within the Chipola formation but has not been reported from outside of it.

Occurrence: Chipola formation, localities 2212[a], 2213[p], 2564[p], 3419[p], 7151[p], 2211[p], 7183[r].

Conus trajectionis Maury

1910. *Conus trajectionis* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 5, pl. 1, fig. 6.

Shell of medium size, elongately pyriform, with an elevated and very acute spire not convex in profile; whorls 11, of which the first 2 nuclear are smooth, the 5 following show a coronation under the lens, while the remainder have only a spiral ornamentation. Spiral sculpture of 3 or 4 strong threads on each volution of the spire. The spirals are absent on the last whorl below the shoulder but are strongly developed near the base of the shell. Lines of growth inconspicuous. Length of shell 50; greatest width 26 millimeters.

Chipola marls, Baileys Ferry, Fla.

Cornell University collection.—Maury, 1910.

Conus trajectionis has much in common with *Conus sulculus* Dall, but the profile of the spire is not the same and the shoulder is rounded more broadly than in Dall's smaller species. Nothing specifically identical with Miss Maury's *trajectionis* is included in our collections.

Conus dodona Gardner, n. sp.

Plate XLIII, figure 4

Shell rather large and heavy. Spire not more than one-fifth of the entire altitude in the adult forms. Whorls approximately 9, including the 2 or 3 nuclear coils, which are small, of nearly the same size, and laterally compressed and form a sharp and prominent little knob in the center of the low spire. Earlier whorls of conch flattened upon the shoulder; later whorls concave, the sutures very closely appressed and the peripheral margin slightly elevated. Incremental sculpture well developed in the concave area between the periphery and the suture. Spiral sculpture restricted to a dozen or more unequal and inequispaced, irregular oblique spirals upon the anterior third of the body. Aperture of average width. Outer lip thin, sharp, deeply emarginate at the shoulder. Inner lip smooth, reinforced at the anterior canal. Anterior canal wide, flaring slightly, obliquely truncated.

Dimensions: Maximum height, 33.8 millimeters; length of aperture, 29.0 millimeters; maximum diameter, 19.0 millimeters.

Holotype: U. S. Nat. Mus. No. 349858.

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

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This species suggests a low-spired *Conus proteus* Hwass (pl. XLIII, fig. 5) with a scooped-out shoulder.

Conus demiurgus Dall attains a larger size, has a lower spire, with a flattened rather than a concave shoulder even in the later whorls, and is more attenuated anteriorly.

Conus isomitratus Dall is smaller and stouter as a rule and does not reveal the periphery of the whorls of the spire.

Conus fusoides brachys Pilsbry from the Gurabo formation of the Dominican Republic is more angular with the suture, particularly on the early whorls, following more closely the periphery.

Conus dodona is the largest cone reported from the Oak Grove. It is abundant at certain localities, notably on the Yellow River, half a mile east of Oak Grove, but it has not been found at any other horizon of the Alum Bluff.

Occurrence: Oak Grove sand, localities 2646[a], 5633[p], 7054[p].

Conus chipolanus Dall

Plate XLIII, figure 6

1896. *Conus chipolanus* Dall, U. S. Nat. Mus. Proc., vol. 18, p. 42.

1903. *Conus chipolanus* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, pl. 60, fig. 23.

Shell double-conic, with a rather elevated spire of 9 normal and about 3 lucid nuclear whorls; profile of the spire somewhat concave, turreted shoulder of the whorls sharply keeled, concave between the keel and the suture, without spiral grooving but showing faint microscopic spiral scratches, the prominent sculpture of this area being the delicately arched lines of the anal fasciole, which are sometimes very conspicuous; the keel is wholly without nodules; sides in front of the keel straight, slightly concave toward the canal, smooth, except for incremental lines, polished anteriorly, with about 9 sharp, channeled spiral grooves, besides some striations on the canal; the grooves are separated by wider interspaces and crossed by numerous elevated lines of growth, which only appear in the channels; each channel in the fully adult shell has a spiral row of faint, round tubercles close to its anterior margin; in the young the grooves sometimes cover the whole shell before the keel, and the nodules are often absent; in the adult the grooves cover somewhat less than half the whorl, while on the smooth part traces of 5 narrow, revolving color bands are sometimes visible, with wider interspaces; anal notch only moderately deep; outer lip thin, only moderately arched; aperture narrow, with nearly parallel sides; the pillar straight, thin, slightly twisted. Longitude of shell, 32; of spire, 7.5; maximum diameter, 15.0 millimeters.

Habitat: Chipola beds (2213), Chipola River, Fla.

Type: No. 113985, U. S. Nat. Mus.; and in the collection of Mr. Aldrich.

This species recalls *C. interstinctus* Guppy, of the Haitian Miocene, but is a smaller, more slender, and more delicate shell, without any grooving in the sutural fasciole. It is more nearly related to *C. marylandicus* [pl. XLIII, fig. 8], of the newer Miocene, and to *C. floridanus* [pl. XLIII, fig. 7], Pliocene and Recent, than to any of the Antillean fossils with which I have compared it.—Dall, 1896.

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

Conus chipolanus Dall, though larger and more attenuated than *C. pealii* Green, suggests that Pliocene and Recent species in general outline and type of sculpture. Some of the variants of *C. multiliratus* are also suggested but the mid-American species is usually stouter and more strongly sculptured.

Conus chipolanus Dall is common at all of the Chipola localities from which extensive collections have been made, but it is apparently restricted to the single horizon.

Occurrence: Chipola formation, 2213[a], 2564[c], 3419[c], 7151[r], ?6175[r].

Conus corrugatus Gardner, n. sp.

Plate XLIII, figure 9

Shell rather small, biconic, the sharply angulated periphery of the body forming the base of each cone. Spire rather high, approximately one-third the altitude of the entire shell. Whorls 10 or more, including the 3 or 4 turns of the protoconch. Nuclear turns small, polished, laterally compressed, and very gradually increasing in size; line of differentiation between conch and protoconch marked by the abrupt initiation of the angulated shoulder and the incremental sculpture. Whorls of conch increasing in size with a moderate degree of rapidity, the sides of the spire serrated by the projecting peripheries of the successive volutions. Shoulder behind the periphery conspicuously flattened as a rule, a broad spiral fillet being thus formed, which is persistent in some individuals almost to the nucleus. Sculpture of spire restricted to arcuate incremental striations that mark the former presence of the posterior siphonal notch and restricted, in those individuals that are conspicuously flattened upon the front part of the shoulder, to the area between the fillet and posterior suture. Sutures distinct, even a little impressed. Body whorl sculptured with 12 or more low, broad spiral bands and in front of these upon the anterior canal 4 to 6 crowded lirae; interspirals linear in most individuals and finely striated by the incrementals. Aperture more than half the altitude of the entire shell, rather narrow, with subparallel margins. Outer lip thin, sharp, deeply indented upon the shoulder for the protrusion of the posterior siphon. Inner lip oblique, parietal wall smooth. Anterior canal slightly flaring, obliquely truncate.

Dimensions: Maximum height, 15.5 millimeters; height of spire, 5.0± millimeters; maximum diameter, 7.9 millimeters.

Holotype: U. S. Nat. Mus. No. 349864.

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

Conus corrugatus is smaller and stouter than *C. chipolanus* Dall and differs from it further in having a well-established spiral sculpture over the entire body whorl in front of the periphery instead of merely the anterior two-thirds, with fortuitous spirals here and

there upon the posterior third. *Conus turbinopsis* has a lower and more evenly sloping spire, with no tendency toward a flattening behind the periphery, more numerous and somewhat lower spiral fillets upon the body, and a constriction at the base of the body that is not suggested in *C. corrugatus*. *Conus fusiformis* is much more slender, with a much higher spire, and is ornamented with narrower but sharper lirations.

Conus corrugatus is the only one of the 11 species from the Alum Bluff group that has been collected at more than one horizon. It has a meager distribution in the Chipola, but in the Oak Grove sand it is abundant and widely distributed. *Conus harveyensis* Mansfield from the Choctawhatchee beds of Florida is more slender (pl. XLIII, fig. 11).

Occurrence: Chipola formation, localities ?7893[r], 2213[p], 2564[p]; Oak Grove sand, localities 2646[a], 5632[a], 5633[c], 7054[c].

Conus fusiformis Gardner, n. sp.

Plate XLIII, figure 10

Shell small for the genus, slender, fusiform in outline. Spire elevated, scalariform, between one-third and one-half the height of the entire shell. Whorls 9 to 9½, including the 3 or 3½ small, smooth, laterally compressed protoconchal turns. First whorl of conch axially costate, the peripheral keel developing only toward the close of the turn. Later whorls of spire strongly angulated at the periphery, which falls a little less than two-thirds the distance from the posterior to the anterior suture. Incremental sculpture vigorous near the posterior suture, especially in the earlier whorls, becoming more feeble toward the periphery and absent altogether in front of it. Sutures distinct, even a little impressed. Shoulder of body whorl sharply angulated, outlined by the posterior of 20 prominent, subequal rounded spirals separated by interspaces of slightly greater width upon the earlier portion of the whorl but becoming more and more narrow toward the anterior canal, where they are reduced to linear dimensions. Incrementals well developed in the interspiral sulci. Aperture very narrow but little more than half the total height. Outer lip broken; the posterior siphonal notch as revealed by the growth lines only moderately deep. Inner lip smooth, straight. Anterior canal narrow, obliquely truncate. The type, which is unique, had suffered injury, but the animal has been able to make effective repairs upon its shell.

Dimensions: Maximum height, 13.8 millimeters; height of spire, 5.6 millimeters; maximum diameter, 5.4 millimeters.

Holotype: U. S. Nat. Mus. No. 349870.

Type locality: No. 5633, Yellow River below Oak Grove Bridge, Okaloosa County, Fla.

C. fusiformis stands apart from all its kin in the slender fusiform outline and relatively few but conspicuous spirals almost equally prominent over the entire body whorl exclusive of the shoulder.

Occurrence: Oak Grove sand, locality 5633[r].

Conus turbinopsis Gardner, n. sp.

Plate XLIII, figure 12

Shell of medium size, moderately heavy, rather stout, suggesting in outline a rather slender, elongated top. Spire between one-fourth and one-third the height of the entire shell, the sides uniformly converging at an angle of about 90° until the nucleus is reached, when the slope becomes abruptly much more steep. Suture line running directly in front of the periphery of the preceding whorl, thus making a barely perceptible break in the uniformity of the slope. Whorls 10 or more, including the 1 or 2 small, smooth, laterally compressed protoconchal volutions and an axially costate turn. Periphery developed on the succeeding whorl acute, that of the whorls of the spire barely visible behind the suture line. External sculpture of spire restricted to vigorous incrementals, which mark the successive margins of the posterior siphonal notch. Suture lines distinct but inconspicuous. Body whorl sculptured in front of the periphery with 20 to 25 spiral fillets separated by squarely channeled sulci of rarely more than half the width of the fillets; spirals uniform for the most part in size and spacing but slightly narrower near the periphery and, at the anterior canal, appearing as crowded linear lirations; interspiral sulci finely striated by the incrementals. Shell rather conspicuously constricted and attenuated near the base of the body. Aperture rather narrow, the margins subparallel. Outer lip probably thin but broken in all specimens collected. Posterior siphonal notch moderately deep. Anterior canal narrow, feebly marginate.

Dimensions: Maximum height, 20.0 millimeters; length of aperture, 16.5 millimeters; maximum diameter, 12.0 millimeters.

Holotype: U. S. Nat. Mus. No. 371397.

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

Conus turbinopsis has a meager representation in the Shoal River faunas. It is most closely related to *Conus corrugatus* of the Chipola and Oak Grove faunas, a form characterized by a higher and steeper spire, upon which the sharply angulated peripheries of the succeeding whorls are plainly revealed; then, too, the body whorl of *C. corrugatus* tapers more uniformly and is not constricted at the base as in *C. turbinopsis*.

The relationship to the more strongly sculptured but variable *C. multiliratus* Böse is in some individuals rather striking.

Occurrence: Shoal River formation, locality 3856[p]

Conus waltonensis Aldrich

Plate XLIII, figures 13, 14

1903. *Conus waltonensis* Aldrich, Nautilus, vol. 16, no. 11, p. 1 31, 2 text figs.

Shell medium in size, substance rather thin; spire elevated, with 9 whorls including the apex, which is rather sharp; profile of spire slightly broken by a shoulder just above the suture on each whorl, the suture impressed, each whorl of the spire concave, and marked by numerous curved lines; periphery sharp; body whorl below the keel in some specimens over one-half smooth, then below this bearing two or three spirals of evenly spaced nodules without any grooves between, gradually changing to rows of nodules on bands between grooves, which are 8 or 10 in number, the nodules fading away as the canal is reached, but in the type specimen the nodules are present over the whole of the smooth part, without, however, any grooves between. Anal notch rather deep and marking the spire with its former positions; outer lip thin, pillar lip straight with a very slight twist; aperture straight above, widening near the base.

Length, 20 millimeters, maximum diameter, 12 millimeters.

Locality: Shoal Creek, Walton County, Fla.—Aldrich, 1903.

Two topotypes: U. S. Nat. Mus. No. 371398.

The apex of the spire is capped by a nucleus of 2 to 3 rather high, flattened whorls that form a prominent little knob on the relatively few individuals from which it is not broken away. The spire is higher proportionately in the young than in the adult form, constituting as much as a third of the total height in some of the former and less than a fifth in some of the latter. The whorls are very closely appressed and usually 10 in the adult. There is a considerable degree of variation in the steepness of the shoulder, the apical angle ranging from less than 90° to more than 120°. Usually there is a slight depression between the shoulder and the suture. The periphery is sharp and visible to the apex. Incremental sculpture is evenly developed behind the periphery but is rather feeble in front of it. Spiral sculpture is present only upon the body whorl. The moniliform spirals are developed over a much wider area in the individual selected by Mr. Aldrich as the type than in the average form. In probably half the individuals on which pustules are developed at all they are confined to the medial portion of the ultima and are commonly stronger near the inner than the outer lip. The pustules range from 20 to 30 to a series and in some specimens are so regularly arranged in the vertical plane that the suggestion of an axial sculpture is stronger than that of a spiral. On the anterior half of the body whorl 10 to 15 prominent spirals are present, the earlier spirals taking the form either of low fillets separated by squarely grooved channels or of oblique ridges separated by asymmetric V-shaped depressions. The 5 or 6 anterior spirals are uniform lirae separated only by linear interspaces. There is a barely perceptible constriction of the body whorl directly behind the anterior canal, a slight flare at the canal, and a feeble emargination.

Conus waltonensis Aldrich is exceedingly abundant at Shoal River and constitutes one of the most conspicuous elements of the molluscan fauna in the area. It is the possible analog of the Pliocene *Conus trisculptis* Pilsbry and Johnson from Limón, Costa Rica, and may perhaps be an ancestral type of *C. pygmaeus* Reeve, which in rare specimens develops pustular spirals upon the posterior and medial portions of the body. *C. verrucosus* Hwass has the same general type of sculpture but coarser, and unlike that of *C. waltonensis*, the periphery is finely nodulated.

Occurrence: Shoal River formation, localities 3856^{pr}, 2645^{p}, 3732^{c}, 3742^{a}, 3731^{a}, 5080^{c}, 5184^{a}.

Conus waltonensis anodosus Gardner, n. subsp.

Plate XLIII, figure 15

Shell of moderate size, of rather heavy texture and inclined to be stout; relative height of spire ranging as in *C. waltonensis* s. s. from less than one-fifth to one-third of the altitude of the entire shell and the apical angle from approximately 90° to 120°. Whorls 9 or 10 in the adult, closely embracing the suture line, falling a little in front of the periphery of the preceding volution. Nucleus, small, smooth, erect, its two or three component whorls relatively high and flattened laterally. Axial sculpture of conch restricted to incrementals, which are strongest upon the shoulders of the whorls of the spires. Spiral sculpture confined to the anterior half of the body, 6 to 10 fillets or ridges separated by narrower channels usually developed, exclusive of the half dozen crowded lirae upon the anterior canal. Sutures strongly impressed. Aperture rather wide, the margins subparallel. Outer lip deeply emarginate at the shoulder for the protrusion of the posterior siphon. Labrum very thin and parallel to the inner lip. Aperture slightly expanded at the anterior canal, which is broadly and very feebly emarginate.

Dimensions: Maximum height, 20.0±millimeters; altitude of spire, 3.5± millimeters; maximum diameter, 12.0 millimeters.

Holotype: U. S. Nat. Mus. No. 351122.

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

The subspecies differs most radically from *C. waltonensis* s. s. in the nondevelopment of spiral rows of pustules upon the body whorl. In some specimens a few rows are present on the medial portion near the aperture, but commonly they are absent altogether. Transitional forms are less abundant than might be expected in two races, both so prolific within the same area. The subspecies runs a little larger possibly than the species in the strict sense, although the relation is apparently not that of young and adult, since young forms occur with no trace of a nodose sculpture developed upon them, whereas adults, such as Mr. Aldrich's type, occur with nodules from the periphery of the ultima to the anterior canal. The thinness of the outer lip seems to have rendered the form peculiarly suscep-

tible to injury, and repairs have been made on a large proportion of the shells collected.

Occurrence: Shoal River formation, localities 3856[pr], 2645[p], 3731[a], 5080[c], 5184[a], 5195[p], 3742[a].

Conus submoniliferus Gardner, n. sp.

Plate XLIII, figure 16

Shell rather large, moderately heavy. Spire low, a little less than one-sixth of the total altitude. Whorls apparently 10 exclusive of the protoconch, which is broken away, the first 5 whorls converging at an angle of approximately 70°, the last 5 at an angle of about 125°; whorls shouldered, those of the earlier turns oblique, and those of the later not far from horizontal. Suture line deeply impressed, following the periphery of the preceding turn except on the later volutions, where it drops forward a little to reveal the slightly elevated peripheral margin. Spire sculptured with somewhat irregular spiral lirations, 3 on the shoulder of each whorl. Incremental sculpture strong enough to crenulate the spiral minutely. Body whorl feebly inflated in front of the shoulder, so that the maximum diameter does not coincide, as in the majority of the cones, with the outer margin of the shoulder; sculptured on its medial portion, with 7 faint moniliform spirals that grow fainter and, with the exception of the anterior 2 or 3, evanesce before reaching the labrum. Simple, irregular, spiral lirae developed between the 3 or 4 anterior beaded spirals and in front of them, becoming more regular and more crowded toward the anterior extremity. Labrum broken away, probably thin and deeply emarginate at the shoulder. Labium simple, smooth, reinforced at the anterior canal. Canal short, somewhat flaring, truncate.

Dimensions: Maximum height, 40.0± millimeters; length of aperture, 36.0± millimeters; maximum diameter, 25.5 millimeters.

Holotype: U. S. Nat. Mus. No. 351132.

Type locality: No. 3732, Dave Adams Mill Creek, sec. 2, T. 3 N., R. 21 W., Walton County, Fla.

C. submoniliferus suggests a *C. sulculus* that has been influenced by the prolific and coexistent *C. waltonensis* Aldrich to the extent of developing a faint copy of the *C. waltonensis* sculpture.

The type is unique.

The most similar cone in the mid-American faunas is perhaps *C. symmetricus* Sowerby *semiobsoletus* Maury, of the Gurabo formation of the Dominican Republic. The Dominican species is stouter, a little more inflated in front of the periphery, higher-spired, and broader at the base.

Occurrence: Shoal River formation, locality 3732[p].

Conus molis Brown and Pilsbry

1911. *Conus molis* Brown and Pilsbry, Acad. Nat. Sci. Philadelphia Proc., vol. 63, p. 343, pl. 23, fig. 1.

A large, ponderous cone resembling *C. promethus* in figure, the ratio of diameter to length as 1 : 1.7.

Spire but little raised except at the center, where the early whorls project in a short acute cone. Whorls about 13, the earlier 6 flat, later whorls concave, spirally striate with about 5 striae between the seamlike sutural margins; crossed by weak growth lines, which are not very deeply arcuate. The shoulder of the last whorl is subacute. Side strongly convex below the angle, then straight, finely striate spirally throughout, the lower third coarsely striate. Aperture as in *C. haytensis* Sowb.

Length, 124, diameter, 71.2 millimeters.—Brown and Pilsbry, 1911.

Holotype: No. 5502, Princeton University.

Type locality: Monkey Hill, Gatun, Panama.

A single worn fragment, obviously of a very large cone and differing in no essential from Brown and Pilsbry's striking species, was collected half a mile east of Oak Grove on the Yellow River.

Occurrence: Oak Grove sand, locality 2646[r].

Conus draperi Maury

1910. *Conus draperi* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 5, pl. 1, fig. 4.

Shell large, surpassing in size all the other species of the genus yet found in the Chipola beds. General form conic, with 8 whorls exclusive of the eroded nucleus; spire moderately elevated, not convex in profile; last whorl distinctly shouldered; surface of shell eroded in small circular spots, which may be an indication that the original color pattern consisted of small dark spots on a light ground. Transverse sculpture lacking except for faint lines near the base of the shell; lines of growth inconspicuous. Length of shell 60; greatest width 38 millimeters.

Chipola marls, Baileys Ferry, Calhoun County, Fla.

Cornell University collection.

Named in honor of Mrs. Henry Draper of New York City.—Maury, 1910.

The type has not been examined but the description and figure indicate a shell rather similar to *C. demiurgus* Dall but broader relatively and less angular. Perforations similar to those mentioned in the description occur in other species—such as *C. proteus* Hwass, which persists into the Recent fauna—and are apparently made by a boring sponge. In *C. proteus* they bear no relation whatever to the color pattern.

Occurrence: Chipola formation, Cornell University collection.

Conus nemorideditus Maury

1910. *Conus nemorideditus* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 5, pl. 1, fig. 5.

Shell large, smooth, thin in proportion to its size; whorls 8 exclusive of the eroded nucleus; spire moderately elevated, not concave in profile, last whorl of the shell full and rounded near the shoulder and tapering rapidly to a rather slender base. Spiral sculpture consisting only of rather faint raised lines on the lower one-third of the shell; lines of growth inconspicuous. Length of shell 70; greatest width 42 millimeters.

This is the largest species of *Conus* found in either the Oak Grove or Chipola beds. Only one specimen was obtained.

Oak Grove, Florida.

Cornell University collection.—Maury, 1910.

This species does not appear in the later collections.

Occurrence: Oak Grove sand, Cornell University collection.

Family CANCELLARIDAE

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.)

Shell of moderate dimensions, usually rather heavy and stout, ovate-conic, or rarely fusoid or oliviform in outline. Spire usually low, commonly scalar. Protoconch smooth, naticoid, generally thrice coiled. Whorls of conch rarely exceeding 6, generally only 3 or 4. Sculpture normally cancellate, the axial sculpture rarely obsolete, the axials usually narrow and inclined to be irregular in size and spacing, the spirals commonly low and flattened upon their summits. Sutures impressed. Aperture obliquely lenticular. Outer lip thickened, lirate within. Parietal wall more or less thickly glazed. Columella heavily plicate, the 2 or 3 folds placed about midway between the extremities of the aperture; the posterior, as a rule, the most prominent and the most nearly horizontal, that in front of it less elevated and more oblique in its external aspect. Margin of pillar usually elevated into a relatively feeble plication, which may persist within the aperture or may, as in *C. reticulata*, be restricted to the apertural face of the pillar. Anterior canal typically narrow, short, twisted, nasute in aspect. Umbilicus perforate or imperforate, generally with a narrow chink between the reverted labium and the arched anterior fasciole, which functions as an umbilical keel.

No true Cancellarias have been found in strata older than the Tertiary, although the genus is well differentiated early in the Tertiary. The recent species probably number between 150 and 200. They are, for the most part, denizens of the inshore waters of the warm temperate and tropical seas.

The Alum Bluff quota is large both in number of species and individuals. Seventeen species have been recognized. Of this number 10, or more than 50 percent, occur in the Shoal River fauna—one of them, *C. waltoniana*, very abundantly; another, *C. pinguis*, is common at the type locality; and all of the remainder are represented by several individuals. *C. druidarum* and possibly *C. runchaena*, are present in the Oak Grove. Two other species occur in the Oak Grove fauna and are largely restricted to it. The most common of them, *C. druidarum*, is the analog of *C. waltoniana* of the Shoal River fauna and of the common Chipola species. The Chipola Cancellarias are rather meager, only 5 species being present and only one of them, *C. paramoorei*, at all commonly.

Margin of pillar elevated to form a more or less well-defined fold, which may or may not be continued within the aperture:
- Umbilicus imperforate:
  - Outline not conspicuously scalariform; axials exceeding 20 upon the body ..... *Cancellaria defuniak* Gardner, n. sp.
  - Outline conspicuously scalariform; axials not exceeding 20 upon the body:
    - Periphery obscurely nodulated by the axials; primary spirals usually exceeding 4 in front of the periphery of the penult ..... *Cancellaria subtiarophora* Gardner, n. sp.
    - Periphery not nodulated by the axials; primary spirals rarely exceeding 4 in number in front of the periphery of the penult ..... *Cancellaria waltoniana* Gardner, n. sp.
- Umbilical perforation reduced to a narrow chink between the reverted labium and the anterior fasciole:
  - Axial sculpture initiated at the opening of the conch:
    - Marginal fold not continued within the aperture:
      - Axials acute or acutely rounded, more or less irregular and incremental in character, usually exceeding 10 on the later whorls of the adult:
        - Outline angular or rounded; axials rarely exceeding 16 upon the body:
          - Axials not conspicuously stronger and more distant upon the penult than upon the ultima; spirals commonly more or less irregular in size and spacing:
            - Spire scalariform, the whorls obtusely angulated at the shoulder; spirals very low and flat. *Cancellaria waltoniana* Gardner, n. sp.
            - Spire not scalariform, whorls broadly rounded; spirals moderately elevated, flattened upon their summits:
              - Outline not conspicuously stout; altitude of adult exceeding 10 millimeters; denticles developed in adult between the posterior columellar fold and that in front of it. *Cancellaria druidarum* Gardner, n. sp.
              - Outline conspicuously stout, altitude of adult not exceeding 10 millimeters; denticles not developed in adult between the posterior columellar fold and that in front of it. *Cancellaria stibara* Gardner, n. sp.
          - Axials conspicuously stronger and more distant upon the ultima than upon the penult; spirals equal and conspicuously close and regular in arrangement ..... *Cancellaria mitrodita* Gardner, n. sp.
        - Outline plump and smoothly rounded; axials usually exceeding 16 on the later whorls of the adult. *Cancellaria pinguis* Gardner, n. sp.
      - Axials obtusely and commonly broadly rounded, rarely exceeding 10 on the later whorls of the adult:
        - Axials conspicuously stronger and more distant upon the ultima than upon the penult; spirals equal and conspicuously close and regular in arrangement ..... *Cancellaria mitrodita* Gardner, n. sp.
        - Axials not conspicuously stronger and more distant upon the ultima than upon the penult; interspiral areas usually as wide or a little wider than the spirals:
          - Altitude of adult exceeding 10 millimeters ..... *Cancellaria spherotopleura* Gardner, n. sp.
          - Altitude of adult not exceeding 10 millimeters ..... *Cancellaria bifoliata* Aldrich.

Margin of pillar elevated to form a more or less well-defined fold, which may or may not be continued within the aperture—Con.
Umbilical perforation reduced to a narrow chink between the reverted labium and the anterior fasciole—Continued.
Axial sculpture initiated at the opening of the conch—Continued.
Marginal fold continued within the aperture:
Secondary spirals not regularly developed between each pair of primaries:
Axials acute, primary spirals usually 5 upon the penult; labrum denticulate within.
Cancellaria aldrichi Gardner, n. sp.
Axials obtuse, primary spirals usually 3 or 4 upon the penult; labrum lirate within.
Cancellaria paramoorei Gardner, n. sp.
Secondary spirals regularly developed between each pair of primaries.....*Cancellaria desmotis* Gardner, n. sp.
Axial sculpture not initiated at the opening of the conch:
Axial sculpture usually initiated near the close of the first whorl of the conch, axials well elevated upon the ultima.
Cancellaria ancycla Gardner, n. sp.
Axial sculpture not initiated upon the first whorl of the conch, axials usually low and incremental in character even upon the ultima.....*Cancellaria runchaena* Gardner, n. sp.
Umbilical funnel moderately wide; the peristome adnate to the body wall for a distance of a little more than a single intercostal area.....*Cancellaria* (*Trigonostoma*) *sphenoidostoma* Gardner, n. sp.
Margin of pillar not elevated:
Outline fusoid; spire scalariform; axials normally 9 or 10 upon the later whorls; primary spirals 3.
Cancellaria (*Narona*) *atraktoides* Gardner, n. sp.
Outline oliviform; axial sculpture not developed excepting for incrementals; entire surface of conch closely and evenly banded spirally.....*Cancellaria* (*Aphera*) *waltonensis* (Aldrich).

Subgenus CANCELLARIA s. s.

Type: *Voluta reticulata* Linnaeus. (Recent off the coast of Florida and the West Indies.)

Shell of moderate dimensions, heavy and stout, ovate or ovate-conic in outline; spire rather low, commonly scalariform; protoconch smooth, naticoid, coiled about 3 times; whorls of conch not very numerous, rapidly enlarging; sculpture more or less cancellate, the axials usually narrow and commonly irregular in size and spacing, spiral sculpture overriding the axial, the spirals usually rather low and flat; aperture oblique; outer lip thickened, lirate within; parietal wall glazed; columella heavily plicate, the marginal fold rarely persistent within the aperture, the medial fold oblique, the posterior the most elevated and the most nearly horizontal; anterior canal narrow, short, slightly twisted, nasute; umbilicus imperforate or narrowly perforate.

Cancellaria defuniak Gardner, n. sp.

Plate XLIV, figures 1, 2

Shell rather large and heavy, moderately stout. Whorls of the spire numerous, narrowly and obtusely tabulated, trapezoidal in front of the tabulation; body whorl sharply constricted basally. Volutions a trifle less than 10 in all; protoconch coiled 4 times, the conch not quite 6; protoconch naticoid, entirely smooth, highly polished; initial turn minute, largely immersed; succeeding volutions increasing rapidly in diameter and altitude. Dividing line between conch and protoconch very sharp, marked by an oblique retractive break in the texture of the shell and by the initiation of the sculpture, both axial and spiral. Axials more or less incremental in character, narrow but rather abruptly elevated, for the most part uniform in prominence between the sutures, though weakening a little on the narrow posterior tabulation, slightly retractive, flexuous and evanescent upon the base of the body, subequal except for a varicose rib here and there, separated by intercostals of approximately the same width, 25 upon the penult of the type, 30 upon the ultima. Spiral sculpture crowding the entire surface of the conch, the spirals low, flat but sharply defined fillets overriding the costals in fresh specimens. The primaries equal and equispaced, 7 upon the penult in the type and 15 upon the ultima; the spirals a little more closely spaced than the axials so that the areas inclosed between them appear as narrow rectangular pits; secondaries intercalated more or less fortuitously upon the body, the concave depression that cuts off the body from the anterior fasciole girded with 5 additional bands, more or less wrinkled and a little lower and narrower than the primaries; feeble secondaries intercalated between each pair. Fasciole obscurely sulcate but not lirate. Incremental striae least feeble near the posterior suture and upon the base of the body. Sutures distinct, impressed, minutely undulated by the costae of the preceding volution. Aperture rather narrow for the group, oblique, its outline obscured by the heavy armature. Labrum broadly arcuate, finely crenate along the edge in harmony with the external spirals, lirate within, the lirae rather short for the group, obsolete at some little distance from the margin of the outer lip and not produced very far within the throat, 8 in the type, the posterior and the 3 anterior lirae the most elevated. Body sharply constricted at the base. Parietal wash too thin to conceal the sculpture; posterior fold more elevated than that in front of it, flattened upon its summit at the mouth of the aperture, nearly horizontal; fold in front a little less prominent, parallel but more produced externally and flexed at its extremity until it almost parallels the margin; edge of the pillar raised to form an obtuse

marginal fold, which is not, however, produced within the aperture. Reverted pillar lip completely filling the crescentic area left by the arched anterior fasciole. Anterior canal short, nasute, recurved.

Dimensions: Height, 21.7 millimeters; length of aperture, 13.7 millimeters; maximum diameter, 12.4 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 352079.

Type locality: No. 5618, 3½ miles southwest of De Funiak Springs, Walton County, Fla.

Cancellaria runchaena, the only other Alum Bluff species of similar dimensions, is much stouter relatively. The whorls are fewer and more rounded in outline, the axial sculpture is not developed on the earliest whorls of the conch, and the umbilicus is narrowly perforate.

Cancellaria defuniak, one of the large and intimately related group represented in the Recent fauna by *C. reticulata* (Linnaeus), is close to *Cancellaria dariena* Toula of the Gatun fauna of the Canal Zone. The most obvious difference is in the form. The Panamanian species is larger and coarser, and the body whorl is less constricted basally.

Cancellaria defuniak has not been reported except from the type locality.

Occurrence: Shoal River formation, locality 5618[p].

Cancellaria subtiarophora Gardner, n. sp.

Plate XLIV, figures 3, 4

Shell of moderate size, rather heavy; aperture little more than half the entire length of the shell. Spire scalariform, the whorls rather numerous, conspicuously tabulated, the shoulder upon the later volutions more than one-third the height of the entire whorl; whorls 8½ in all, 5 of them included in the conch. Protoconch small, moderately elevated, polished in fresh specimens, smooth except for exceedingly faint spirals near its close, coiled 3½ times; initial turn minute, broadly rounded, almost entirely submerged; 2 succeeding volutions increasing rapidly in diameter, broadly and smoothly rounded; final half turn of protoconch somewhat flattened. Bounding line between conch and protoconch obscure, indicated by the introduction of the axial sculpture and by the rapid strengthening of the spiral, which is first developed upon the protoconch. Axials narrow, sharp, more or less irregular in size and spacing, separated for the most part by wider interspaces, subnodose at the periphery, feebly retractive upon the spire, inclined to be obsolete directly in front of the suture and evanescent upon the pillar, 17 on the last two whorls of the type. Spirals low and flat, very regular in size and spacing, 4 or 5 in front of the periphery of the penult of the type, 13 upon the body exclusive of the base and pillar; peripheral spiral a little wider and more elevated than those in front of it; sublinear secondaries here and there intercalated; spirals overriding the axials in perfectly fresh individuals but usually worn off from their summits; shoulder spirals 3 or 4, running nearer to the periphery than to the suture, the anterior shoulder spiral approximating the peripheral in prominence; base of body and pillar wound with 9 narrower bands, equal in size and equispaced; 3 additional and wider fillets upon the anterior fasciole, evanescing toward the aperture. Sutures distinct, feebly impressed. Aperture obliquely lenticular, the outline obscured by the oral armature. Outer lip obtusely angulated at the periphery, broadly arcuate, thin edged, plicate within, 7 plicae, not persistent to the margin, becoming increasingly more elevated and more produced posteriorly. A feeble internal ridge also developed directly in front of the posterior commissure, persisting far within the aperture. Parietal wash very thin, not sufficient to conceal the body sculpture. Columellar folds very heavy, the posterior sharply elevated, almost horizontal, that in front of it a little less prominent, parallel to the posterior fold within the aperture but flexed parallel to the margin near its outer extremity; edge of pillar raised at the mouth into an obscure fold, which does not persist within the aperture. Anterior canal short and twisted, obliquely truncate at its extremity. Umbilicus entirely concealed.

Dimensions: Height, 22.8 millimeters; length of aperture, 14.7 millimeters; maximum diameter, 13.3 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 351237.

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

Cancellaria subtiarophora is readily separable from its congeners by the scalariform outline, sharp, rather irregular axial sculpture, very close and regular spirals, and the subnodose protuberances that crown the periphery at the intersection of the axials and the spirals. *Cancellaria waltoniana* has less numerous and elevated axials, lower, flatter, and less closely spaced spirals, a crenulate but not a coronate periphery, a marginal pillar fold that persists within the aperture, a less developed anterior canal, and usually an umbilical chink. Furthermore, it is exceedingly prolific, whereas *C. subtiarophora*, though not rare, is far from abundant.

Occurrence: Shoal River formation, localities 3856[p], 3742[p], 5195[r], 3748[r].

Cancellaria waltoniana Gardner, n. sp.

Plate XLIV, figures 5, 6

Shell of moderate size for the genus, subovate in outline. Spire rather low, scalariform; whorls obtusely tabulated, increasing rapidly in diameter; sides of the whorl, including the body, flattened, the body abruptly constricted at the base. Whorls of the conch 4, the protoconch coiled 3½ times, nearly smooth and highly polished in perfectly fresh individuals; initial turn of protoconch minute, somewhat inflated, almost entirely

submerged; succeeding volutions increasingly elevated; exceedingly faint and obscure spiral lirae introduced upon the final half turn, continued across upon the conch as low but sharply defined spiral fillets. Line of demarcation between the conch and protoconch indicated by a change in the texture of the shell, the contour of the whorl, and the introduction of the well defined spiral and axial sculpture. Axial sculpture somewhat irregular over the entire shell, suggesting a very strong and slightly modified incremental sculpture. Costae acute upon their summits, feebly retractive or flexuous, 12 on each of the later whorls of the type, including the body, separated by wider, feebly concave intercostal areas. Spiral sculpture of low, flattened, straplike fillets overriding the costals, approximately equal and regularly spaced in front of the periphery, 3 or 4 upon the penult, not counting the peripheral fillet, and about twice as many upon the body between the periphery and the pillar; peripheral spiral usually a little wider than those in front of it and isolated by a relatively wide interspiral; interspirals for the most part only a little wider than the spirals except upon the base of the body, where they are fully twice as wide; fortuitous secondaries introduced in places; shoulder spirals usually 3, increasingly stronger toward the periphery, the anterior of the shoulder spirals commonly almost as prominent as the peripheral; pillar and anterior fasciole similarly threaded with 6 to 9 low, flat, rather ill-defined rugose spirals. Incrementals for the most part microscopically fine, taking the same direction as the axials. Suture line distinct, impressed. Aperture decidedly more than half as high as the entire shell, moderately wide. Outer lip thin edged, obtusely angulated at the shoulder, broadly arcuate, lirate within, the 7 lirae very sharply defined both vertically and horizontally, increasingly less elevated and less produced anteriorly, not persistent to the outer edge. Inner margin of aperture abruptly constricted basally. Parietal wash very thin, not sufficient to conceal the body sculpture. Pillar heavily plicate, the posterior fold strongly and sharply elevated, approximately horizontal, not carried to the margin of the wash; medial fold oblique, not quite so prominent but more produced than that behind it; anterior fold marginal, the least elevated of the 3, produced externally as far as that behind it but evanescent within the aperture after a little more than a single turn; 1 or 2 irregular denticles commonly developed between the posterior and medial folds. Anterior extremity fashioned into an incipient canal. Umbilical chink not entirely closed, as a rule, by the reverted pillar lip.

Dimensions: Height, 14.0 millimeters; length of aperture, 8.6 millimeters; maximum diameter, 8.5 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 351242.

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

Cancellaria waltoniana is one of the most prolific of the Shoal River univalves. The young are stouter relatively than the adults, but the adults are rather uniform in outline. The axials have a moderate range of variation in number and character. The spirals in front of the periphery may run up to 6 upon the penult and to 12 or 13 upon the body, but the straplike character is constant.

Cancellaria subtiarophora is obscurely coronated at the periphery by the subnodular intersections of the axials and spirals; the axials are also sharper and more numerous than in *waltoniana*, the spirals not quite so low, more regular, and more closely spaced; the anterior canal is better developed; the umbilicus is entirely concealed; there are no denticles developed between the anterior and medial columellar folds, and the marginal fold is not produced within the aperture.

Cancellaria pinguis is smaller and stouter, the spire is lower and its component whorls more rounded. The axials in *C. pinguis* are very numerous, usually 25 to 30 or more upon the body, and the spirals are also more numerous and more regularly spaced. The columellar folds are equal in elevation to those of *C. waltoniana* but they are much broader and flattened upon their summits.

Cancellaria druidarum is typically a larger and heavier shell than *C. waltoniana*. The whorls are more rounded and the tabulation narrower, so that the spire has not the scalariform aspect that characterizes *waltoniana*. The axials of *C. waltoniana* are not quite so elevated but more acute and more uniform in size and spacing. The spirals are lower, flatter, and more closely spaced and usually number 1 more upon the penult; the umbilical chink is also narrower than in the Oak Grove species.

The larger, coarser *Cancellaria springvaleënsis* Mansfield from the upper Miocene of Trinidad has much in common with the Shoal River species.

Occurrence: Shoal River formation, localities 3856^{pr}, 3732^{r}, 3742^{pr}, 3731^{r}, 5184^{c}, 5195^{r}, 2238^{r}, 3748^{p}, 7264^{r}, 5618^{r}.

Cancellaria druidarum Gardner, n. sp.

Plate XLIV, figures 7, 8

Shell of average size and build, stout, fusiform in outline. Spire moderately elevated, the component whorls rounded, trapezoidal, numerous, very narrowly and obscurely tabulated, increasing regularly in diameter and with moderate rapidity. Volutions between 9 and 10 in all, the conch performing a little more or a little less than 5, the smooth, highly polished protoconch about 4½. Initial turn of protoconch minute, inflated, immersed at the tip, succeeding volutions increasing regularly in altitude and diameter, strongly convex, and constricted at the sutures except near the close of the protoconch, where the whorl flattens out. Line of division between the conch and protoconch clearly defined, marked by a change in the texture of

the shell and by the abrupt initiation of the sculpture both axial and spiral. Axials similar and more or less incremental in general character over the entire surface of the conch; axials narrow, acutely rounded, retractive, uniform in prominence between the sutures except upon the posterior tabulation, where they are inclined to weaken, persistent upon the ultima almost to the anterior fasciole, unequal in size and more or less irregular in spacing, 14 upon the penult and ultima of the type but running down to 11 and up to 16 in other individuals. Spiral sculpture more regular than the axial, equally developed upon the costal and the intercostal areas; primaries moderately elevated, straplike fillets overriding the costals, usually 4 upon the penult and from 8 to 10 upon the body, the posterior primary a little more isolated than those in front of it; interspirals squarely channeled, usually a little wider than the spirals; a secondary intercalated in some shells in the interspace between the two posterior primaries and another near the base of the body; 1 or 2 feeble spirals also developed between the posterior primary and the posterior suture; extreme base of the body and the basal sulcus girded with 2 to 4 spirals, narrower and sharper than the primaries; fasciole coarsely threaded with an equal number, similar in character but more closely spaced. Suture line distinct, undulated by the costae of the preceding volution. Height of aperture less than two-thirds the entire altitude of the shell, the outline obliquely lenticular, the angle at the posterior commissure obtuse. Outer lip broadly and symmetrically arched, finely crenated along the margin in harmony with the spiral sculpture, lirate within, the 8 lirae more prominent and more distantly spaced posteriorly. Excavation at the base of the body abrupt. Parietal wash not sufficiently heavy to conceal the sculpture. Columellar plications prominent; posterior fold shelflike, nearly horizontal, expanding near its extremity; fold in front of it more produced, less elevated, parallel with it internally but sharply flexed at the entrance to the aperture to parallel the edge of the pillar, which is raised into a pseudomarginal fold; irregular denticles developed between the posterior fold and that in front of it. Anterior extremity of the aperture compressed into a narrow nasute canal. Anterior fasciole arched, crescentic, the umbilical area between it and the reverted pillar narrowly perforate.

Dimensions: Height, 16.8 millimeters; length of aperture, 10.7 millimeters; maximum diameter, 9.8 millimeters.

Holotype and paratype: U. S. Nat. Mus. 350245.

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

Cancellaria druidarum, though less abundant, occupies much the same relative position in the Oak Grove fauna as does its Shoal River analog, *Cancellaria waltoniana*. The Shoal River species does not attain the maximum dimensions of *C. druidarum;* the whorls are more strongly tabulated posteriorly and less rounded medially; the axials are less elevated, a little more acute, and more regular in size and spacing. The spirals are lower, flatter, commonly more numerous, and usually more closely spaced. The lirae upon the inner lip are usually less by one or two, and the umbilical chink is even narrower than in *C. druidarum.*

The Chipola analog, *C. paramoorei*, is stouter relatively, the whorls of the spire more rounded and more strongly constricted at the sutures, the body more strongly constricted at the base. The aperture is also narrower, the posterior labial fold is not expanded near its extremity as in *C. druidarum*, and the marginal fold persists for some distance within the aperture.

The coexistent *C. stibara* is much lower and stouter, with fewer, more rapidly enlarging volutions, broader and more irregular axials, and lower, flatter spirals. The anterior fasciole of *C. stibara* is also more strongly arched and the umbilical perforation wider.

Occurrence: Oak Grove sand, localities 2646^{c}, 5632^{p}, 5631^{r}, 5633^{r}, 7054^{r}, 7055^{r}. Shoal River formation, locality 5079^{p}.

Cancellaria stibara Gardner, n. sp.

Plate XLIV, figures 9, 10

Shell small but rather heavy and stout. Spire very low, less than one-half the total height, the component whorls few, rounded, trapezoidal, increasing very rapidly in diameter; body whorl relatively large, inflated, strongly constricted at the base. Total number of volutions a little less than 7, the conch performing between 3 and 3½, the small, smooth, highly polished protoconch an equal number. Initial turn of protoconch inflated, immersed at the tip; succeeding volutions increasing regularly and rapidly in altitude and diameter. Bounding line between conch and protoconch sharply defined, marked by a change in the texture of the shell and by the abrupt initiation of the sculpture. Axials similar in general character over the entire conch, narrow, rounded upon their summits, retractive, persistent from suture to suture and on the body well down to the base, 11 or 12 upon the penult and ultima of the type, running up to 14 on other individuals, about 3 of that number, including the terminal rib, broader and heavier than the rest; intercostal areas concave, of approximately the same width as the costals. Spiral sculpture less conspicuous than the axial but well developed over the entire conch; primaries consisting of sharply delimited but not strongly elevated, flattened lirae, equal in size and equispaced by slightly wider interspirals, uniform in prominence upon the costal and intercostal areas, 3 or 4 upon the whorls of the spire, running up to 5 on other individuals and twice as many upon the body exclusive of the base; secondaries not intercalated; 1 or 2 less prominent threads usually developed between the posterior primary and the posterior suture;

base of body of type girded with 4 lirae slightly narrower than the primaries behind them but more elevated and more distantly spaced; anterior fasciole coarsely threaded with 4 additional lirae. Suture lines distinct, impressed, undulated by the costae of the preceding volution. Aperture more than half the height of the entire shell, moderately wide, obliquely lenticular in outline, the outline obscured, however, by the heavy armature. Outer lip quite strongly arched, heavily lirate within, the 8 lirae in the type persistent almost to the margin of the labrum, produced far within the throat, the posterior and the 4 anterior slightly less elevated and not so distantly spaced as the 3 intermediate lirae. Body whorl abruptly excavated at the base. Parietal wash very thin, scarcely sufficient to obscure the heavy basal spirals. Columella biplicate, the folds developed a little more than halfway from the posterior to the anterior extremity of the aperture. Posterior fold horizontal, much the more prominent of the two, expanding slightly at its termination; anterior fold less elevated than that behind it, parallel with it internally but flexed near its extinction to parallel the obscure pseudoplication that is developed in front of it on the edge of the pillar just at the mouth of the aperture. Anterior canal short, narrow, recurved. Anterior fasciole strongly arched, crescentic. Umbilicus narrowly perforate between the reverted labium and the arcuate fasciole.

Dimensions: Height, 7.5 millimeters; length of aperture, 4.9 millimeters; maximum diameter, 5.6 millimeters.

Holotype: U. S. Nat. Mus. No. 350251; paratype, U. S. Nat. Mus. No. 371399.

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

The less rare *Cancellaria bifoliata* Aldrich is relatively higher and more slender, the axials are less numerous, a little sharper, and more regular in size and spacing, the spirals are broader and more closely spaced, the aperture is not so choked with labral folds and labial plications, and the umbilical perforation is much narrower.

Occurrence: Oak Grove sand, localities 2646[r], 5632[r].

Cancellaria mitrodita Gardner, n. sp.

Plate XLIV, figure 11

Shell of moderate dimensions, rather angular in outline. Spire approximately half as high as the entire shell, scalariform in outline, the component whorls narrowly tabulated posteriorly, approaching the vertical in front of the shoulder; body very broadly rounded, abruptly constricted at the base. Whorls 7 in all; spire somewhat decorticated in the apical region so that the boundary line between the conch and protoconch is obscured but probably falling, so that 4 of the 7 whorls are included in the conch and 3 in the protoconch. Protoconch small and smooth, naticoid in outline; initial turn minute, almost entirely submerged; succeeding volutions increasing regularly and rapidly in diameter and altitude. Conch ornamented with both axial and spiral sculpture. Axials feebly retractive, narrow, not very strongly elevated, obtuse upon their summits, more or less irregular in size and spacing, becoming increasingly stronger and more distant anteriorly, 12 in number upon the antepenult of the unique type, 11 upon the penult, and 9 upon the ultima; intercostal areas broadly concave, varying in relative and absolute width; spiral sculpture regular in its development over the entire shell. Spirals rather narrow, moderately elevated; fillets equal and equispaced, uniform in prominence upon the costal and intercostal areas, the primaries 6 in number upon the later whorls of the spire and twice as many upon the body, those upon the base of the body a little narrower and more distantly spaced, separated normally by squarely channeled interspirals of approximately the same width; 1 to 3 narrower and less elevated spirals intercalated between the posterior primary and the posterior suture; basal sulcus and the anterior fasciole girded with 5 spirals similar in character to those upon the base of the body; interspiral areas rather coarsely striated by the incrementals. Suture lines inconspicuous, undulated in harmony with the costals of the preceding volution. Aperture rather wide, slightly oblique. Outer lip obtusely angulated at the shoulder, flaring anteriorly but almost straight medially, finely crenate at the edge, dentate within, the denticles elongated normal to the margin, becoming increasingly finer and more closely spaced anteriorly, 8 in front of the shoulder, a ninth directly beneath the suture line. Body excavated at the base, heavily glazed columella strongly plicate, the posterior fold the most prominent, approximately horizontal; fold in front of it broader but not so elevated and slightly twisted forward near its extremity; margin of pillar raised into an obscure fold which does not persist within the aperture; anterior canal short, twisted, nasute; anterior fasciole strongly arched, crescentic, the umbilical area included between it and the reverted pillar narrowly perforate.

Dimensions: Height, 14.2 millimeters; length of aperture, 8.5 millimeters; maximum diameter, 8.5 millimeters.

Holotype: U. S. Nat. Mus. No. 371400.

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

Cancellaria mitrodita may be isolated by its clean-cut, rather angular outline, relatively feeble axial sculpture, and very regular and well-developed spiral sculpture. No species in the Chipola fauna is sufficiently close to cause confusion. A possible analog is *C. subtiarophora* of the Shoal River fauna, a larger form ornamented with more elevated axials, which are subnodose at the periphery, and with lower, broader spirals.

Occurrence: Chipola formation, locality 3419[r].

Cancellaria pinguis Gardner, n. sp.

Plate XLIV, figures 12, 13

Shell rather small, solid, and very plump, the spire low, the body relatively large and full; later volutions narrowly and obtusely tabulated, broadly convex in front of the tabulation. Whorls 7 in all, the conch thrice coiled, the protoconch rather large, smooth, naticoid in outline, of 4 component volutions. Initial turn minute, flattened, almost entirely submerged, the two succeeding volutions increasing rapidly in diameter and elevation, smoothly rounded but flattened posteriorly; final turn of protoconch more evenly and less strongly convex. Line of demarcation between conch and protoconch retractive, indicated by a slight change in the texture of the shell and by the initiation of the axial and spiral sculpture. Axials incremental in character, rather sharp, strongly retractive, and about 15 upon the first turn of the conch, irregular in size and spacing and more than double that number upon the body of the type. Spiral sculpture of low, flattened fillets approximately equal and regular in size and spacing, usually 6 or 7 upon the whorls of the spire and 15 or 16 upon the body, including the base, the posterior spirals usually a little wider and more distantly spaced than those in front of them; interchannels straight-sided, sharply defined, of approximately the same width as the spirals; 3 or 4 additional spirals upon the well-arched anterior fasciole. Suture line distinct, impressed, finely crenulated by the costae of the preceding volution. Aperture rather wide, more than half as high as the entire shell, obtusely angulated at the posterior commissure. Outer lip strongly arcuate, minutely crenulated at the margin, the notches corresponding in number and position to the interspiral areas; 6 internal lirae, prominent, not persisting to the margin but produced for some distance within; a second series of lirations, the site of a former labrum, visible far within the aperture; a rather prominent ridge also developed on the parietal wall directly in front of the commissure. Inner margin of aperture deeply excavated at the base of the body. Parietal wash very thin, not sufficient to conceal the sculpture. Columella conspicuously plicate, the posterior fold the most strongly elevated, flattened upon its summit and horizontal; the fold in front of it slightly less elevated but also flattened upon its summit and horizontal except near the extremity, where it is sharply flexed parallel to the pillar; an elongated denticle simulating a marginal fold developed upon the edge of the pillar; one or two denticles usually developed, too, between the posterior and the medial plications. Anterior extremity of the aperture compressed into an incipient canal. Umbilical chink barely visible between the reverted labial callus and the crescentic fasciole.

Dimensions: Height, 11.3 millimeters; length of aperture, 7.5 millimeters; maximum diameter, 7.8 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 351254.

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

Cancellaria pinguis is a smaller, stouter shell than *C. waltoniana*, the spire is lower and more rounded, the axial sculpture is much closer and less regular, and the spirals narrower, more numerous, and more evenly spaced posteriorly. One of the most constant differences, too, is in the columellar folds; those of *C. pinguis* are very broad and flattened upon their summits; those of *C. waltoniana* much narrower and more acute.

Cancellaria pinguis is abundant at the type locality but rather rare elsewhere.

Occurrence: Shoal River formation, localities 3732^{r}, 3742^{c}, 5184^{r}.

Cancellaria spherotopleura Gardner, n. sp.

Plate XLIV, figures 14, 15

Shell of moderate size for the genus, subovate to ovate-conic in outline, the spire differing widely in elevation in different individuals and the maximum diameter ranging from a little more than half to approximately two-thirds the total altitude. Whorls of conch broadly rounded, 4 in the stouter forms, 5 in the more slender. Protoconch of moderate size, smooth except for exceedingly faint spiral striations near its close, polished, coiled 3½ times; initial turn minute, almost entirely immersed; succeeding volutions broadly rounded, increasing rapidly in diameter and elevation. Dividing line between conch and protoconch very distinct, marked by a sharp break in the texture of the shell, the initiation of the axial sculpture and of 6 or 7 flattened spiral lirae, 4 or 5 of them equal and equispaced, the 2 posterior spirals more feeble and less regular in arrangement. Axials increasing very rapidly in breadth and elevation; in their typical development, inflated, undulatory, more or less irregular in size and spacing, feebly retractive, usually 7 to 9 upon the later whorls. Incrementals finely striating the interspiral areas, less distinct upon the summits of the spirals. Spirals prominently elevated, flattened cords, equisized and equispaced, overriding the costals with undiminished vigor, the primaries usually 5 or 6 upon the penult and 7 upon the ultima, exclusive of those upon the base; fortuitous linear secondaries rarely intercalated upon the body; 1 to 3 less elevated spirals also developed upon the rounded shoulder, the anterior of these the most prominent; basal spirals narrower and not quite so high as those upon the medial portion of the body, usually 4; the 4 or 5 lirae upon the anterior fasciole even lower and narrower and more or less

crinkled by the incrementals. Suture line commonly rather deeply impressed, strongly undulated by the costate of the preceding volution, the posterior portion of the succeeding volution arching away from it. Aperture lobate, attenuated anteriorly, almost vertical. Outer lip broad, arcuate, lirate within, 6 lirae, weakening slightly anteriorly, not persistent to the outer edge but extending far within the throat. Posterior portion of aperture broadly rounded, a single ridge commonly developed at the commissure. Inner wall of aperture sharply excavated at the base of the body. Parietal glaze heavy. Columellar plications vigorous, the posterior the most prominent, approximately horizontal, the one in front of it much less conspicuous and slightly flexed near its outer extremity, the anterior feeble and ill-defined, not persistent within the aperture. Anterior extremity of the aperture constricted into an incipient canal. Umbilicus narrow, perforate, the anterior fasciole curving around it to form an obtuse crescentic keel.

Dimensions: Height of holotype, 13.8 millimeters; length of aperture, 7.3 millimeters; maximum diameter, 8.7 millimeters. Height of paratype, 13.8 millimeters; length of aperture, 5.4 millimeters; maximum diameter, 7.5 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 351259.

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

Despite the variation in general proportion *C. spherotopleura* may be readily isolated by the broadly rounded, elevated costals, prominent, overriding spirals, the configuration of the aperture, and the perforate umbilicus.

Cancellaria bifoliata Aldrich, the analog in the Oak Grove fauna, is smaller and less solid and does not include quite so many whorls. The ribs are not so broad as those of *C. spherotopleura* and run 8 to the whorl. The spirals are a little sharper, and the umbilical perforation is much narrower.

Cancellaria alternata Conrad, of the Miocene of Maryland, is very similar in contour and sculpture but differs widely in the characters of the aperture.

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

Cancellaria bifoliata Aldrich

Plate XLV, figure 1

1903. *Cancellaria bifoliata* Aldrich, Nautilus, vol. 16, p. 101, pl. 4, fig. 24.

Shell small, whorls 6, first 2 smooth, the third partially so, and the last three strongly cancellated. The ribs prominent, spiral lines alternately coarse and fine. Umbilicus open, pillar lip with two plaits. Shell appears to be turreted from the strong ribbing.

Length, 7 millimeters, breadth, 4 millimeters.

Locality: Oak Grove, Fla., Oligocene of Dall.

This little species differs from *C. mississippiensis* Con in its less number of plaits on the pillar, its higher spire, and open umbilicus.—Aldrich, 1903.

Topotype: U. S. Nat. Mus. No. 371401.

The whorls of the conch are convex and may exceed 4; the small smooth, highly polished protoconch is coiled between 3 and 3½ times. The initial turn of the protoconch is minute and for the most part submerged, the succeeding volutions increasing regularly in diameter and altitude. The bounding line between the conch and protoconch is very sharp and is marked by a change in the texture of the shell and by the abrupt initiation of the sculpture. The axials are rather narrow, abruptly elevated and rounded upon their summits; anteriorly they persist to the suture and on the body to the anterior fasciole, but posteriorly they round off and evanesce, thus lending to the posterior portion of the whorl a pseudotabular aspect. There are usually 8 axials to each of the later volutions and about half a dozen sharply elevated, flattened primary cords which increase to 10 upon the body; linear secondaries may or may not be intercalated in the squarely channeled interspiral areas. Two or three lirae are also developed upon the shoulder, and the fasciole is coarsely threaded with 3 or 4 cords similar to the primaries but not quite so heavy. The sutures are sunken but distinct and undulated in harmony with the costals of the preceding volution. The aperture is lobate, broad posteriorly, narrow, and acutely angulated anteriorly, and the peristome is continuous. The outer lip is broadly arcuate and finely crenated along the margin in harmony with the external sculpture. There are about 8 prominent internal lirae, not including the one that follows directly beneath the suture line nor the two shorter and less elevated anterior lirae. The body whorl is rather strongly constricted at the base. The parietal glaze is very heavy. The posterior columellar fold is the stronger of the two and is approximately horizontal. The fold in front of it is less elevated and is feebly flexed near its termination. There is no true marginal fold, but the edge of the pillar is raised at the aperture to simulate a third plication. The anterior extremity of the aperture is compressed and feebly sulcated to form an incipient canal. There is a chink of an umbilical opening left between the vertical pillar and the feebly crescentic columella.

Mr. Aldrich's type is probably not fully mature. Intercalaries are apparently much more common upon the young than upon the adults. On none of the adults in the material at hand are secondaries regularly intercalated, whereas on the young even tertiaries are developed in some specimens.

Cancellaria spherotopleura, the analog in the Shoal River fauna, is larger and heavier and usually includes a larger number of volutions. The ribs are broader and usually fewer. The spirals are not quite so sharp, and the umbilical perforation is also deeper.

Occurrence: Oak Grove sand, localities 2646^{p}, 5632^{r}, Aldrich collection, Johns Hopkins University.

Cancellaria aldrichi Gardner, n. sp.

Plate XLV, figure 2

Shell of moderate dimensions for the genus, not very stout nor heavy; spire relatively high, scalariform; body inclined to be flattened laterally, though abruptly constricted at the base. Protoconch thrice coiled like that of *C. paramoorei*, highly polished, smooth, and naticoid in outline; initial turn minute, almost entirely submerged; the succeeding volutions broadly and smoothly rounded, increasing regularly in diameter and altitude. Boundary between conch and protoconch very sharply defined by the change in the texture of the shell and by the abrupt initiation of the axial sculpture and of 4 low, flattened spirals equal in size and regular in spacing. Whorls of conch 5½ in the type, the later volutions narrowly tabulated. Sculpture of conch sharply reticulate, the axial dominant. Axials narrow, acute, especially upon the later turns, retractive, approximately though not entirely equal in size and regular in spacing, 15 upon the penult of the type and 17 upon the body, including the terminal varicose rib; costae uniform in elevation upon the sides of the whorl and well down to the base of the body, though evanescing upon the horizontal tabulation and upon the depression at the base of the body; intercostal areas shallow, wider than the costals. Spiral sculpture of low, flattened fillets, equally prominent upon the axial and interaxial areas, usually 5 upon the penult and twice as many upon the body, the second and third spirals from the posterior suture a little more prominent and a little more distantly spaced than those in front of them; posterior spiral the last to be introduced and consequently inclined to be a little less elevated than the others, especially in immature individuals; a feeble secondary usually intercalated upon the shoulder between the posterior fillet and the posterior suture and also in the wide interspace upon the body between the second and third spirals; basal spirals slightly narrower than those upon the medial portion of the body. Anterior fasciole cut off from the base of the body by a broad and rather shallow depression outlined medially by a band a little narrower than those upon the base of the body; 3 coarse and not very sharply defined fillets developed upon the crest of the anterior fasciole. Suture line distinct, impressed, finely crenulated by the costae of the preceding volution. Aperture lobate, obtusely angulated posteriorly, the outline rather obscured by the armature. Outer lip subvaricose, broadly arcuate, reinforced within by 7 denticles elongated transversely to the margin, becoming increasingly more prominent and more distantly spaced posteriorly; an amorphous deposit of callus also laid down directly in front of the suture. Excavation at the base of the body very sharp. Parietal wash thin, not sufficient to obliterate the sculpture. Columella straight, strongly plicate, the posterior fold the most elevated and the most nearly horizontal; medial fold parallel to it internally but flexed at the entrance to the aperture to parallel the marginal fold, which probably persists for only a short distance within; a small, well-rounded tubercle developed upon the pillar between the extremities of the posterior and medial folds. Anterior extremity of aperture compressed into a short, narrow, and somewhat nasute canal. Umbilicus narrowly perforate; a crescentic umbilical funnel included between the reverted labial margin and the strongly arched anterior fasciole.

Dimensions: Height, 18.7 millimeters; length of aperture, 10.5 millimeters; maximum diameter, 10.6 millimeters.

Holotype: U. S. Nat. Mus. No. 328646.

Type locality: Chipola River, Calhoun County, Fla.

Cancellaria aldrichi is closely allied to the congenetic *C. paramoorei*. *C. aldrichi* is not so stout, however, as *C. paramoorei*, the sides of the whorls are more flattened, the spire consequently more scalariform, the axials are sharper and more numerous on the later volutions, the spirals lower, more straplike, and usually more numerous by 1 or 2 upon the whorls of the spire, and the inner surface of the labrum is strengthened by 7 denticles instead of 10 or 11 lirae produced far within the throat.

Cancellaria aldrichi takes its name from the collector, Truman H. Aldrich, who has so greatly advanced the knowledge of the early Tertiary faunas of the Gulf both by his extensive collections and by his published observations upon them.

Occurrence: Chipola formation, localities 7893^r, 2213^r, Aldrich collection, Johns Hopkins University.

Cancellaria paramoorei Gardner, n. sp.

Plate XLV, figures 3, 4

Snell of moderate dimensions, rather heavy, and stout; spire a little less than one-half as high as the entire shell, the component whorls obscurely tabulated posteriorly, broadly rounded, increasing rapidly in diameter, the body whorl relatively large and rather sharply constricted at the base, the fasciole isolated by a shallow groove. Whorls of conch probably 5 or 6 in a complete adult. Protoconch small, highly polished, thrice coiled, naticoid in outline, and perfectly smooth; initial turn minute, inflated, immersed at the tip, the succeeding volutions strongly constricted at the sutures, increasing regularly in altitude and diameter. Bounding line between conch and protoconch very distinct, marked by a change in the texture of the shell and by the abrupt initiation of the axial and spiral sculpture. Axials similar in general character over the entire surface of the conch, more or less irregular in size and spacing, rather low, sharply rounded upon their summits, feebly retractive, approximately uniform in strength between the sutures, though tending to

evanesce upon the posterior tabulation, persistent upon the ultima even to the anterior fasciole, 14 on the later whorls of the type, though probably with a wide range of variation in different individuals, 3 out of this number, including the terminal rib, broader and more elevated than the rest; intercostal areas broadly concave, usually a little wider than the costals. Spiral sculpture equally developed upon the costal and intercostal areas; spirals low, flattened bands, for the most part equal in size and regularly spaced; primaries usually 3 or 4 upon the penult and 9 or 10 upon the body, those upon the base a little narrower and more distantly spaced than the primaries behind them; secondaries not intercalated; 1 to 3 or more feeble spirals developed between the posterior primary and the posterior suture. Anterior fasciole heavily threaded with 4 or 5 additional lirae. Suture line distinct, impressed, undulated in harmony with the costals of the preceding volution. Aperture obliquely lenticular, obtusely angulated at the posterior commissure. Outer lip broadly and symmetrically arcuate, finely crenulated at the margin in harmony with the spirals, strongly lirate within, the lirae 10 or 11 in the adult, symmetrically disposed between the commissure and the anterior canal, weakening slightly anteriorly, persistent almost but not quite to the outer margin and produced far within the throat. Inner margin of aperture abruptly constricted at the base of the body. Parietal wash not sufficient to conceal the sculpture. Columella triplicate at the aperture, the posterior fold much the most prominent, projecting from the columella like a horizontal shelf; medial fold a little less elevated, parallel with the posterior fold within the aperture but flexed at the mouth to parallel the anterior fold; anterior fold marginal, much less elevated than the two behind it and persistent for only a short distance within the mouth of the aperture; a short denticle developed in the adults between the extremities of the posterior and medial folds. Anterior canal short, narrow, recurved. Anterior fasciole strongly arched, crescentic, the umbilical area included between it and the reverted labium, narrowly perforate.

Dimensions: Height, 19.0± millimeters; length of aperture 11.4 millimeters; maximum diameter, 11.9 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 113958.

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

The young of this species are very much more abundant than the adults.

Cancellaria paramoorei has been confused in the collections with *Cancellaria moorei* Gabb from the Bowden of Jamaica. The Jamaican species is stouter relatively than the Floridian; the whorls both of the spire and the body are more rounded and more strongly constricted at the sutures. The depression at the base of the body is much more pronounced in *C. moorei;* the anterior fasciole is more strongly arched and is deeply emarginate at its extremity. The axial sculpture is a little sharper; the spirals are similar in character but narrower and more elevated. The aperture is much wider than in *C. paramoorei;* the outer lip much more strongly arched but less strongly lirate; the parietal wash is much heavier; the posterior labial fold decidedly less prominent; the anterior labial fold almost as strong as the medial and persistent to the apex.

The congenetic *C. aldrichi* is not so stout and more angular; the axials are more acute and on the later volutions more numerous; the spirals are more like straps and are usually 5 upon the penult instead of 3 or 4; and the labrum instead of being lirate within is furnished with denticles, usually 7.

The Oak Grove analog, *Cancellaria druidarum,* is more slender, the whorls are more obscurely tabulated posteriorly, the constriction at the base of the body is less marked, the aperture is not so wide nor the outer lip so strongly arched, the posterior labial fold is expanded at its extremity, and the marginal fold is developed only at the mouth of the aperture. It is interesting to observe that the Chipola species is intermediate in its characters between the Jamaica form and the younger Oak Grove analog.

The Shoal River representative of the group, *C. waltoniana,* is much farther removed. It is decidedly higher relatively and more angular, the axial sculpture is less elevated, and the spiral sculpture lower and broader.

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

Cancellaria desmotis Gardner, n. sp.

Plate XLV, figure 5

Shell of only moderate dimensions and moderately heavy, the spire elevated and turreted, the body tapering at the base, apparently varying widely in relative proportions. Whorls 8, 5 of them included in the conch. Protoconch imperfectly preserved in the topotype, small, smooth, and polished, naticoid in outline, thrice coiled. Initial whorl minute, rounded, for the most part submerged; succeeding volutions increasing regularly and rapidly in diameter and altitude, separated by rather deeply impressed sutures. Bounding line between conch and protoconch indicated by an irregular, retractive thickening, a change of the texture of the shell, and the initiation of the sculpture, both the axial and the spiral. Axial sculpture similar in general character over the entire surface of the conch, the axials narrow but rounded upon their summits, feebly retractive, somewhat irregular in size and spacing, the terminal rib relatively heavy, persisting with nearly uniform elevation from suture to suture and, on the body, almost to the anterior fasciole; usually 11 ribs on the later volutions. Spiral cording heavy, developed over the entire surface of the conch, the primaries nor-

mally 4 or 5 upon the later whorls of the spire and 8 or 9 on the body, those upon the base narrower and a little more closely spaced than those upon the medial portion of the body, sharply elevated, flattened upon their summits, equal in size and spacing; secondaries regularly intercalated in the squarely channeled cross-striated interspaces, and even tertiaries introduced in the widening interprimary areas upon the medial portion of the body; anterior fasciole closely threaded with 4 to 6 rounded lirae. Suture lines distinct, impressed, undulated by the costae of the preceding volution. Aperture moderately wide, lobate. Outer lip arcuate, the margin crenate in harmony with the spiral sculpture, lirate within, the lirae rather sharp, persistent almost but not quite to the margin and produced rather far within the throat, 10 not including that directly beneath the suture line nor the 2 obscure lirae at the mouth of the anterior canal. Columella smoothly excavated at the base of the body. Parietal wall heavily glazed, the callus carried across on a line with the suture and spread rather widely and heavily over the body wall, though not entirely concealing the sculpture. Columella triplicate, the posterior fold the most elevated, almost horizontal, less produced than that in front of it, which is slightly oblique; anterior fold marginal, sharply elevated, persisting with diminished strength within the aperture. Anterior canal short, twisted, nasute. Anterior fasciole arched, crescentic, the narrow umbilical area included between the fasciole and the reverted pillar, narrowly perforate.

Dimensions: Height, 14.7 millimeters; length of aperture, 7.5 millimeters; maximum diameter, 7.8 millimeters.

Holotype: U. S. Nat. Mus. No. 113961.

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

Cancellaria bifoliata Aldrich of the Oak Grove fauna is less than half as large, the axials are narrower, more abruptly elevated, and less numerous, and the columella bears only two true folds instead of three.

Occurrence: Chipola formation, locality 2213[p].

Cancellaria ancycla Gardner, n. sp.

Plate XLV, figures 6, 7

Shell solid, of moderate dimensions, the axial sculpture not sufficiently strong to obscure the broad and even curvature of the whorls; constriction at the base of the body rather abrupt; height of aperture between one-third and one-half the entire height. Whorls probably about 7 in all, the tip broken away in the only adult, so that the number must be computed from different individuals. Protoconch smooth, polished, rather low, broadly rounded, thrice coiled, the initial turn very small and almost entirely submerged, the succeeding volutions increasing rapidly in diameter and less rapidly in height. Line of demarcation between conch and protoconch distinct but not conspicuous, indicated by an irregular thickening and change in the texture of the shell, and by the initiation of faint spiral lirae. Spirals 5 to 8, equal in size and symmetrically disposed between the sutures, increasing slightly in number upon the later whorls of the spire by intercalation at the suture, and becoming decidedly wider and more elevated, with slightly wider interspirals; adult spirals slightly flattened cords, 7 upon the penult of the type, with 2 more feeble lirae near the posterior suture; 13 body primaries, exclusive of those upon the pillar and fasciole, those upon the base a little narrower and less elevated than those upon the medial portion; linear secondaries intercalated between each pair of primaries upon the anterior half of the ultima except between those nearest the suture; pillar and anterior fasciole banded with 3 primaries, the 3 upon the fasciole lower and more straplike than those upon the pillar and separated by less deeply channeled interspirals in which a secondary is usually developed. Axial sculpture not fully developed until the penultima or antepenult; the axials more or less irregular, increasing in prominence and decreasing in number toward the aperture; rather fine, acutely rounded, feebly retractive, 17 upon the penult, less acute and only 12 upon the ultima; the terminal rib and one other upon the final half turn subvaricose; axials persistent upon the body almost to the anterior fasciole. Incrementals coarsely striating the interspiral areas, especially upon the body. Suture line distinct, impressed. Aperture narrow, auriculate. Outer lip heavy, broadly arcuate, the edge thin and finely crenate, the inner surface of the varix lirate, the lirae 7, more elevated and more distantly spaced posteriorly, the lirae not persistent to the margin nor produced very far within the throat; a heavy internal ridge also developed directly beneath the suture. Excavation at the base of the body rather abrupt. Parietal glaze not sufficiently heavy to obscure the external sculpture. Columella strongly biplicate, the posterior fold broader, more elevated, and more nearly horizontal than that in front of it, which is slightly flexed near its reduced extremity to run almost parallel to the pillar; a marginal fold suggested by the obscure elevation of the pillar. Anterior canal rather long for the group, narrow, nasute. Anterior fasciole arched, crescentic. Umbilical area reduced to a narrow depression between the fasciole and the reverted labial lining.

Dimensions: Height, 19.0± millimeters; length of aperture, 11.4 millimeters; maximum diameter, 10.9 millimeters.

Holotype: U. S. Nat. Mus. No. 113959; paratype, U. S. Nat. Mus. No. 371402.

Type locality: No. 2212, Tenmile Creek, 1 mile west of Baileys Ferry, Chipola River, Calhoun County, Fla.; paratype from locality No. 2213, 1 mile below Baileys Ferry, Chipola River, Calhoun County, Fla.

In *Cancellaria runchaena*, the analog in the Oak Grove and Shoal River faunas and the only other member of the group in the Alum Bluff in which the axial sculpture is not developed until the later whorls, the body is less sharply constricted at the base, the axial sculpture is introduced later and does not attain so great a prominence, the spirals are lower and more numerous, and the labral lirae are more numerous and more persistent within the mouth of the aperture. The type of *C. runchaena* is from Shoal River, and the Oak Grove representatives, though more closely allied to *C. runchaena*, show a strong tendency to vary in the direction of *C. ancycla*.

Occurrence: Chipola formation, localities 2212[r], 2213[r].

Cancellaria runchaena Gardner, n. sp.

Plate XLV, figures 8, 9

Shell large but not very heavy, almost naticoid in outline; whorls more or less flattened behind, broadly rounded medially and anteriorly, 7 in all in the type, 4 of these included in the conch and 3 in the smooth, polished protoconch. Initial turn of protoconch minute, almost entirely immersed, the 2 succeeding volutions increasing rapidly in diameter and elevation. Bounding line between the conch and protoconch marked by a retractive break in the texture of the shell and the initiation of the spiral sculpture in the form of 7 low, flattened, equal lirae closely and symmetrically spaced between the sutures. Number of spirals increased to 9 or 10 upon the penult and to 17 or 18 upon the body of the type; the lirae widening into bands of about half a millimeter on the medial portion of the body, separated by interspiral areas of approximately the same width; spirals upon the sulcus at the base of the body and the fasciole narrower and more closely spaced, 7 in the type. Axial sculpture restricted on the early whorls to retractive incrementals which are, however, strong enough to striate both the spirals and the interspiral areas, the former the more feebly; axials, though still incremental in character, sufficiently developed upon the penult to reticulate the spirals more or less evenly; augmented upon the body into irregular rugae, which, upon the final turn, are rather prominent; incremental striae strongest directly in front of the suture line. Sutures distinct, in general deeply impressed. Aperture rather wide, auriculate. Outer lip broadly arcuate, finely crenate along the margin, very strongly lirate within, the 13 lirae, most prominent medially, persisting almost to the outer margin and produced far within the throat; a very heavy internal ridge developed directly in front of the posterior commissure. Parietal wash very thin but widely spread, carried along for a short distance on a line with the suture, then turned at an obtuse angle and bent parallel to the outer lip through its medial expansion. Constriction at the base of the body sharp. Columella biplicate, the folds set a little more than halfway from the posterior to the anterior extremity of the aperture; posterior fold the more conspicuously elevated, not very broad but flattened upon its summit and almost horizontal; anterior fold a little less elevated and a little more oblique; an obscure thickening between the two plications and parallel to the margin of the pillar in front of the anterior fold; anterior extremity constricted into a very short, nasute canal; reverted labium not entirely concealing the umbilical chink.

Dimensions: Height, 21.9 millimeters; length of aperture, 15.9 millimeters; maximum diameter, 14.3 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 351263.

Type locality: No. 3732, Adams Mill Creek, Walton County, Fla.

Cancellaria runchaena is best characterized by its large size and naticoid outline, by the absence of an axial sculpture upon the early whorls and its irregularity upon the later, by the equal and regular spiral sculpture and the biplicate columella. The species offers a considerable range of variation in the strength of the axials upon the penult and ultima and in the number and spacing of the spirals. The numbers given for the type are a minimum rather than a maximum, although the spacing in some specimens is more distant. For lack of good material 3 individuals, only one of them adult, from beds near Mossyhead have been tentatively admitted under this name. They differ in that the spirals are narrower than the interspirals and number only 8 upon the penult and 13 upon the ultima. They differ further in having a relatively and an absolutely broader and more prominent posterior columellar fold, a more strongly arched anterior fasciole, and a more open umbilicus.

Cancellaria defuniak attains similar dimensions, but in that species the whorls are more numerous and less rounded, the spire more elevated and scalariform; axials are developed upon the earliest turn of the conch, and the umbilicus is entirely imperforate.

Cancellaria runchaena is represented in the Oak Grove fauna by a single rather doubtful, imperfect individual that shows a strong tendency to vary toward the Chipola analog, *C. ancycla*, a species that differs in the more strongly constricted body, the earlier and more strongly developed axial sculpture, the fewer and more prominent spirals, and the sparser and less produced labial lirae.

Cancellaria venusta Tuomey and Holmes (pl. XLV, fig. 10) of the Pliocene of the Carolinas and Florida has a similar sculpture but the anterior fasciole is not arched and there is a mere suggestion of an umbilical chink.

Occurrence: Oak Grove sand, locality ?5632[r]; Shoal River formation, localities 3856[r], 3732[r], 3742[p], 5079[r].

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Subgenus TRIGONOSTOMA Blainville

1827. *Trigonostoma* Blainville, Manuel de malacologie et de conchyliologie, p. 652.

Type (by monotypy): *Delphinula trigonostoma* Lamarck. (Recent in the Indo-Pacific.).

The subgenus is characterized by the rapidly enlarging, angulated whorls, the trigonal outline of the aperture, the absence of an anterior canal, and the wide umbilical funnel.

The group is represented in the Alum Bluff by a single species that is restricted to the Shoal River formation.

Cancellaria (Trigonostoma) sphenoidostoma Gardner, n. sp.

Plate XLV, figures 11, 12

Shell small, rather fragile, ovate-conic in outline; whorls of conch from 3 to 3½, inflated medially, obtusely angulated and slightly concave posteriorly, increasing rapidly in diameter, the outline obscured by the heavy axial ribbing; body whorl not constricted anteriorly, terminating rather abruptly in the obtuse umbilical keel. Protoconch rather small, smooth, naticoid, coiled like the conch from 3 to 3½ times; initial turn of protoconch minute, broadly rounded, partly immersed; succeeding volutions convex, increasing rapidly in diameter and altitude. Bounding line between conch and protoconch very clearly defined by a sharp break in the texture of the shell and by the initiation of the sculpture, both axial and spiral. Axials increasing rapidly in prominence, appearing on the later whorls as conspicuously narrow and conspicuously elevated costae, rounded upon their summits and commonly a little more expanded at the top than at the base, normally 6 to the whorl, equal and equispaced, lower and strongly retractive upon the shoulder, feebly retractive in front of the shoulder, persistent to the posterior suture and across the umbilical keel, evanescing within the umbilical funnel. Spiral sculpture very regular in its development over the entire conch; primaries moderately elevated, flattened lirae, 8 or 9 upon the penult, and 15 to 18 upon the ultima, separated by wider interspaces, in each of which a narrow medial secondary is intercalated; spirals most prominent upon the medial portion of the whorl overriding the costal and intercostal areas with uniform vigor, reduced upon the sunken posterior area to 5 or 6 linear threadlets. Suture line distinct but submerged. Aperture cuneate, very broad posteriorly, acutely angulated anteriorly; peristome continuous. Outer lip thin, sharp, finely crenate along the margin, lirate within, the lirae usually 9, increasingly more prominent and more distant posteriorly, extending from the inner surface of the terminal rib far within the throat. Inner margin of aperture adnate along the body wall for a distance of one intercostal area. Columella biplicate, the folds approximately medial in position between the extremities of the aperture; the posterior fold the stronger, approximately horizontal; the anterior not quite so strong and a little oblique, a denticle simulating the extremity of a third fold commonly developed in front of the anterior fold. Anterior extremity of aperture constricted into a canaliculate sulcus. Umbilicus funicular, rather narrow but very deep, the umbilical keel obtuse, crescentic; umbilicus finely lirate within, the lirae becoming increasingly narrower and more distantly spaced toward the apex; axial costae also persistent for a short distance within the funnel.

Dimensions: Height, 7.9 millimeters; length of body, 5.2 millimeters; length of aperture, 3.1 millimeters; maximum diameter, 4.4 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 351267.

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

Trigonostoma sphenoidostoma is rather common at the type locality but very rare elsewhere. This very dainty little shell exhibits all the characters peculiar to the subgenus.

There is nothing close to it in the Alum Bluff faunas, but *Trigonostoma scalatella* (Guppy) of the Bowden fauna is not far removed.

Occurrence: Shoal River formation, localities 3742[p], 5079.[r]

Subgenus NARONA H. and A. Adams

1854. *Narona* H. and A. Adams, Genera of Recent Mollusca, vol. 1, p. 277.

Type (by subsequent designation, Jousseaume, 1887, Le Naturaliste, sér. 2, year 9, p. 222): *Cancellaria clavatula* Sowerby. (Recent off the west coast of Panama and Payta, Peru.)

Shell ovately fusiform; spire elevated, acute, whorls ribbed and clathrate; aperture oblong, produced anteriorly into a short canal; columella usually with two plaits, the posterior the largest; outer lip crenate.—H. and A. Adams, 1854.

The subgenus is characterized by the thin shell, slender outline, elevated angular spire, rather distant sculpture, biplicate columella, and long anterior canal. It is decidedly rare in the Tertiary.

The single Alum Bluff representative occurs both in the Oak Grove and the Shoal River faunas, although it is much more closely identified with the latter.

Cancellaria (Narona) atraktoides Gardner, n. sp.

Plate XLV, figures 13, 14

Shell rather small and thin, slender for the genus and fusiform in outline; spire elevated, scalar, the shoulder almost horizontal, acutely angulated at the periphery, almost half as wide as the entire whorl. Volutions 7½ in all, 4 of these included in the conch. Protoconch rather small, naticoid, polished in fresh specimens, entirely smooth, coiled 3½ times; initial turn minute, broadly rounded, almost entirely submerged; succeeding

volutions of protoconch smoothly convex, increasing rapidly in diameter and elevation. Dividing line between conch and protoconch very distinct, marked by a retractive, oblique break in the texture of the shell, and by the initiation of the axial sculpture and of 2 or 3 equal and equally spaced spirals; the suture line following the anterior of the 3 and in some individuals partly or entirely concealing it. Axials similar in general character over the entire conch, rather narrow, rounded upon their summits, feebly retractive, persistent across the shoulder but less elevated and somewhat flexuous upon it, evanescent upon the base of the body, approximately equal and regularly spaced, with wider, feebly concave intercostals, 9 or 10 on the later volutions. Three primary spirals initiated at the beginning of the conch and not increased in number, although the anterior is commonly concealed by the suture in some individuals as far as the ultima; spirals low, rather narrow fillets, the posterior outlining the shoulder, the anterior the suture, and the medial placed midway between them; secondaries intercalated upon the penult or antepenult, 1, rarely 2, upon the shoulder, symmetrically disposed between the periphery and the posterior suture, another between the posterior and medial spirals, and later another between the medial and anterior spirals, the secondaries becoming increasingly stronger and, on the body, approximating the primaries; a fourth secondary developed upon the body in front of the anterior primary; pillar girded with 3 narrow lirae with linear threadlets intercalated between each pair; anterior fasciole rather coarsely threaded with 4 rugose spirals. Sutures very closely appressed though not creeping up upon the preceding volution, crenulated in harmony with the costals of the preceding volution. Aperture rather wide, lobate, a little less than half as high as the entire shell, obtusely angulated at the posterior commissure. Outer lip broadly arcuate, obtusely angulated at the shoulder, lirate within, the distal lirae the least elevated; a second series of half a dozen visible far within the aperture, marking the site of a former labrum. Body wall sharply excavated at the base. Parietal glaze thin, not sufficient to conceal entirely the sculpture. Columella biplicate, the posterior fold the more prominent and the more nearly horizontal, the folds placed a little more than halfway from the posterior to the anterior extremity of the aperture. Anterior canal long for the group, rather slender, feebly recurved. Anterior fasciole obliquely truncate at its extremity. Umbilicus usually imperforate, rarely open, a mere chink at the fasciole.

Dimensions: Height, 10.0 millimeters; length of aperture, 4.9 millimeters; maximum diameter, 5.0 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 351270.

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

Cancellaria atraktoides is well characterized by its slender fusiform outline, angular whorls, distant and regular spirals, and biplicate columella.

The species is not rare in the environs of the type locality.

Occurrence: Shoal River formation, localities 3856^{p}, 3742^{p}, 5079^{p}.

Subgenus APHERA H. and A. Adams

1854. *Aphera* H. and A. Adams, Genera of Recent Mollusca, vol. 1, p. 277.

Type (by monotypy): *Cancellaria tessellata* Sowerby. (Recent on the Pacific coast from Mexico to Ecuador.)

Shell ovate, not umbilicated; outer lip thickened; inner lip callous, and spread over the body whorl; aperture effuse in front.—H. and A. Adams, 1854.

Aphera is known by its ovate, commonly subcylindrical outline, low spire, the absence of strong axial sculpture, the close and regular spiral banding, the slightly flaring labrum, the wide and heavy parietal glaze, and the biplicate columella.

The single Alum Bluff species is restricted to the Shoal River formation. It is strikingly similar to the type, *C. tessellata* Sowerby, a recent form recognized on the west coast from the Gulf of California to Ecuador.

Cancellaria (Aphera) waltonensis (Aldrich)

Plate XXXVII, figures 3, 4; plate XLV, figures 15, 16

1910. *Mitra* (*Chrysame*) *waltonensis* Aldrich, Nautilus, vol. 23, p. 121, pl. 11, fig. 1.

Shell rather solid, thick; apex scarcely pointed. Whorls 6, 3 smooth, balance cancellated and shouldered, suture deep; varices near the aperture predominating over the spirals and appressed to the suture. Aperture with strong outer lip, which is serrated on its outer edge and showing 7 or 8 strong lirations within; inner lip curved and covered with a strong enamel, which spreads over part of the body whorl, 2 strong quadrangular folds on the lower central part and a pointed tooth near the posterior part of the aperture, base rounded, shell slightly umbilicated.

Height, 16 millimeters; breadth, 9 millimeters; length of aperture, 9 millimeters.

Locality: Shoal River bed, West Florida. Oligocene of Dall.

Remarks: This is another Pacific Ocean form that adds to the evidence of a channel between the two oceans during the Tertiary period.—Aldrich, 1910.

Shell of moderate size, rudely oliviform, heavy, the spire relatively very low and very slender. Body whorl large relatively, broadly rounded, slightly tapering but not constricted anteriorly. Aperture more than half the altitude of the entire shell. Whorls 6½ in all, only 3 of these included in the conch. Protoconch naticoid, polished in fresh individuals, smooth; initial turn minute, broadly rounded, almost entirely submerged; succeeding volutions smoothly convex, increasing rapidly in diameter and elevation, flattening a little toward the close of the nucleus. Bounding line

between conch and protoconch very distinct, marked by a retractive break in the texture of the shell and by the abrupt initiation of the conchal sculpture. Axial sculpture restricted to the incrementals, which are developed as a closely overlapping series of finely crenulated laminae. Entire conch closely banded spirally, the fillets 6 or 7 upon the trapezoidal whorls of the spire, equal and equispaced, symmetrically disposed between the sutures; body spirals 19 upon the type, somewhat irregular in size and spacing near the posterior suture and narrower upon the base; anterior fasciole girded with 3 additional lirae. Sutures distinct feebly impressed. Aperture narrow, almost vertical. Outer lip dropping straight from the acutely angulated posterior commissure, flaring a little in front, the edge denticulated, the denticles corresponding in number and position to the interspiral areas. Labrum lirate within, the lirae 6 or 7, not persistent to the edge, slightly more prominent posteriorly, all but the anterior of them extending far within the throat. Body sharply constricted at the base. Parietal wash very heavy and spread in rather a wide, arcuate area over the body. Columella biplicate, the posterior fold decidedly the broader and heavier of the two, commonly developing a secondary fold along its upper posterior margin. Anterior extremity of aperture compressed into an incipient canal. Umbilical perforation faintly visible between the reverted labial callus and the crescentic anterior fasciole.

Dimensions: Height, 15.4 millimeters; length of body, 12.2 millimeters; length of aperture, 10.0 millimeters; maximum diameter, 8.6 millimeters.

Topotypes (3): U. S. Nat. Mus. No. 351274.

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

Cancellaria waltonensis (Aldrich) is readily isolated by its rudely oliviform outline, the absence of axial sculpture, and the uniformity of the spiral banding over the entire surface of the conch.

The species is represented by about half a dozen individuals but only at the type locality.

Occurrence: Shoal River formation, locality 3742[p].

Superfamily RHACHIGLOSSA

Family OLIVIDAE

Genus OLIVA Martyn

1786. *Oliva* Martyn, Universal Conchologist, vol. 3, pl. 111.
1905. *Oliva* Dall, U. S. Nat. Mus. Proc., vol. 29, p. 428.

Type (by subsequent designation, Dall, 1905): *Oliva corticata* Martyn. (Recent off the coasts of Guinea.)

Usually rather large, heavy, ovoid to subcylindrical shells; substance porcellanous; surface polished; spire short; protoconch paucispiral; nucleus obtuse; whorls flattened or concave laterally, separated by channeled sutures; aperture long and narrow, obliquely emarginate anteriorly; outer lip simple, thick, almost vertical; columellar lip subparallel to the labrum, heavily glazed and commonly wrinkled, obliquely plicate at the mouth of the aperture.

The presence of *Oliva* in strata older than the Tertiary has not been definitely established.

The Recent species are peculiarly characteristic of the infratidal sand flats of the tropical seas.

Only two species and one subspecies of *Oliva* have been reported from the Alum Bluff. *O. liodes* s. l. is one of the very few forms occurring at every horizon in the Alum Bluff, and even in this species the Shoal River representatives are readily separable subspecifically. The Recent Olivas are commonly associated with extensive sand flats covered at high tide with a few feet of warm water. The fact that the genus *Oliva* is so much more rare in the Oak Grove than in either the Chipola or the Shoal River and more abundant in the Shoal River than in the Chipola is further evidence of the relative warm and shallow waters in which the Shoal River fauna flourished.

Depressed band not present upon the posterior portion of the ultima ..... *Oliva liodes* Dall s. l.
Body whorl approximating a cylinder, the posterior and anterior curvature very feeble ..... *Oliva liodes* Dall s. s.
Body whorl distantly approximating a cylinder, the posterior and anterior curvatures moderately strong. *Oliva liodes waltoniana* Gardner, n. subsp.
Depressed band present upon the posterior portion of the ultima ..... *Oliva* (*Omogymna*) *martensii* Dall.

Oliva liodes Dall

Plate XLVI, figure 1

1903. *Oliva liodes* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1576 (name only), pl. 58, fig. 1.

Shell of moderate dimensions for the group but thick and heavy, smooth, and polished and subcylindrical in outline, the maximum diameter falling a little behind the median line. Spire very low, approximately one-sixth the total altitude of the shell, tapering rather unevenly in the apical region owing to the more rapid enlargement of the later volutions. Whorls 8 in all in the type, 9 in larger individuals, 4 or 5 of them included in the conch and 4 in the small, smooth knob of a protoconch. Initial turn minute and almost entirely submerged; succeeding turns broadly rounded, all but the second increasing more rapidly in altitude than in diameter, the final whorl of the protoconch flattening laterally toward its close. Bounding line between conch and protoconch obscure, indicated by the more porcellanous texture of the conch, the greater lateral flattening, and the more deeply impressed suture. Whorls of spire trapezoidal in outline, the earlier whorls increasing more slowly in diameter than the later. Incremental striae feeble, least so toward the aperture. Sutural channel profound, deeply undercutting the preceding turn, partly concealed by the acute overhanging margins. Aperture narrow, the

sides rudely parallel through their posterior and medial extent. Outer lip smooth, sharp-edged, almost vertical, very feebly contracted near the suture, rounding smoothly anteriorly into the siphonal notch. Parietal wall scored with numerous transverse corrugations, which become increasingly lower and less produced and commonly evanesce altogether toward the posterior commissure. Base of pillar heavily reinforced with 4 or 5 overlapping folds of callus which die out near the siphonal notch; posterior margin of basal callus intersecting the labium about one-third of the way from the anterior to the posterior extremity of the shell, cutting obliquely across the base of the shell toward the anterior notch, where it almost but not quite evanesces, faintly discernible upon the labrum at a distance of about 3 millimeters from the outer margin. Siphonal notch broad and deep, the margins parallel and obliquely directed.

Dimensions: Height, 27.0 millimeters; length of aperture, 22.5 millimeters; maximum diameter, 11.5 millimeters.

Holotype: U. S. Nat. Mus. No. 113971.

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

Oliva liodes Dall is a member of the group of *O. litterata* Lamarck. It is smaller, however, than the Recent form. The spire tapers more rapidly, and its component whorls are evenly trapezoidal instead of feebly concave as in *O. litterata.* The parietal walls are similarly calloused in the two species, but the anterior emargination is relatively broader and its sides more nearly parallel in *O. liodes.*

Oliva gatunensis Toula is even closer to *O. liodes* than *O. litterata,* particularly in the contour of the spire. In *O. reticularis* the protoconch is relatively lower and broader and the body and the whorls of the spire are more rounded.

Oliva liodes Dall is the most common representative of the group in the Chipola.

The subspecies *waltoniana* is separated by the more rounded body and usually by a slightly narrower siphonal notch.

Occurrence: Chipola formation, localities 2212^{p}, 2564^{p}, 3419^{r}, 7151^{c}; Oak Grove sand, 2646^{p}, 5631^{r}, 2652^{r}, 7055^{r}.

Oliva liodes subsp. waltoniana Gardner, n. subsp.

Plate XLVI, figures 2, 3

Shell of only moderate altitude but rather stout and heavy. External surface smooth and very brightly polished. Spire only a little less than one-fifth the total altitude in the type but less than one-eighth in other individuals. Body whorl smoothly rounded both posteriorly and anteriorly, the maximum diameter falling a little behind the median line. Whorls probably 9 in all in the adult, 5 of these included in the conch and 4 in the rather small, obtusely rounded protoconch. Initial turn minute, rather inflated but almost entirely submerged, the two succeeding volutions broadly rounded and increasing rather rapidly both in diameter and in altitude; final whorl of the protoconch flattened laterally toward its close, increasing in altitude but scarcely at all in diameter. Boundary line between conch and protoconch very obscure, oblique, retractive, performing in the figured specimen about half a complete revolution, indicated by the more porcellanous texture of the conch, the increased flattening of the whorl, and the deepening of the sutural channel. Conchal whorls of spire trapezoidal in outline, the degree of obliquity varying with the height of the spire. Incremental striae faint, least so toward the aperture. A polka-dotted color pattern discernible in some individuals. Sutural channel rather deep, undercutting the whorl behind it, partly concealed by the overhanging margin both of the whorl behind and the whorl in front of it. Aperture rather narrow, the margins approximately parallel throughout their posterior and medial extents. Labrum feebly constricted toward the suture but approximating the vertical, broadly and smoothly rounding into the siphonal notch in front. Parietal wall quite heavily corrugated except in the immediate environs of the posterior commissure, 8 rugae behind the heavy pillar callus, increasingly heavier, broader, and more cuneiform in outline anteriorly. Pillar reinforced near the base by 4 sharply overlapping folds of callus, terminating in heavy parietal rugae, the anterior the thinnest and the most clearly defined, obliquely directed toward the siphonal notch but evanescing before reaching it. A thinner wash spread across the base of the body, originating at a point about two-thirds of the distance from the posterior commissure to the anterior extremity and evanescing a short distance back from the outer margin of the siphonal notch, which it parallels through about half its extent. Siphonal notch only moderately deep and rather narrow, obliquely directed, its margins not quite parallel.

Dimensions: Height, 29.3 millimeters; length of aperture, 23.0 millimeters; maximum diameter, 13.4 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 351282.

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

Oliva liodes subsp. *waltoniana* covers rather a confusing assemblage of end members which differ widely in relative and absolute dimensions and in the relative height of the spire but which possess in common, in contrast to *O. liodes* s. s., a rather strongly rounded body whorl and a rather narrow anterior notch. In outline and general dimensions many of the individuals are very similar to *O. reticularis* of the recent Floridian and Antillean fauna, but the protoconch is more nu-

merously coiled in the fossil species and the parietal corrugations are heavier. *Oliva sayana* Ravenel (pl. XLVI, fig. 4), of the upper Miocene of the Atlantic Coast, is larger and the later whorls of the spire are slightly concave.

The subspecies is widely distributed and rather abundant at the type horizon.

Occurrence: Shoal River formation, localities 3856[a], 2645[r], 3732[r], 3742[a], 3731[c], 5080[r], 5184[p], 5195[r], ?5079[r], 5193[r], 3733[r], 3748[p].

Subgenus OMOGYMNA Martens

1897. *Omogymna* Martens, Conchologische Miscelleen 2, p. 157.
1903. *Omogymna* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1576 (name only), p. 1631, pl. 58, fig. 4.
1928. *Omogymna* Woodring, Miocene mollusks from Bowden, Jamaica, pt. 2: Carnegie Inst. Washington Pub. 385, p. 226.

Type (by monotypy): *Oliva* (*Omogymna*) *paxillus* Reeve. (Recent off Mauritius.)

Both the subgenus and the monotypic species were described by the author. *Omogymna* is characterized by the sunken band on the posterior portion of the body. This band, on *O. martensii* Dall, is almost as wide as the final whorl of the spire and as smooth and clean cut as if it had been planed with a turning lathe. It is entirely obliterated by the callus at the posterior commissure, and there is no trace of it upon the spire.

The occurrence of the closely related *Oliva* (*Omogymna*) *gradata* Gabb in the Cercado formation of the Dominican Republic is probably significant stratigraphically.

Oliva (Omogymna) martensii Dall

1903. *Oliva* (*Omogymna*) *martensii* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, pl. 58, fig. 4. (No description.)

Shell small for the group but moderately thick and heavy, subcylindrical in outline, smooth and highly polished. Spire approximately one-fourth as high as the entire shell, smoothly tapering, commonly a little convex, the protoconch appearing as a minute apical knob. Whorls 8 in all, probably only 3 of them included in the protoconch. Initial turn of protoconch minute, largely submerged; succeeding volution broadly rounded, increasing slowly in altitude but rather rapidly in diameter, the 2 remaining volutions increasing in altitude but scarcely at all in diameter. Boundary line between conch and protoconch obscure, indicated by the more porcelaneous texture of the conch, the increased flattening of the whorl and its more rapid enlargement, and the deepening of the suture Whorls of spire trapezoidal in outline, the body rounding smoothly toward the suture, a band a trifle narrower than the penult planed off from the body directly in front of the suture, margined anteriorly by a sharp clean-cut edge. Sutural channel undercutting the whorl behind it, deep but not very wide, overhung by the free and proximate margins of both the preceding and the succeeding volutions. Aperture rather narrow, the margins subparallel through their posterior and medial extent. Outer lip thin, sharp, approximately vertical. Parietal callus smooth and moderately heavy at the posterior commissure, thinning out just in front of the commissure, then thickening again and becoming increasingly heavy and heavily corrugated anteriorly, spreading out rather abruptly at about two-thirds of the distance from the commissure to the anterior extremity in two major, overlapping folds with minor surficial sulci; major folds swinging from the base of the pillar across toward the siphonal notch but evanescing before reaching it. A lighter but more widely spread coat of glaze extending from about half way down the apertural wall obliquely across the base of the body until it parallels the outer margin of the notch, where it gradually evanesces without mounting the labrum. Siphonal notch rather narrow but very deep, the margins parallel and obliquely directed.

Dimensions: Height, 19.5 millimeters; length of aperture, 14.5 millimeters; maximum diameter, 8.5 millimeters.

Holotype: U. S. Nat. Mus. No. 113974.

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

Oliva martensii Dall is well characterized by the planing of the posterior portion of the body. This band is slightly convex because of the posterior curvature and seems at first glance to be the penult rather than a part of the ultima, for its sharp anterior margin simulates a suture line. The spire, together with this posterior band of the body, constitutes a smoothly rounded miter, topped by the protoconchal knob. *Oliva gradata* Gabb from the Cercado formation of the Dominican Republic is larger and the spire is higher but the relationship is close and obvious.

Oliva martensii Dall is not uncommon at the single horizon at which it occurs.

Occurrence: Chipola formation, localities 2212[c], 2213[c], 2564[p], 3419[p].

Genus OLIVELLA Swainson

1831. *Oiivella* Swainson, Zoological illustrations, vol. 2, pl. 58 and text.
1909. *Olivella* Dall, U. S. Geol. Survey Prof. Paper 59, p. 31.

Type (by subsequent designation, Dall, 1909): *Olivella purpurata* Swainson=*Olivella dama* Mawe. (Recent off the west coast of Mexico.)

Small polished, cylindrical shells, produced into tapering spires. Sutures channeled. Aperture narrow posteriorly, dilated anteriorly. Outer lip simple, sharp. Parietal wall calloused and commonly plicate. Margin of pillar acute, at least within the aperture, flattening in certain groups near the outer extremity. Anterior end emarginate.

The Olivellas are separated from the Olivas by their smaller size and by the less oblique, more shallow, basal notch, the higher spire and, in the recent shells, by the presence of an operculum and the absence of eyes.

The genus has not been recorded from strata older than the Eocene.

The distribution of the recent species is similar to that of *Oliva*.

The most striking feature in the distribution of *Olivella* in the Alum Bluff faunas is the relative importance of the genus in the Chipola. Five of the 6 species occur at that horizon, whereas only a single form has been found in the Oak Grove and 2 in the Shoal River. The few Oak Grove representatives are all juvenile but are probably referable to *O. cotinados*, a Chipola species.

Pillar not strongly compressed dorsoventrally; marginal fold inclined to flatten at the aperture:
- Anterior margin of pillar obtuse, not elevated at the aperture into a distinct fold:
  - Posterior portion of parietal wall not free from glaze, sutural channel undercutting the preceding volution:
    - Altitude of adult exceeding 7.5 millimeters:
      - Protoconch of 2 volutions; initial turn minute, almost entirely submerged in succeeding whorl. *Olivella eutacta* Dall.
      - Protoconch of 1½ volutions; initial turn moderately large, bulbous, immersed only at the tip. *Olivella cotinados* Gardner, n. sp.
    - Altitude of adult not exceeding 7.5 millimeters ..... *Olivella oryzoides* Gardner, n. sp.
  - Posterior portion of parietal wall free from glaze, sutural channel not undercutting the preceding volution. *Olivella cofacorys* Gardner, n. sp.
- Anterior margin of pillar acute, elevated into a feeble but distinct fold ..... *Olivella eleutheria* Gardner, n. sp.

Pillar strongly compressed dorsoventrally, even a little concave; marginal fold sharp and prominent. *Olivella dasa* Gardner, n. sp.

Subgenus OLIVELLA s. s.

Type: *Oliva purpurata* Swainson = *Oliva dama* Mawe. (Recent off the west coast of Mexico.)

The subgenus is characterized by the dorsoventral compression of the pillar and the prominence of the marginal fold.

H. and A. Adams [12] created the subgenus *Dactilidia* for Olivellas with the

> spire obtuse, covered with a thick deposit of enamel; aperture narrow, plicate; inner lip with a large, thickened callus, produced at the hind part, and covering and concealing the spire.

Three species were listed—*Olivella millepunctata* Duclos, *O. mutica* Say, and *O. nana* Lamarck. *Olivella mutica* Say was later designated as the type by Cossmann (Essais de paléoconchologie comparée, pt. 3, p. 54, 1899). The greater number of the Alum Bluff species are of the *O. mutica* group, but the dissimilarities between them and the *O. purpurata* group do not seem to be of subgeneric value. In both groups there is a wide group, specific, and individual age variation in the characters of the parietal callus and the parietal and pillar folds, and the differences are largely of degree rather than kind. No trace has been observed, however, of the lirations upon the inner surface of the outer lip that characterize *Dactylidella* Woodring.[13]

Olivella eutacta Dall

Plate XLVI, figure 5

1903. *Olivella eutacta* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1576 (name only), pl. 58, fig. 3.

Shell of moderate dimensions for the group, slender, smoothly tapering posteriorly, truncated anteriorly, gently rounded medially. Whorls 8 in all, only the first 2 included in the protoconch. Initial turn minute, broadly rounded, partly submerged; succeeding volution increasing in altitude and to a lesser degree in diameter, flattening toward the close of the protoconch. Line of division between the conch and protoconch obscure, indicated chiefly by the more deeply impressed suture and the more conspicuously flattened whorls. Postnuclear whorls of spire trapezoidal, converging at an angle of approximately 45°. Incremental striae exceedingly faint; sutural channel narrow, not very deep for the group, undercutting the preceding whorl, the margins proximate. Aperture cuneate, acutely angulated posteriorly. Outer lip thin, sharp, approximately vertical, slightly patulous anteriorly. Parietal wash heavy, the terminal wall dropping obliquely from the posterior suture, thinning out gradually over the penult and thinner also in front of the posterior commissure, parallel to the inner wall of the aperture for a little more than half the distance from the commissure to the anterior extremity, then sweeping obliquely across in a well-defined fold that evanesces before reaching the siphonal notch; about half a dozen secondary corrugations developed upon the medial portion of the parietal wall. Basal glaze thin, extending from the parietal callus obliquely across the shell to the labral margin, parallel throughout its later extent with the outer arm of the siphonal notch; a heavy fold scored with secondary sulci also developed at the base of the pillar in front of the oblique extension of the parietal fold and parallel to it. Pillar margin obtuse. Siphonal notch neither very broad nor very deep, approximately vertical.

Dimensions: Height, 15.0 millimeters; length of aperture, 8.0 millimeters; maximum diameter, 5.5 millimeters.

Holotype: U. S. Nat. Mus. No. 114305.

[12] Adams, H. and A., Genera of Recent Mollusca, vol. 1, p. 146, 1853.

[13] Woodring, W. P., Miocene mollusks from Bowden, Jamaica, pt. 2: Carnegie Inst. Washington Pub. 385, p. 233, 1928.

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

The differences in the conch of this species and that of *O. cotinados* are not sufficiently great to warrant their separation, but the differences in the protoconchs are too marked to warrant their union. The protoconch of *O. eutacta* is small and twice coiled; that of *O. cotinados* includes only 1½ volutions. The initial turn of *O. eutacta* is minute, flattened behind, and almost entirely submerged in the succeeding turn; that of *O. cotinados* is relatively large, bulbous, and immersed only at the tip, so that it seems to be coiled in a plane oblique to the axis of the conch. The final half turn also is much higher relatively than that of *O. eutacta* and the deepening of the suture at the initiation of the conch much more abrupt. It is remarkable that two species so similar in their adult characters and in their distribution should exhibit such radical nuclear differences.

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

Olivella cotinados Gardner, n. sp.

Plate XLVI, figures 6, 7

?1910. *Olivella diadematophoros* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 15, pl. 4, fig. 1.

Shell of moderate dimensions for the group, slender, fusiform, the maximum diameter falling near the median horizontal. Spire a smooth, evenly rounded, slender cone a little less than half as high as the entire shell. Whorls 7½ in all, 6 of them included in the conch. Protoconch rather small, bulbous, smooth, and highly polished; initial turn relatively large, well rounded, immersed at the tip, apparently coiled in a plane a little oblique to the axis of the conch; final half turn relatively high, very feebly convex. Dividing line between conch and protoconch indicated by the lower luster of the conch and the abrupt initiation of the sutural channel. Postnuclear whorls of spire trapezoidal in outline, increasing regularly in diameter and altitude. Sutural channel narrow but quite deep, undercutting the preceding volution; channel margins proximate, the anterior acute. Incremental striae very fine and faint. Aperture narrow, cuneiform. Outer lip thin, sharp, approximately vertical, slightly patulous anteriorly. Inner wall of aperture oblique. Parietal glaze heavy, extending from the posterior suture obliquely forward, parallel to the body wall, for a little more than half the distance from the posterior to the anterior extremity, then curving broadly toward the siphonal notch but evanescing before reaching it. Basal callus spreading obliquely across the shell from a short distance in front of the posterior commissure to the labral margin, parallel throughout its later extent to the outer arm of the siphonal notch; base of pillar heavily reinforced with a thick deposit of callus laid parallel to the parietal fold. Margin of pillar obtuse. Feeble secondary corrugations developed along the entire length of the parietal wall. Siphonal notch deep but not very broad, obliquely directed.

Dimensions: Height, 10.5 millimeters; length of aperture, 5.1 millimeters; maximum diameter, 3.7 millimeters.

Holotype: U. S. Nat. Mus. No. 328659.

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

The folds upon the parietal callus are too far within the aperture to be indicated upon the figure as it is posed.

The character of the initial whorl constitutes the most reliable diagnostic by which *O. cotinados* may be separated from *O. eutacta* Dall. In the former it is relatively large, bulbous, slightly tilted, and immersed only at the tip; in the latter it is minute, flattened or very broadly rounded, and almost entirely immersed in the succeeding volutions. There are also 2 full turns in *O. eutacta* but only 1½ in *O. cotinados*, and the opening of the conch is more obscurely defined in the former.

The Oak Grove species are all immature, and there is a chance that they may prove distinct subspecifically. Miss Maury's *O. diadematophoros*, described from the Oak Grove, is apparently a young shell, only 3 millimeters in altitude, whose diadem was acquired by the same extensive processes of weathering that have decorticated the apex and the entire external surface, deepened the sutural channels, and removed all the finer details of the body wash. The form is possibly the young of *O. cotinados*, for the general outline is the same and *O. cotinados* is the only member of the group which occurs at that horizon. It is inadvisable, however, to utilize as a type a juvenile in which only the bare generic characters have been preserved.

The apertural characters of *O. cotinados* and *O. eutacta* are similar to those of *O. akera* Woodring, but the Alum Bluff shells are more slender than the Bowden and the spires relatively higher.

Occurrence: Chipola formation, localities 2213[r], 2564[p], 3419[p]; Oak Grove sand, localities 2646[p], 5632[r]; Shoal River formation, locality 5079[p].

Olivella oryzoides Gardner, n. sp.

Plate XLVI, figures 8, 9

Shell very small, smooth, highly polished, suggesting a rice kernel in outline and luster. Spire low, averaging a little more than one-third the total altitude, smoothly rounded except for the protoconchal knob. Body whorl subcylindrical in outline. Volutions approximately 6 in all, 3 of these included in the relatively large naticoid protoconch. Initial turn of protoconch minute, largely submerged, the succeeding volutions broadly and smoothly convex, increasing rapidly in diameter and altitude; final whorl of protoconch becoming increasingly lower and less rounded toward its

close, so that the protoconch appears to be partly submerged in the sutural channel of the opening whorl of the conch. Line of demarcation between the conch and protoconch obscure, indicated merely by the lower polish of the conch and by the deepening of the sutural channel. Postnuclear whorls of spire trapezoidal in outline, increasing rapidly in altitude. Sutures relatively wide and deep, undercutting the preceding volution, the margins, particularly the anterior, acute. Incremental striae exceedingly faint. Aperture cuneiform, angulated posteriorly. Outer lip thin, sharp, approximately vertical, slightly patulous anteriorly. Parietal wall heavily glazed, the wash spread over the last quarter turn of the penult almost to the posterior suture and filling up the commissure, the outer margin of the wash approximately parallel to the inner wall of the aperture except in front, where it arches before evanescing near the siphonal notch; feeble secondary corrugations developed upon the medial portion of the parietal wall. Basal glaze thin, spread obliquely over the base from the parietal wash to the labral margin, parallel in its later extent with the outer arm of the siphonal notch. Pillar heavily reinforced near the base, the posterior margin of the callus elevated, sharply defined, approximately parallel to the outer margin of the parietal glaze; secondary scoriations developed upon it and a rather deep depression cutting it off from the obtuse edge of the pillar. Siphonal notch rather deep; U-shaped, obliquely directed.

Dimensions: Height, 5.8 millimeters; length of aperture, 4.4 millimeters; maximum diameter, 2.7 millimeters.

Holotype: U. S. Nat. Mus. No. 113979. Paratype: U. S. Nat. Mus. No. 371403.

Type locality: No. 2213, 1 mile below Baileys Ferry, Chipola River, Calhoun County, Fla., paratype; No. 7257, Sexton's marl bed, Tenmile Creek, Calhoun County, Fla.

Olivella oryzoides is less than half the size of any congenetic species of the genus. Its naticoid protoconch and the narrow opening whorls of the conch cut off from one another by deep sutures readily separate the species from the young of larger forms. It is by far the most abundant member of the genus in the single horizon at which it occurs.

Occurrence: Chipola formation, localities 7893^{p}, 7257^{p}, 2213^{a}, 2564^{c}, 3149^{c}, 7151^{c}.

Olivella cofacorys Gardner, n. sp.

Plate XLVI, figures 10, 11

Shell of moderate dimensions for the group, rudely elliptical in outline, smooth and very highly polished. Spire rather elevated, the whorls closely overlapping one another like a bandage. Body broadly and smoothly rounded. Whorls 5½ in all, 4 of this number included in the conch. Initial whorl broad and full, immersed at the tip; succeeding half turn high, feebly convex. Dividing line between conch and protoconch indicated by a slight difference in the texture of the shell and by the abrupt initiation of the sutural channel. Postnuclear whorls of the spire trapezoidal in outline, increasing regularly and not very rapidly in diameter. Sutural channels very narrow, not undercutting the preceding volution, margined in front by the sharp edge of the succeeding turn. Incremental striae exceedingly feeble. Aperture narrow, cuneiform in outline, acutely angulated posteriorly. Outer lip thin, sharp, approximately vertical, slightly patulous anteriorly; posterior two-thirds of ultima free from callus, even at the posterior commissure. Basal coat of glaze cutting obliquely across from a point a little less than halfway from the posterior to the anterior extremity of the aperture, the labral margin parallel throughout its later extent with the outer arm of the siphonal notch. Body wall obscurely corrugated with 6 or 8 transverse sulci. Base of pillar reinforced with a narrow but heavy deposit of callus laid parallel to the obtuse pillar margin, bearing a few secondary sulci directed toward the siphonal notch but evanescing before reaching it. Anterior emargination very broad but shallow, approximately horizontal.

Dimensions: Height, 11.6 millimeters; length of aperture, 7.4 millimeters; maximum diameter, 4.7 millimeters.

Holotype: U. S. Nat. Mus. No. 328665.

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

Olivella cofacorys is characterized by the rather obtusely rounded nucleus, the narrow sutural channel, which does not, as in the majority of the members of the group, undercut the preceding whorl, and by the entire absence of glaze upon the posterior portion of the ultima.

The likeness to *Olivella sancti-dominici* Maury from the Rio Gurabo is much closer than to any *Olivella* of the Alum Bluff group. The whorls that make up the spire of the Dominican species are slightly more tumid and less numerous by one than those of *O. cofacorys*.

The species is not uncommon at the single horizon at which it occurs.

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

Olivella eleutheria Gardner, n. sp.

Plate XLVI, figures 12, 13

Shell rather large for the genus; the body ovate, the spire evenly conic; the shell varying widely in relative altitude and diameter and in the relative height of the spire, the altitude of the aperture in some individuals a little more than half the entire altitude of the shell, in other individuals a little less. Whorls approximately 6 in all. Protoconch obtuse, inflated, perform-

ing only 1½ volutions; initial turn very tumid and immersed at the tip, the final half turn gradually flattening toward its close. Dividing line between conch and protoconch indicated by a change in the texture of the shell and by the deepening of the suture. Postnuclear whorls of the spire trapezoidal in outline, increasing more rapidly in diameter away from the apex. Incremental striae very faint. Sutural channel deep, undercutting the preceding volution, the margins proximate, rather sharp, particularly the anterior. Aperture narrow, acutely angulated posteriorly. Outer lip thin, sharp, almost vertical, patulous anteriorly. Parietal wash heavy in the region of the posterior commissure and along the posterior margin of the sutural channel, persisting anteriorly as far as the heavy folds at the base of the pillar. A thin glaze spread around the base of the body from a little in front of the commissure obliquely across to the labrum, the margin parallel in its later extent with the outer arm of the siphonal notch; base of pillar heavily reinforced with 3, in some individuals 4, overlapping folds of callus with a couple of minor corrugations behind them, the heavier folds directed toward the siphonal notch but evanescing before reaching it; edge of pillar rather sharp and very slightly elevated; siphonal notch moderately broad, not very deep, a little oblique.

Dimensions of holotype: Height, 14.2 millimeters; length of aperture, 7.8 millimeters; maximum diameter, 6.2 millimeters. Dimensions of another individual: Height, 14.3 millimeters; length of aperture, 6.8 millimeters; maximum diameter, 5.1 millimeters.

Holotype: U. S. Nat. Mus. No. 114304.

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

The Alum Bluff species suggests the later Tertiary and Recent *O. mutica* Say (pl. XLVI, fig. 14) in general outline, but it is larger by a third or more, not so smoothly rounded, and more acutely tapering posteriorly. The twisted edge of the pillar is more acute in *O. eleutheria* and the plications upon the parietal and basal callus more uniformly developed. *Olivella muticoides* of the Cercado formation of the Dominican Republic has a relatively shorter spire and more slender body. None of the other Olivellas from the Alum Bluff group approach very closely to *O. eleutheria* except perhaps *O. cotinados*, from the Chipola, which has a very similar protoconch. This form is not only smaller, however, but is decidedly more slender, the edge of the pillar is obtuse instead of acute, as in *O. eleutheria*, and it differs also in the details of the reinforcement of the pillar.

Olivella eleutheria is abundant at the type locality, but it has not been recognized elsewhere.

Occurrence: Chipola formation, localities 7893^{p}, 2211^{a}, 7183^{p}.

Olivella dasa Gardner, n. sp.

Plate XLVI, figures 15, 16

Shell rather low but broad, ovoid in outline. Spire evenly conic, less than half as high as the entire shell. Body very broadly rounded. Protoconch small, slender, performing 3½ volutions; initial turn minute, flattened, almost entirely submerged; succeeding volutions of the protoconch rather broadly rounded, increasing more rapidly in altitude than in diameter. Line of demarcation between the conch and protoconch oblique, retractive, performing half of a complete revolution; initiation of conch indicated by the flattening of the whorl and the deepening of the sutural channel. Conchal turns in a rather small individual 3, probably more in larger forms; postnuclear whorls of spire trapezoidal. Incremental striae feeble. Sutural channels deep, undercutting the preceding volution; margins sharp and proximate, slightly overhanging the channel. Aperture narrow, oblique, acutely angulated posteriorly. Outer lip thin, sharp, almost vertical. Parietal wall heavily coated with a gob of callus, the outer margin of which extends from the posterior suture of the body obliquely forward, thinning out parallel to the inner margin of the aperture and persisting almost but not quite to the siphonal notch. Labial margin of aperture rudely parallel medially to the labral. Columella reinforced by an angular strip of callus, defined posteriorly by the sharply elevated margin transverse to the axis, its outer edge also sharply elevated, parallel medially with the outer edge of the parietal wash and parallel throughout its extent with the inner margin of the aperture, and with the twisted and sharply elevated margin of the pillar. Callus scored with 3 or 4 transverse grooves, the anterior of which is produced parallel to the marginal fold of the pillar. Basal callus rather thin, evenly spread across the shell from the parietal callus to the margin of the labrum, throughout its later extent paralleling the outer margin of the siphonal notch. Edge of pillar sharply elevated and twisted, merging smoothly into the inner margin of the siphonal notch. Notch broad, obliquely directed, the outer arm more produced than the inner.

Dimensions: Height, 9.0± millimeters; length of aperture, 5.0 millimeters; maximum diameter, 4.6 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 351296.

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

It differs from the other representatives of the group not only in the dorsoventrally compressed, even slightly concave pillar and the sharply elevated marginal fold but also in the low, broad body, the evenly conic spire, and the character of the labial callus.

Occurrence: Shoal River formation, localities 3742[p], 5618[r].

Genus ANCILLA Lamarck

1799. *Ancilla* Lamarck, Prodrome d'une nouvelle classification des coquilles: Soc. hist. nat. Paris Mém., p. 70.
1811. *Ancillaria* Lamarck, Mus. hist. nat. Paris Annales, vol. 16, p. 302.

Type (by monotypy): *Ancillaria candida* Lamarck = *Voluta ampla* Gmelin.[13a] (Recent in the Indo-Pacific.)

Shell rather thick and heavy, ovoid to fusiform in outline, in some specimens globose, smooth, and as a rule highly polished; spire varying widely in relative proportions; sutures and commonly the entire spire veiled with a coating of enamel; aperture usually angulated posteriorly, broadening anteriorly; outer lip thin, sharp, and not very strongly arcuate; labial curvature higher than that of the labrum; parietal wall glazed; pillar reinforced, twisted, expanded anteriorly, obliquely sulcated externally; anterior emargination usually broad but not very deep.

Ancilla was established apparently as early as the Cretaceous, and the culmination in this country occurred in the early half of the Tertiary. The Recent species favor the same habitat as *Oliva*—sand flats covered at high tide by a few feet of warm water. The group is not so well represented as *Oliva* along the east coast of America but is in the main restricted to the African shores and to the Indian and Pacific Oceans.

Ancilla chipolana Dall

Plate XLVI, figures 17, 18

1900. *Ancillaria chipolana* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 5, pl. 41, fig. 3. (No description.)
1903. *Ancilla chipolana* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1576 (name only).

Shell rather small for the group and thin, highly polished; fusiform in outline, the aperture less than half as high as the entire shell, the maximum diameter falling about two-thirds of the distance from the posterior to the anterior extremity. Spire slender and evenly tapering, the body broadly rounded and rather evenly constricted at the base. Whorls probably 8 in all, although it is difficult to count them because of the thin but dense cap of callus, drawn closely over the spire to a line a little in front of the body suture. Protoconch small, obtuse, auriculate in outline, a little more than twice coiled, slightly tilted, the second whorl broadly rounded, rapidly enlarging and almost entirely concealing the initial turn; succeeding whorl partly concealed by the glazed veil and the exact line of division between the conch and protoconch obscured. External sculpture not developed except for the grooving upon the base of the body. Incrementals faintly discernible. Sutures indicated by narrow, smoothly rounded depressions, a band of heavier callus developed in front of the suture and sometimes behind it as well, so that the medial portion of the whorl is broadly and feebly depressed. Aperture lenticular, acutely angulated at the posterior commissure. Outer lip broadly and symmetrically arcuate, thin except at the termination of the posterior band of callus. Inner margin of aperture more strongly curved than the outer. Parietal wall heavily glazed, the margin of the wash approximately vertical and continuous with the terminal margin of the glaze upon the penult. Pillar heavily reinforced, the callus sweeping across the base of the shell from a point less than halfway from the posterior to the anterior extremity of the body, parallel in its later extent with the outer margin of the siphonal notch; posterior edge of callus sharp, parallel to and a little in front of the linear sulcus at the base of the body a second coat overlapping the first, its margin also sharp but much less elevated than the first, sweeping in a parabolic curve from the pillar wall to the head of the siphonal notch. Base of pillar splayed and twisted, scored with 10 or 12 feeble sulci parallel to the inner margin of the pillar, and with 2 or 3 deeper sulci parallel to the outer margin of the pillar. A rather deep gutter directly behind the pillar terminating anteriorly in a feeble lobe. Anterior emargination broad, not very deep, U-shaped, the arms parallel and obliquely directed.

Domensions: Height, 25.5 millimeters; length of aperture, 12.2 millimeters; maximum diameter, 9.5 millimeters.

Holotype: U. S. Nat. Mus. No. 109023. Topotype, U. S. Nat. Mus. No. 371404.

Type locality: Chipola River, Calhoun County, Fla.

Ancilla shephardi Dall from the beds at Ballast Point runs larger and is not so slender. The spire is usually a little less elevated relatively, and the apical angle is larger. The aperture is also a little wider in the Tampa form, and there is usually a low ridge developed on the basal callus of *A. shephardi* continuous with the outer margin of the basal notch, which is not present in *A. chipolana* Dall. The forms are so closely similar, however, that there is no doubt about their genetic relationship.

Occurrence: Chipola formation, localities 2564[c], 3419[c].

[13a] It is true, as Vokes observed (Geol. Soc. America Proc. for 1935, p. 414, June, 1936), that Lamarck cited no named species in his original description of *Ancilla*, but he cited the single reference "*Voluta*. . . . Martin, Conch. 2, p. 359, t. 65, f. 722-724." This is also the reference and the only reference given by Gmelin (Linné, Systema Naturae, ed. 13, pt. 6, p. 3497, 1792) to illustrate his *Voluta ampla* so that *ampla* becomes, per force, the monotype of *Ancilla* Lamarck, 1799. A number of subgeneric names have been subsequently proposed. The Chipola species may be referred to *Sandella* Gray (Guide to the Mollusca in the British Museum, pt. 1, p. 26, 1857), type by monotypy, *Ancillaria tankervillii* Swainson, Recent in the West Indies.

Family MARGINELLIDAE

Genus MARGINELLA Lamarck

1799. *Marginella* Lamarck, Prodrome d'une nouvelle classification des coquilles: Soc. hist. nat. Paris Mém., p. 70.

Type (by monotypy): *Voluta glabella* Linnaeus. (Recent off the west coast of Africa.)

Shell small, usually rather thick and heavy, ovate, fusiform or subcylindrical in outline. Spire low and in one subgenus almost entirely concealed. External surface smooth and as a rule rather highly polished. Sutures generally obscured. Aperture narrow or sublinear, commonly equaling or approximating the altitude of the entire shell, truncate or emarginate anteriorly, angulated or emarginate posteriorly. Outer lip usually reinforced, smooth, or denticulate within. Columella plicate.

The presence of the genus in the Cretaceous has not been established, but it was certainly abundant and well differentiated early in the Eocene. The Recent species number several hundreds and are, as the name implies, denizens of the shallower waters of the warm seas.

Some of the most conspicuous and peculiar features of the Alum Bluff of Florida are typified in this group. Twenty-seven species and subspecies have been isolated. Of this number 21 or more, probably 22, approximately 80 percent, occur in the Chipola, 6 in the Oak Grove, and only 3, a little more than 10 percent, in the Shoal River. There are 2 or more, probably 3, species common to the Chipola and Oak Grove, but all of the Shoal River forms are restricted to the single horizon. Concomitant with the extreme differentiation of species in the Chipola, there is a tendency, less pronounced, however, than in many other genera, toward a small number of individuals, whereas in the Shoal River, where the number of species is relatively very small, the number of individuals referable to the genus is quite as large as in the Chipola. The development of the genus at Alum Bluff is especially notable: 17 or 18 out of the 27 species occur at that single locality. The group characterized by low, heavily enameled spires is represented in the Alum Bluff deposits by half a dozen species, all of them restricted to the Chipola formation and all of them occurring at Alum Bluff.

The Marginellas flourish both in shallow and deep water, but the much more diversified fauna of the Chipola speaks for a more diversified habitat than that of either the Oak Grove or the Shoal River.

It is perhaps because of the relatively slight representation of the genus in the Shoal River that the relationship to the mid-American faunas is less obvious than in many other groups.

Spire not involute:
- Columellar folds 4, all of them persistent within the aperture:
  - Altitude of adult shell exceeding 15.0 millimeters ..... *Marginella* (*Egouena*) *aurora* Dall.
  - Altitude of adult shell not exceeding 15.0 millimeters:
    - Spire usually but not invariably rather elevated, the component volutions commonly convex, the sutures distinct or obscured, the aperture not posteriorly produced beyond the penult:
      - Altitude of adult exceeding 6 millimeters, the maximum diameter usually more than half the altitude:
        - Altitude of spire usually less than one-fourth the altitude of the entire shell, the component volutions strongly convex, the sulcus defining the labral varix conspicuously sharp. *Marginella* (*Serrata*) *chipolana* Maury.
        - Altitude of spire more than one-fourth the altitude of the entire shell, the sulcus defining the labral varix not conspicuously sharp:
          - Whorls of spire more or less convex:
            - Inner labral margin strongly dentate:
              - Body whorl attenuated and feebly constricted at the base. *Marginella* (*Serrata*) *euancycla* Gardner, n. sp.
              - Body whorl ovate:
                - Body whorl not strongly inflated medially. *Marginella* (*Serrata*) *xanthophaës* Gardner, n. sp.
                - Body whorl strongly inflated medially ..... *Marginella* (*Serrata*) *vadosa* Gardner, n. sp.
            - Inner labral margin feebly dentate:
              - Altitude of spire more than one-third the altitude of the entire shell:
                - Maximum diameter approximately half the altitude. *Marginella* (*Serrata*) *denticulatoides* Maury.
                - Maximum diameter more than half the altitude. *Marginella* (*Serrata*) *xanthophaës* Gardner, n. sp.
              - Altitude of spire less than one-third the altitude of the entire shell:
                - Maximum inflation falling well behind the median horizontal. *Marginella* (*Serrata*) *cornelliana* Maury.
                - Maximum inflation falling near the median horizontal. *Marginella* (*Serrata*) *vadosa* Gardner, n. sp.

Spire not involute—Continued.
Columellar folds 4, all of them persistent within the aperture—Continued.
Altitude of adult shell not exceeding 15.0 millimeters—Continued.
Spire usually but not invariably rather elevated, etc.—Continued.
Altitude of adult exceeding 6 millimeters, the maximum diameter usually more than half the altitude—Con.
Altitude of spire more than one-fourth the altitude of the entire shell, etc.—Continued.
Whorls of spire trapezoidal:
Inner labral margin strongly dentate:
Body whorl attenuated and constricted at the base.
Marginella (*Serrata*) *euancycla* Gardner, n. sp.
Body whorl not attenuated nor constricted at the base:
Body whorl not strongly inflated medially:
Body broadly rounded in the adult; oral armature conspicuously heavy.
Marginella (*Serrata*) *brithia* Gardner, n. sp.
Body obscurely shouldered in the adult, oral armature not conspicuously heavy.
Marginella (*Serrata*) *xanthophaës* Gardner, n. sp.
Body whorl strongly inflated medially——*Marginella* (*Serrata*) *vadosa* Gardner, n. sp.
Inner labral margin feebly dentate:
Body whorl obtusely shouldered——*Marginella* (*Serrata*) *denticulatoides* Maury.
Body whorl smoothly rounded——*Marginella* (*Serrata*) *vadosa* Gardner, s. l.
Altitude of adult usually exceeding 7 millimeters.
Marginella (*Serrata*) *vadosa* Gardner, s. s.
Altitude of adult not exceeding 7 millimeters.
Marginella (*Serrata*) *vadosa ischna* Gardner, n. subsp.
Altitude of adult not exceeding 6 millimeters:
Inner labral margin coarsely dentate in the adult——*Marginella* (*Serrata*) *coloba* Gardner, n. sp., s. l.
Maximum diameter approximately three-fifths of the altitude.
Marginella (*Serrata*) *coloba* Gardner, n. sp., s. s.
Maximum diameter less than three-fifths of the altitude.
Marginella (*Serrata*) *coloba conoispira* Gardner, n. subsp.
Inner labral margin finely dentate in the adult:
Later volutions smoothly rounded, aperture not conspicuously wide:
Body whorl attenuated and feebly constricted at the base.
Marginella (*Serrata*) *nanna* Gardner, n. sp.
Body whorl less attenuated and constricted at the base.
Marginella (*Serrata*) *critha* Gardner, n. sp.
Later volutions obtusely shouldered, aperture conspicuously wide.
Marginella (*Serrata*) *eurystoma* Gardner, n. sp.
Inner labral margin smooth——*Marginella* (*Volvarina*) *oryzoides* Gardner, n. sp.
Spire low, broadly and regularly conic as a rule, the component volutions not convex, the sutures obscured or obliterated, and the aperture produced to a greater or less degree:
Inner labral margin crenate in the adult:
Altitude of adult usually exceeding 10.0 millimeters, maximum diameter decidedly more than half the altitude——*Marginella* (*Egouena*) *eleutheria* Gardner, n. sp., s. l.
Altitude of adult usually exceeding 12.0 millimeters; the maximum diameter less than two-thirds the altitude——*Marginella* (*Egouena*) *eleutheria* Gardner, n. sp., s. s.
Altitude of adult rarely exceeding 12.0 millimeters; the maximum diameter approximately two-thirds of the altitude——*Marginella* (*Egouena*) *eleutheria dasa* Gardner, n. subsp.
Altitude of adult not exceeding 10.0 millimeters; maximum diameter approximately half the altitude.
Marginella (*Egouena*) *lipara* Gardner, n. sp.
Inner labral margin not crenate in the adult:
Outline rudely biconic——*Marginella* (*Egouena*) *apalachee* Gardner, n. sp.
Outline subcylindrical, labral varix conspicuously broad and heavy.
Marginella (*Egouena*) *capsa* Gardner, n. sp.
Columellar folds 4 or more, only the 2 anterior persistent within the aperture:
Altitude of adult exceeding 5 millimeters:
Outline subconic, body whorl obtusely shouldered——*Marginella* (*Persicula*) *calhounensis* Maury.
Outline ovate or subcylindrical, body whorl smoothly rounded:
Posterior extremity of aperture acutely angulated——*Marginella* (*Persicula*) *majuscula* Gardner, n. sp.
Posterior extremity of aperture channeled——*Marginella* (*Persicula*) *progravida* Gardner, n. sp.
Altitude of adult not exceeding 5 millimeters:
Sutures obscured but not obliterated by the enamel coating:
Anterior extremity emarginate——*Marginella* (*Gibberula*) *dryados* (Maury).
Anterior extremity not emarginate——*Marginella* (*Gibberula?*) sp.
Sutures obliterated by the enamel coating:
Anterior extremity not emarginate——*Marginella* (*Gibberula?*) sp.

Spire not involute—Continued.
Columellar folds 4 or more, only the 2 anterior persistent within the aperture—Continued.
Altitude of adult not exceeding 5 millimeters—Continued.
Sutures obliterated by the enamel coating—Continued.
Anterior extremity emarginate:
Apical surface obtusely conic ..... *Marginella (Gibberula) chondra* Gardner, n. sp.
Apical surface flattened or very broadly rounded ..... *Marginella (Gibberula) waltoniana* Gardner, n. sp.
Spire involute:
External surface smooth ..... *Cypraeolina defuniak* Gardner, n. sp.
External surface axially wrinkled ..... *Cypraeolina pyrenoides* Gardner, n. sp.

Subgenus SERRATA Jousseaume

1875. *Serrata* Jousseaume, Rev. et mag. zoologie, sér. 3, vol. 3, pp. 167, 230–232.
1928. *Serrata* Woodring, Miocene mollusks from Bowden, Jamaica, pt. 2: Carnegie Inst. Washington Pub. 385, p. 239.

Type (by tautonymy): *Marginella serrata* Gaskoin. (Recent off Mauritius.)

Coquille à ouverture très-étroite, avec 3 à 4 plis columellaires placés très-près de l'extrémité antérieure. Bord externe denticulé intérieurement avec un bourrelet externe épais, nettement séparé du reste de la coquille et formant en arrière un angle saillant.—Jousseaume, 1875.

The apparent spire gives to all the members of this group a spindle outline. The narrow aperture is dentate along the thickened labral margin and in all of the Alum Bluff species quadruplicate along the labial. The parietal wash is usually heavy. The group is well represented, both in number of species and individuals, in the later Tertiary of the southern Atlantic and mid-American faunas. The Alum Bluff species, as a group, are notably less slender than those of the later Miocene.

Marginella (Serrata) chipolana Maury

Plate XLVI, figure 19

1910. *Marginella chipolana* Maury, Bull. Am. Paleontology, vol. 4, pt. 21, p. 15, pl. 4, fig. 2.

Shell small, biconic, broad in proportion to its length, smooth and polished, 4-whorled; spire acute; suture distinct; aperture rather broad, two-thirds the length of the shell; outer lip thickened, marginated externally, with about 10 denticles extending along the inner margin from the anterior to the posterior canals, the posterior denticles being the most prominent and widely separated while the anterior are small and crowded; inner lip with 4 subequal plaits, the anterior being somewhat more oblique and pronounced.

Length of shell 6; greatest width 4 millimeters.
Oligocene of the Chipola marls, Baileys Ferry, Fla.
Cornell University collection.—Maury, 1910.

Dimensions of figured topotype: Height 6.1 millimeters; length of aperture 4.6 millimeters; maximum diameter 3.5 millimeters.

Topotype: U. S. Nat. Mus. No. 371405, from U. S. Geol. Survey station 3419, Baileys Ferry, Chipola River, Fla.

The number of whorls is probably 5 rather than 4, but the suture at the very apex is obliterated by the heavy glaze. *Marginella chipolana* Maury is conspicuous for the convexity of the whorls and the clear delineation of the sutures. Then, too, the labral varix is very heavy and is outlined externally with a sharply incised sulcus.

The species is rather widespread in the single horizon at which it is represented, but it is not abundant at any one locality.

Occurrence: Chipola formation, localities 2213^{p}, 2564^{p}, 3419^{p}, 2211^{p}, Cornell University collection.

Marginella (Serrata) euancycla Gardner, n. sp.

Plate XLVI, figure 20

Shell of moderate dimensions for the group, very smooth and highly polished, the spire rather elevated, relatively slender, the body strongly rounded medially, constricted anteriorly. Whorls probably as many as 6 in all, the later whorls of the spire feebly convex or trapezoidal; sutures distinct except near the apex. Aperture usually about three-fifths as high as the entire shell, though varying somewhat in relative dimensions, rather narrow and oblique. Labrum heavily varicated, the varix delimited externally by a linear sulcus, abutting posteriorly against the preceding whorl and posteriorly produced, dragging the suture with it for a distance of a little less than half the width of the penult. Inner margin of labrum strongly denticulate, a prominent posterior denticle placed at some little distance from the commissure and isolated from those in front of it; usually 7 subequal medial denticles elongated normal to the margin and 3 shorter and increasingly feeble anterior denticles. Parietal wash fused with the surface enamel. Pillar slightly reinforced. Plications of columella very broad and heavy for the group, the 2 posterior folds less proximate, more nearly horizontal, and less produced than the anterior pair; foremost fold marginal, not so broad as those behind it, fusing externally with the ill-defined terminal band of callus, which is itself the reduced continuation of the labral varix. Anterior extremity channeled within, obscurely truncate without.

Dimensions: Height, 11.6 millimeters; length of aperture, 8.1 millimeters; maximum diameter, 5.7 millimeters.

Holotype: U. S. Nat. Mus. No. 114490.

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

Marginella euancycla differs from *M. cornelliana* Maury in the greater medial inflation and basal constriction of the body, the relatively higher spire, and the stronger and more numerous denticulations on the inner margin of the labrum.

The species is not abundant at any locality, but it is rather widely distributed through the Chipola.

There is no other species very close to *M. euancycla*. In *M. hematita* Kiener of the Recent fauna the outline of the body is very similar, but the spire is much lower relatively and more uniformly tapering. *M. mollitor* Dall from the "silex beds" is smaller and not so strongly inflated medially, usually with a broader spire, a heavier labral varix, and a more finely dentate inner labral margin. The congenetic *M. xanthophaës* is smaller and usually more slender, the body is not so strongly constricted nor attenuated at the base, and the denticulations on the inner labral margin are usually finer and less regular.

Occurrence: Chipola formation, localities 2213^{p}, 2564^{p}, 3419^{p}, 2211^{p}.

Marginella (Serrata) xanthophaës Gardner, n. sp.

Plate XLVI, figure 21

Shell of moderate dimensions for the genus, not very heavy, highly polished and exhibiting in well-preserved individuals a rich orange color that is probably directly related to the original color. Spire elevated, rather slender, the regularity of the profile slightly or not at all interrupted at the sutures. Whorls of spire trapezoidal or feebly convex in outline. Body whorl relatively large, ovate, obscurely shouldered in the adults, feebly constricted at the base. Volutions probably between 5 and 6, the suture lines obliterated near the obtuse apex. Aperture not conspicuously narrow, slightly oblique. Outer lip margined with a heavy white varix, defined externally by a sharp sulcus, abutting posteriorly against the preceding volution but not as a rule produced upon it. Inner labral margin sharply but irregularly dentate, the posterior denticles the sharpest and the most prominent. Parietal wall free from glaze between the commissure and the columellar folds. Pillar rather feebly reinforced. Columella quadruplicate, the posterior pair less produced externally, less proximate, and more nearly horizontal, than the pair in front of them; foremost fold marginal, not so heavy as that directly behind it. Anterior extremity smoothly channeled within, broadly rounded or very broadly and obscurely insinuated without, the labral varix continued along the margin but usually evanescing before reaching the pillar.

Dimensions: Height, 7.2 millimeters; length of aperture, 4.7 millimeters; maximum diameter, 3.7 millimeters.

Holotype: U. S. Nat. Mus. No. 328678.

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

Marginella xanthophaës is stouter than *M. denticulatoides* Maury from the Oak Grove, and the inner margin of the labrum is more coarsely dentate. It is neither so large nor so heavy as *M. euancycla* from the Chipola, the whorls of the spire are, as a rule, more strongly compressed laterally; the body is, as a rule, feebly but distinctly shouldered in the adult and is not so strongly constricted at the base. *Marginella brithia* runs smaller, heavier, and stouter. The spire is less elevated relatively, the body is not shouldered, as it usually is in *M. xanthophaës*, and the oral armature, particularly that of the labium, is more vigorous.

M. xanthophaës exhibits a considerable range of variation in relative dimensions and in the outline of the shell. The whorls may be feebly convex or they may be regularly trapezoidal. The body is broadly and smoothly rounded in the young, but the body of the adult is narrowly and very obtusely shouldered.

The species is widespread and by no means uncommon in the Chipola. It has also a meager representation in the Oak Grove.

Occurrence: Chipola formation, localities 7893^{r}, ?2212^{p}, 2213^{p}, 2564^{p}, 3419^{p}; Oak Grove sand, 5632^{r}.

Marginella (Serrata) denticulatoides Maury

Plate XLVI, figure 22

1910. *Marginella denticulatoides* Maury, Bull. Am. Paleontology, vol. 4, No. 21, p. 16, pl. 4, fig. 4.

Shell long and slender, fusiform, apex acute; suture not concealed by callus; whorls 4; terminal varix narrow, sharply defined; outer lip with 4 or 5 denticles within; columella with 4 strong plaits. Length of shell 8; of aperture 4; greatest width 3.5 millimeters.

This species is of the same size and has the general aspect of *M. denticulata* Conrad but is much more slender, and thus resembles also *M. aureocincta* Stearns.

Oak Grove, Santa Rosa (now Okaloosa) County, Fla.

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

Dimensions of figured topotype: Height, 7.2 millimeters; length of aperture, 4.4 millimeters; maximum diameter, 3.4 millimeters.

Topotype: U. S. Nat. Mus. No. 371406, from U. S. Geol. Survey station 2646, Oak Grove, Yellow River, Fla.

The whorls are probably 5 in all, and those of the spire taper regularly to an obtuse apex. The body is smoothly rounded, with no abrupt constriction at the base. The final half turn is very obscurely shouldered. The terminal varix abuts against the preceding volution and drags the suture back for a short distance. The outer lip is almost vertical except for the flexure near the commissure. The posterior portion of the body wall is free from an additional coat of glaze. The foremost of the labial folds is marginal and perceptibly narrower than those behind it. The anterior extremity is rather broadly channeled internally and smoothly rounded or obscurely truncate externally.

Conrad's recent *M. denticulata* is not only decidedly stouter, but it probably has not quite so many component volutions. Furthermore, there is in *M. denticulata* no evidence of shouldering upon the final half turn, and consequently the flexure near the posterior commissure is not so well defined. The terminal varix and the labial folds are heavier in the Miocene species than in the later form, and the anterior extremity of the shell is not so broadly channeled.

Marginella xanthophaës is perhaps the mostly closely allied congenetic species. *M. xanthophaës*, a form much more characteristic of the Chipola than of the Oak Grove, is usually not so slender as *M. denticulatoides* nor so strongly shouldered. The aperture is narrower also and both the labral and the labial armature heavier. *M. eurystoma* from the Chipola suggests a dwarf *M. denticulatoides* in which the characteristic features of that species—the obtuse shouldering of the later volutions, the rather wide aperture, and the feeble labral armature—have been exaggerated.

The Chipola individuals referred to this species are not fully mature, and their determination is a little dubious.

Occurrence: Chipola formation, localities ?2213[p], ?2211[r]; Oak Grove sand, locality 2646[c]; Shoal River formation, locality ?5079[p] (juveniles), Aldrich collection, Johns Hopkins University.

Marginella (Serrata) brithia Gardner, n. sp.

Plate XLVI, figure 23

Shell of moderate dimensions for the group, highly polished, thick and heavy; regularly fusiform in outline in the apertural view, the maximum diameter falling not far from the median horizontal; the profile of the spire not interrupted at the sutures; the component whorls trapezoidal; the body broadly and smoothly rounded. Whorls probably about 5, the sutures traceable almost to the obtuse apex. Aperture narrow, usually choked with the dental armature, very slightly oblique. Outer lip approximately straight, heavily varicated externally, the outer margin of the varix defined by an incised line. Varix abutting posteriorly against the preceding volution and dragging the suture backward with it. Inner labral margin coarsely dentate, the denticles 9 in the type and a little coarser posteriorly than anteriorly. Parietal wall free from glaze between the extremity of the labral varix and the posterior fold. Pillar reinforced. Columella quadruplicate, the 2 posterior folds less produced, less proximate, and more nearly horizontal than the anterior pair; foremost fold marginal, not so broad as that behind it and not so flattened near its outer termination. Anterior extremity rather narrow, scooped internally, rounded externally, its margin reinforced by the reduced continuation of the labral callus, which persists as an ill-defined band around the extremity and fuses with the 2 anterior folds.

Dimensions: Height, 8.3 millimeters; length of aperture, 6.0 millimeters; maximum diameter, 4.8 millimeters.

Holotype: U. S. Nat. Mus. No. 114505.

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

Marginella brithia is characterized by its smoothly rounded outline, heavy shell, and heavy oral armature. In the larger *M. euancycla* the whorls are not so strongly compressed laterally, the spire is relatively higher, the body is more constricted at the base, and neither the labral nor the labial armature is so heavy. *M. xanthophaës* is more slender, the spire is more elevated, the inner labral margin less coarsely dentate, and the labial plications not so heavy. The type is decidedly larger than the majority of individuals, which run about 7 millimeters in altitude, and these smaller forms commonly approach *M. coloba conoispira* n. subsp., which is usually more slender and has the whorls more rounded and the columellar folds less heavy than in *M. brithia*.

Occurrence: Chipola formation, locality 2213[c].

Marginella (Serrata) cornelliana Maury

1910. *Marginella cornelliana* Maury, Bull. Am. Paleontology, vol. 4, pt. 21, p. 15, pl. 4, fig. 3.

Shell of moderate size, biconic, very smooth and highly polished, 4-whorled, the convexities of the whorls of the spire not wholly concealed by the callus glaze; aperture fully two-thirds the length of the shell, rather narrow; outer lip thickened and reflexed, marginated sharply externally, bearing 6 nearly obsolete denticles, visible only with a lens; inner lip with a slight callus and four strong plaits, the anterior very oblique, the posterior nearly horizontal.

Length of shell, 9; greatest width, 4.75 millimeters.

Oligocene of the Chipola marls, Baileys Ferry, Fla.

Cornell University collection.—Maury, 1910.

This species has not been identified in the collections under discussion. It is apparently related to *M. euancycla* but the spire is relatively lower, the sides of the body more obliquely compressed, and the labral denticles less numerous.

Occurrence: Chipola formation, Cornell University collection.

Marginella (Serrata) vadosa Gardner, n. sp.

Plate XLVI, figures 24, 25

Shell rather small for the genus and not very heavy, smooth and very highly polished; remnants of the color pattern preserved in some individuals in the form of zigzag axial lineations darker in color than the background. Shell rudely biconic in outline, the spire moderately elevated, not far from one-third the altitude of the entire shell, tapering to an obtuse apex, the body ovate, not shouldered, strongly rounded medially, tapering anteriorly. Number of volutions probably about 5 in all, those of the spire trapezoidal in outline; nucleus low but rather broad, consisting of

1½ component volutions. Initial half turn largely submerged, the succeeding whorl very broadly rounded. Dividing line between conch and protoconch obscure, most surely indicated by a change in the texture of the shell and the diminished height of the initial whorl of the conch. Sutures not conspicuous but distinct except near the apex. Aperture rather narrow, oblique, acutely angulated posteriorly, widening anteriorly with the constriction at the base of the body, the outline obscured, however, by the heavy labial armature. Outer lip approximately straight, marginal varix narrow but heavy, outlined externally by a narrow sulcus, rather finely but irregularly crenate within. Varix produced backward for a short distance but less than halfway across to the posterior suture; produced also around the commissure on to the body wall. Parietal wall not glazed except near the commissure. Pillar heavily reinforced with callus, which is continuous around the anterior extremity with the varical callus of the outer lip. Columella quadruplicate, the two posterior folds a little less elevated, more nearly horizontal and less proximate than those in front of them, the foremost plication marginal and a little narrower and more produced than that behind it. Anterior extremity smoothly rounded within, truncate or very obscurely marginate externally.

Dimensions: Height, 8.2 millimeters; length of aperture, 6.0 millimeters; maximum diameter, 4.8 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 351302.

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

Marginella vadosa, possibly the progenitor of *M. aureocincta* Stearns of the Recent Atlantic coast and Gulf faunas, is apparently one of those species that can be properly described as protean. The form has a bewilderingly wide range of variation in relative dimensions, number of whorls, degree of convexity of the whorls, thickness of the labral varix, and number and character of the labral denticulations. The variations are commonly not progressive, however, but parallel. There is, moreover, a remarkable constancy in the ensemble—a rather small, thin shell, with an obtuse apex, the sutures indicated by a thread of lighter color, the parietal wall free from wash between the commissure and the pillar, the uniformity in the elevation and disposition of the columellar folds, and the smoothly rounded anterior extremity. The conspicuously slender forms have been isolated under the subspecies *ischna*. The specimen selected as the type is a little stouter than the average, but there are individuals, most of them young, which are decidedly stouter than the type. There did not seem, however, to be any advantage gained in the further splitting of a group so intimately related. In both the stouter and the more slender races the whorls may be smoothly trapezoidal in outline or they may be decidedly convex; the body may be very broadly and very smoothly rounded, or it may be obtusely shouldered. The more convex whorls and the shouldered body are, however, much more common in *M. vadosa* s. s. The variations in the characters of the outer lip are probably most of them age variations, although the coarser denticulations are apparently peculiar to the stouter forms.

Marginella coloba, a probable analog in the Chipola, is only about two-thirds as large as *M. vadosa*, the spire is usually lower and its component volutions less compressed laterally, the body is not so strongly inflated medially, and the labrum is more coarsely dentate within. There is furthermore no trace in *M. coloba* of the peculiar flattening of the pillar which helps to characterize the Shoal River species.

Occurrence: Shoal River formation, localities 3856^{p}, 3742^{a}, 5184^{r}, 7264^{r}, 5618^{r}.

Marginella (Serrata) vadosa ischna Gardner, n. subsp.

Plate XLVI, figure 26

Shell rather small, not very heavy, smooth and highly polished, slender, fusiform in outline, the maximum diameter approximating the median horizontal. Spire rather elevated for the group, tapering regularly to an obtuse apex. Body whorl ovate, broadly and smoothly tapering anteriorly. Incremental striae perceptible only near the base of the body. Whorls probably about 5. Sutures inconspicuous but distinct except at the very apex. Aperture narrow, oblique, angulated posteriorly. Outer lip almost straight, thickened marginally, the varix defined externally by an obscure sulcus. Inner surface of labrum finely and somewhat irregularly crenate, the posterior denticle the most prominent and set at some little distance from the posterior commissure; remaining denticles, 9 in the type, becoming increasingly feeble anteriorly. Varical callus spread across the commissure to the body wall but not diffused for any distance upon it. Parietal wall free from glaze between the commissure and the pillar. Pillar reinforced from the posterior fold to the anterior extremity. Columellar plications 4, heavy, becoming increasingly broader, less produced, and more nearly horizontal posteriorly, the anterior fold marginal. Anterior extremity smoothly excavated, obscurely truncate.

Dimensions: Height, 6.6 millimeters; length of aperture, 4.2 millimeters; maximum diameter, 3.3 millimeters.

Holotype: U. S. Nat. Mus. No. 371407.

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

The subspecies *ischna* includes the conspicuously slender individuals of *M. vadosa*. The shell is decidedly smaller than that of the normal *M. vadosa* and may not be fully mature. It is, however, very much higher relatively than the young *M. vadosa* s. s. of approxi-

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mately the same size. Numerous intergrading individuals occur between the species and the subspecies, and there is a parallel series of variations developed in the degree of convexity of the whorls of the spire.

Of all the variants of *M. vadosa,* those segregated under the subspecies *ischna* approach the most closely to the later Tertiary and Recent *M. aureocincta* Stearns. However, the subspecies *ischna* does not run so small as *M. aureocincta,* and it is not so delicate; the oral armature, both the labral denticulations and the labial folds, are heavier in the Shoal River shell.

Both *M. vadosa* and the subspecies *ischna* are abundant at the type locality, but the subspecies *ischna* does not occur commonly elsewhere.

Occurrence: Shoal River formation, localities 3742[a], 3748[r], 7264[r], 5618[p].

Marginella (Serrata) coloba Gardner, n. sp.

Plate XLVI, figure 27

Shell small, smooth, polished, low and squat in outline. Spire moderately elevated for the group, the component whorls rather strongly convex for the genus. Body broadly rounded, ovate in outline, somewhat constricted at the base. Volutions probably 5 in all, the suture lines traceable almost to the very apex. Aperture usually a little more than two-thirds as high as the entire shell, narrowly lenticular in outline, acutely angulated posteriorly. Outer lip very slightly flexed near the commissure, not expanded medially. Marginal varix heavy for so small a shell, defined externally by an incised line, abutting against the preceding volution and very slightly produced upon it, dragging the suture about one-third of the way across the penult. Inner margin of labrum irregularly crenate. Parietal wall free from an additional coat of glaze. Pillar feebly reinforced. Columella quadruplicate, the two posterior folds more nearly horizontal, less proximate and less produced externally than the anterior pair; foremost fold marginal and a little narrower and sharper than that behind it. Anterior extremity canaliculate on the inner surface, rounded or obscurely truncate on the outer, the labral varix evanescing while outlining it.

Dimensions: Height, 5.0 millimeters; length of aperture, 3.7 millimeters; maximum diameter, 2.9 millimeters.

Holotype: U. S. Nat. Mus. No. 114508.

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

Marginella solitaria montserratensis Mansfield from the Brasso bed of Trinidad is rather similar in outline and apertural characters but it is only about half the size of *M. coloba* and has fewer whorls.

Marginella newmani Dall of the "silex beds" of the Tampa formation is very similar in general outline, but the aperture is much wider relatively than in *M. coloba.*

Marginella vadosa of the Shoal River fauna is more than half as large again as *M. coloba,* the whorls of the spire are usually more compressed laterally, the body is more strongly inflated medially, and as a rule the denticulations upon the inner surface of the labrum are finer. Both species, however, exhibit a rather similar range of variations, so that the peripheral members approach one another. Unlike the relatively slender subspecies *conoispira, M. coloba* is apparently restricted in its distribution to the single horizon.

Occurrence: Chipola formation, localities 7893[r], 2212[p], 2213[c], 2564[p], 3419[p], 2211[c], 7183[p].

Marginella (Serrata) coloba conoispira Gardner, n. subsp.

Plate XLVI, figure 28

Shell small but rather thick and solid, more or less regularly conic behind the periphery, ovate in front of it, the maximum diameter approximating the median horizontal. Spire moderately elevated in the type, less than one-third as high as the entire shell, the component whorls feebly or not at all inflated medially. Body rounded, obscurely shouldered toward the aperture, obliquely compressed anteriorly. Whorls probably 5 in all, the sutures faint but perceptible almost to the obtuse apex. Incremental striae visible near the anterior extremity. Aperture rather narrow, oblique. Outer lip straight except for the sharp flexure at the commissure. Terminal varix heavy, margined externally by a distinct but not a deeply impressed sulcus; varix abutting against the preceding whorl and dragging the suture backward almost halfway across the penult. Parietal wall free from glaze between the labral varix and the posterior fold. Pillar feebly reinforced. Labial folds so heavy that they obscure the slight constriction at the base of the body; 4 folds, the posterior pair less produced and more nearly horizontal than those in front of them; the foremost marginal, a little narrower than that behind it. Anterior extremity smooth, channeled internally, obscurely truncate externally, the margin slightly reinforced by the reduced continuation of the labral varix.

Dimensions: Height, 5.8 millimeters; length of aperture, 3.5 millimeters; maximum diameter, 3.1 millimeters.

Holotype: U. S. Nat. Mus. No. 114502.

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

Marginella coloba conoispira is of approximately the same altitude as *M. coloba* s. s., but the maximum diameter is not quite so high and the whorls, both of the spire and of the body, are decidedly less convex, so that in consequence the spire is very much more regularly conic in outline than in *M. coloba.* The apertural characters are very similar in the two shells, but the basal constriction is less marked, both in the profile and the labium of the subspecies.

Marginella nanna runs a little larger and decidedly more slender. The spire is higher, the body is more attenuated and constricted basally, and the denticulations upon the inner margin of the labrum are finer and less regular. Both *M. xanthophaës* and *M. brithia* are larger, the spire is more elevated in both, and the component volutions are more compressed laterally. *M. coloba* sensu stricto is a smaller but heavier shell, the whorls of the spire are usually more rounded, the body more evenly inflated, and the armature both of the labrum and labium less vigorous.

Marginella coloba conoispira is less commonly represented in the Chipola than the species s. s., but unlike that species it has a meager representation in the Oak Grove as well.

Occurrence: Chipola formation, localities 2212[r], 2213[c], 2564[r], 3419[p], 2211[c]; Oak Grove sand, localities 2646[p], 5632[p], 7054[r].

Marginella (Serrata) nanna Gardner, n. sp.

Plate XLVI, figure 29

Shell small, usually rather slender, though varying in relative proportions, smooth, polished. Spire elevated, the later volutions slightly convex and feebly constricted at the sutures. Body broadly rounded, medially contracted, and somewhat attenuated at the base. Whorls probably between 5 and 6 in all, the sutures distinct almost, but not quite, to the very obtuse apex. Aperture rather narrow, somewhat oblique, the margins approximately parallel. Outer lip obtusely angulated near the commissure, reinforced by a heavy but not very wide marginal varix, which is outlined externally by a deeply impressed sulcus. Varix abutting against the preceding whorl but not posteriorly produced upon it. Inner margin of labrum furnished with about half a dozen small and usually obtuse denticles. Parietal wall free from glaze between the commissure and the posterior fold. Pillar slightly thickened. Labial folds 4, very heavy, the posterior fold shorter and more nearly horizontal than those in front of it, the adjacent fold intermediate in obliquity between the posterior plication and the 2 anterior; foremost fold marginal, a little narrower and sharper than that directly behind it and parallel to it. Anterior extremity smoothly channeled within, broadly truncate without, the margin reinforced by the diminished remnant of the labral varix.

Dimensions: Height, 5.7 millimeters; length of aperture, 3.7 millimeters; maximum diameter, 2.7 millimeters.

Holotype: U. S. Nat. Mus. No. 114503.

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

Marginella nanna is about half the size of *euancycla* and is usually more slender. They share the same general outline, the elevated spire, feebly convex whorls, and the broadly rounded body, more constricted and more produced anteriorly than is usual for the subgenus. There are, however, no adult individuals of intermediate dimensions.

Marginella coloba conoispira is stouter and heavier than *M. nanna* and has a less elevated spire and a more coarsely dentate labral margin. *Marginella critha* is smaller, the whorls of the spire are more compressed laterally, and the body is less constricted at the base.

Occurrence: Chipola formation, localities 2211[c], 7183[r].

Marginella (Serrata) critha Gardner, n. sp.

Plate XLVI, figure 30

Shell minute, smooth, highly polished, rather solid, slender, fusiform in outline, the maximum diameter falling near the median horizontal. Spire elevated for the group, slender, the component volutions trapezoidal, tapering regularly to an obtuse apex. Body ovate, broadly rounded, obliquely compressed anteriorly. Whorls probably about 5 in all. Sutures inconspicuous but usually outlined by a slightly lighter thread of color. Incremental striae usually visible near the base of the body. Aperture narrow, oblique, acutely angulated posteriorly. Outer lip flexed near the commissure, very broadly and almost imperceptibly arcuated, thickened marginally. Varix defined externally by an obscure sulcus, abutting posteriorly against the preceding volution. Inner labral margin finely and somewhat irregularly dentate, the posterior denticle set at some little distance from the commissure and decidedly heavier than those in front of it. Parietal wall free from glaze between the commissure and the pillar. Columellar plications conspicuously heavy for the small dimensions of the shell, becoming increasingly broader, less produced, and more nearly horizontal posteriorly; anterior fold marginal. Pillar feebly reinforced from the posterior fold to the anterior extremity of the shell, which is smoothly rounded and is margined externally by the reduced continuation of the labral varix.

Dimensions: Height, 4.5 millimeters; length of aperture, 2.7 millimeters; maximum diameter, 2.1 millimeters.

Holotype: U. S. Nat. Mus. No. 350265.

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

Marginella critha is very close superficially to a dwarf *M. denticulatoides* Maury. However, aside from the fact that *M. critha* is but little more than half the dimensions of Miss Maury's species, though of approximately the same number of whorls, the smaller form is less angular, has a more heavily plicated pillar, and is not so broadly truncate anteriorly.

Marginella aureocincta Stearns of the later Tertiary and Recent faunas is similar in dimensions and contour, but the columellar folds of *M. aureocincta* are more oblique and not so heavy.

The congenetic *Marginella oryzoides* is thinner and more nearly cylindrical in outline, the spire is less elevated relatively, and the outer lip is medially constricted and is smooth within. *M. nanna* is larger, stouter, and heavier than *M. critha*, the whorls of the spire are usually less compressed laterally than in the smaller species, the body is more attenuated and more strongly constricted at the base.

Marginella critha is one of the relatively few species that have a wide distribution both in the Oak Grove and the Chipola.

Occurrence: Chipola formation, localities 2212[p], 2213[c], 2564[p], 3419[p], 2211[c]; Oak Grove sand, localities 2646[p], 5632[p], 5631[r], 7054[r].

Marginella (Serrata) eurystoma Gardner, n. sp.

Plate XLVI, figure 31

Shell small, thin, smooth, highly polished. Spire quite elevated for the genus, the component volutions feebly convex, the body obtusely shouldered and constricted at the base. Whorls probably 5, the sutures distinct and traceable almost to the obtuse apex. Aperture conspicuously wide for the group, more than half as high as the entire shell. Outer lip angulated sharply at the shoulder and more widely and obtusely near the anterior extremity, vertical between the angulations. Marginal varix not very heavy, abutting against the preceding whorl but not produced upon it, the impressed line defining it commonly evanescing anteriorly; labrum finely and irregularly dentate within, the posterior denticle prominent and isolated from those in front of it; parietal wall not at all and the pillar very feebly reinforced; body smoothly constricted at the base; posterior fold approximately horizontal, less produced than those in front of it, the fold next to it a little more produced and decidedly more oblique; anterior fold marginal, not quite so prominent as that directly behind it; anterior extremity broad, truncate, the margin not reinforced.

Dimensions: Height, 5.2 millimeters; length of aperture, 3.7 millimeters; maximum diameter, 3.0 millimeters.

Holotype: U. S. Nat. Mus. No. 328697.

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

Marginella eurystoma is conspicuous for its thin shell, angular outline, and wide aperture. The vertical outer lip is angulated at the shoulder and more obscurely near the anterior extremity; the dentition of the inner labral margin is conspicuously feeble. The labral folds are sharp but not at all heavy for the group, and the anterior extremity is very broad.

M. eurystoma suggests a short and relatively broad miniature of *M. denticulatoides* Maury. The shoulder angle is, however, more strongly defined and more persistent toward the apex than in Miss Maury's species, and the aperture is relatively wider. The smaller form is apparently restricted to the Chipola horizon, the larger to the Oak Grove.

Occurrence: Chipola formation, localities 2564[p], 3419[p], 2211[p].

Subgenus VOLVARINA Hinds

1844. *Volvarina*, Hinds, Zool. Soc. London Proc., pt. 12, p. 75.

Type: *Marginella avena* Valenciennes. (Recent in the West Indies.)

The following species belongs to a section of this genus, which might with much propriety be separated as a subgeneric group, under the name of *Volvarina*. They are all delicate and rather thin shells, with an apparent spire, the labrum never varixed, and usually not even thickened, with a sharp edge, always bent in on the aperture. The columellar folds are nearly constantly 4 in number, slender, and more or less oblique. *M. avena*, Valenciennes, is a typical species.—Hinds, 1844.

The only other species listed is *Marginella nitida* from an unknown habitat.

This group of small slender shells with no conspicuous thickening of the outer lip and no denticulation upon its inner surface is given no more than equal rank with *Serrata*.

Marginella (Volvarina) oryzoides Gardner, n. sp.

Plate XLVII, figure 1

Shell minute, smooth, polished, very slender in outline, the maximum diameter falling not far behind the median horizontal. Spire varying widely in relative elevation, moderately high for the group, usually approximating one-third of the altitude of the entire shell. Whorls probably about 5 in all, the sutures so nearly obliterated, however, by the surface glaze that the exact number is not determinable; the outline of the whorls, as seen through the callus, trapezoidal or very feebly convex; body broadly and smoothly rounded. Aperture narrow, especially in the posterior half. Outer lip feebly flexed near the posterior commissure, broadly and feebly constricted medially, commonly flaring a little anteriorly. Labral margin thickened, the varix obscurely defined externally; varical callus produced backward for a short distance upon the penult, dragging the suture with it. Inner margin of labrum smooth, not reinforced. Parietal callus indicated by a broad, ill-defined bulge upon the posterior portion of the body wall opposite the labrum. Pillar quadruplicate, the 2 medial folds the most prominent, equal to one another and approximately parallel to the slightly narrower marginal fold; posterior fold less produced, more nearly horizontal, and narrower than those in front of it. Anterior extremity obscurely and somewhat obliquely emarginate.

Dimensions: Height, 5.9 millimeters; length of aperture, 4.0 millimeters; maximum diameter, 2.7 millimeters.

Holotype: U. S. Nat. Mus. No. 328700.

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

Marginella oryzoides suggests a very pointed grain of rice. It is well characterized by its small size, very slender, smoothly rounded, rudely cylindrical outline, the slight labial varix medially constricted, the smooth inner margin of the labrum, and the columeller folds, all but the posterior approximately parallel and conspicuously oblique.

Marginella oryzoides is the probable progenitor of *Marginella bella* Conrad (pl. XLVII, fig. 4) of the later Tertiary and Recent faunas. The Recent individuals are, as a rule, not so slender, and specimens from the upper part of the Yorktown formation near Days Point —Conrad's type locality—are decidedly larger, lower spired, and not so slender. The *M. bella* variant to which *M. oryzoides* approaches the most closely is *M. bella tersa* Mansfield (pl. XLVII, fig. 2) from the uppermost Miocene of Florida. The lower Miocene species is smaller, with a slightly higher spire. *M. bella hosfordensis* Mansfield (pl. XLVII, fig. 3), also from the uppermost Miocene, is figured to show the range of variation in this prolific species during the upper Miocene.

The later Tertiary and Recent *Marginella aureocincta* Stearns is a species of comparable dimensions, but it is not so slender nor so smoothly rounded. The outer lip is crenate within, and the marginal varix is more strongly defined externally than it is in *M. oryzoides*.

M. critha from the Chipola fauna runs smaller and heavier than *M. oryzoides*, the spire is more elevated relatively, and the outer lip is finely dentate along the inner margin and not constricted medially.

Marginella oryzoides is not at all uncommon at the type locality, but it has not been recognized at any other horizon and is rare along Chipola River.

Occurrence: Chipola formation, localities 2213[r], 3419[r], 2211[c].

Subgenus EGOUENA Jousseaume

1875. *Egouena* Jousseaume, Rev. et mag. zoologie, sér. 3, vol. 3, p. 167.

Type (by tautonymy): *Porcellana egouen* Adanson= *Marginella amygdala* Kiener. (Recent off the west coast of Africa.)

Coquille à spire courte, avec 4 plis columellaires, le premier se continuant avec le bord externe en décrivant une courbe spirale.—Jousseaume, 1875.

Egouena includes heavy shells of moderate dimensions with short but not concealed spires. The marginal callus is continued around the anterior extremity of the aperture and unites with the parietal wash. As in all groups with a thickened outer lip there is a tendency toward a denticulation of the inner surface. This is true in *Egouena*, but it is not a constant character in the group or even in some single species—for example, *Marginella apicina* Menke, the Floridian and West Indian shell. In many specimens of *apicina* there is no trace of any labral roughening, but in others there is a regular and obvious corrugation of the inner margin of the labrum.

In 2 of the 55 species described by Jousseaume, *E. laeta* and *E. egouen*, the name is spelled "*Egouana*." Obviously a derivative of Adanson's specific name, it first appears in the short description of the subgenus and is written "*Egouena*."

Section EGOUENA Jousseaume

1875. *Egouena* Jousseaume, Rev. et mag. zoologie, sér. 3, vol. 3, p. 167.

Type (by tautonymy): *Porcellana egouen* Adanson= *Marginella amygdala* Kiener. (Recent off the west coast of Africa.)

The section is reserved for Marginellas of small and medium size which have in common a short spire, a varicose outer lip, usually smooth within, and a quadruplicate columella. The labral callus in *Egouena* is continued forward around the anterior extremity of the shell to fuse with the parietal callus.

Marginella (Egouena) apalachee Gardner, n. sp.

Plate XLVII, figure 5

Shell usually small but commonly attaining moderate dimensions for the genus, smooth and rather highly polished, broadly conic behind the periphery, ovate to cuneate in front of it. Spire rather low, regularly tapering to an obtuse apex. Whorls probably about 5, the sutures more or less obliterated by the surface glaze. Aperture narrow, broadening a little anteriorly, slightly oblique. Outer lip flexed at the shoulder, usually broadly and very feebly constricted medially. Terminal varix broad but not very heavy, defined externally by a shallow sulcus, smooth within, produced backward about halfway across the penult, fusing around the posterior commissure with the body wash; parietal callus indicated by the broad bulge upon the body wall but with no well-defined outer margin. Pillar quadruplicate, the posterior pair not quite so broad, less oblique and less produced externally than the anterior pair; foremost fold marginal, very narrow within the aperture but broadening at the entrance, fusing with the narrow, ill-defined band of callus which outlines the truncated anterior extremity and which is also continuous with the labral callus.

Dimensions: Height, 9.0 millimeters; length of aperture, 7.6 millimeters; maximum diameter, 5.1 millimeters.

Holotype: U. S. Nat. Mus. No. 114479.

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

M. apalachee runs decidedly larger than the congenetic *M. lipara*. The outline of the shell behind the

periphery is as a rule more regularly conic than in *M. lipara*, and the sutures are more completely obliterated. Then, too, the labral varix is not usually quite so heavy nor its outer margin so sharply defined, and the inner edge is smooth instead of being crenate, as in the smaller *M. lipara*.

M. apalachee is much less common and less widely distributed than the congener in question. *M. eleutheria* is another member of the Alum Bluff fauna that exhibits the same general characters, but *M. eleutheria* is decidedly larger than *M. apalachee*, the aperture is more produced posteriorly, and the inner labral margin is crenated.

The characters of the aperture ally *M. apalachee* with the lower-spired, more conical species *M. contracta* Conrad (pl. XLVII, fig. 6) of the later Tertiary and *M. virginiana* Conrad (pl. XLVII, fig. 7) of the later Tertiary and Recent faunas.

Occurrence: Chipola formation, localities 2211[c], 7183[r].

Marginella (Egouena) lipara Gardner, n. sp.

Plate XLVII, figure 9

Shell small, smooth, very highly polished, broadly conic behind the periphery, compressed, ovate in front of it. Spire short, tapering to an obtuse apex. Body obliquely and obtusely shouldered. Whorls probably about 5. Sutures inconspicuous but traceable except at the very apex, the suture in the adult dragged backward near the aperture about half the width of the whorl. Aperture narrow, oblique, the margins rudely parallel. Outer lip sharply flexed at the shoulder, broadly varicated, the margin of the varix sharply defined externally, in general broadly and feebly contracted medially, finely and somewhat irregularly crenate along the inner edge. Varix produced posteriorly across the penult continuing around the commissure and fusing with the body wash, which is heavy and forms an obscure ridge opposite the posterior half of the labrum. Outer margin of parietal wash ill defined, thinning anteriorly and fusing with the light pillar callus. Labial plications 4, heavy for so small a shell, the posterior the shortest and the most nearly horizontal; anterior plication marginal and very sharp and narrow, the one directly behind it approximately parallel to it and the broadest and most elevated of any of the 4. Marginal fold merging imperceptibly into the narrow band of enamel which forms the outer border of the very broad and shallow anterior notch and which is continuous with the varical callus of the labrum.

Dimensions: Height, 8.0 millimeters; length of aperture, 6.8 millimeters; maximum diameter, 4.4 millimeters.

Holotype: U. S. Nat. Mus. No. 371409.

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

The subspecies *lepta* is conspicuously smaller. *M. apalachee* from Alum Bluff runs larger than *M. lipara;* the spire of the former is as a rule more regularly conic and the sutures more completely obliterated, the labral varix is not so sharply defined externally, and the inner edge is smooth instead of crenate, as in *M. lipara*. *Marginella contracta* Conrad (pl. XLVII, fig. 6) of the later Tertiary and Recent fauna, has a lower, flatter spire, a more sharply defined body shoulder, and a labrum similar to that of *M. apalachee*. *Marginella bella* Conrad (pl. XLVII, fig. 4), also of the later Tertiary and Recent, is more cylindrical in outline; there is no conspicuous thickening of the labrum and the two anterior folds upon the pillar are more oblique and not so heavy.

Marginella virginiana Conrad (pl. XLVII, fig. 7), a third species of the same general distribution, runs larger than *M. lipara;* the spire is usually more obtuse, and the aperture more produced posteriorly.

By far the greater number of similar species that are crenulated upon the inner surface of the labrum are included under *Microspira*, but the other characters of *M. lipara* ally it more closely to shells of the *M. apalachee* group than to those represented by *M. oviformis* Conrad.

Occurrence: Chipola formation, localities 2212[p], 2213[a], 2564[c], 3419[c], 2211[c].

Marginella (Egouena) lipara lepta Gardner, n. subsp.

Plate XLVII, figure 8

Shell small, very smooth and highly polished, slender, subcylindrical to rudely ovate in outline. Spire moderately elevated for the group, tapering to an obtuse apex, the convexities of the later whorls of the spire perceptible in some individuals under the coat of glaze. Body obtusely shouldered, commonly broadly and feebly contracted medially toward the labrum. Whorls probably about 5 in all, the sutures more or less obscured by the enamel. Aperture narrow, oblique, the margins approximately parallel. Outer lip broadly thickened, flexed at the shoulder, in many specimens feebly constricted medially, the varix defined externally by a shallow groove. Varix produced backward, dragging the suture with it; inner labral margin finely and irregularly crenulated. Inner wall of aperture flattened posteriorly, the parietal wash well fused with the surface enamel. Pillar quadruplicate, the folds becoming increasingly less produced and more nearly horizontal posteriorly; foremost plication marginal, narrow and sharp just within the aperture, spreading broadly at the entrance and fusing with the labral varix by way of the ill-defined band of callus that outlines the anterior extremity; fold behind the marginal fold very prominent and approximately parallel to that in front of it. Anterior extremity obtusely truncate.

• Dimensions: Height, 7.0 millimeters; length of aperture, 6.0 millimeters; maximum diameter, 3.7 millimeters.

Holotype: U. S. Nat. Mus. No. 371410.

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

Marginella lipara lepta is separated from *M. lipara* s. s. by its conspicuously slender outline.

The subspecies is very much less common than the species.

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

Marginella (Egouena) capsa Gardner, n. sp.

Plate XLVII, figure 10

Shell rather small, heavy, smooth, polished, well rounded, subcylindrical to subovate in outline. Aperture almost as long as the entire shell. Posterior surface broadly rounded except for the low apical knob. Body not shouldered. Whorls apparently rather numerous, although the sutures are so obscured by the heavy glaze that the number is not determinable. Aperture narrow, less so in the anterior half than in the posterior. Outer lip very feebly arcuated, margined with a very heavy band of callus 2 millimeters wide in some portions of the type. Inner margin of labrum smooth except for an amorphous denticle at the entrance to the anterior canal. Labral varix posteriorly produced almost or quite to the apical knob, continuing around the commissure. Parietal wall not reinforced by an additional coat of glaze. Columella quadruplicate, the anterior pair a little broader, a little more oblique, and a little more produced than the posterior pair; foremost fold marginal but not fused with the edge of the pillar. Anterior extremity broadly truncate, the varical band continued around it and fusing with the pillar wash.

Dimensions: Height, 6.2 millimeters; length of aperture, 5.6 millimeters; maximum diameter, 3.7 millimeters.

Holotype: U. S. Nat. Mus. No. 114484.

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

Marginella capsa is well characterized by its well-rounded, subcylindrical outline, the aperture produced almost to the apex of the spire, and the very broad and heavy band of callus that margins the outer lip and persists around the anterior extremity. The species has not been recognized except at the type locality.

If it were not for the number and disposition of the columellar folds the species would be referred to *Gibberula*. The broad flat band of callus that borders the labrum is very suggestive of that upon *Gibberula oryza* Lamarck, the type of the subgenus.

Occurrence: Chipola formation, locality 2211^{p}.

Section MICROSPIRA Conrad

1868. *Microspira* Conrad, Am. Jour. Conchology, vol. 4, p. 66.
1928. *Leptegouana* Woodring, Miocene mollusks of Bowden, Jamaica, pt. 2: Carnegie Inst. Washington Pub. 385, p. 237. Type: *Voluta guttata* Dillwyn. (Recent off the coast of Florida and the West Indies.)

Type (by monotypy): *Volutella* (*Microspira*) *oviformis* Conrad (pl. XLVII, figs. 11–14). (Miocene of Virginia.)

This shell differs from all the recent species of *Volutella* in its slightly prominent spire, and especially in its greatly thickened labrum, with its large thick stria on the inner margin.—Conrad, 1868.

Woodring mentioned the possible identity of his section with the *Microspira* of Conrad, but the type species could not be found, and *Microspira* was for the time being a nomen nudum. As it has since appeared as No. 1617 in the collections of the Academy of Natural Sciences in Philadelphia, Conrad's name may well be revived.

Marginella (Egouena) aurora Dall

Plate XLVII, figure 15

1890. *Marginella aurora* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 51, pl. 6, fig. 4a.

Shell large, strong, with a short but sharp spire, and about 5 whorls; suture obscure; outer lip thick, strong, a channel behind it externally, inner edge finely irregularly denticulate; aperture narrow, posterior commissure extended to the third whorl from the nucleus, wider anteriorly; pillar with 4 subequal plaits, the anterior pair contiguous; body moderately callous; shell showing traces of a rich orange color, perhaps originally red, uniformly diffused. Max. lon. of shell 27.0; lat. 15.0 millimeters.

The form is that of *prunum*, with a higher spire, different lip, and a posterior commissure like that of *M. carnea*.—Dall, 1890.

Holotype: U. S. Nat. Mus. No. 97498.

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

M. aurora is the probable analog of *M. dominigensis* Dall of the Dominican fauna, but the body of the former is more slender and the columella is more strongly plicate. There is also a probable analog in the Shoal River fauna, but it is represented by a single individual too imperfect to describe.

Occurrence: Chipola formation, locality 2213^{r}.

Marginella (Egouena) eleutheria Gardner, n. sp.

Plate XLVII, figure 16

Shell large for the genus, smooth, highly polished when fresh, ovate in outline. Spire short, varying from one-sixth to one-eighth of the altitude of the entire shell; the callus commonly not entirely concealing the convexities of the component whorls. Whorls probably 5 in all, rapidly enlarging from the obtuse apex. Body whorl obscurely shouldered posteriorly, broadly rounded or obliquely compressed medially, slightly constricted anteriorly. Aperture rather narrow, ob-

lique, the margins rudely parallel. Outer lip oblique except for a sharp bend at the posterior commissure. Marginal varix heavy, defined externally by a narrow sulcus, finely and irregularly crenate along the inner edge in some but not in all individuals. Varical callus produced backward for a short distance, fusing around the commissure with the heavy parietal glaze, which sometimes forms an obscure ridge along the posterior half of the body wall. Columella quadruplicate, the posterior pair less elevated, less oblique, and less proximate than the anterior; foremost fold marginal, more produced, and a little less elevated than that behind it. Anterior extremity smoothly rounded, not emarginate, the varical callus much diminished but persisting around the extremity and fusing with the pillar wash.

Dimensions: Height, 14.0 millimeters; length of aperture, 12.2 millimeters; maximum diameter, 8.4 millimeters.

Holotype: U. S. Nat. Mus. No. 114464.

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

Both *Marginella ballista* and *M. tampae* Dall from the "silex" fauna are larger and have lower spires and wider apertures. *M. gregaria* Dall, also from beds at Ballast Point, has a much more slender and more smoothly rounded body. *Marginella precursor* (pl. XLVII, fig. 20) of the Floridian Pliocene is larger and the aperture mounts almost to the apex of the spire. *Marginella limatula* Conrad from the later Tertiary faunas is decidedly more slender and not quite so large as *M. eleutheria*. *M. eleutheria* is abundant at the type locality, but it has not been recognized elsewhere. The subspecies *dasa*, characterized by a short and relatively very broad outline together with a very heavy labral varix and parietal glaze, also occurs at Alum Bluff, although it is much more closely associated with the fauna of Chipola River. No other congenetic member of the biconic Marginellas with ill-defined sutures attains the dimensions of *M. eleutheria*. In *M. apalachee*, which, perhaps, approaches it most closely, the spire is not so broad and the outer lip is smooth within.

Occurrence: Chipola formation, locality 2211[a].

Marginella (Egouena) eleutheria dasa Gardner, n. subsp.

Plate XLVII, figure 17

Shell of moderate dimensions for the group, relatively broad, thick, and heavy, rudely ovate, smooth, and highly polished, retaining traces, apparently, of a brilliant orange coloration. Spire short and broadly conic. Body obtusely shouldered; sides of body obliquely compressed. Whorls approximately 4 in all, the sutures inconspicuous but usually traceable almost but not quite to the apex. Aperture narrow, oblique, the margins approximately parallel. Outer lip heavily varicated, the varix sharply defined externally by a shallow groove, the inner margin very finely crenate. Varical callus produced backward almost but not quite to the apex, fusing around the commissure with the heavy parietal glaze. Body wash very heavy, forming an obtuse ridge along the inner margin of the aperture between the commissure and the posterior fold, diffusing gradually and rather widely over the body wall; pillar wash less heavy than that upon the medial portion of the body but continuous with it. Columellar folds 4, prominent; the posterior pair less proximate and more nearly horizontal than the pair in front of them; anterior fold marginal, narrower, sharper, and more persistent externally than those behind it. Anterior extremity smoothly scooped internally, broadly truncate or very obscurely emarginate externally, the margin reinforced by the much reduced extension of the varical callus, which continues around the extremity or fuses with the marginal fold.

Dimensions: Height, 10.5 millimeters; length of aperture, 9.0 millimeters; maximum diameter, 7.0 millimeters.

Holotype: U. S. Nat. Mus. No. 371408.

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

The subspecies *dasa* is isolated from *M. eleutheria* s. s. because of its much lower altitude and relatively greater diameter. These conspicuously smaller and stouter individuals have all the earmarks of complete maturity. Both the labral varix and the parietal wash are heavier as a rule in the subspecies than in the normal form. *M. eleutheria* s. s. is restricted in its distribution to the type locality, and the subspecies is very rare at Alum Bluff.

The subspecies has much the dimensions and outline of *M. apicina* Menke (pl. XLVII, figs. 18, 19) of the later Tertiary and Recent fauna, but the Alum Bluff form is heavier and the sutures are much more obscured than in *M. apicina*.

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

Subgenus PERSICULA Schumacher

1817. *Persicula* Schumacher, Essai d'un nouveau système des habitations des vers testacés, p. 235.

Type (by monotypy): *Persicula variabilis* Schumacher = *Voluta persicula* Linnaeus. (Recent off the west coast of Africa and the Indo-Pacific.)

Shell of medium size or small, ovoid or ovately globose in outline. Spire depressed, almost or entirely concealed by the peristomal glaze. Aperture nearly as long as the shell, the margins subparallel and curving with the inflated body. Outer lip varicose, dentate within. Parietal wash heavy, produced backward at the posterior commissure and in many entirely concealing the spire. Columellar folds usually more than 4, set at a higher angle to the axis of the shell than in

Serrata and *Egouena;* the two anterior plications the most prominent, the most oblique, and the most persistent; both the anterior and the posterior extremities of the aperture emarginate.

Marginella (Persicula) calhounensis Maury

Plate XLVII, figure 21

1910. *Persicula calhounensis* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 16, pl. 4, fig. 5.

Shell rather small, stout, oval, highly polished; spire so depressed as to appear quite flat; volutions hidden by a wash of callus; body whorl shouldered; aperture extending the whole length of the shell; outer lip thickened at the margin, finely serrate within; inner lip with a callus terminated by a bordering ridge, and bearing 5 plaits of which the three posterior are horizontal and feeble, the anterior oblique and strong. Length of shell 5.5; greatest width 4 millimeters.

Chipola Oligocene, Baileys Ferry, Fla.

Cornell University collection.—Maury, 1910.

Shell small, stout, heavy, regularly conic, more or less flattened posteriorly, the body obtusely angulated at the shoulder, the sides of the body obliquely compressed; aperture almost as long as the entire shell. Suture separating the ultima from the penult distinct, those separating the component whorls of the spire entirely obliterated by the heavy coat of enamel, which is spread evenly over the spire and is continuous with the parietal glaze. Spire flattened or reduced to a very low, rounded apical mound. Aperture narrow, oblique except for a very slight posterior curvature, the margins approximately parallel. Outer lip thickened but with no well-defined varix, more or less angulated at the shoulder, the margin usually beveled and finely crenate within. Parietal wall very heavily calloused; the wash continuous posteriorly with that which conceals the whorls of the spire, forming an ill-defined boss directly opposite the posterior commissure, less heavy medially, extending obliquely across the base of the shell anteriorly and reinforcing the outer margin of the siphonal notch. Anterior half of the inner wall of the aperture plicated, the marginal fold and that directly behind it proximate, oblique, parallel, equally elevated; 2 to 5 less elevated and less produced folds developed behind them, which become increasingly feeble and more nearly horizontal posteriorly and do not persist within the aperture. Anterior notch rather narrow and very deep for the genus, the margins parallel and obliquely directed.

Dimensions: Height, 6.8 millimeters; maximum diameter, 5.0 millimeters.

Topotype: U. S. Nat. Mus. No. 328714.

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

There is no species that very closely approaches this broad little cone. The oblique band of callus surrounding the base is much more suggestive of the Olividae than of *Marginella*. *Marginella calhounensis* is abundant in the Chipola. The specimens from Alum Bluff seem to be a little more flattened posteriorly and more acutely angulated at the shoulder of the body.

Occurrence: Chipola formation, localities, 2211[a], 2564[c], 3419[c], 7183[r], Cornell University, Aldrich collection, Johns Hopkins University.

Marginella (Persicula) progravida Gardner, n. sp.

Plate XLVII, figure 22

Shell of moderate dimensions for the group, broadly ovate in outline, stout and heavy and probably polished when fresh. Spire entirely concealed. Apical surface obscurely flattened, the periphery of the body whorl smoothly rounded, the sides obliquely compressed into the broad base. Aperture almost but not quite so long as the entire shell, not conspicuously narrow, the margins approximately parallel and arching with the curvature of the body. Labrum very slightly thickened within, feebly crenulated along the inner edge. Parietal wall heavily washed with callus laid down along a rather wide area rudely parallel to the apertural opening, obliquely deflected near the extremity and running across the base to the outer margin of the notch. Labial folds probably 5, the two anterior more elevated and more oblique than those behind them, which probably do not persist within the aperture. Posterior extremity of aperture narrowly and deeply emarginate. Anterior extremity broadly and not very deeply notched, the margin of the notch heavily reinforced.

Dimensions: Height, 7.0 millimeters; length of aperture, 6.3 millimeters; maximum diameter, 5.2 millimeters.

Holotype: U. S. Nat. Mus. No. 371411.

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

Marginella progravida is apparently an antecedent of *M. gravida* Dall (pl. XLVII, fig. 23) of the later Tertiary but is smoothly rounded at the periphery and not obscurely shouldered as in *M. gravida;* the posterior notch is conspicuously deeper and the anterior notch a little more shallow. None of the described Alum Bluff species approaches very closely to *M. progravida*. *M. calhounensis* Maury is conspicuously conic in outline, and *M. majuscula* is decidedly more slender and more cylindrical and angulated at the posterior extremity of the aperture. *Marginella progravida* is described from a unique type, but this Bainbridge fauna is so meager that it seems best to recognize all well-preserved individuals.

Occurrence: Oak Grove sand, locality 7148[r].

Marginella (Persicula) majuscula Gardner, n. sp.

Plate XLVII, figure 24

Shell large for the group, smooth, highly polished, ovate in outline, evenly rounded except toward the

labrum, where the flattening is rather conspicuous; maximum diameter not very far behind the median horizontal. Spire involute. Apical surface flattened, the sutures entirely concealed by a thin nautiliform wash of enamel. Incremental striae exceedingly faint. Aperture almost but not quite so long as the entire shell, very narrow, gently curved posteriorly and angulated at the commissure. Outer lip not greatly thickened marginally, approximately parallel to the body wall throughout its extent, finely and evenly lirate from the commissure to the anterior notch. Parietal wash thin, its margin ill-defined except near the anterior extremity of the labrum. Anterior half of inner wall of aperture plicate, only the 2 anterior folds persistent; 3 or rarely 4 plications developed upon the parietal wall normal to the axis of the shell, the folds becoming increasingly feeble posteriorly; anterior fold marginal, that behind it parallel to it but broader; anterior extremity of pillar obliquely flattened. Anterior extremity of aperture broadly and obliquely emarginate.

Dimensions: Height, 7.9 millimeters; maximum diameter, 5.1 millimeters.

Holotype: U. S. Nat. Mus. No. 350271.

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

Marginella majuscula is almost twice the size of the abundant congenetic species *M. dryados* Maury. It differs further from the smaller form in the more flattened apical surface, the complete obliteration of the sutures, the greater approximation of the aperture to the apex, and the less shallow anterior emargination.

Occurrence: Oak Grove sand, localities 2646^{r}, 5632^{r}.

Subgenus GIBBERULA Swainson

1840. *Gibberula* Swainson, A treatise on malacology, p. 323.

Type (by monotypy): *Gibberula zonata* Swainson= *M. oryza* Lamarck, not *Marginella zonata* Kiener. (Recent off the west coast of Africa.)

Suboval; spire slightly prominent; top of the outer lip dilated and gibbous; base of the inner lip with plaits; inner lip broad, spreading.—Swainson, 1840.

There are usually 5 or 6 plications developed upon the inner wall of the aperture, but only the 2 anterior folds persist within the aperture. The base is emarginate as a rule, and the species attain only slight dimensions.

Marginella (Gibberula) dryados (Maury)

Plate XLVII, figure 25

1910. *Persicula dryados* Maury, Bull. Am. Paleontology, vol. 4, No. 21, p. 16, pl. 4, fig. 6.

Shell small, oval, spire depressed and involute, in adult shells covered with callus so as to conceal entirely the volutions; aperture extending nearly the length of the shell; outer lip very finely crenulate along the entire inner margin; pillar washed over with callus, with 4 or 5 plaits of which the posterior are very feeble, the anterior more oblique and stronger.

Length of shell, 4.5; greatest width, 3 millimeters.

Oligocene of the Oak Grove sands, Santa Rosa (Okaloosa) County, Fla.

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

Topotype: U. S. Nat. Mus. No. 371412.

The maximum diameter falls within the posterior third. The posterior extremity is broadly and evenly rounded except for a low apical knob. The shell when resting upon the apertural surface is obliquely flattened toward the labrum. The incremental striae show up faintly upon the highly polished surface. The sutures are much obscured but not entirely obliterated by the enamel and indicate a conch of 4 or 5 volutions. The aperture is sublinear, angulated at the posterior commissure but not produced backward. The outer lip is thickened only in the fully adult, obtusely angulated posteriorly and parallel, for the most part, with the inner wall of the aperture. The columellar plications are apparently absorbed to a certain extent. As many as 7 have been noted in immature individuals but never more than 5 in the fully adult, and the fifth is usually obsolete. Of this number only the marginal fold and that directly behind it persist within the aperture. The anterior notch is very shallow, and its margin is not thickened.

The congenetic *M. majuscula* is not only almost twice as large as *M. dryados*, but the apical surface is more flattened and the sutures are obliterated by the surface glaze. The Chipola analog *M. chondra* is smaller than *M. dryados*. The spire of *M. chondra* is even lower than that of *M. dryados*, and the sutures are so obscured by the enamel coating that they cannot be traced. The Shoal River analog, *M. waltoniana*, has a more strongly rounded body and is more flattened apically. The sutures of *M. waltoniana* are even more obscured by enamel, the aperture is relatively longer, the columellar folds are more elevated, and the anterior extremity is more strongly channeled.

Occurrence: Oak Grove sand localities, 2646^{a}, 5632^{c}, 5631^{r}, 5633^{r}, 7054^{p}. Aldrich collection, Johns Hopkins University; Cornell University collection.

Marginella (Gibberula) chondra Gardner, n. sp.

Plate XLVII, figure 26

Shell minute, ovate conic in outline, moderately heavy. External surface smooth and highly polished. Aperture almost but not quite as high as the entire shell, the rounded apical knob rising a little beyond it. Sutures almost or entirely obliterated by the dense external glaze. Body whorl broadly and evenly rounded, the maximum diameter falling within the posterior third of the shell. Aperture narrow, sublinear, acutely angulated behind. Outer lip thickened but with no well-defined terminal varix, obtusely

shouldered posteriorly, smoothly rounded and a little patulous anteriorly, broadly and obscurely contracted medially, finely and evenly crenate along the inner margin. Parietal wash fused with the surface enamel. Inner margin of aperture plicated along the anterior half, the folds usually 5, becoming increasingly feeble and less oblique posteriorly, only the 2 anterior, one of them marginal, persistent within the aperture. Anterior extremity rather broadly and somewhat obliquely emarginate.

Dimensions: Height, 3.3 millimeters; maximum diameter, 2.2 millimeters.

Holotype: U. S. Nat. Mus. No. 371413.

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

M. chondra is the analog in the Chipola fauna of *M. dryados* in the Oak Grove. *M. dryados* is longer by almost a third and is more strongly curved. The spire is not quite so low in *M. dryados*, and the sutures are not obliterated as in *M. chondra*. The anterior emargination is also a little more shallow in the Oak Grove species and a little more oblique. Both forms are abundant at their respective horizons, the Chipola species even more so than the Oak Grove.

M. waltoniana, the Shoal River analog, is of approximately the same altitude but is slightly broader. The Shoal River species is also more flattened posteriorly, and in consequence the aperture is relatively longer. Then, too, the columellar folds are more sharply elevated than in *M. chondra*, the base of the pillar is more excavated, and the anterior emargination is more shallow. The congenetic *M. calhounensis* Maury is half as large again and broader, both relatively and absolutely. *M.* (*Gibberula*) sp. which has been recognized only at the type locality, Alum Bluff, is very similar in general outline and dimensions, but the apical knob is less prominent and the anterior extremity is not emarginate.

Occurrence: Chipola formation, localities 2212[r], 2213[c], 2564[p], 3419[c], 7151[p], 2211[c], 7183[p].

Marginella (Gibberula) waltoniana Gardner, n. sp.

Plate XLVII, figure 27

Shell minute but rather solid, ovate conic in outline, broadly and smoothly rounded both posteriorly and laterally, the maximum diameter falling within the posterior third. External surface smooth and highly polished, faintly streaked and striated incrementally. Aperture extending almost but not quite the length of the shell. Spire indicated by a slightly darker line inclosing a subcircular area, from the center of which rises the low, broadly rounded apical knob; number of component volutions not determinable. Aperture very narrow, angulated posteriorly, the margins subparallel. Outer lip obscurely shouldered behind, slightly patulous in front, its margin feebly constricted from the shoulder almost to the base; inner surface set with 9 or 10 fine denticles, evenly disposed between the extremities of the labrum. Parietal wash fused with the surface enamel. Columellar plications 4 or 5 becoming increasingly shorter and more feeble posteriorly, only the 2 anterior, one of them marginal, persistent within the aperture. Anterior extremity of pillar obliquely flattened. Anterior extremity of aperture relatively broad, slightly flaring, widely but not deeply emarginate.

Dimensions: Height, 3.3 millimeters; maximum diameter, 2.25 millimeters.

Holotype: U. S. Nat. Mus. No. 351311.

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

M. waltoniana is the analog in the Shoal River fauna of *M. dryados* in the Oak Grove and *M. chondra* in the Chipola. It is of approximately the same altitude as the Chipola species but is more strongly rounded than either the Chipola or the Oak Grove form and decidedly more flattened posteriorly. Concomitant with the flattened apical surface is the relatively long aperture, which more closely approximates the altitude of the shell than that of either of the other species. The configuration of the labrum is rather similar to that of *M. chondra*, but it is a little heavier, less obscurely shouldered, and less finely dentate within. The columellar plications are equal in number to those of the two other species in question, but they are more sharply elevated, particularly the marginal fold. The pillar is also more excavated at the base, leaving a relatively wider anterior opening. Though far from rare, *M. waltoniana* does not equal in abundance its analogs in the other horizons of the Alum Bluff.

Occurrence: Shoal River formation, localities 3856[r], 3742[c].

Marginella (Gibberula) sp.

Plate XLVII, figure 28

Shell small, not very heavy, ovate conic in outline, broadly and smoothly rounded both posteriorly and laterally, flattening toward the margin of the labrum, maximum diameter falling within the posterior third. External surface smooth, highly polished, faintly striated incrementally. Spire very low but extending for a perceptible distance behind the aperture. Sutures entirely obliterated in fresh specimens by the surface enamel. Type slightly decorticated in the apical region, revealing a coil of about 4 volutions; apical knob not developed. Aperture narrow, constricted a little in front of the commissure by the curvature of the body and the slight contraction of the margin of the labrum. Outer lip not thickened, obscurely shouldered posteriorly, feebly contracted medially, not patulous anteriorly, simple within. Parietal wash fused with the surface glaze. Columellar plications 4, the 2 posterior very short, normal to the axis of the shell, not produced within the aperture, the 2 anterior oblique, more ele-

vated than those behind them, more produced externally, and persistent within the aperture. Anterior extremity broadly rounded, not emarginate.

Dimensions: Height, 2.8 millimeters; maximum diameter, 1.8 millimeters.

Figured specimen: U. S. Nat. Mus. No. 328718.

Type locality: Station 2211 (lower bed), Alum Bluff, Liberty County, Fla.

Marginella (*Gibberula*) sp. superficially resembles the abundant congenetic *M. chondra*. These two minute forms may be most readily separated by the character of the anterior extremity. That of *M. chondra* is distinctly notched, whereas in *M.* (*Gibberula*) sp. there is no trace of a depression. Then, too, the apical surface is more evenly rounded in *M.* (*Gibberula*) sp., the outer lip is not crenate within, no more than 4 columellar folds have been observed in any individual, and the 2 anterior columellar folds are more nearly equal and parallel to one another than those of *M. chondra*.

The species is apparently restricted in its distribution to the type locality.

The number and disposition of the columellar folds on this minute form ally it to *Gibberula*, but the aspect of the spire and the truncate anterior extremity suggest *Egouena*.

Occurrence: Chipola formation, locality 2211[p].

Genus CYPRAEOLINA Cerulli-Irelli

1911. *Cypraeolina* Cerulli-Irelli, Palaeontographia italica, vol. 17, p. 231.

1928. *Cypraeolina* Woodring, Miocene mollusks from Bowden, Jamaica, pt. 2: Carnegie Inst. Washington Pub. 385, p. 241.

Type (by monotypy): *Marginella clandestina* Brocchi. (Pliocene and Recent of the Mediterranean.)

Shell minute, inflated, cypraeid in outline. Aperture very narrow, the margins parallel and crescentic. Outer lip thickened, crenate within. Parietal wash heavy, produced backward at the posterior commissure and concealing the spire. Columella quadruplicate, the anterior folds the more prominent.

Cypraeolina is similar in outline to the much larger *Closia* Gray.[14] Type: *Marginella sarda* Kiener, Recent (Ceylon).

Species properly referable to *Cypraeolina* have for the most part been included under *Persicula* Schumacher or *Volutella* Swainson. *Persicula* is a much larger shell than *Cypraeolina* and is normally characterized by an aperture terminating posteriorly in a narrow channel that passes between the labral varix and a spur of callus on the parietal wall opposite. In *Cypraeolina*, on the other hand, the labral varix is continued around the posterior extremity of the aperture and merges into the widely diffused parietal wash. The inner wall of the aperture of *Persicula* is corrugated by 6 heavy folds, only 3 of them, however, in the type of *Persicula* persisting within the mouth of the aperture. The labial plications in *Cypraeolina* are more oblique than those of *Persicula*, and only 4, but all of them persistent. The type of *Volutella* Swainson, *Voluta bullata* Born, is a shell that attains an altitude of 70.0 millimeters. The labial plications are similar in character in *Volutella* and *Cypraeolina*, but the labral varix in *Volutella* is not continued around the posterior extremity of the aperture, and the parietal wall is free from glaze.

Cypraeolina includes perhaps a score of Tertiary and Recent species, most of them minute. The Recent forms are restricted in their distribution to the tropical seas. *Cypraeolina* is represented in the Alum Bluff faunas by only two species, each of them restricted to a single horizon, *C. defuniak*, with a very meager representation in the Shoal River and *C. pyrenoides*, rather widely distributed and not uncommon in the Chipola.

Cypraeolina defuniak Gardner, n. sp.

Plate XLVII, figure 29

Shell minute, globose, obliquely flattening toward the margin of the labrum; the maximum diameter falling not far behind the median horizontal. Aperture extending a little beyond the body whorl both posteriorly and anteriorly. Spire completely concealed by the heavy coat of enamel evenly spread over the external surface. Aperture feebly arcuate, the margins approximately parallel. Labrum margined externally by a flattened band of callus about half a millimeter wide, which extends not only the length of the labrum but also around the extremities of the aperture to the inner margin; labrum very finely dentate along the inner margin, a low, narrow thread of callus running along the body wall directly opposite the margin of the outer lip. Two pairs of columellar plications developed along the anterior half of the inner wall, the posterior pair approximately horizontal, the pair in front of them, the anterior of which is marginal, more oblique and more produced. Anterior extremity of the aperture a little more sharply excavated than the posterior.

Dimensions: Height, 2.5 millimeters; maximum diameter, 1.8 millimeters.

Holotype: U. S. Nat. Mus. No. 352145.

Type locality: No. 7264, Defuniak *Cardium* beds, Walton County, Fla.

Cypraeolina pyrenoides of the Chipola fauna is smaller and less globose and wrinkled externally like a dried seed. The Shoal River species is larger, more globose in outline, and the aperture is more produced posteriorly than in either of the Recent species, *C. lachrimula* Gould or *C. ovuliformis* D'Orbigny.

Volutella dacria Dall (Pl. XLVII, fig. 31) from the Croatan beds is characterized by a similar labral callus but the Pliocene species is larger and relatively more slender.

Occurrence: Shoal River formation, localities 7264[r], 5618[r].

[14] Guide to the systematic distribution of the Mollusca in the British Museum, pt. 1, p. 36, 1857.

Cypraeolina pyrenoides Gardner, n. sp.

Plate XLVII, figure 30

Shell minute, strongly rounded, ovate in outline, the maximum diameter falling behind the median horizontal. Length of aperture equal to or slightly greater than the length of the body. Spire entirely concealed. External surface highly polished, usually more or less wrinkled like the surface of a dried seed. Aperture sublinear, feebly arcuate, the margins approximately parallel, more strongly curved posteriorly than anteriorly. Outer lip thickened marginally, the marginal callus fusing with the apical callus, which is washed down around the commissure, persistent anteriorly around the extremity of the shell and fusing with the body wash; labrum finely and obtusely crenate within. Parietal glaze rather heavy, its outer margin ill defined, its inner margin a sharp ridge directly opposite the margin of the labrum. Labial plications 4, all of them persistent within the aperture, the 2 posterior short, approximately horizontal, the marginal fold and that next behind it oblique but not parallel in all specimens. Anterior extremity scooped out to form a narrow channel.

Dimensions: Height, 2.0 millimeters; maximum diameter, 1.5 millimeters.

Holotype: U. S. Nat. Mus. No. 371414.

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

Cypraeolina pyrenoides is smaller and not so globose as *C. defuniak*. The wrinkling of the external surface is peculiar to the Chipola species, and the aperture is less produced posteriorly than in *C. defuniak*.

Cypraeolina lachrimula Gould of the Recent fauna is not quite so minute nor is it so strongly wrinkled. The aperture is also wider, and the outer lip less evenly rounded posteriorly. *C. ovuliformis* D'Orbigny is relatively wider and more rounded anteriorly and less wrinkled externally. The aperture is also a little more produced behind than it is in *C. pyrenoides*. This minute shell is not rare at the single horizon at which it occurs.

Occurrence: Chipola formation, localities 7893[r], 2213[p], 2564[r], 3419[p], 7151[r], 2211[p], 7183[r].

Family VOLUTIDAE Gray

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 slightly recurved toward the axis of the shell. From the Mitridae, on the other hand, the volutes differ as a rule in the increasing prominence of the columellar folds anteriorly instead of posteriorly.

Dall [15] divided the family of the Volutidae into two subfamilies on the basis of the protoconchal characters. The Volutinae were characterized by Dall [15a] as follows:

> Shell with the protoconch shelly and persistent, the adult usually elegantly colored * * * operculum usually absent; teeth of the radula usually in one tricuspid series.

The name of the second subfamily, the Caricellinae, has been used by Dall to replace the older Scaphellinae because he found that the type of the genus, *Scaphella*, did not possess the characteristics of the family, namely,

> a 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 an ancestral type of the North American volutes possessing a membranous protoconch.

The meager representation of this typically deep-water group in the Alum Bluff is very significant. There is a single and not at all abundant species of *Lyria* in the Chipola. No members of the group have been observed in the Oak Grove and only one species—a reticulately sculptured *Caricella*, represented by only 3 individuals in the Shoal River.

Outer lip reinforced with a marginal varix, parietal wall lirate at the mouth of the aperture---*Lyria pycnopleura* Gardner, n. sp.
Outer lip not reinforced with a marginal varix, parietal wall not lirate at the mouth of the aperture.
Caricella pycnoplecta Gardner, n. sp.

Subfamily VOLUTINAE Dall

1907. Volutinae Dall, Smithsonian Misc. Coll., vol. 48, pt. 3, no. 1663, p. 343.

Genus LYRIA Gray

1847. *Lyria* Gray, Zool. Soc. London Proc., p. 141.

Type (by monotypy): *Voluta nucleus* Lamarck. (Recent off the northern coast of Australia.)

Shell heavy, fusiform or strombiform in outline. Spire more or less elevated as a rule and turriculated. Nucleus shelly, varying in outline and dimensions. External surface axially costate, the costae usually numerous and obtuse upon their summits. Sutures appressed or channeled. Aperture ovate or lenticular, angulated at the posterior commissure; outer lip thickened marginally, simple within. Columella multiplicate, the anterior folds the most prominent. Parietal wall also plicated, the folds similar in general aspect to those upon the pillar but not persisting within the aperture. Anterior canal usually short and broad, emarginate at its extremity.

Lyria is similar in general character to the prolific Eocene genus *Volutocorbis* Swainson. However, the axial sculpture of *Volutocorbis* is usually sharper and the labrum is lirate within. *Lyria* is not conspicuously abundant at any horizon, but it persists throughout the Tertiary and is widely distributed in the tropical seas of today. The Recent species are separated from the

[15] Dall, W. H., Review of American Volutidae: Smithsonian Misc. Coll., vol. 48, pp. 341–373, 1907.

[15a] Idem, p. 343.

other volutes mainly upon anatomical characters not available in the fossil forms, and it is possible that all the Eocene species are referable to *Lyria* and that the true *Voluta* was not differentiated until later.

Lyria pycnopleura Gardner, n. sp.

Plate XLVIII, figures 1, 2

1890. *Lyria musicina* Heilprin, Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 85 (part).
Not *Voluta musicina* Heilprin, Wagner Free Inst. Sci. Trans., vol. 1, p. 109, pl. 15, fig. 45, 1887.
1915. *Lyria musicina* Heilprin, Dall, U. S. Nat. Mus. Bull. 90, p. 59 (part), pl. 9, figs. 1, 4.

Shell heavy, solid, rather large, attaining an altitude in one individual of 63.0 millimeters. Spire moderately elevated in the type, one-third of the altitude of the entire shell, turriculated, the whorls of the spire narrowly tabulated behind, the sides trapezoidal, their outline obscured, however, by the heavy axial ribbing. Body ovate, not sharply constricted at the base. Whorls of conch usually 6, in the larger individuals, 7. Protoconch of moderate dimensions and performing between 2 and 2½ volutions; initial turn of protoconch strongly and smoothly rounded, immersed at the tip, the succeeding turn becoming increasingly flattened laterally toward the close of the protoconch. Opening of conch marked only by the introduction of the axial ribbing and not by any perceptible change in the contour of the shell. Costals upon the early volutions narrow, sharply and prominently elevated; cordate ridges uniform in elevation throughout their extent, terminating abruptly at the posterior suture, thus forming an obscurely defined sutural corona; axials normally 10 to each whorl not including the terminal varix, the axials upon the later volutions broader and more broadly rounded than upon the earlier and much lower and inclined to be less regularly spaced upon the last half turn of the body. Spiral sculpture restricted to 2 or 3 ridges at the base of the body, an obscure threading upon the fasciole and a very obscure groove a little before the posterior suture, which partly dissects the axials. Sutures deeply impressed, crenulated by the costae of the preceding volution. Aperture narrow, obtusely angulated at the posterior commissure. Outer lip approximately straight medially, curving anteriorly into the terminal notch, posteriorly produced for a short distance, dragging the suture about one-fourth of the way across the penult. Marginal varix narrow but rather heavy; inner surface of labrum thickened but smooth. Inner margin of the aperture feebly constricted by the curvature of the body. Parietal wall heavily glazed, the callus extending in a wide arcuate area between the extremities of the aperture, heaviest anteriorly; transversely lirate with 3 or 4 fine but rather sharp, commonly broken lirae approximately parallel to the labial plications in front of them but not persistent far within the aperture. Columella folds usually 6, the posterior approximately horizontal, the anterior, especially the foremost, slightly oblique; folds broadest and most prominent just at the entrance to the aperture, evanescing externally. Siphonal fasciole strongly arched, incrementally striated, cut off from the base of the body by a shallow sulcus. Anterior canal incipient, the extremity profoundly emarginate, the walls parallel and obliquely directed.

Dimensions: Height, 39.0 millimeters; length of aperture, 27.0 millimeters; maximum diameter, 18.5 millimeters.

Holotype: U. S. Nat. Mus. No. 328729.

Paratype: U. S. Nat. Mus. No. 328728.

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

Lyria pycnopleura is so intimate a member of the group of the Eocene *L. costata* Sowerby and the lower Miocene *L. musicina* Heilprin that they have been confused in the check lists. *Lyria costata* is more slender and the whorls of the spire are much more smoothly rounded. The axial costae are lower, more smoothly rounded, and more numerous in *L. costata*, the spiral sculpture is finer but less restricted, and there are about twice as many parietal lirae and only half as many columellar plications as in *L. pycnopleura*. *L. musicina* Heilprin is stouter, the body more strongly rounded, and the apical angle more open. The spiral sculpture is very obscure in *L. musicina*, but it is developed over the anterior half of the body and usually over the entire whorl. The columellar plications are narrower and less numerous than in *L. pycnopleura* and the terminal notch broader and less profound. The form figured by Dall in Bulletin 90 of the National Museum is from the Chipola. *Lyria vaughani* Cooke from the Antigua formation is only about half as large as *L. pycnopleura* and differs in sculpture detail.

Lyria pycnopleura is not common at any locality in the Chipola, but it is rather widely distributed.

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

Subfamily CARICELLINAE Dall

1907. Caricellinae Dall, Smithsonian Misc. Coll., vol. 48, pt. 3, no. 1663, p. 344.

Genus CARICELLA Conrad

1835. *Caricella* Conrad, Fossil shells of the Tertiary formations of North America, 2d ed., vol. 1, no. 3, p. 44.
1846. *Caricella* Conrad, Acad. Nat. Sci. Philadelphia Proc., p. 21.

Type (by subsequent designation, Cossmann, 1899, Essais de paléoconchologie comparée, pt. 3, p. 129): *Turbinella praetenuis* Conrad. (Eocene of Claiborne, Ala.)

Shell of moderate dimensions, thin in substance, pyriform to slender fusiform in outline, nucleus bearing, when perfect, an elevated spur; external surface smooth

spirally or reticulately sculptured; pillar plicate, the folds more than 3, situated well up on the pillar, oblique, commonly approaching the horizontal; the anterior plication the least prominent; canal broad, usually rather wide, not emarginate at the extremity.

The genus is apparently restricted in its distribution to the Eocene and Oligocene of North America. Cossmann refers a Senonian form to *Caricella*, the *Melo pyruloides* Forbes from the Arrialoor beds of India, but he is in error.

Subgenus CARICELLA s. s.

Shell of moderate dimensions, rather stout, pyriform in outline; external surface usually smooth or feebly sculptured spirally.

This is the dominant type of the genus during the middle and late Eocene, but none of its representatives have yet been found in the Alum Bluff.

ATRAKTUS, new section

Type: *Caricella leana* Dall. (Midway of Alabama.)

Shell usually small, slender, fusiform; external surface, as a rule, finely and rather obscurely cancellated.

The type is from the lower Eocene, but the group is best represented in the lower Miocene. Among the species included in it are *C. demissa* Conrad and *C. reticulata* Aldrich.

Caricella (Atraktus) pycnoplecta Gardner, n. sp.

Plate XLVIII, figures 3, 4

Shell rather small for the genus and thin. Spire moderately elevated, the body rather slender, smoothly constricted and attenuated basally. Whorls 4¼ in all in the type. Protoconch large, poorly differentiated from the conch, a little more than once coiled, terminating apically in an acutely elevated spur. Succeeding volution narrow and flattened laterally, sculptured with obscure and irregular spiral lines; later volutions obliquely and rather obscurely shouldered. Axial sculpture introduced at about the beginning of the third volution, developed as rather broad, obtusely Λ-shaped costals separated by V-shaped intercostals, irregular in size and spacing, persisting from suture to suture upon the spire, evanescing upon the base, 32 upon the body of the type. Spiral sculpture dominated by the axial except upon the base of the body and the pillar; spirals very low, broad, ill defined, approximately 7 in front of the periphery of the penult, narrower and less regular upon the shoulder, least feeble upon the base of the body and the pillar. Anterior fasciole very finely lirated with about 10 finely crenulated threadlets. Sutures distinct, impressed, finely sinuated by the axials. Aperture rather narrow and somewhat oblique, acutely angulated posteriorly. Outer lip thin, sharp, simple, obtusely angulated at the shoulder, feebly expanded in front of the shoulder. Inner margin of aperture oblique. Parietal wall washed with a coat of glaze too thin to conceal the sculpture; pillar wash heavy. Columellar plications broad and prominently elevated, 4 parallel to one another, not deviating greatly from the horizontal, the posterior fold the broadest and the most prominent, the anterior conspicuously narrower and lower and a little less produced than the 3 behind it. Anterior canal rather long, ill defined, not emarginate at the extremity. Umbilicus imperforate but suggested by the slight depression between the reflected labium and the arched fasciole.

Dimensions: Height, 27.0± millimeters; length of aperture, 19.7± millimeters; maximum diameter, 12.3 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 351315.

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

The nucleus is very large for the genus, but the labial plications are too prominent to permit the reference of the species to *Aurinia*. There is no other form with which *C. pycnoplecta* can be readily confused.

Occurrence: Shoal River formation, localities 3732[r], 3742[r].

Family MITRIDAE

Genus MITRA Martyn

1784. *Mitra* Martyn, The Universal Conchologist, explanatory table, vol. 1, fig. 19.

Type (by subsequent designation, Dall, 1905, U. S. Nat. Mus. Proc., vol. 29, p. 428): *Mitra tessellata* Martyn. (Recent in the Indo-Pacific.)

Shell of moderate dimensions, rather solid, usually fusiform or rudely biconic in outline; spire elevated as a rule, the component volutions more or less flattened laterally, gradually tapering to the small but slender and commonly polygyrate protoconch; external surface smooth, axially or spirally sculptured; sutures impressed in the majority of forms; aperture narrow, commonly half the length of the shell; outer lip sharp edged, the throat generally lirate; columella bearing 3 or 4 or 5 folds which, unlike the plaits of most volutes, increase in prominence posteriorly; anterior extremity emarginate or truncate.

The genus is for the most part tropical and subtropical in its distribution. The bathymetric range is rather wide, but the smaller species are largely restricted to the inshore waters. The habitat of any given group is apparently constant, certain species and sections and subgenera being reef shells, others sand burrowers, and still others burying themselves in the soft mud. The burrowing forms are commonly nocturnal in their habits.

The Mitridae are well differentiated in the Alum Bluff. Sixteen species have been determined, and there are probably a third as many more represented by material too imperfect to describe. These are)

however, distributed through several genera and subgenera. A single species represented by a unique type from the Chipola is possibly referable to *Mitra* s. s. There is also a *Pleioptygma* and two species are referred to *Tiara*. *Vexillum* is much the best represented, however, of all the genera, both by species and individuals, for out of the 16 species 11 are included under this name. As is the case with so many of the univalves, the group is most diversified in the Chipola, 7 out of the 11 being restricted to that formation, the other 4 equally distributed between the Oak Grove and Shoal River. Two of the six, however, are known to occur only at the type locality at Alum Bluff. The most interesting feature in the distribution of the genus is the fact that the group of smaller forms characterized by the absence of spiral grooving in the intercostal areas is very common in the Chipola but apparently does not occur above it. Three out of the seven Chipola Vexilla are thus characterized, and this number could easily be doubled with better material.

Although many of the 16 forms have obvious analogs at other horizons, none of them is represented by identical individuals at more than one horizon. The closest of the analogs are *M. mitrodita* from the Chipola and *M. desmia* from the Shoal River. *M. prodroma* is probably a direct ancestor of members of the group of *M. carolinensis* Conrad of the North Carolina Miocene and *M. lineolata* Heilprin of the Caloosahatchee Pliocene.

Mitra is one of the more characteristic genera of the tropical and subtropical waters, and the abundance of the small Vexilla suggests a shallow sandy bottom.

Sculpture similar to that of *Actaeon*, spiral sulci numerous, uniform in development over the entire shell, finely punctated by the incrementals ..... *Mitra acteoglypha* Gardner, n. sp.

Axial sculpture restricted to incrementals; spiral lirae few, conspicuously elevated as a rule, obsolete upon the medial and anterior portions of some of the adult whorls.

Altitude of adult exceeding 45 millimeters, spirals more or less obsolete upon the medial and anterior portions of the later whorls ..... *Mitra* (*Pleioptygma*) *prodroma* Gardner, n. sp.

Altitude not exceeding 45 millimeters, spirals not obsolete upon the medial and anterior portions of the later whorls.

A spiral thread not developed at the anterior margin of the suture behind the posterior primary. *Mitra* (*Pleioptygma*) *prodroma* Gardner, n. sp. (young).

A spiral thread developed at the anterior margin of the suture behind the posterior primary.

Secondary spirals commonly developed, the third labial plication very much less elevated than the two behind it ..... *Mitra* (*Tiara*) *mitrodita* Gardner, n. sp.

Secondary spirals rarely developed, the three labial plications increasing regularly in prominence posteriorly, a fourth incipient fold present in some specimens ..... *Mitra* (*Tiara*) *desmia* Gardner, n. sp.

Mitra acteoglypha Gardner, n. sp.

Plate XLVIII, figure 5

Shell of moderate dimensions for the group, moderately heavy, regularly fusiform in outline, the maximum diameter falling near the median horizontal. Body rudely ovate. Whorls of the elevated spire closely appressed, regularly trapezoidal in outline, a little less than 5, the final half turn of the protoconch broken away in the unique type. Axial sculpture restricted to incrementals, least feeble upon the body and pillar. Spiral sculpture evenly developed over the entire surface of the conch, Acteonlike in character; sulci very narrow, evenly spaced, finely and regularly punctate, 7 upon the antepenult, probably running up to 10 upon the penult and 28 upon the body, the flattened areas separating them more than twice as wide as the furrows except upon the pillar, where they are relatively more rounded and elevated and only a little wider than the sulci. Fasciole sculptured with about half a dozen linearly spaced lirae. Sutures deeply impressed, the posterior margin of the succeeding volution thin and sharp. Aperture narrow, more than half as high as the entire shell; edge of outer lip broken away but probably thin and sharp, not lirate within. Parietal wash very thin. Pillar more strongly reinforced; excavation at the base of the body feeble. Labial plications 5, narrow, sharply elevated, parallel to one another, and equally spaced, increasing regularly in prominence posteriorly; an incipient sixth fold developed in front of the others but probably not persistent within the aperture. Anterior canal moderately long, not sharply defined, very broadly emarginate at the extremity; anterior fasciole slightly swollen.

Dimensions: Height, 19.0± millimeters; length of aperture, 11.6 millimeters; maximum diameter, 7.0 millimeters.

Holotype: U. S. Nat. Mus. No. 114328.

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

Mitra acteoglypha is described from a unique and imperfect type, but it is so well characterized and so distinct from any of the other species recognized in a larger collection that it does not seem wise to delay its introduction for further credentials. The best diagnostics of *M. acteoglypha* are the smoothly rounded and symmetrical, fusiform outline, the closely appressed whorls, separated by deeply impressed linear channels, suggesting those of some of the Olivas, and the evenly spaced, punctate spirals that are developed over the entire conch.

The species is more fusiform in outline and more subdued in sculpture than the usual *Mitra* s. s., but the appressed sutures, the number and disposition of the columellar folds, the slight swelling of the anterior fasciole, and the presence of a siphonal notch ally it more closely to the members of that group than to any of the established subgenera.

Occurrence: Chipola formation, locality 2213[r].

Subgenus PLEIOPTYGMA Conrad

1863. *Pleioptygma*, Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 563.

Type (by monotypy): *Mitra carolinensis* Conrad. (Miocene of North Carolina.)

Subfusiform; aperture long; columella with very oblique plaits, numerous, alternated in size, or irregular, the largest being the second one from above.—Conrad, 1863.

The subgenus includes relatively large fusiform conchs with many-whorled tapering spires and small shelly paucispiral protoconchs. The regular spiral sculpture of the early whorls tends to become obsolete upon the later and upon the body to be restricted to the sutural band and the anterior canal. The aperture is narrow, the columella multiplicate, the throat smooth, and the terminal fasciolar notch broad and relatively deep.

The group has not been recognized outside of the east coast later Tertiary and Quaternary faunas.

Mitra (Pleioptygma) prodroma Gardner, n. sp.

Plate XLVIII, figures 6, 7

Shell large for the genus, rather thin, slender, fusiform in outline, the maximum diameter falling not far from the median horizontal. Spire elevated, the profile interrupted at the suture line. Body gently rounded medially, smoothly constricted at the base. Protoconch small but relatively high, smooth, and highly polished, performing about two and one-half revolutions; initial turn rounded, submerged at the tip; succeeding turn and a half elevated, becoming increasingly flattened laterally toward the close of the protoconch; final quarter turn of protoconch very faintly striated incrementally. Beginning of conch indicated by a slight change in the texture of the shell, the more deeply impressed suture, and the abrupt initiation of 3 or rarely 4 subequal spiral sulci disposed with approximate symmetry between the sutures. Whorls of conch 8 in the type. Axial sculpture restricted to fine and very faint incremental striae, least feeble in the interspiral channels. Spiral sculpture varying widely with the age of the individual; young and adolescent whorls sculptured with 3 or 4 subequal, prominently elevated spiral cords flattened upon their summits and separated by channeled interspiral areas of approximately the same width as the spirals; posterior spiral set very close to the suture line, thus narrowly tabulating the whorl; change in character of the sculpture usually occurring at about the fifth whorl, the 1 or 2 anterior spirals becoming increasingly feeble, the channel in front of the posterior spiral becoming increasingly deeper and more angular, the space between the posterior spiral and the suture line gradually widening and becoming more oblique and an additional spiral developed upon it which becomes stronger and stronger, so that upon the body of the adult it is usually the most prominent of all the spirals except those of the very base; body sculpture of the adult varying widely in the minor details but typically with 2 posterior spirals separated from one another and from the rest of the shell by shallow but rather angular channels, the anterior of the two the reduced continuation of the original posterior spiral but usually not quite so prominent as that behind it, the medial portion of the body rather distantly and very obscurely and irregularly lineated; base of body and pillar coarsely and irregularly sculptured with 8 to 12 lirae and sulci. Anterior fasciole set off by an acutely elevated margin, threaded with 6 or 8 obscure and irregular lirae overridden by flexuous incremental striae. Suture lines impressed but inconspicuous. Aperture rather narrow, obliquely lenticular, acutely angulated posteriorly. Outer lip thin and sharp, very feebly arcuated both axially and incrementally, inclined to be a little patulous in front. Inner margin of aperture smoothly concave, the parietal wall and pillar reinforced with a glaze which thickens slightly anteriorly. Labial plications normally 4, all of them persistent within the aperture, medial in position between the commissure and the anterior extremity, the folds increasingly stronger posteriorly and the anterior fold decidedly more feeble than that directly behind it. Anterior canal rather long and wide, not recurved; anterior extremity very deeply emarginate, the notch broadly U-shaped, the margins converging slightly and obliquely directed.

Dimensions: Height, 68.0± millimeters; length of aperture, 39.0 millimeters; maximum diameter, 22.5 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 114326.

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

Mitra prodroma has been confused in the check lists with the later *Mitra carolinensis* Conrad (pl. XLVIII, figs. 8, 9) with which it is no doubt closely related genetically. Conrad's species reaches dimensions very much greater—117 millimeters in one individual—than those attained by any known specimen of *M. prodroma*. The spire is more elevated relatively in the earlier form and more slender. The spiral sculpture is usually less persistent in the Duplin species; there is rarely an additional spiral developed between the suture and the

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original posterior primary, and the channel in front of the latter is much deeper. The most radical difference, however, is in the columellar folds. There is a slight degree of variation in *M. prodroma*. There are invariably 3 well-developed plications, which increase regularly in prominence, and there may be a fourth and even a fifth developed in front of them, which persist for a certain distance within the aperture. In *M. carolinensis*, however, there are 2 major folds, the posterior much the more prominent, and 4 to 5 or even 6 irregular minor folds in front of these 2. A number of individuals have been examined from both horizons, and these differences hold constant, with no intermediate individuals to bridge the wide gap between them.

The adult *M. mitrodita* may be distinguished from the young *M. prodroma* by the fine but sharp incremental grating of the interspiral channels, and the elevated thread upon the anterior margin of the suture behind the posterior primary.

The analog in the Recent fauna is *Mitra swainsoni antillensis* Dall. *Mitra prodroma* is the most prominent, though by no means the most abundant, representative of the genus in the Chipola.

Occurrence: Chipola formation, 2212[p], 7257[r], 2213[c], 2564[p], 3419[p], 2211[p], Aldrich collection, Johns Hopkins University.

Subgenus TIARA Swainson

1831. *Tiara* Swainson, Zoological illustrations, ser. 2, vol. 2, explanation of pl. 50.

Type (by subsequent designation, Herrmannson, 1849, Indices generum malacozoorum, vol. 2, p. 576): *Tiara isabella* Swainson. (Recent in the China Sea.)

Shell relatively slender, fusiform; base of body constricted into a short, broad canal; entire surface spirally threaded, the lirae regular in size and spacing; axials restricted to an incremental grating in the interspiral areas; aperture narrow; columella multiplicate, the folds diminishing in prominence anteriorly; inner surface of outer lip smooth; anterior extremity emarginate.

The strong regular spiral sculpture, which in *Pleioptygma* is restricted to the early whorls, in *Tiara* persists over the entire conch.

Mitra (Tiara) mitrodita Gardner, n. sp.

Plate XLVIII, figures 10, 11

Shell moderately tall, very slender, subcylindrical to rounded fusiform in outline; spire elevated, more than half as high as the entire shell; the prominence of the spiral sculpture obscuring the outline of the whorls, the posterior spiral narrowly tabulating them. Body whorl laterally compressed, smoothly constricted at the base. Whorls probably 7 in the adult conch. Protoconch very slender, smooth, highly polished, thrice coiled, the initial turn elevated, broadly rounded, immersed at the tip, the succeeding whorl also feebly constricted at the sutures, the maximum diameter falling a little in front of the median horizontal; final turn of protoconch relatively lower and increasingly flattened toward the close. Dividing line between conch and protoconch obscure, indicated by the lower luster of the conch and the microscopic spiral shagreening. Three or 4 equal and equispaced sulci introduced within the first half turn, rapidly increasing in strength, the flattened areas between them gradually developing into the prominent primaries of the adult; primaries normally 3 upon the whorls of the spire, the suture following and more or less concealing a fourth, the 3 primaries conspicuously elevated, flattened upon their summits, approximately equal—the medial commonly a little more prominent—and separated by equal interspaces; spirals 12 or 13 upon the body and pillar, gradually becoming lower and more closely spaced anteriorly. Fasciole rather sharply threaded with 4 or 5 additional lirae.

Anterior margin of suture elevated and developed into a sharp secondary lira. Interspiral channel deep and in many specimens obtusely V-shaped, a rounded secondary thread commonly intercalated midway between the primaries upon the later whorls of the spire and the posterior and medial portions of the body. Interspiral areas finely but sharply and regularly grated by the incrementals; other axial sculpture not developed. Sutures deeply impressed but more or less obscured by the prominence of the spiral sculpture. Aperture narrowly lobate, angulated posteriorly, slightly oblique. Outer lip thin, sharp, very feebly arcuate, the margin crenated in harmony with the external sculpture, and a series of shallow grooves developed upon the inner surface corresponding in number and position to the primary spirals. Inner margin of aperture constricted at the base of the body. Parietal wall and pillar thinly glazed. Columella triplicate, the posterior fold not conspicuously strong but the most elevated and the most produced externally, the anterior much more feeble than either of the other 2, the 3 very slightly oblique, parallel to one another, disposed along the medial portion of the inner wall of the aperture with slightly wider interspaces separating them. Canal moderately long and broad, not sharply differentiated, broadly and obliquely emarginate at its extremity.

Dimensions: Height, 27.0± millimeters; length of aperture, 12.7 millimeters; maximum diameter, 8.8 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 371435.

Type locality: No. 2213, 1 mile below Baileys Ferry, Chipola River, Calhoun County, Fla. A less perfect individual from the same locality attains an altitude of 37.0 millimeters.

Mitra mitrodita offers its greatest range of variation in the presence or absence of the medial secondary lira.

The general outline and other details of the sculpture and of the aperture are remarkably constant. The Shoal River species, *M. desmia* is a very close analog, but the spirals are relatively narrower, the interspirals acutely V-shaped in the young and adolescent forms, and there are 3 major labial folds and usually a feeble anterior fourth. The young of the congenetic *M. prodroma* are less smoothly rounded and more strongly constricted at the base of the body. The interspiral areas are less strongly and evenly striated incrementally, and there is no spiral developed at the anterior margin of the suture.

The closest analog among the described West Indian species is *Mitra henekeni* Sowerby, a form which attains an altitude of over 50 millimeters, is less angular in outline, and has more numerous primary spirals than *M. mitrodita*. The Bowden individuals that have been covered by that name are doubtless distinct and much closer to the Chipola species, though more slender. The Recent analog is *M. straminea* A. Adams of the Carribbean Sea and the Gulf of Mexico.

M. mitrodita, though less common than *M. prodroma*, is well represented in the Chipola.

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

Mitra (Tiara) desmia Gardner, n. sp.

Plate XLVIII, figure 12

Shell of moderate altitude for the genus but slender and very smoothly rounded. Spire elevated, more than half as high as the entire shell, narrowly tabulated posteriorly by the prominent posterior primary. Body not inflated medially, smoothly constricted at the base. Whorls probably 12 or 13 in all. Protoconch smooth, polished, slender, elevated, and seemingly performing 4 or 5 volutions, though this apparent number may be increased by the slight decortication of the apical region; extreme tip of protoconch broken away. Sculpture uniform in general character over the entire surface of the conch. Primary spirals narrow, conspicuously elevated, flattened upon their summits, 3 to each of the whorls of the spire, the anterior suture following and for the most part concealing the fourth; a similar but less prominent spiral also developed a little in front of the suture; primaries 11 or 12 in number upon the body, becoming gradually finer and more closely spaced anteriorly. Anterior fasciole threaded with 3 or 4 rather obscure lirae. Interprimary channels acutely V-shaped in the young and adolescent forms, broadly convex in the adults and in some specimens developing an obscure medial secondary. Channels very finely ribbed by the incrementals, which do not, however, override the spirals. Suture lines impressed but obscured by the prominence of the spiral sculpture. Aperture narrowly lobate, slightly oblique. Outer lip very feebly arcuate both axially and incrementally, the edge crenated in harmony with the external sculpture; a series of linear sulci developed upon the inner surface, the grooves corresponding in number and position to the primary spirals. Parietal wall and pillar thinly glazed, a rather heavy deposit of wash laid down directly in front of the commissure. Medial portion of inner wall of aperture triplicate, the folds slightly oblique, parallel to one another, and increasing regularly in prominence posteriorly; a fourth incipient fold commonly developed in front of the other 3 but not persistent within the mouth of the aperture. Anterior canal short, broad, obscurely differentiated. Fasciole cuneate, acutely margined posteriorly. Anterior extremity broadly and rather deeply emarginate.

Dimensions: Height, 21.5± millimeters; length of aperture, 10.0 millimeters; maximum diameter, 7.0 millimeters.

Holotype: U. S. Nat. Mus. No. 371436.

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

Mitra desmia is the analog in the Shoal River fauna of *M. mitrodita* in the Chipola. The protoconchs are apparently distinct, that of *M. desmia* performing more volutions than that of *M. mitrodita*. The primary spirals of *M. desmia* are also relatively narrower, the interspiral areas more acutely V-shaped in the young and adolescent forms, the secondaries developed later or not at all and never reaching the prominence of the secondaries of *M. mitrodita*.

In *M. mitrodita* there are 2 major plications with a third relatively feeble fold in front of them. In *M. desmia* the 3 posterior folds increase regularly in prominence toward the apex, and there is commonly an incipient anterior fourth fold.

Mitra stephensoni Mansfield (pl. XLVIII, fig. 13), of the Choctawhatchee fauna of northern Florida, is another closely allied member of this uncommonly well characterized group. It is more regularly fusiform than either the Chipola or the Shoal River species, the body whorl is less constricted at the entrance to the anterior canal, the spiral cords are not quite so elevated, and the interspiral areas are less angular and more commonly incised with obscure spiral lines.

Certain forms from the Bowden that have been mistaken for *M. henekeni* Sowerby are very close to *M. desmia* but a little more slender and more evenly tapering. Then, too, the spirals are a little more obtuse in the Bowden species and the interspiral channels less angular than in the immature *M. desmia*. However, the resemblance is suggestively intimate.

M. desmia occupies a relatively less important position in the accompanying fauna than its Chipola analog.

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

Genus VEXILLUM ("Bolten") Roeding

1798. *Vexillum* ("Bolten") Roeding, Mus. Boltenianum, pt. 2, p. 138.
1810. *Vulpecula* Montfort, Conchyliologie systématique, vol. 2, p. 539.
1824. = *Vulpecula* Blainville, Dict. sci. nat., vol. 31, p. 106.
1753. = *Turricula* Klein (nonbinomial).

Type (by subsequent designation, Woodring, Carnegie Inst. Washington Pub. 385, p. 244): *Vexillum plicatum* ("Bolten") Roeding. (Recent in the Indo-Pacific.)

The revival of catalog names given by Roeding to the shells in the Bolten collection throws Montfort's *Vulpecula* into the discard.

Shell elongate, asymmetrically fusiform, the spire as a rule more than half as high as the entire shell; protoconch paucispiral, obtuse; conch multispiral; whorls more or less flattened laterally; external sculpture dominantly axial; aperture rather narrow, usually angulated posteriorly; outer lip commonly thickened, lirate within; inner lip thickened, reflected, usually triplicate or quadruplicate, the folds more or less oblique, becoming increasingly more prominent posteriorly; anterior canal short but well differentiated; anterior extremity truncate or obscurely emarginate.

Vexillum is characterized by the slender, turriculate spire, the dominantly axial ornamentation, the distinct anterior canal, and the truncate and very obscurely emarginate anterior extremity.

Sculpture dominantly axial, the spirals, when present, incised and restricted to the intercostal areas and the anterior portion of the ultima:
- Intercostal areas spirally lirate ---- *Vexillum* (*Uromitra*) *climax* Gardner, n. sp.
- Intercostal areas spirally sulcate:
  - Axials obsolete upon the posterior portion of the whorl ---- *Vexillum* (*Uromitra*) *climacoton* Gardner, n. sp.
  - Axials persistent to the posterior suture:
    - Altitude of adult exceeding 10.0 millimeters; axial and spiral sculpture not evanescent toward the aperture:
      - Maximum diameter approximating one-third the altitude; protoconch thrice coiled. *Vexillum* (*Uromitra*) *barnardense* (Maury).
      - Maximum diameter decidedly more than one-third the altitude, protoconch twice coiled. *Vexillum* (*Uromitra*) *scopuli* (Maury).
    - Altitude of adult not exceeding 10.0 millimeters; axial and spiral sculpture commonly evanescent toward the aperture:
      - Altitude of adult usually exceeding 6.0 millimeters; columella triplicate:
        - Axial costae rarely exceeding 14; spirals very faint and irregular in development; both the axials and the spirals evanescent toward the aperture ---- *Vexillum* (*Uromitra*) *triptum* Gardner, n. sp.
        - Axial costae usually exceeding 14; spirals distinct and regular in development; both the axials and the spirals less conspicuous and commonly irregular upon the last quarter turn but usually persistent to the aperture ---- *Vexillum* (*Uromitra*) *ctenotum* Gardner, n. sp.
      - Altitude of adult rarely exceeding 6.0 millimeters; columella quadruplicate, the marginal fold commonly obsolete at the aperture; both the axials and the spirals evanescent toward the aperture. *Vexillum* (*Uromitra*) *hamadryas* Gardner, n. sp.
- Intercostal areas not spirally lirate nor sulcate:
  - Intercostal areas spirally shagreened, axial costae usually exceeding 12 -- *Vexillum* (*Uromitra*) *cnestum* Gardner, n. sp.
  - Intercostal areas not spirally shagreened, axial costae rarely exceeding 12:
    - Altitude of adult not exceeding 10 millimeters:
      - Costal and intercostal areas rounded, usually more than 1 spiral developed behind the threading of the anterior fasciole ---- *Vexillum* (*Uromitra*) *mangilopse* Gardner, n. sp.
      - Costal and intercostal areas commonly angular, usually a single spiral developed behind the threading of the anterior fasciole ---- *Vexillum* (*Uromitra*) *mikkulum* Gardner, n. sp.
    - Altitude of adult exceeding 10.0 millimeters ---- *Vexillum* (*Uromitra*) *amblipleura* Gardner, n. sp.

Sculpture very finely reticulate, the altitude not exceeding 15.0 millimeters ---- *Vexillum* (*Uromitra*) *berkeyi* (Maury).

Subgenus UROMITRA Bellardi

1887. *Uromitra*, Bellardi, Molluschi dei terreni terziarii del Piemonte e della Liguria, pt. 5, p. 277.

Type (by subsequent designation, Cossmann, 1899, Essais de paléoconchologie comparée, pt. 3, p. 168): *Voluta* (*Mitra*) *cupressina* Brochi. (Miocene and Pliocene of Italy.)

Shell medium sized or small, slender; axial costae numerous, narrow, obtuse; spirals usually incised and restricted to the intercostals, commonly very feeble and in some specimens absent altogether. Columella triplicate, or more commonly quadruplicate. Anterior canal terminating in a broad, very shallow notch.

The group is very well represented at all three horizons of the Alum Bluff. It is rather significant that in the Recent faunas these small Mitras are peculiarly characteristic of the shallow inshore waters and are almost entirely restricted in their distribution to the east coast of the Americas.

Vexillum (Uromitra) climax Gardner, n. sp.

Plate XLVIII, figures 14, 15

Shell small, thin, slender in outline, the aperture a little less than half the length of the entire shell. Whorls six and one-half in all, including the one and

one-half nuclear turns; whorls of spire flattened laterally, narrowly but very sharply tabulated posteriorly, increasing very slowly in diameter. Body whorl smoothly but quite sharply rounded at the periphery. Protoconch small, smooth, slender, polished, obliquely flattened behind, performing only one and one-half revolutions; initial turn immersed at the tip, strongly inflated before the close of the turn; final half turn decidedly elevated, broadly convex. Opening of conch marked by the abrupt initiation of the axial sculpture and the very gradual development of the spiral. Axials dominating the spirals except upon the base of the body; axials very narrow, rather acute upon their summits, uniform in prominence between the shoulder and the anterior suture and persisting across the shoulder to the posterior suture and across the base of the body to the basal sulcus, 13 or 14 upon the later whorls of the spire; intercostal areas broadly and smoothly concave, more than double the width of the axials. Spiral sculpture rather obscure, least so upon the base of the body and the fasciole; spirals flattened, usually 5, the posterior outlining the shoulder angle, the spiral next in front of the shoulder very feeble, the third and fourth spirals relatively prominent and the suture line following close upon and commonly concealing the fifth; shoulder angle coronated by the feebly nodose intersections of the axials and spirals; spirals upon the base of the body 5, less obscure than those upon the sides, becoming increasingly narrower toward the anterior fasciole; basal sulcus outlined by a single coarse thread and the anterior fasciole threaded with about 6 rather obscure and crowded lirae. Suture line distinct, finely crenulated by the costae of the preceding volution. Aperture obliquely lenticular, imperfectly preserved. Outer lip angulated at the shoulder, arcuate in front of the shoulder. Parietal wall thinly glazed, abruptly constricted at the base of the body. Pillar reinforced, moderately long, straight, triplicate, the plaits approximately parallel, oblique, the posterior a little more prominent than the 2 in front of it and set in line with the posterior margin of the fasciole. Anterior canal rather short, feebly recurved, truncate at its anterior extremity.

Dimensions: Height, 6.3 millimeters; length of aperture, 3.0 millimeters; maximum diameter, 2.9 millimeters.

Holotype: U. S. Nat. Mus. No. 371437.

Type locality: No. 2212, Tenmile Creek, near Baileys Ferry, Calhoun County, Fla.

Vexillum climax is the only known member of the genus in the Alum Bluff that develops a raised spiral sculpture in the intercostal areas. The type is unique.

Vexillum hosfordense libertiense (pl. XLVIII, fig. 16) of Mansfield, described from the upper Miocene of Florida, is extremely close, differing mainly in the details of the sculpture. The axials are rather more numerous upon the Choctawhatchee species, and the spirals are less definitely developed upon the early whorls.

Vexillum climax is not a typical *Uromitra*. The outline is too stout, the basal constriction too pronounced, the anterior canal too short, the protoconchal whorls too large and too few, and the columella triplicate rather than quadruplicate.

Occurrence: Chipola formation, locality 2212[r].

Vexillum (Uromitra) climacoton Gardner, n. sp.

Plate XLVIII, figures 17, 18

Shell very small, rather thin, the spire elevated and conspicuously scalariform, the body rudely cuneate in outline. Whorls of conch a little less than 5 in the unique type. Protoconch obtuse, smooth, polished, twice-coiled, the initial whorl broadly flattened posteriorly and immersed at the tip, the succeeding volution more elevated and feebly constricted at the posterior suture; very faint incremental striae developed near the close of the protoconch. Line of demarcation between the conch and protoconch obscure, indicated by a very slight thickening of the shell and by the gradual initiation of the axial sculpture. Shoulder, also initiated on the first postnuclear whorl, narrow, approximately horizontal, evenly rounding into the compressed lateral portion of the whorl, unsculptured except for faint incremental striae. Axials low, rounded, feebly protractive, 17 on each of the later whorls of the spire, equisized and equispaced, uniform in elevation upon the sides of the whorls, entirely obsolete upon the shoulder, the base of the body, and the final half turn; intercostal areas a little—but only a little—wider than the costals. Spiral sculpture manifested in the form of faint linear sulci, 3 or 4 upon the penult and 4 to 6 upon the costate portion of the ultima, the spirals equal and regularly spaced but not overriding the axials; exceedingly faint spiral striae also developed upon the base of the body and behind the less feeble sulci; extreme base of body and pillar girded with 2 or 3 low, ill-defined spirals, the fasciole with 3 additional lirae linearly spaced. Aperture narrowly and somewhat obliquely lobate. Outer lip thin, sharp, smoothly but strongly rounded at the shoulder, feebly arcuate in front of the shoulder. Throat lirated with 5 equal and equispaced threads which abruptly evanesce before reaching the outer margin. Parietal wall and pillar very thinly glazed. Columella triplicate, the posterior fold placed near the base of the body decidedly stronger than either of those in front of it; anterior of the three the least elevated. Anterior canal very short and ill defined, broadly and obliquely truncate at its extremity.

Dimensions: Height, 3.6 millimeters; length of aperture, 1.7 millimeters; maximum diameter, 1.6 millimeters.

Holotype: U. S. Nat. Mus. No. 371440.

Type locality: No. 7054, 400 feet below bridge near Oak Grove, Yellow River, Okaloosa County, Fla.

Vexillum climacoton is represented by a unique type, but it is unusually well characterized and entirely unlike any congenetic species. The most striking diagnostics are the flattened initial whorl, the manner in which the whorls of the conch are smoothly but rather abruptly folded in at the suture, and the restriction of the characteristic axial and spiral sculpture to the sides of the whorls.

Occurrence: Oak Grove sand, locality 7054[r].

Vexillum (Uromitra) barnardense (Maury)

Plate XLVIII, figure 19

1910. *Mitra barnardensis* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 18, pl. 4, fig. 9.

1910. ?*Mitra myttonis* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 18, pl. 5, fig. 1.

Shell with tip eroded, remaining whorls 8; suture distinct; transverse sculpture of sharply defined riblets of which there are about 12 on the last whorl. These riblets extend from suture to suture and over three-quarters of the body whorl. Spiral sculpture of grooves channeled in the interspaces between the riblets, and of about 7 unequal threads on the canal; aperture narrow; columella with 4 plaits of which the 2 anterior are much less prominent; outer lip lirate within. Length of shell, 13; greatest width, 4.5 millimeters.

Chipola marls, Baileys Ferry, Fla.

Cornell University collection.—Maury, 1910.

Topotype: U. S. Nat. Mus. No. 371441.

The protoconch is small, slender, smooth and highly polished, and performs a little more than 3 revolutions. The initial turn is rather elevated, broadly rounded, and immersed at the tip, the succeeding turns increasingly flattened laterally. There are about 9 volutions in the adult conch. The whorls of the spire are flattened laterally and very narrowly and obscurely tabulated posteriorly. The body is constricted and attenuated at the base, smoothly in the adults and very abruptly in the young. The axial costae are approximately equal and regular in size and spacing, rather acutely Λ-shaped, persisting with uniform strength from suture to suture and well down to the base of the body commonly increasing to 15 upon the later whorls. The intercostal areas are broadly concave and grooved with angular sulci, usually 5 to 7 upon the later whorls of the spire and twice as many upon the body. They do not override the costals and are separated by flattened areas as wide or wider than the furrows. The sutures are deeply impressed and undulated in harmony with the axial sculpture. The aperture is slightly oblique, the outer lip very feebly arcuated. The half dozen lirations of the throat do not persist to the margin. There is a rather heavy deposit of callus on the inner wall of the aperture directly in front of the commissure, and the parietal wall and pillar are covered with a dense glaze. The 4 labial plications are submedial in position between the extremities of the aperture, and they increase in prominence posteriorly. The anterior canal is rather long for the group and is truncate or obscurely emarginate at its extremity.

Vexillum barnardense (Maury) offers rather a wide variation in relative dimensions. The young are much more conic than the adults and the body is very much more angular. There is also a limited range in the number and character of the axial costae and a much wider range in the character of the spiral sculpture and the relative width of the sulci and the dividing areas.

Vexillum myttone (Maury) was described from an immature individual.

Vexillum scopuli (Maury), from Alum Bluff, is ornamented in a similar manner but is stouter and inclined to be rounded biconic in outline. The protoconch is only twice instead of thrice coiled, and the initial whorl and a half of *V. scopuli* are relatively larger than those of *V. barnardense*, more flattened posteriorly, and more strongly inflated.

The Oak Grove analog, *V. hamadryas*, is only half as large as *V. barnardense* (Maury), the protoconch contains a little less than 2 instead of 3 volutions and the conch only 6. The average number of axial costae is higher, the spiral sulci are finer, and there is a strong tendency in *V. hamadryas* toward the evanescence of both the axials and the spirals upon the final whorl. In the Shoal River members of this group, *V. ctenotum* and *V. triptum*, the axials are much smaller and they contain fewer whorls both in the conch and protoconch. In *V. triptum* the axials are more obtuse, the spirals finer and more obscure, and both the axials and the spirals less persistent upon the body. *V. ctenotum* is more slender and the axial sculpture is more crowded than in *V. barnardense* (Maury). *Vexillum syrum* (Dall), the analog in the "silex beds" of the Tampa formation, attains comparable dimensions but is much more slender. All the later representatives of the group—*Vexillum wandoense* (Holmes) (pl. XLVIII, fig. 26), *V. holmesii* (Dall), and *V. willcoxii* (Dall)—are much smaller and present differences in the details of the sculpture.

Among the allied mid-American species are *V. bristoli* (Maury) from the Brasso beds of Trinidad, and *Vexillum tortuosellum* and the subspecies *frater* Pilsbry and Johnson from the Gurabo formation of the Dominican Republic.

Vexillum barnardense is widespread and not at all uncommon in the Chipola.

Occurrence: Chipola formation, localities 2213[c], 2564[p], 3419[p], Aldrich collection, Johns Hopkins University[p], and Cornell University collection[p].

Vexillum (Uromitra) myttone (Maury)

1910. *Mitra myttonis* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 18, pl. 5, fig. 1.

Shell small, slender, fusiform, whorls 6; nuclear smooth; subsequent whorls sculptured with nearly straight transverse ribs and fine spiral grooves in the interspaces; penultimate whorl with 15 ribs; body whorl almost smooth over its latter third or half as the ribs become obsolete; outer lip lirate within; columella with 3 well-marked plaits.

Length of largest specimen 5; of last whorl 3; of aperture 1.5; greatest width 1.5 millimeters.

This little species bears some resemblance to Dr. Dall's *M. holmesii* of the Caloosahatchie marls.

Chipola Oligocene, Baileys Ferry, Fla.

Cornell University collection.—Maury, 1910.

This species is probably the young of *V. barnardense*.

Vexillum (Uromitra) scopuli (Maury)

Plate XLVIII, figure 20

1910. *Mitra scopuli* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 18, pl. 4, fig. 10.

A species closely related to *Mitra barnardensis* occurs in the lower bed (Oligocene) of Alum Bluff, Fla. This species differs from the Chipola shell in its broader, shorter form and more convex whorls. Length of decollate shell 11.5; greatest width 5 millimeters.

Cornell University collection.—Maury, 1910.

Topotype: U. S. Nat. Mus. No. 371442.

Shell of moderate dimensions for the genus, rather solid, rudely conic to subfusiform in outline. Protoconch small, obtuse, smooth, polished, twice coiled, the first 1½ turns strongly inflated medially, the tip immersed, the whorl flattening toward the close of the protoconch. Dividing line between conch and protoconch indicated by a slight change in the texture of the shell and by the initiation of the axial sculpture. Whorls of conch probably 8 or 9, those of the spire flattened laterally and narrowly and obscurely tabulated, the body rather abruptly constricted and attenuated at the base. Axial costae narrow, ∧-shaped, rather acute ridges persisting with uniform prominence from suture to suture and well down to the base of the body, vertical or feebly arcuate, running about 15 to the adult whorl, approximately equal and regular in size and spacing. Intercostal areas wider than the costae and sulcated with angular grooves which do not override the spirals and number about 6 to the penult and twice as many to the ultima; interareas flattened and usually a little broader than the furrows. Extreme base of body and pillar banded with 2 or 3 rather broad fillets separated by shallow channels, incrementally striated; fasciole threaded with 3 or 4 linearly spaced lirae. Suture lines deeply impressed and undulated in harmony with the axial sculpture. Aperture narrowly lobate in outline, acutely angulated posteriorly. Outer lip very feebly arcuate, thin edged; throat lirated with about half a dozen equal and equally spaced threads. Parietal wall and pillar glazed, the callus especially heavy near the commissure. Columella quadruplicate, the folds increasing in prominence posteriorly. Canal rather short and moderately broad. Siphonal fasciole well differentiated, arched in the older forms, emarginate at its extremity.

Were it not for the differences in the protoconch the specific rank of this shell would be doubted, so slight are the conchal differences between it and *V. barnardense*. The protoconch of the Chipola River species contains one more whorl than that of the form from Alum Bluff, and the initial 1½ turns are relatively smaller, more elevated, and less flattened posteriorly. Furthermore, the conch of *V. barnardense* is more slender, less inclined to be biconic in outline, and a little more solid. The characters that separate *V. barnardense* from other members of the group prevail also in *V. scopuli*.

Vexillum scopuli (Maury) is restricted in its known distribution to the type locality.

Occurrence: Chipola formation, locality 2211^{e}, Cornell University collection.

Vexillum (Uromitra) triptum Gardner, n. sp.

Plate XLVIII, figures 21, 22, 23

Shell small, slender, acuminate, the whorls of the spire numerous, flattened laterally, tapering very gradually to the obtuse apex; body rather abruptly constricted at the base. Whorls of conch a little less than 7 in the type, a little more in other individuals. Protoconch performing about one and one-half revolutions; initial half turn almost entirely submerged, the succeeding volution broadly rounded, flattened posteriorly and, toward the close of the protoconch, laterally as well. Dividing line between conch and protoconch obscure, indicated chiefly by the initiation of the axial sculpture. Early whorls of conch regularly trapezoidal, and in some specimens slightly depressed a little behind the median horizontal. Axial costae narrow, obtuse, vertical or very slightly flexuous, subequal and equispaced, persisting from suture to suture upon the whorls of the spire with approximately uniform elevation and, in some individuals, well down to the base of the body but tending to evanesce more or less completely upon the ultima and also to be feebly compressed in front of the posterior suture, thus simulating a presutural band, 13 to the whorl upon the type; intercostal areas broadly concave, wider than the costals. Spiral sculpture varying widely in the degree of development in different individuals, most commonly manifested in the form of microscopically faint linear sulci, running about 8 to the later whorls and restricted entirely to the intercostal areas and commonly reduced to still more faint and very irregular spiral striae. Extreme base of body and pillar girded with 2 or 3 irregular lirae and the anterior fasciole with 4 additional unevenly

spaced threadlets. Suture lines distinct, strongly impressed. Aperture not far from one-third as high as the entire shell, only moderately narrow, angulated posteriorly. Outer lip thin, sharp, a little sinuous, lirate far within the throat with about half a dozen subequal linear threads that do not persist to the outer margin. Inner margin of aperture deeply excavated at the base of the body. Parietal wall and pillar densely enameled. Columella triplicate, the folds oblique and approximately parallel, increasing in prominence posteriorly. Body angle high, the canal rather short but well differentiated, broad, and very feebly recurved. Anterior fasciole truncate at its extremity.

Dimensions: Height, 8.3 millimeters; length of aperture, 3.3 millimeters; maximum diameter, 2.6 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 371443.

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

There is a moderate range of variation in these small, acutely tapering *Terebra*-like Mitras. The posterior and medial portions of the spire are commonly more regularly coiled than the anterior. Generally, in the penult and ultima, there is rather an abrupt increase in the diameter of the whorl, producing an obtuse shouldering. The number of costals in a few individuals may run as low as 10 or as high as 15. They are usually more or less obsolete upon the body, commonly persisting posteriorly for a short distance as a series of small nodes.

The congenetic *V. ctenotum* is a smaller and more slender shell with more sharply elevated axials, which usually run up to 15 or 16 and which are more persistent upon the base of the body and toward the aperture. The spiral sculpture is also sharper than in *V. triptum* and the anterior canal longer. *V. barnardense* (Maury), the Chipola analog, is decidedly larger and coarser, and the sculpture, both the axial and the spiral, is stronger and more persistent. The Oak Grove analog, *V. hamadryas*, is decidedly smaller, the axials are more crowded, and the spirals are more consistently developed. None of the later species approach it very closely in general aspect.

Vexillum triptum is the most abundant and widely distributed member of the genus in the Shoal River, and it is apparently restricted to that single horizon.

Occurrence: Shoal River formation, localities 3856[c], 3742[a], 3731[r], 5079[r], 3748[r].

Vexillum (Uromitra) ctenotum Gardner, n. sp.

Plate XLVIII, figures 24, 25

Shell small, rather solid, the spire elevated and slowly tapering to an obtuse apex, the body whorl relatively short and abruptly constricted at the base. Whorls of conch 6 in the complete adult. Protoconch small, smooth, highly polished, performing not quite 2 complete revolutions; initial fraction of a whorl flattened posteriorly, almost entirely submerged; succeeding volution strongly inflated, flattening laterally toward the close of the protoconch. Opening of conch indicated by the abrupt initiation of the axial sculpture. Axials narrow, obtuse upon their summits, strongly elevated, commonly a little flexuous, persisting with uniform prominence from suture to suture and well down to the base of the body, though tending to be less elevated and less regular upon the final half turn, approximately equal and equispaced, usually 15 or 16 to the whorl. Intercostal areas strongly concave, a little wider than the costals, grooved with usually 6 to 9 linear sulci that do not override the costals. Sulci upon the base of the body more or less obsolete; extreme base of body and pillar girded with 3 or 4 rude but rather prominent lirae and the anterior fasciole with 3 additional threads linearly spaced. Suture lines deeply impressed. Aperture rather narrow, somewhat oblique, acutely angulated posteriorly. Outer lip thin, sharp, a little sinuous, lirate far within the throat with about half a dozen threads that tend to increase in prominence posteriorly. Inner margin of aperture strongly excavated. Parietal wall glazed, an amorphous deposit of callus being laid down directly in front of the posterior commissure; pillar also reinforced. Labial folds 3, the margin of the pillar acute but not elevated into a well-defined fold, even within the aperture; posterior plication broader, more elevated, and more nearly horizontal than either of those in front of it. Anterior canal well differentiated, short, rather broad, very feebly recurved. Anterior fasciole obliquely truncate at its extremity.

Dimensions: Height, 6.0 millimeters; length of aperture, 2.8 millimeters; maximum diameter, 2.2 millimeters.

Holotype: U. S. Nat. Mus. No. 371444.

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

Vexillum ctenotum is best characterized by its slender outline, numerous elevated axials, and well-developed spirals.

The congenetic *V. triptum* is larger, the axials are less numerous, less elevated, and more prone to evanesce toward the aperture, and the spiral sculpture is more obscure and more irregular in its development. *V. hamadryas* from the Oak Grove is smaller and more slender, the axials are less elevated and very rarely persistent to the aperture, the spirals are less strongly impressed and less persistent, and the edge of the pillar is pinched into a marginal fold, bringing the number of labial plaits up to 4. *V. wandoense* (Holmes) (pl. XLVIII, fig. 26) of the later Tertiary is a possible descendant of this species, but in the later form the posterior portion of the whorl is slightly compressed, the axials are more numerous and more flexuous, and the spiral sculpture is finer and more uniformly de-

veloped upon the body. The anterior canal is also shorter and more obscurely differentiated in *V. wandoense*.

Vexillum ctenotum is less abundant and less widely distributed than *V. triptum*, but it is fairly common at the type locality.

Occurrence: Shoal River formation, localities 3742[r], 5618[r].

Vexillum (Uromitra) hamadryas Gardner, n. sp.

Plate XLVIII, figures 27, 28

Shell very small for the genus, thin in substance, slender, acuminate. Whorls of spire trapezoidal in outline, increasing very slowly in diameter. Body whorl short, rather abruptly constricted at the base. Whorls of conch 6. Protoconch small, smooth, polished, obtuse, flattened posteriorly, performing a little less than 2 revolutions; the initial whorl largely submerged; the succeeding volution broadly rounded and flattening toward the close of the nucleus. Dividing line between conch and protoconch indicated by a slight change in the texture of the shell and by the initiation of the axial sculpture. Axials very narrow, compressed, obtuse upon their summits, vertical or feebly arcuate, approximately equal in size and spacing, persisting for the most part with uniform strength from suture to suture, though commonly a little less elevated posteriorly, almost or altogether obsolete upon the base of the body and in some specimens over the entire ultima, running 16 to the later whorls in the type; intercostal areas concave and, in the type, of approximately the same width as the costals. Spiral sculpture of more or less deeply impressed sulci restricted entirely to the intercostal areas; sulci 9 upon the penult and ultima of the type; spiral sculpture evanescing with the axial and becoming almost or altogether obsolete in those forms that lose their costals; base of body sculptured with about half a dozen exceedingly faint sulci, the pillar girded with 3 or 4 unequal lirae and the fasciole with 4 additional lirae, equal and linearly spaced. Sutures deeply impressed, finely crenulated by the costae of the preceding volution. Aperture narrow, obliquely lenticular in outline, acutely angulated posteriorly. Outer lip flaring a little anteriorly, sharp edged, very thin at the margin; throat lineated with half a dozen subequal lirae. Inner wall of aperture excavated at the base of the body, covered with a coat of glaze sufficiently strong to conceal the sculpture, an amorphous protuberance developed directly in front of the commissure. Columella quadruplicate, the folds parallel within the aperture, the posterior fold the most elevated though only a little more so than that in front of it, the 2 posterior folds much heavier, more nearly horizontal at the mouth, and more widely separated than the anterior; fold directly behind the edge of the pillar thin, sharp, and strongly oblique; edge of pillar pinched into a sharp fold at a little distance within the aperture but obsolete at the mouth. Canal short, ill differentiated, obliquely truncate at its extremity.

Dimensions: Height, 5.5 millimeters; length of aperture, 2.0 millimeters; maximum diameter, 2.0 millimeters.

Holotype and paratype: U. S. Nat. Mus. No. 371445.

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

Vexillum hamadryas offers a very great range of variation in the details of the sculpture and, to a lesser degree, in the outline. These variations do not seem, however, to be coordinated in any way and to be consistent; either half a dozen varieties must be made or none at all. There is no stratigraphic significance in the different manifestations, so they have all been retained under the single name. The type is a little stouter than the average adult but of the same general proportions as the normal young and adolescent forms. This may possibly bear some relation to the fact that the axial sculpture is perhaps a little stronger and more persistent than in most individuals of the same size. The axials, which are approximately the same in number on each whorl—16 in the type—may run as low as 12 and as high as 18. They may be vertical or they may be arcuated. On perhaps more than half the individuals they are obsolete upon the final half turn and in a few upon the entire ultima. In the type, they do not evanesce until very near the aperture. The variations in the spiral sculpture are, to a certain extent, concomitant with those of the axials, though upon the spire they exhibit an independent variation in the degree of depression. The sulci upon the pillar and anterior fasciole may be rather sharp or they may be almost altogether obsolete.

The group as a whole is, however, characterized by the small size, more or less slender outline, obtuse, paucispiral nucleus, the absence of sutural constrictions, the numerous narrow, obtuse axial ribs separated by concave, spirally sulcated interaxials, and by the tendency toward the obsolescence of both the axial and the spiral sculpture upon the final whorl.

This is the smallest member of the group in the Alum Bluff and one of the most feebly sculptured. The Chipola, *V. barnardense* (Maury), is more than double its size and has a much more persistent axial and spiral sculpture. In neither of the two Shoal River analogs—*V. triptum* and *V. ctenotum*—is the margin of the pillar raised into a fold as in *V. hamadryas*. *V. triptum* is also decidedly larger, the axials are usually less numerous and more distantly spaced, and the spirals are relatively narrower and fainter. *V. ctenotum* is more similarly sculptured, but the axials are more elevated and the spirals more depressed and both the axials and the spirals are more persistent upon the body. The canal is also longer in *V. ctenotum* and better differentiated. *Vexillum willcoxii* (Dall) and *V.*

holmesii (Dall) of the Caloosahatchee Pliocene are similar in general aspect but more strongly sculptured.

Vexillum hamadryas is restricted in its known distribution to the Oak Grove and is one of the most common and most characteristic of the small univalves.

Occurrence: Oak Grove sand, localities 2646[a], 5632[c], 5631[p], 5633[p], 7054[p].

Vexillum (Uromitra) cnestum Gardner, n. sp.

Plate XLVIII, figures 29, 30

Shell small, thin, rather slender, elongate conic in outline. Spire elevated and tapering very gradually to the small but obtuse apex; the sides of the whorls flattened. Body rather abruptly constricted at the base in the young but smoothly in the adult. Whorls of conch 6. Protoconch smooth and very highly polished, a little less than twice coiled; initial whorl broadly rounded, flattened behind, partly submerged in the succeeding turn, which is quite strongly inflated medially, moderately elevated, and flattened toward the close of the protoconch. Dividing line between conch and protoconch rather obscure, indicated most clearly by the gradual introduction of the axial sculpture. Axials uniform in character over the entire conch, narrow, obtuse, approximately vertical or feebly arcuate, subequal and regularly spaced, persistent from suture to suture, though weakening a little posteriorly and commonly obsolete altogether over the whole or a part of the body, 14 upon the penult of the type. Intercostal areas smoothly concave, microscopically striated with linear sulci which do not override the costals, numbering 7 or 8 on the later whorls of the spire and about as many on the body. Base of the body and the pillar girded with 3 or 4 irregular and ill-defined spirals and the anterior fasciole with 4 or 5 equal lirae linearly spaced. Suture lines deeply impressed, finely undulated by the costals of the preceding volution. Aperture narrow, oblique, acutely angulated posteriorly. Outer lip thin, sharp, broadly arched, the throat lirated with 6 to 8 sharp subequal threads that persist almost but not quite to the outer edge of the labrum. Inner margin of aperture excavated at the base of the body. Parietal wall glazed, the wash heaviest directly in front of the posterior commissure. Pillar reinforced. Columella plicated with 3 oblique, equally spaced folds that increase in prominence posteriorly and with a fourth incipient fold in front of them, which does not, however, seem to persist within the aperture. Anterior canal well differentiated, moderately long, rather broad, slightly recurved, and very feebly emarginate at its extremity.

Dimensions: Height, 6.1 millimeters; length of aperture, 2.8 millimeters; maximum diameter, 2.0 millimeters.

Holotype: U. S. Nat. Mus. No. 371446.

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

There is a moderately wide range in the relative dimensions in this species, and the type is a little larger than the majority of individuals. The number of axial costals may decrease to 12, and the spiral sculpture is commonly so faint as to be barely perceptible under high magnification. The spiral shagreening and the close-set axials are usually sufficient, however, to separate it from its nearest kin, *V. mangilopse*. In *V. mikkulum*, from Alum Bluff, the costals and intercostals are usually less numerous and more angular; there is, as a rule, only a single spiral behind the threading of the anterior fasciole, and the columella is quadruplicate. *V. cnestum* has a distribution very similar to that of *V. mangilopse*.

Vexillum cnestum is one of a group of three determinate and as many more indeterminate species characterized by smooth or nearly smooth intercostal areas, all of them restricted in their known distribution to the Chipola and most of them fairly common at that horizon. They are by far the most puzzling group of the genus. Most of the species are very small and offer rather a wide variation in outline, both in the same and in different species. The axial costae may be two or three more or less than the average number, and they usually offer a rather wide range of variation in the contour of their summits. The members of the group seem to be peculiarly susceptible to injury, two or three breaks commonly occurring on a single individual, and with every injury there is usually some modification in the outline of the whorl or the sculpture. The nuclei are very similar in all the forms, and in most of them there is a strong tendency toward the evanescence of the sculpture toward the aperture. Apparently, however, some individuals assume this character very much earlier than others, some of them, indeed, while still in the adolescent state.

Vexillum cnestum is to a certain extent intermediate between the typical *Vexilla* and those in which there is no trace of spiral sculpturing preserved upon the spire and the posterior and medial portions of the body.

Occurrence: Chipola formation, localities 7893[r], 2213[p], 2564[p], 3419[r].

Vexillum (Uromitra) mangilopse Gardner, n. sp.

Plate XLVIII, figures 31, 32

Shell very small and slender, resembling *Mangelia* in general aspect. Spire elevated, obtusely tapering. Body smoothly but rather strongly constricted at the base. Whorls of conch between 5 and 6. Protoconch small, smooth, highly polished, rather obtuse, twice coiled, the initial whorl inflated medially, somewhat flattened posteriorly, immersed at the tip, the succeeding volution flattening toward its close. Dividing line between conch and protoconch marked by a slight

change in the texture of the shell and by the gradual initiation of the axial sculpture. Axials, usually 10, vertical, low, broadly and smoothly rounded as a rule, inclined to spread a little and become a little more prominent anteriorly, persisting from suture to suture upon the spire but absent upon the body of the fully adult, those upon the earlier volutions narrower and more closely spaced. Spirals restricted to 1 or 2 ill-defined lirae at the extreme base of the body, a slightly stronger lira girding the pillar and usually 4 linearly spaced threads upon the anterior fasciole. Sutures impressed, undulated by the axials of the preceding volution. Aperture narrowly lobate, acutely angulated at the posterior commissure. Outer lip thin, sharp, broadly and feebly arcuate; throat lirated with about half a dozen evenly spaced threads, which evanesce at some distance from the labral margin. Parietal wall rather thinly glazed, the wash heaviest directly in front of the commissure. Pillar also reinforced. Labial folds 4, submedial in position, regularly spaced and increasing regularly in prominence posteriorly. Anterior canal rather short, open, obscurely emarginate at its extremity.

Dimensions: Height, 6.1 millimeters; length of aperture, 2.8 millimeters; maximum diameter, 2.1 millimeters.

Holotype: U. S. Nat. Mus. No. 371447.

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

There is some variation in the relative dimensions and in the character of the axial sculpture. The axials may be very narrow and subacute upon their summits or they may be patted smooth. They run normally 10 to the whorl, though this number is in some specimens increased to 11 and in a few to 12. These slight variations change the general aspect of the shell very materially.

Vexillum amblipleura runs about twice as large, is stouter relatively as well as absolutely, and because of its greater diameter for an equal number of ribs is more distantly sculptured axially. The young of *V. amblipleura* are stout little cones entirely unlike the *V. mangilopse* of the same altitude. *Vexillum cnestum* is of similar dimensions but exhibits a microscopically fine spiral striation or shagreening and has usually from 2 to 4 more ribs to the whorl than *V. mangilopse*. *V. mikkulum* from Alum Bluff, which is apparently restricted in its distribution to the type locality, is smaller but relatively less slender, the axial sculpture is usually more angular, and there is, as a rule, only a single spiral developed behind the threading of the anterior fasciole.

V. mangilopse is not at all uncommon at the single horizon at which it occurs.

Occurrence: Chipola formation, localities 2213[c], 2564[p], 3419[p].

Vexillum (Uromitra) mikkulum Gardner, n. sp.

Plate XLVIII, figures 33, 34

Shell small but rather solid, asymmetrically fusiform in outline, the maximum diameter falling in front of the median horizontal. Whorls of the spire flattened laterally and tapering gradually to an obtuse apex. Body rather abruptly constricted at the base. Whorls 6½ in all, the last 4½ included in the conch. Protoconch small, obtuse, smooth and highly polished, the initial turn almost entirely immersed, the second whorl medially inflated, flattening gradually toward the close of the protoconch. Initiation of conch marked only by the gradual introduction of the axial sculpture. Axials uniform in general character over the entire conch, rather broad and obtusely Λ-shaped, equisized and equally spaced, approximately vertical and uniform in elevation between the sutures, tending to become obsolete upon the ultima, especially upon the final half turn; intercostal areas a little wider than the costals and commonly rather acutely V-shaped. True spiral sculpture restricted to rather a coarse liration upon the pillar and 3 or 4 finer lirations directly in front of it and separated from it and from one another by linear interspaces. Suture lines distinct, rather deeply impressed, undulated by the costals of the preceding volution. Aperture narrow, acutely angulated posteriorly. Outer lip thin, sharp, the throat lirated with about half a dozen subequal threads that do not persist to the outer edge. Inner margin of aperture excavated at the base of the body. Parietal wall and pillar thinly glazed, an amorphous deposit of callus laid down directly in front of the commissure. Columella quadruplicate, the posterior fold the heaviest and the most isolated, the 3 folds in front rather closely spaced and increasing gradually in prominence posteriorly. Anterior canal short but well differentiated, moderately broad, feebly recurved. Anterior fasciole strongly arched, truncate at its extremity.

Dimensions: Height, 4.9 millimeters; length of aperture, 2.5 millimeters; maximum diameter, 1.8 millimeters.

Holotype: U. S. Nat. Mus. No. 371448.

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

Vexillum mikkulum varies widely in relative proportions and in the outline of the anterior part of the ultima. The number of costals does not run below 9 on any individual observed, but it may go as high as 12. The intercostal areas may be quite smoothly convex or they may be decidedly angular. *Vexillum mikkulum* is the smallest member of the group in the Alum Bluff. *Vexillum amblipleura* is more than twice as large as *V. mikkulum*. *V. mangilopse* and *V. cnestum* do not greatly exceed it in height, but *V. cnestum* is more closely sculptured axially, the costals are 14 upon the penult of the type, the intercostal areas are microscop-

ically striate, and the columella is triplicate instead of quadruplicate.

V. mangilopse from the same horizon is relatively more slender in outline, the costals and intercostals are usually less angular, and the spirals upon the base of the body and the pillar are more numerous.

V. mikkulum is apparently restricted in its distribution to the type locality.

Occurrence: Chipola formation, localities 2211[p], 7183[r].

Vexillum (Uromitra) amblipleura Gardner, n. sp.

Plate XLVIII, figure 35

Shell rather small for the genus, not very heavy, the spire elevated, conic in outline, the body rather short and abruptly constricted at the base in the young but much more smoothly in the adults. Whorls probably 6 in the adult conch. Protoconch rather small, smooth, highly polished, twice coiled, the initial volution very strongly inflated and immersed at the tip, the succeeding turn flattening gradually toward the close of the protoconch. Line of demarcation between the conch and protoconch indicated by a slight break in the texture of the shell and by the initiation of the axial sculpture. Whorls of spire trapezoidal, not constricted at the sutures, the increasing diameter of the whorl anteriorly emphasized by the character of the axial sculpture. Axials rather low, least elevated near the posterior suture, broadest and most prominent directly behind the anterior suture and upon the periphery of the body, numbering approximately 10 to the whorl, the number remaining constant, the ribs becoming more and more widely spaced anteriorly. Spiral sculpture absent except for a rather low, rounded cord girding the base of the body, another more prominent upon the pillar and in line with the posterior fold, and 4 coarse lirae linearly spaced upon the anterior fasciole. Sutures impressed, undulated by the costae of the preceding volution. Aperture narrow, a little sinuous, acutely angulated posteriorly. Outer lip thin, broad, and feebly arcuated, not lirate within. Parietal wall thinly glazed, the heaviest deposit being laid down directly in front of the commissure. Pillar more heavily reinforced. Labial plications, 4; submedial in position between the extremities of the aperture, the posterior, a little isolated, the 3 in front evenly spaced and decreasing regularly in prominence. Canal moderately long, well differentiated, inclined to be slightly recurved, the margins approximately parallel. Anterior fasciole rather wide, broadly emarginate at its extremity.

Dimensions: Height, 12.0± millimeters; length of aperture, 5.0 millimeters; maximum diameter, 4.0 millimeters.

Holotype: U. S. Nat. Mus. No. 371449.

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

Vexillum amblipleura may be recognized by the regularly conic outline of the spire, the obtuse axial sculpture, and the restriction of the spirals to the base of the body and the pillar. The coexistent members of this group—*V. mangilopse*, the microscopically striate *V. cnestum*, and *V. mikkulum*—are all much smaller, less than half the size of *V. amblipleura*. The regularly conic outline of the young of this species is more than sufficient to separate them from the slender adults of the other species mentioned. *Vexillum myrum* (Dall) of the "silex bed" fauna is somewhat similar in general contour but is smaller and triplicate.

Occurrence: Chipola formation, localities 2213[r], ?2212[r], 2564[p], 3419[p].

Vexillum (Uromitra) berkeyi (Maury)

1910. *Mitra berkeyi* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 19, pl. 5, fig. 2.

Shell when perfect with about 7 whorls, the single specimen found being decollated and showing only 6. Transverse sculpture of riblets so extremely fine as to be barely visible without a lens on the three earlier whorls but becoming slightly broader on the last three whorls so as to be easily seen by the unaided eye. Spiral sculpture of revolving threads developed only on the last 3 whorls, where they equal in strength the transverse riblets and form with them a most exquisite and delicate cancellation, covering the entire surface of the three later whorls. Columella with four plaits; aperture elliptical; canal short, reflexed. Length of shell, 9; greatest width, 3.5 millimeters.

Chipola marls, Baileys Ferry, Fla.

Cornell University collection.

Named in honor of Dr. Berkey, of Columbia University.—Maury, 1910.

This species is very doubtfully represented in the later collections.

Occurrence: Chipola formation, locality ?2213[r], Cornell University collections.

Genus PERPLICARIA Dall

1890. *Perplicaria* Dall, Wagner Free Inst. Sci. Trans., vol. 3, pt. 1, p. 90.

Type (by monotypy): *Perplicaria perplexa* Dall (Pliocene of the Caloosahatchee River, Fla.).

Shell ovate-fusiform, cancellated; nucleus smooth, involute, small; outer lip thickened; pillar thin, twisted, with a single high, sharp plait parallel with it throughout its length.

This singular shell has a small, smooth nucleus, with the tip infolded. Its general aspect would recall *Daphnella*, having much the same cancellated surface and obliquely coiled whorls. There is no sutural sinus, and the pillar is unlike that of any shell known to me.—Dall, 1890.

Perplicaria ? prior Maury

1910. *Perplicaria prior* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 17, pl. 4, fig. 8.

Shell with 5 whorls; nucleus consisting of a whorl and a half, smooth to the unaided eye but showing under the lens 3 revolving threads; sculpture of the remaining whorls cancellate, due

to the intersections of the spirals (of which there are on the body whorl 15 strong and an equal number of fine alternating threads) with obliquely transverse costae; suture distinct; outer lip with a submarginal varix, lirate within along the entire length but more sharply so toward the base; columella with 3 plaits, that nearest the base being nearly horizontal and denticulate, the second very oblique, and the uppermost slightly oblique; pillar glazed with a slight callus.

Length of shell, 14; greatest width, 6 millimeters.

Chipola marls, Baileys Ferry, Fla.

Cornell University collection.

This interesting shell is the second species of the genus *Perplicaria* Dall yet described. The type of the genus, *P. perplexa* from the Caloosahatchee Pliocene, was described by Dr. Dall in 1890. The Chipola shell resembles closely that species but differs from it in possessing much more oblique transverse costae, in having 3 instead of 2 columellar plaits, and in its proportionally broader form. But in other respects the earlier, Chipola species shows the characters of its Pliocene descendant.—Maury, 1910.

This interesting species has unfortunately not appeared in the later collections. Some of its characters suggest *Aphera*.

Genus STRIGATELLA Swainson

1840. *Strigatella* Swainson, Treatise on Malacology, p. 319.

Type (by subsequent designation, Gray, 1847, Zool. Soc. London Proc., p. 141): *Mitra zebra* Lamarck. (Recent in the Indian Ocean.)

Shell of moderate dimensions but rather stout and heavy, ovate or broadly fusiform in outline. Protoconch small, obtuse, paucispiral. Whorls of spire more or less trapezoidal in outline, little or not at all constricted at the impressed sutures, acutely tapering. Body broadly ovate. Axial sculpture absent or incremental in character, a very low and obscure spiral sculpture usually developed upon the whorls of the spire and the posterior portion of the body with commonly a few strong sulci or lineations at the base of the body. Aperture obliquely lenticular as a rule, acutely angulated posteriorly. Outer lip thickened but with no sharply defined marginal varix, posteriorly produced for a short distance upon the preceding volution, a rather prominent but ill-defined tubercle or protuberance developed upon the inner labral margin a little behind the median line of the aperture. Parietal wall thinly glazed, the wash thickening upon the pillar. Labial plications usually 4, nearly horizontal or slightly oblique, the posterior placed approximately midway between the commissure and the anterior extremity, the anterior plication usually less elevated and less produced than those behind it; anterior canal broad, ill defined. Siphonal fasciole usually well differentiated; siphonal notch deep, more or less oblique.

The presence of this genus in the lower Miocene of the east coast is peculiarly interesting, for it apparently did not persist into the Recent faunas of the adjacent seas but is almost entirely restricted in its distribution to the coral reefs of the Indian and Pacific Oceans.

Strigatella isabellae (Maury)

1910. *Caricella isabellae* Maury, Bull. Am. Paleontology, vol. 4, no. 21, p. 17, pl. 4, fig. 7.

1915. *Strigatella americana* Dall, U. S. Nat. Mus. Bull. 90, p. 61, pl. 9, fig. 2.

Shell of moderate size, thick and strong, whorls 6, exclusive of the eroded nucleus; suture distinct. Sculpture consisting only of numerous longitudinal striations. Columella with 4 plaits; canal short; reflexed. Length of shell, 27; of aperture and canal, 18; greatest width, 14 millimeters.

Chipola marls, Baileys Ferry, Fla.

Cornell University collection.—Maury, 1910.

Shell ovoid, heavy, with a short acute spire of 7 whorls, exclusive of the (lost) protoconch; upper whorls closely spirally threaded, the threads disappearing in front of the shoulder on the last whorl; suture closely appressed; axial sculpture of fine rounded riblets, with equal interspaces traversing the whole width of the last whorl, but faint and irregular on the spire; outer lip much thickened with a prominent nodule internally near the middle; body with a thin wash of callus; pillar with 4 stout nearly horizontal plaits, with wider interspaces; canal short, narrow, sharply recurved; siphonal fasciole well marked. Height, 28; maximum diameter, 15; aperture, 20 millimeters.

Oligocene of the Chipola River marls near the county bridge (station 2212), U. S. Nat. Mus. No. 114343; also in the Tampa silex beds(?).

Fragments were found at Ballast Point, which were supposed to belong to this species but were subsequently mislaid. It is probably the first American fossil species of the genus.—Dall, 1915.

The protoconch is very small, obtuse, smooth, and highly polished and performs between two and two and one-half revolutions. The initial turn is broadly rounded posteriorly and almost entirely immersed. The succeeding one and one-half turns are feebly convex, flattening laterally toward the close of the protoconch. The dividing line between the conch and protoconch is indicated by a slight change in the texture of the shell, the increased lateral flattening of the whorl, and the introduction of faint spiral and incremental striae. The spirals are low and obscure, finely waved, and more or less irregular. They usually run from 9 to 13 to the whorl. The axial sculpture is incremental in character and irregular in development. Both the axial and the spiral sculpture have been somewhat exaggerated in Dall's figure. Miss Maury's type was doubtless slightly weathered, and the ornamentation is so obscure that it is easily obliterated by only a slight degree of erosion. The suture line is deeply impressed and is dragged backward near the aperture. The aperture is obliquely lenticular in outline and acutely angulated posteriorly. The anterior of the four labial

plications is less elevated and less produced than any of those behind it. The siphonal notch is deep but not conspicuously wide; its margins are parallel and obliquely directed.

Occurrence: Chipola formation, localities 2212[r], 2213[r], ?3419[r], Cornell University collections.

Genus CONOMITRA Conrad

1865. *Conomitra* Conrad, Am. Jour. Conchology, vol. 1, p. 25.

Type (by subsequent designation, Cossmann, 1889, Catalogue illustrée de coquilles fossiles, vol. 4, p. 186): *Mitra fusoides* Lea. (Eocene of Claiborne, Ala.)

Shell of moderate dimensions, rather solid, rudely biconic in outline; whorls of spire more or less compressed laterally, in many specimens narrowly tabulated posteriorly; body broadly rounded or obliquely constricted; protoconch obtuse, smooth, paucispiral; surface of conch ornamented as a rule with numerous low, narrow costae, commonly evanescing anteriorly and intercepted by more or less obscure spiral sulci and fillets; sutures impressed; aperture narrow, oblique; outer lip smooth or dentate within; parietal wall glazed; columella plicated with 4 major and in some specimens, a fifth minor fold, the plications submedial and horizontal or feebly oblique, increasing regularly in prominence posteriorly; anterior canal not well differentiated, truncate at its extremity.

The outline of the members of this group is much more suggestive of a volutoid than of a mitroid.

The genus is not uncommon in the east coast Eocene and Oligocene, and it has also been reported from the Eocene of the Paris Basin. It has not been recognized in the late Tertiary, but Dall has assigned to it a species from the Recent Antillean fauna.

Conomitra apalachee Gardner, n. sp.

Plate XLVIII, figure 36

Shell of moderate dimensions, rather thin, compact, rudely biconic in outline, the maximum diameter falling a little behind the median horizontal. Spire elevated, evenly terraced, the posterior portion of the whorl rolled smoothly but rather abruptly into the suture line; the sides laterally compressed; whorls 9½ in the type, 7½ of these included in the conch. Protoconch small, smooth, polished, obtuse, moderately elevated, the initial turn broadly rounded and partly submerged, the succeeding volution becoming increasingly flattened toward the close of the protoconch. Dividing line between the conch and protoconch indicated by a slight change in the texture of the shell and the initiation of the axial sculpture. Axials narrow, obtuse, cordlike, vertical, weakening a little upon the rounded shoulder but persisting with uniform prominence from the shoulder to the anterior suture and well down to the base of the body, 21 upon the initial postnuclear whorl of the type, increasing to 28 upon the body but not so strong relatively and less uniform in size and spacing. Spiral sculpture introduced near the close of the first whorl of the conch in the form of 2 or 3 faintly impressed sulci, all of them in front of the median horizontal; sulci developing on the later volutions into very shallow, angular channels separated by low, broad fillets of approximately the same width, 3 upon the penult of the type, the posterior a little behind the median horizontal, 16 in number upon the body of the type, those on the medial portion a little more shallow than those in front of or behind them; base of the body and pillar sculptured with 4 or 5 broader grooves separated by more elevated fillets, which merge, however, into the finer, closer threading of the anterior fasciole. Suture lines deeply impressed. Aperture narrow, oblique, the margins approximately parallel. Outer lip thin, sharp, flexed at the shoulder and produced backward for a short distance upon the penult. A heavy deposit of callus laid down just inside of the suture line and parallel with it, thinning out along the parietal wall, slightly heavier upon the pillar. Labial plications very slightly oblique, parallel to one another, disposed along the medial portion of the inner wall, increasing regularly in prominence posteriorly, separated in the type by interspaces of approximately double width; a fifth very obscure fold developed in front of the 4 major plications, persisting within the aperture and with the same relative elevation. Canal short, ill defined, broad, open, very slightly flexed, obliquely truncate at its extremity.

Dimensions: Height, 24.8 millimeters; length of aperture, 16.5 millimeters; maximum diameter, 10.5 millimeters.

Holotype: U. S. Nat. Mus. No. 371450.

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

This is the largest and most ornate of all the described members of the genus. It has been confused in the check lists with *Conomitra staminea* Conrad from the Vicksburg and a form cited under the same name but probably distinct from the "silex beds." The Vicksburg species is only about half the size of that from the Chipola, the spire is relatively more elevated but less strongly turreted, and the body is less obliquely compressed. The spiral sculpture is not so restricted in its development and there are about twice as many sulci upon the penult. The inner wall of the aperture is more strongly contracted at the base of the body and the labial plications are much heavier than in *C. apalachee*. The species from Ballast Point is more slender as a rule, the whorls of the spire are relatively higher and less broadly shouldered, the axials are more numerous, more closely spaced, and more flexuous, the spiral sculpture is finer and developed over the entire whorl, the columellar plications are broader and not so sharp, and the feeble fifth fold is less commonly present.

Conomitra apalachee exhibits a certain amount of variation in relative proportions, the number of axials, the width of the spirals and the relative area covered by them, and in the width of the labial folds, but the ensemble of the characters is very constant.

Occurrence: Chipola formation, localities 2213^{p}, 2564^{p}, 3419^{p}, ?2211^{r}.

Genus CYMAKRA Gardner, n. gen.

Type (hereby designated): *Cymakra poncei* Gardner. (Chipola formation, lower Miocene of Florida.)

Shell small, solid, biconic to fusiform. Protoconch smooth, obtuse, paucispiral. Early whorls of conch axially rippled, the axials almost or entirely obsolete upon the later whorls. Entire conch spirally corded, the number of the spirals constant and their character uniform from the opening of the conch to the final whorl. Interspiral channels incrementally grated. Aperture narrow, angulated posteriorly. Outer lip lirate within. Parietal wash dense but not widely spread. Two narrow plaits obliquely placed upon the pillar at the base of the body abruptly disappearing at the outer opening but continuous within. Anterior canal broad and ill-defined, truncate but not emarginate at the extremity.

The genus includes the closely related *Mitromorpha pygmaea* Dall of the Caloosahatchee fauna, and probably *Mitromorpha mitrodita* Gardner of the Duplin fauna and *Mitromorpha smithfieldensis* Olsson of the Yorktown. They cannot be included under the genus to which they were originally referred, as the type of *Mitromorpha, Daphnella? filosa* Carpenter, exhibits a smooth pillar. The plicate pillar, the smooth blunt nucleus, and the incremental grating between the strong spirals suggest the Mitridae. Against such a placement is the feeble development of the folds both in number and in height. A few of the turrids develop similar plications, and some of the plicate species incorrectly referred to *Mitromorpha*, such as *M. biplicata* Dall of the recent Floridian fauna, show a shallow but well-defined turrid notch. However, in the group assembled under *Cymakra*, no siphonal sinus has been detected, and the alliance to the Mitridae seems closer than to any other family.

Cymakra poncei Gardner, n. sp.

Plate XLI, Figure 37

Shell small, slender, smoothly fusiform in outline, the maximum diameter falling a little in front of the median horizontal. Whorls of conch a little less than 6 in number, those of the spire trapezoidal and increasing very slowly and regularly in diameter. Body whorl broadly rounded medially, smoothly constricted into the rather broad pillar. Protoconch small, smooth, obtuse including the initial fraction of a whorl largely immersed in the succeeding volution and a full whorl that is strongly inflated at its beginning and flattened toward its close. Dividing line between conch and protoconch irregular, indicated by the appearance of 4 feeble spirals. Axial sculpture least feeble upon the early whorls, obsolete upon the body; axials low, broad, and rippling, 8 on the first whorl of the conch, 7 on the two succeeding whorls; intercostals smoothly rounded, of approximately the same width as the costals, continuous from one whorl to the next so that the second and third whorls are fluted with evenly rounded, slightly protractive miniature columns, which become increasingly broader and increasingly lower anteriorly and disappear on the later whorls of the spire. Spiral sculpture uniform in its development over the entire shell. Spirals narrow, flattened upon their summits, sharply elevated, 4 to each of the whorls of the spire, 11 upon the body exclusive of the canal, equal and separated by angular, subequal interspaces of approximately their own width, the interspace between the two posterior spirals a little wider than those in front of it and the spirals upon the base of the body a little lower and more distantly spaced than those behind. Sutures linear, inconspicuous by reason of the prominent spirals. Interspiral areas striated with microscopically fine incrementals. Anterior fasciole threaded with 7 or 8 finer lirae. Aperture narrow, acutely angulated posteriorly. Outer lip feebly arcuate, reinforced by 7 equispaced lirations which persist for some distance within the throat but which become increasingly lower and shorter anteriorly. Parietal and pillar wash rather thin but dense, the outer margin sharply delimited. Pillar straight, bearing well up toward the base of the body two moderately strong plications, the posterior a little the stronger, almost at right angles to the axis of the shell, and disappearing directly upon reaching the aperture. Anterior canal moderately long, broad, ill-differentiated, obliquely truncate at its anterior extremity.

Dimensions: Height, 6.5 millimeters; length of aperture, 3.2 millimeters; maximum diameter, 2.4 millimeters.

Holotype: U. S. Nat. Mus. No. 371438.

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

The two individuals that establish this species are the only known representatives of the genus within the Alum Bluff. They are possibly the precursors of *Cymakra pygmaea* (Dall) from the Caloosahatchie Pliocene, a species that includes fewer whorls but that has the same general type of sculpture, though the axials upon the posterior portion of the shell are sharper and more numerous.

Occurrence: Chipola formation, localities 2213^{r}, 2564^{r}.

NOTE.—I wish to acknowledge my great indebtedness to those responsible for the illustrations, especially to Miss Frances Wieser, the artist who retouched the photographs, and to Mr. W. O. Hazard, who made them. As Alice said, "What is a book without a picture?"—especially a book on systematic paleontology.—J. G.

PLATES XXXVII–XLVIII

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PLATE XXXVII

FIGURES 1, 2. *Vaginella chipolana* Dall (p. 257).
1. Ventral view of cotype; height 5.5 millimeters; transverse diameter 3.6 millimeters; anteroposterior maximum diameter 2.0 millimeters. (After Dall.)
2. Profile of second cotype; height 5.2 millimeters; transverse diameter 2.4 millimeters; anteroposterior maximum diameter 1.9 millimeters. (After Dall.)

FIGURES 3, 4. *Cancellaria (Aphera) waltonensis* (Aldrich) (p. 377).
3. Apertural view of topotype; height 16.8 millimeters; maximum diameter 9.4 millimeters.
4. Rear view of topotype.

FIGURE 5. *Acteon* sp. cf. *A. textilis* (Guppy) (p. 259). Apertural view of young and probably immature specimen; height 5.7 millimeters; maximum diameter 2.8 millimeters.

FIGURES 6, 7. *Acteon korphys* Gardner, n. sp. (p. 259).
6. Apertural view of holotype; height 6.1 millimeters; maximum diameter 3.1± millimeters.
7. Rear view of holotype.

FIGURE 8. *Acteon fusulus* Dall (p. 260). Apertural view of holotype; height (of decollate specimen) 7.5 millimeters; maximum diameter 2.9 millimeters. (After Dall.)

FIGURES 9, 10. *Acteon hamadryados* Maury (p. 260).
9. Rear view of topotype; height 6.2 millimeters; maximum diameter 3.2 millimeters.
10. Apertural view of topotype.

FIGURE 11. *Acteon chipolanus* Dall (p. 261). Apertural view of holotype; height 6.3 millimeters; maximum diameter 2.8 millimeters. (After Dall.)

FIGURE 12. *Acteocina sphalera* Gardner, n. sp. (p. 262). Apertural view of holotype; height 9.0 millimeters; maximum diameter 4.4 millimeters.

FIGURE 13. *Acteocina incisula* (Dall) (p. 262). Apertural view of cotype; height 6.4 millimeters; maximum diameter 2.9 millimeters. (After Dall.)

FIGURE 14. *Acteocina incisula curtoides* Gardner, n. subsp. (p. 263). Apertural view of holotype; height 4.1 millimeters; maximum diameter 2.0 millimeters.

FIGURE 15. *Acteocina incisula kolos* Gardner, n. subsp. (p. 263). Apertural view of holotype; height 3.5 millimeters; maximum diameter 1.8 millimeters.

FIGURE 16. *Acteocina persimilis* (Dall) (p. 263). Apertural view of holotype; height 2.9 millimeters; maximum diameter 1.35 millimeters. (After Dall.)

FIGURE 17. *Acteocina rusa* Gardner, n. sp. (p. 264). Apertural view of holotype; height 3.1 millimeters; maximum diameter 1.7 millimeters.

FIGURE 18. *Acteocina fischeri* (Dall) (p. 264). Apertural view of holotype; height 2.5 millimeters; maximum diameter 1.5 millimeters. (After Dall.)

FIGURE 19. *Sulcularia prosulcata* Gardner, n. sp. (p. 265). Apertural view of holotype; height 3.9 millimeters; maximum diameter 1.5 millimeters.

FIGURE 20. *Sulcularia chipolana* (Dall) (p. 265). Apertural view of cotype; height 5.5 millimeters; maximum diameter 2.35 millimeters. (After Dall.)

FIGURE 21. *Cylichnella biplicata* (H. C. Lea) (p. 266). Apertural view of specimen from Oak Grove; height 3.7 millimeters; maximum diameter 2.0 millimeters.

FIGURE 22. *Cylichnella biplicata* (H. C. Lea)? (p. 266). Apertural view of specimen from Shoal River formation, 3½ miles southwest of DeFuniak Springs; height 4.0 millimeters; maximum diameter 2.25 millimeters.

FIGURES 23, 24. *Volvula oxytata* Bush (p. 267).
23. Apertural view; height (estimated) 3.4 millimeters; maximum diameter (estimated) 1.3 millimeters. (After Bush.)
24. Apertural view of specimen from Chipola formation on Tenmile Creek, Calhoun County; height 2.8 millimeters; maximum diameter 1.2 millimeters.

FIGURE 25. *Volvula oxytata dodona* Gardner, n. subsp. (p. 267). Apertural view of holotype; height 4.0 millimeters; maximum diameter 1.6 millimeters.

FIGURE 26. *Volvula phoinicoides* Gardner, n. sp. (p. 268). Apertural view of holotype; height 4.5 millimeters; maximum diameter 1.5 millimeters.

FIGURE 27. *Scaphander langdoni* Dall (p. 268). Apertural view of holotype; height 8.9 millimeters; maximum diameter 5.1 millimeters. (After Dall.)

FIGURE 28. *Atys oedemata* Dall (p. 269). Apertural view of cotype; height 4.5 millimeters; maximum diameter 2.5 millimeters. (After Dall.)

FIGURE 29. *Atys (Aliculastrum) obscuratus* Dall (p. 269). Apertural view of cotype; height 4.2 millimeters; maximum diameter 2.1 millimeters. (After Dall.)

FIGURE 30. *Atys (Roxaniella) gracilis* Dall (p. 270). Apertural view of cotype; height 5.1 millimeters; maximum diameter 2.1 millimeters. (After Dall.)

FIGURE 31. *Cylichna decapitata* (Dall) (p. 271). Apertural view of holotype; height 5.4 millimeters; maximum diameter 2.3 millimeters. (After Dall.)

FIGURE 32. *Cylichna quercinensis* (Dall) (p. 271). Apertural view of holotype; height 2.5 millimeters; maximum diameter 1.3 millimeters. (After Dall.)

FIGURE 33. *Cylichna anthera* Gardner, n. sp. (p. 271). Apertural view of holotype; height 5.0 millimeters; maximum diameter 2.2 millimeters.

FIGURES 34, 35. *Bulla striata waltonensis* Gardner, n. subsp. (p. 272).
34. Apertural view of holotype; height 16.5 millimeters; maximum diameter 9.5 millimeters.
35. Rear view of holotype.

FIGURE 36. *Haminaea pompholyx* Dall (p. 273). Apertural view of lectotype; height 6.5 millimeters; maximum diameter 5.5 millimeters. (After Dall.)

FIGURE 37. *Abderospira chipolana* Dall (p. 274). Apertural view of holotype; height 4.6 millimeters; maximum diameter 3.0 millimeters. (After Dall.)

FIGURE 38. *Abderospira funiakensis* Gardner, n. sp. (p. 274). Apertural view of holotype; height 4.5 millimeters; maximum diameter 3.3 millimeters.

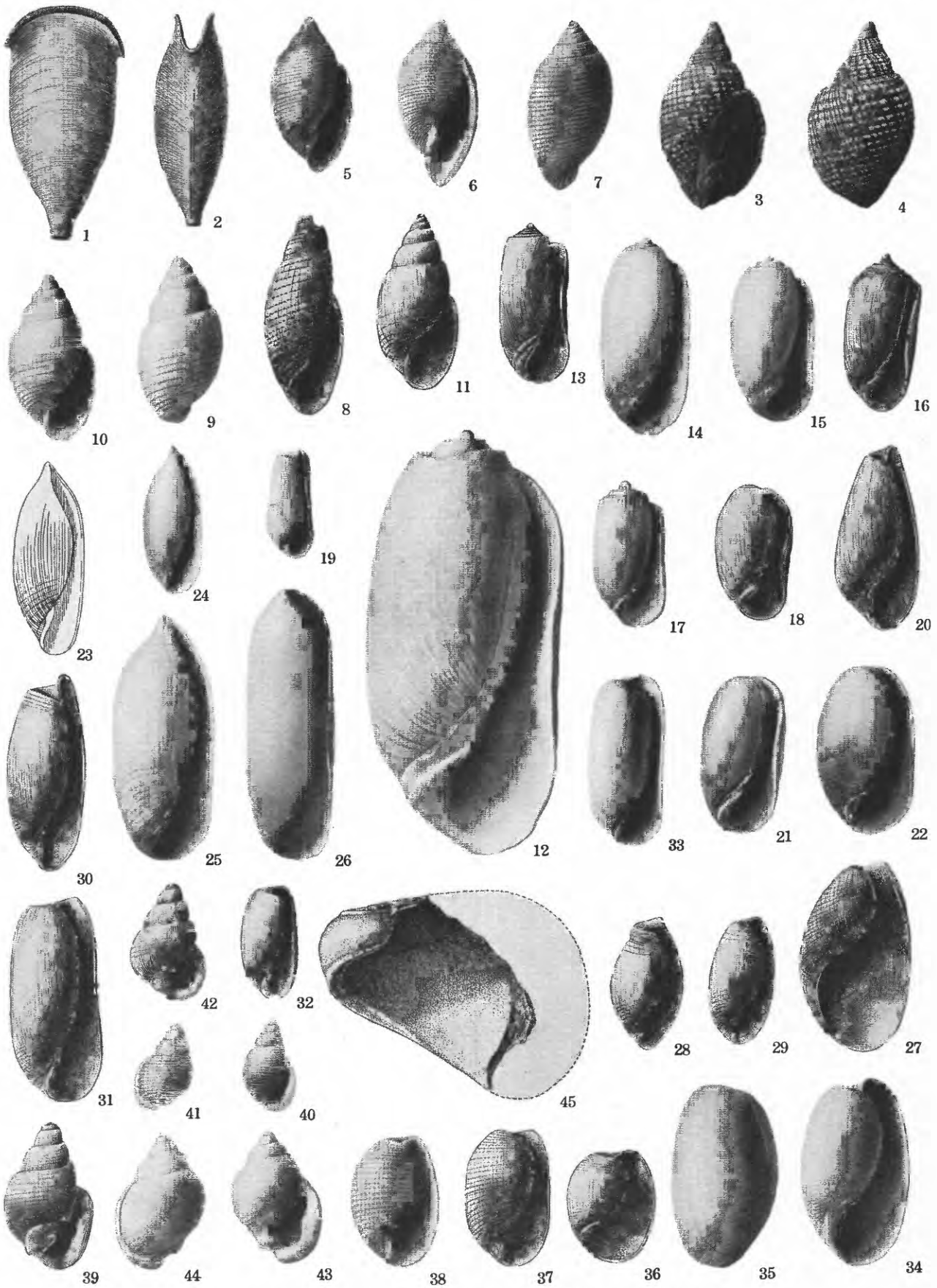
FIGURE 39. *Ringicula chipolana* Dall (p. 275). Apertural view of holotype; height 2.2 millimeters; maximum diameter 1.3 millimeters. (After Dall.)

FIGURES 40, 41. *Ringicula boyntoni* Gardner, n. sp. (p. 275).
40. Apertural view of holotype; height 1.6 millimeters; maximum diameter 0.8 millimeter.
41. Rear view of holotype.

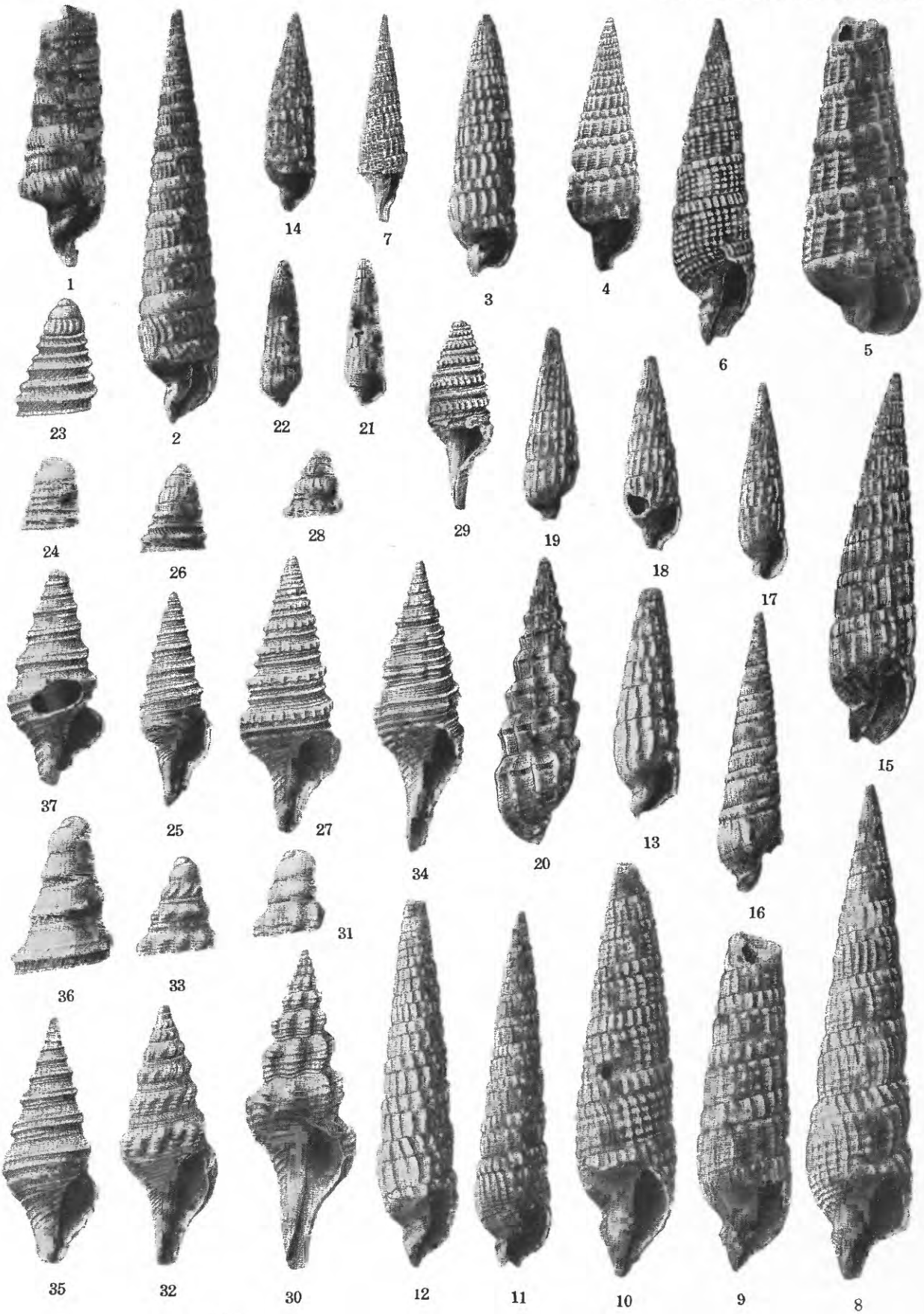
FIGURE 42. *Ringicula semilimata* Dall (p. 275). Apertural view of holotype; height 2.0 millimeters; maximum diameter 1.2 millimeters. (After Dall.)

FIGURES 43, 44. *Ringicula stiphera* Gardner, n. sp. (p. 276).
43. Apertural view of holotype; height 2.8 millimeters; maximum diameter 1.8 millimeters.
44. Rear view of holotype.

FIGURE 45. *Dolabella aldrichi* Dall (p. 276). Apertural view of holotype; height 18.0 millimeters; width 25.0 millimeters; maximum thickness of shell 5.0 millimeters. (After Dall.)



PTEROPODA AND TECTIBRANCHIATA OF THE ALUM BLUFF GROUP.



TEREBRIDAE AND TURRITIDAE OF THE ALUM BLUFF GROUP.

PLATE XXXVIII

FIGURE 1. *Terebra* (*Paraterebra*) *sulcifera* Sowerby? (p. 278). Apertural view of specimen from Chipola formation, 1 mile below Baileys Ferry, Calhoun County; height of broken specimen 47.0 millimeters; maximum diameter 14.5 millimeters.

FIGURE 2. *Terebra* (*Paraterebra*) *odopoia* Gardner, n. sp. (p. 280). Apertural view of holotype from Chipola formation on Tenmile Creek, Calhoun County; height 38.0± millimeters; maximum diameter 7.0 millimeters.

FIGURE 3. *Terebra* (*Strioterebrum*) *pupiformis* Gardner, n. sp. (p. 280). Apertural view of holotype; height 24.0± millimeters; maximum diameter 6.0 millimeters.

FIGURE 4. *Terebra* (*Strioterebrum*) *gausapata* Brown and Pilsbry (p. 281). Apertural view of specimen from Shoal River formation, Walton County; height 12.0 millimeters; maximum diameter 3.5 millimeters.

FIGURE 5. *Terebra* (*Strioterebrum*) *bipartita* Sowerby (p. 281). Apertural view of specimen from Shoal River formation, Walton County; height of broken specimen 14.0 millimeters; maximum diameter 5.1 millimeters.

FIGURES 6, 7. *Terebra* (*Strioterebrum*) *spirifera* Dall (p. 281).

6. Apertural view of holotype; height 30.0 millimeters; maximum diameter 8.0 millimeters. (After Dall.)
7. Apertural view of holotype at present.

FIGURES 8–10. *Terebra* (*Strioterebrum*) *waltonensis* Gardner, n. sp. (p. 282).

8. Apertural view of holotype; height 44.0± millimeters; maximum diameter 9.0± millimeters.
9. Apertural view of specimen with low and irregular spirals; height of broken specimen 29.0 millimeters; maximum diameter 8.1 millimeters.
10. Apertural view of specimen with relatively strong and regular spirals; height 40.0± millimeters; maximum diameter 8.7 millimeters.

FIGURES 11, 12. *Terebra* (*Strioterebrum*) *waltonensis tribaka* Gardner, n. subsp. (p. 283).

11. Apertural view of holotype; height 30.2± millimeters; maximum diameter 6.4± millimeters.
12. Apertural view of specimen with very feeble spiral sculpture; height 34.0± millimeters; maximum diameter 7.0 millimeters.

FIGURE 13. *Terebra* (*Strioterebrum?*)*eskata* Gardner, n. sp. (p. 283). Apertural view of holotype; height 23.0± millimeters; maximum diameter 6.0± millimeters.

FIGURE 14. *Terebra* (*Strioterebrum*) *rabdota* Gardner, n. sp. (p. 284). Apertural view of holotype; height 18.5 millimeters; maximum diameter 4.5 millimeters.

FIGURE 15. *Terebra* (*Strioterebrum*) *langdoni* Dall (p. 284). Apertural view of holotype; height 20.0 millimeters; maximum diameter 4.0 millimeters. (After Dall.)

FIGURE 16. *Terebra* (*Strioterebrum*) *chipolana* Dall (p. 285). Apertural view of holotype; height 12.0 millimeters; maximum diameter 2.8 millimeters. (After Dall.)

FIGURE 17. *Terebra* (*Strioterebrum*) *langdoni perpunctata* Dall (p. 285). Apertural view of holotype; height 11.0 millimeters; maximum diameter 2.7 millimeters.

FIGURES 18, 19. *Terebra* (*Strioterebrum*) *rapta* Gardner, n. sp. (p. 285).

18. Apertural view of holotype; height 18.5 millimeters; maximum diameter 4.8 millimeters.
19. Rear view of holotype.

FIGURE 20. *Spineoterebra psilis* (Dall) (p. 286). Rear view of holotype; height 17.2 millimeters; maximum diameter 4.3 millimeters.

FIGURES 21, 22. *Terebra aulakoessa* Gardner, n. sp. (p. 287).

21. Apertural view of holotype; height 8.7 millimeters; maximum diameter 2.2 millimeters.
22. Rear view of holotype.

FIGURE 23. *Polystira virgo* (Wood) (p. 288). Protoconch of a recent specimen (U. S. Nat. Mus. No. 93861) collected off Grenada, West Indies, in 73 fathoms, × 10.

FIGURE 24. *Polystira albidoides* Gardner (p. 287). Protoconch of holotype, × 10.

FIGURES 25, 26. *Polystira* (*Pleuroliria*) *tenagos* Gardner, n. sp. (p. 288).

25. Apertural view of holotype; height 39.0± millimeters; maximum diameter 12.0 millimeters.
26. Protoconch of paratype, × 10.

FIGURES 27, 28. *Hemipleurotoma eileta* Gardner, n. sp. (p. 290).

27. Apertural view of holotype; height 25.0± millimeters; maximum diameter 8.6 millimeters.
28. Protoconch of holotype, × 10.

FIGURE 29. *Hemipleurotoma bitropis* Gardner, n. sp. (p. 290). Apertural view of holotype; height 19.0± millimeters; maximum diameter 6.0± millimeters.

FIGURES 30, 31. *Fusiturricula paraservata* Gardner, n. sp. (p. 291).

30. Apertural view of holotype; height 27.8 millimeters; maximum diameter 9.6 millimeters.
31. Protoconch of paratype, × 10.

FIGURES 32, 33. *Fusiturricula? glaphura* Gardner, n. sp. (p. 292).

32. Apertural view of cotype; height 12.0 millimeters; maximum diameter 4.4 millimeters.
33. Protoconch of cotype, × 10.

FIGURE 34. *Knefastia glypta* Gardner, n. sp. (p. 293). Apertural view of holotype; height 25.3 millimeters; maximum diameter 8.0 millimeters.

FIGURES 35–37. *Knefastia? waltonia* Gardner, n. sp. (p. 294).

35. Apertural view of holotype from the Shoal River formation, 5 to 6 miles northwest of Mossyhead, Walton County; height 38.0± millimeters; maximum diameter 11.4 millimeters.
36. Protoconch of paratype, × 10.
37. Apertural view of specimen from Shell Bluff, Shoal River; figured to show posterior siphonal notch but not properly posed; upper margin of outer lip intact, indicating depth of sinus. Height of broken specimen 26.0 millimeters; maximum diameter 12.0± millimeters.

PLATE XXXIX

FIGURE 1. *Crassispira boadicea* (Dall) (p. 297). Rear view of holotype; height 25.0 millimeters; maximum diameter 9.7 millimeters. (After Dall.)

FIGURE 2. *Crassispira meunieri* (Maury) (p. 298). Apertural view of specimen from locality 2213, 1 mile below Baileys Ferry, Calhoun County; height 38.0± millimeters; maximum diameter 13.0 millimeters.

FIGURE 3. *Crassispira calligona paraconsors* Gardner, n. subsp.? (p. 299). Apertural view of holotype; height 30.0 millimeters; maximum diameter 9.0 millimeters.

FIGURE 4. *Crassispira calligonoides* Gardner, n. sp. (p. 300). Apertural view of holotype; height 32.0± millimeters; maximum diameter 8.5 millimeters.

FIGURE 5. *Crassispira calligona* (Maury) (p. 298). Apertural view of specimen from locality 3419, 1 mile below Baileys Ferry, Calhoun County; height 21.0± millimeters; maximum diameter 7.5 millimeters.

FIGURE 6. *Clavatula kalliglypta* Gardner, n. sp. (p. 302). Apertural view of holotype; height 16.0 millimeters; maximum diameter 6.0 millimeters.

FIGURES 7, 8. *Clavatula compsa* Gardner, n. sp. (p. 307).

7. Protoconch of holotype, × 10.

8. Apertural view of holotype; height 15.7 millimeters; maximum diameter 5.7 millimeters.

FIGURE 9. *Crassispira calligonoides* Gardner, n. sp. (p. 300). Protoconch of paratype, × 10.

FIGURE 10. *Clavatula habra* Gardner, n. sp. (p. 307). Apertural view of holotype; height 12.3 millimeters; maximum diameter 4.3 millimeters.

FIGURES 11, 12. *Clavatula elatocompsa* Gardner, n. sp. (p. 308).

11. Protoconch of holotype, × 10.

12. Apertural view of holotype; height 11.1 millimeters; maximum diameter 4.3 millimeters.

FIGURES 13, 14. *Clavatula libertalis* Gardner, n. sp. (p. 306).

13. Protoconch of paratype, × 10.

14. Apertural view of holotype; height 9.6 millimeters; maximum diameter 3.7 millimeters.

FIGURES 15, 16. *Clavatula panopla* Gardner, n. sp. (p. 301).

15. Protoconch of paratype, × 10.

16. Apertural view of holotype; height 23.5± millimeters; maximum diameter 8.4 millimeters.

FIGURE 17. *Clavatula eleutheria* Gardner, n. sp. (p. 301). Apertural view of holotype; height 16.6 millimeters; maximum diameter 6.0 millimeters.

FIGURE 18. *Clavatula vandenbroecki* (Maury) (p. 306). Apertural view of specimen from locality 2564, 1 mile below Baileys Ferry, Calhoun County; height 22.5 millimeters; maximum diameter 8.0 millimeters.

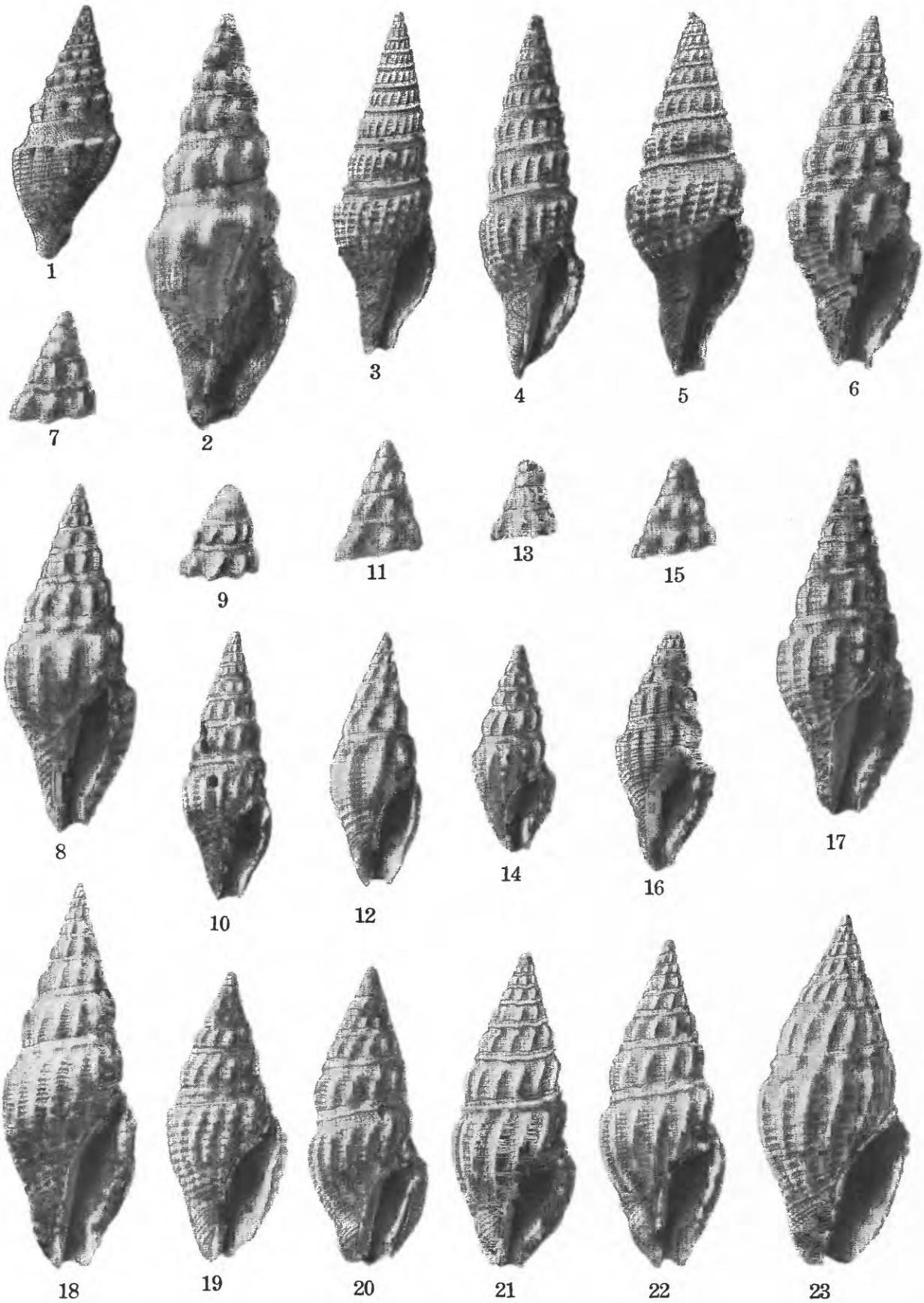
FIGURE 19. *Clavatula apoia* Gardner, n. sp. (p. 303). Apertural view of holotype; height 13.5 millimeters; maximum diameter 5.4 millimeters.

FIGURE 20. *Clavatula proebenina* Gardner, n. sp. (p. 305). Apertural view of holotype; height 14.5± millimeters; maximum diameter 5.4 millimeters.

FIGURE 21. *Clavatula anthera* Gardner, n. sp. (p. 305). Apertural view of holotype; height 14.7 millimeters; maximum diameter 5.7 millimeters.

FIGURE 22. *Clavatula euparypha* Gardner, n. sp. (p. 304). Apertural view of holotype; height 15.0 millimeters; maximum diameter 5.8 millimeters.

FIGURE 23. *Clavatula polyploka* Gardner, n. sp. (p. 303). Apertural view of holotype; height 16.6 millimeters; maximum diameter 6.8 millimeters.



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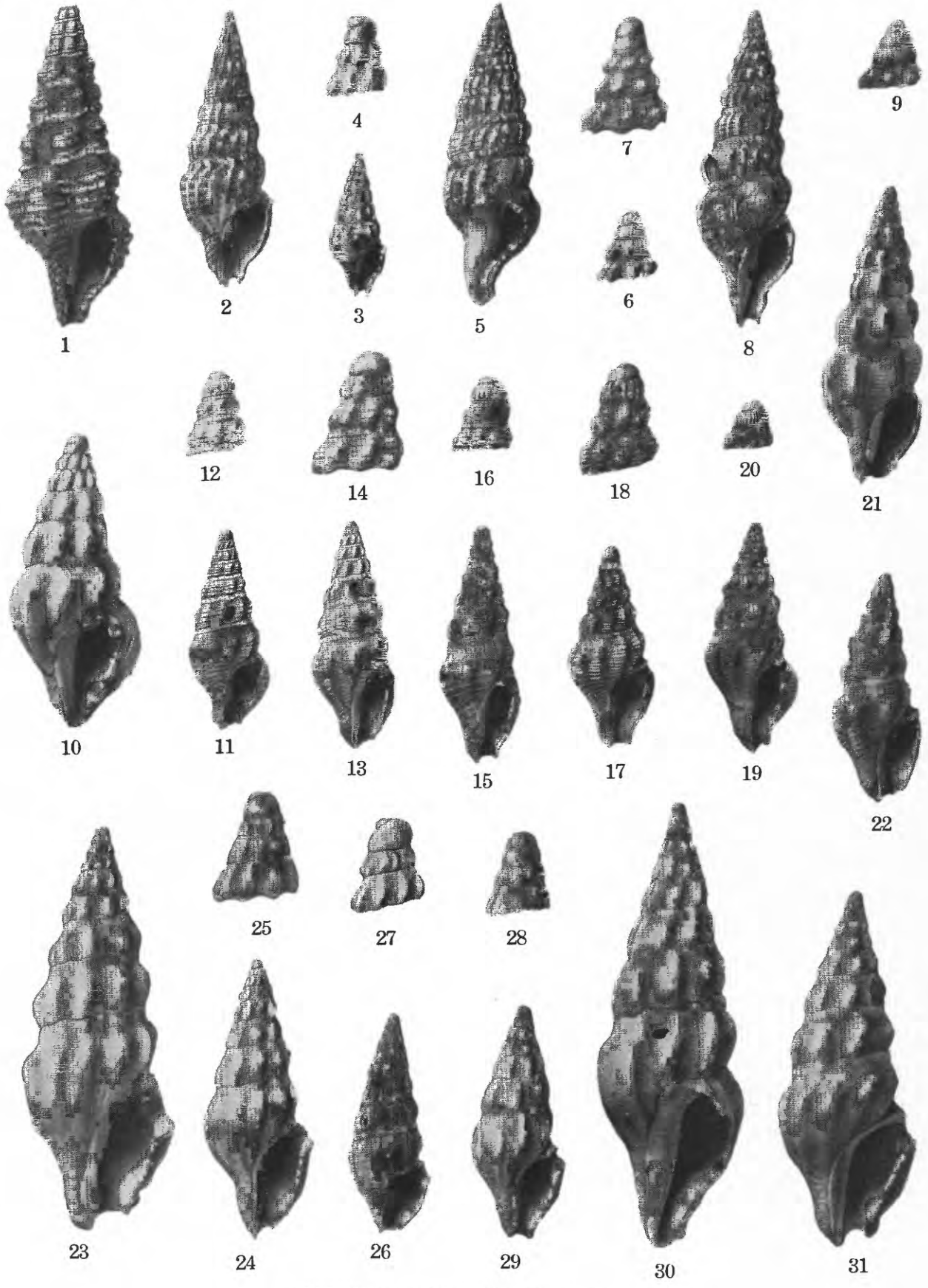


TURRITIDAE OF THE ALUM BLUFF GROUP.

PLATE XL

FIGURE 1. *Carinodrillia cymatoides* Gardner, n. sp. (p. 309). Apertural view of holotype; height 16.0 millimeters; maximum diameter 5.5 millimeters.

FIGURES 2–4. *Agladrillia aulakoessa* Gardner, n. sp. (p. 310).

2. Apertural view of holotype; height 25.0 millimeters; maximum diameter 8.0 millimeters.
3. Apertural view of paratype; height 12.6 millimeters; maximum diameter 5.0 millimeters.
4. Protoconch of second paratype, × 10.

FIGURES 5, 6. *Agladrillia subvaricosa* Gardner, n. sp. (p. 312).

5. Apertural view of holotype; height 26.6 millimeters; maximum diameter 8.5 millimeters.
6. Protoconch of paratype, × 10.

FIGURES 7, 8. *Agladrillia empera* Gardner, n. sp. (p. 312).

7. Protoconch of paratype, × 10.
8. Apertural view of holotype; height 28.0± millimeters; maximum diameter 8.4 millimeters.

FIGURE 9. *"Drillia" microneta* Gardner, n. sp. (p. 317). Protoconch of paratype, × 10.

FIGURE 10. *"Drillia" eurysoma* Gardner, n. sp. (p. 316). Apertural view of holotype (tip decollated); height 9.2 millimeters; maximum diameter 4.0 millimeters.

FIGURES 11, 12. *"Drillia" centrodes* Gardner, n. sp. (p. 318).

11. Apertural view of holotype; height 9.3 millimeters; maximum diameter 3.7 millimeters.
12. Protoconch of holotype, × 10.

FIGURES 13, 14. *"Drillia" zosta* Gardner, n. sp. (p. 319).

13. Apertural view of holotype; height 10.7 millimeters; maximum diameter 4.0 millimeters.
14. Protoconch of paratype, × 10.

FIGURES 15, 16. *"Drillia" trypanion* Gardner, n. sp. (p. 320).

15. Apertural view of holotype; height 11.0 millimeters; maximum diameter 3.8 millimeters.
16. Protoconch of paratype, × 10.

FIGURES 17, 18. *"Drillia" pycnoklosta* Gardner, n. sp. (p. 321).

17. Apertural view of holotype; height 9.8 millimeters; maximum diameter 3.8 millimeters.
18. Protoconch of holotype, × 10.

FIGURES 19, 20. *"Drillia" waltoniana* Gardner, n. sp. (p. 321).

19. Apertural view of holotype; height 10.7 millimeters; maximum diameter 4.2 millimeters.
20. Protoconch of paratype, × 10.

FIGURE 21. *"Drillia" microneta* Gardner, n. sp. (p. 317). Apertural view of holotype; height 14.0 millimeters; maximum diameter 4.7 millimeters.

FIGURE 22. *"Drillia" pachycheila* Gardner, n. sp. (p. 322). Apertural view of holotype; height 11.0 millimeters; maximum diameter 4.2 millimeters.

FIGURE 23. *Eumetadrillia rabdotacona* Gardner, n. sp. (p. 314). Apertural view of holotype; height 24.0± millimeters; maximum diameter 9.0 millimeters.

FIGURES 24, 25. *"Drillia" prion paraprion* Gardner, n. subsp. (p. 315).

24. Apertural view of holotype; height 12.8 millimeters; maximum diameter 5.0 millimeters.
25. Protoconch of holotype, × 10.

FIGURE 26. *"Drillia" coryphodes* Gardner, n. sp. (p. 316). Apertural view of holotype; height 10.4 millimeters; maximum diameter 3.8 millimeters.

FIGURE 27. *Eumetadrillia rabdotacona* Gardner, n. sp. (p. 314). Protoconch of paratype, × 10.

FIGURE 28. *"Drillia" coryphodes* Gardner, n. sp. (p. 316). Protoconch of holotype, × 10.

FIGURES 29, 30. *"Drillia" prion* Gardner, n. sp. (p. 315).

29. Apertural view of paratype; height 11.0 millimeters; maximum diameter 4.2 millimeters.
30. Apertural view of holotype; height 20.0 millimeters; maximum diameter 6.4 millimeters.

FIGURE 31. *Eumetadrillia dodona* Gardner, n. sp. (p. 313). Apertural view of holotype; height 16.0 millimeters; maximum diameter 6.0 millimeters.

PLATE XLI

FIGURE 1. *Kurtziella thektapleura* Gardner, n. sp. (p. 327). Apertural view of holotype; height 6.4 millimeters; maximum diameter 2.0 millimeters.

FIGURES 2, 3. *"Drillia" trimitrodita* Gardner, n. sp. (p. 318).
2. Apertural view of holotype; height 10.0± millimeters; maximum diameter 3.5 millimeters.
3. Protoconch of paratype, × 10.

FIGURE 4. *Kurtziella websteri* (Maury) (p. 327). Apertual view of figured specimen; height 7.7 millimeters; maximum diameter 2.8 millimeters.

FIGURES 5, 6. *"Mangelia" pyrgota* Gardner, n. sp. (p. 332).
5. Apertural view of holotype; height 6.9 millimeters; maximum diameter 2.6 millimeters.
6. Protoconch of holotype, × 10.

FIGURE 7. *Saccharoturris centrodes* Gardner, n. sp. (p. 331). Apertural view of holotype; height 4.8 millimeters; maximum diameter 1.6 millimeters.

FIGURES 8, 9. *Kurtziella stephanophora* Gardner, n. sp. (p. 328).
8. Apertural view of holotype; height 5.7± millimeters; maximum diameter 2.0 millimeters.
9. Protoconch of paratype, × 10.

FIGURES 10, 11. *Kurtziella prionota* Gardner, n. sp. (p. 326).
10. Protoconch of holotype, × 10.
11. Apertural view of holotype; height 7.2 millimeters; maximum diameter 3.0 millimeters.

FIGURES 12, 13. *Ithycythara? radinos* Gardner, n. sp. (p. 335).
12. Apertural view of holotype; height 9.6 millimeters; maximum diameter 3.0 millimeters.
13. Protoconch of paratype, × 10.

FIGURES 14, 15. *Brachycythara dasa* Gardner, n. sp. (p. 338).
14. Protoconch of holotype, × 10.
15. Apertural view of holotype; height 4.6 millimeters; maximum diameter 2.2 millimeters.

FIGURES 16, 17. *"Mangelia" klimakota* Gardner, n. sp. (p. 339).
16. Apertural view of holotype; height 3.4 millimeters; maximum diameter 1.6 millimeters.
17. Protoconch of holotype, × 10.

FIGURES 18, 19. *"Mangelia" stypteria* Gardner, n. sp. (p. 340).
18. Apertural view of holotype; height 5.5 millimeters; maximum diameter 2.3 millimeters.
19. Protoconch of holotype, × 10.

FIGURES 20, 21. *Kurtziella ramondi* (Maury) (p. 329).
20. Apertural view of figured specimen; height 6.1 millimeters; maximum diameter 2.2 millimeters.
21. Protoconch of a second specimen also from Oak Grove sand, Oak Grove, Fla.

FIGURES 22, 23. *"Mangelia" teirata* Gardner, n. sp. (p. 330).
22. Apertural view of holotype; height 5.5 millimeters; maximum diameter 2.2 millimeters.
23. Protoconch of holotype, × 10.

FIGURE 24. *Cryoturris daidalea* Gardner, n. sp. (p. 331). Apertural view of holotype; height 6.0 millimeters; maximum diameter 2.4 millimeters.

FIGURES 25, 26. *"Mangelia" phrixae* Gardner, n. sp. (p. 337).
25. Apertural view of holotype; height 6.9 millimeters; maximum diameter 2.7 millimeters.
26. Protoconch of paratype, × 10.

FIGURES 27, 28. *"Mangelia" lissa* Gardner, n. sp. (p. 337).
27. Apertural view of holotype; height 8.1 millimeters; maximum diameter 3.0 millimeters.
28. Protoconch of paratype, × 10.

FIGURES 29, 30. *"Mangelia" asteria* Gardner, n. sp. (p. 336).
29. Apertural view of holotype; height 6.2 millimeters; maximum diameter 2.4 millimeters.
30. Protoconch of holotype, × 10.

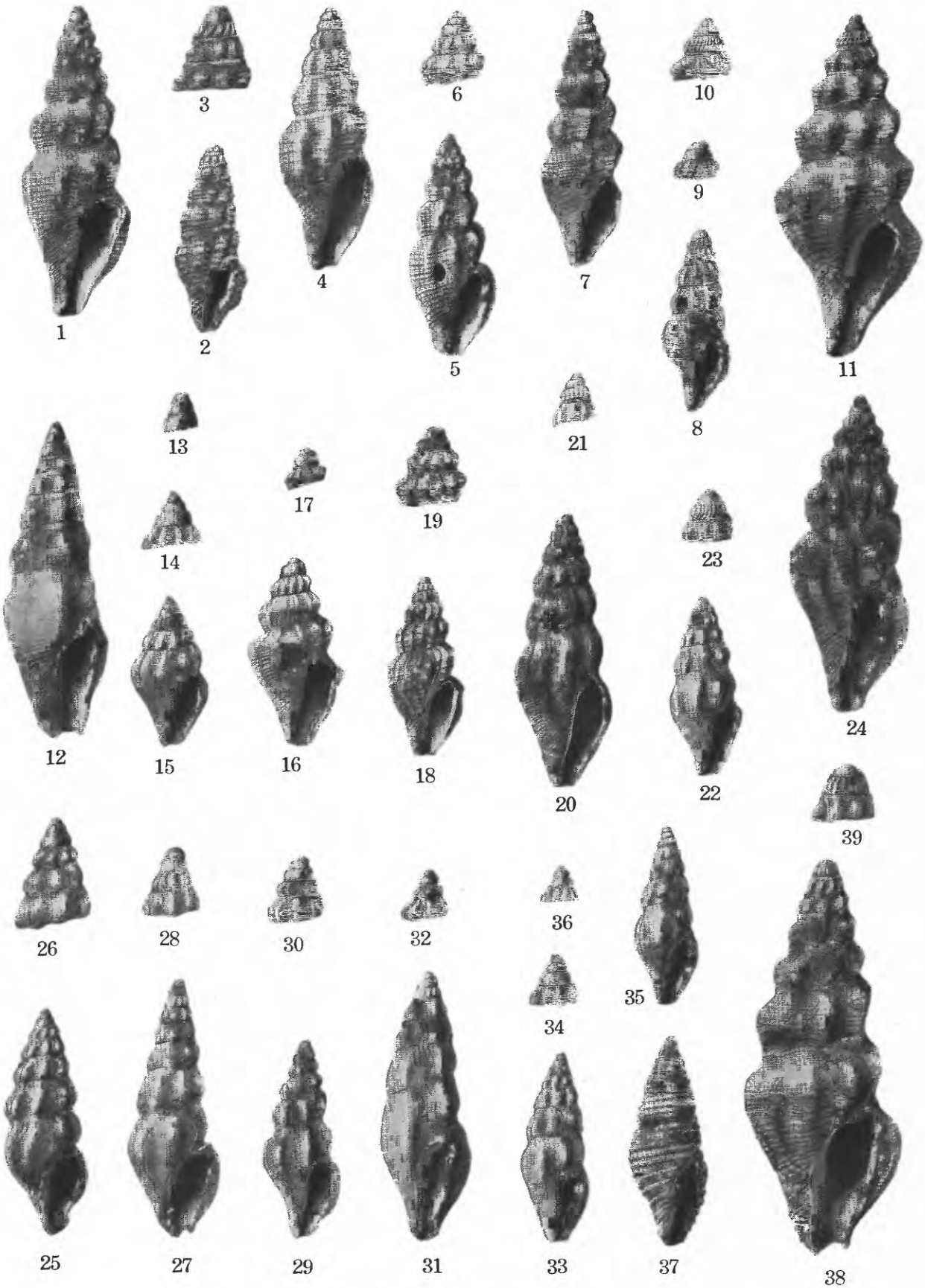
FIGURES 31, 32. *Ithycythara defuniak* Gardner, n. sp. (p. 333).
31. Apertural view of holotype; height 5.8 millimeters; maximum diameter 1.9 millimeters.
32. Protoconch of holotype, × 10.

FIGURES 33, 34. *Ithycythara compsacosta* Gardner, n. sp. (p. 334).
33. Apertural view of holotype; height 5.8 millimeters; maximum diameter 2.0 millimeters.
34. Protoconch of paratype, × 10.

FIGURES 35, 36. *Ithycythara tarri* (Maury) (p. 334).
35. Apertural view of figured specimen from Oak Grove sand, Oak Grove, Fla.; height 5.3 millimeters; maximum diameter 1.9 millimeters.
36. Protoconch of second specimen from the Oak Grove sand, Oak Grove, Fla. ,× 10.

FIGURE 37. *Cymakra poncei* Gardner, n. sp. (p. 421). Apertural view of holotype; height 6.5 millimeters; maximum diameter 2.4 millimeters.

FIGURES 38, 39. *"Mangelia" anthetika* Gardner, n. sp. (p. 325).
38. Apertural view of holotype; height 12.4 millimeters; maximum diameter 4.8 millimeters.
39. Protoconch of holotype, × 10.



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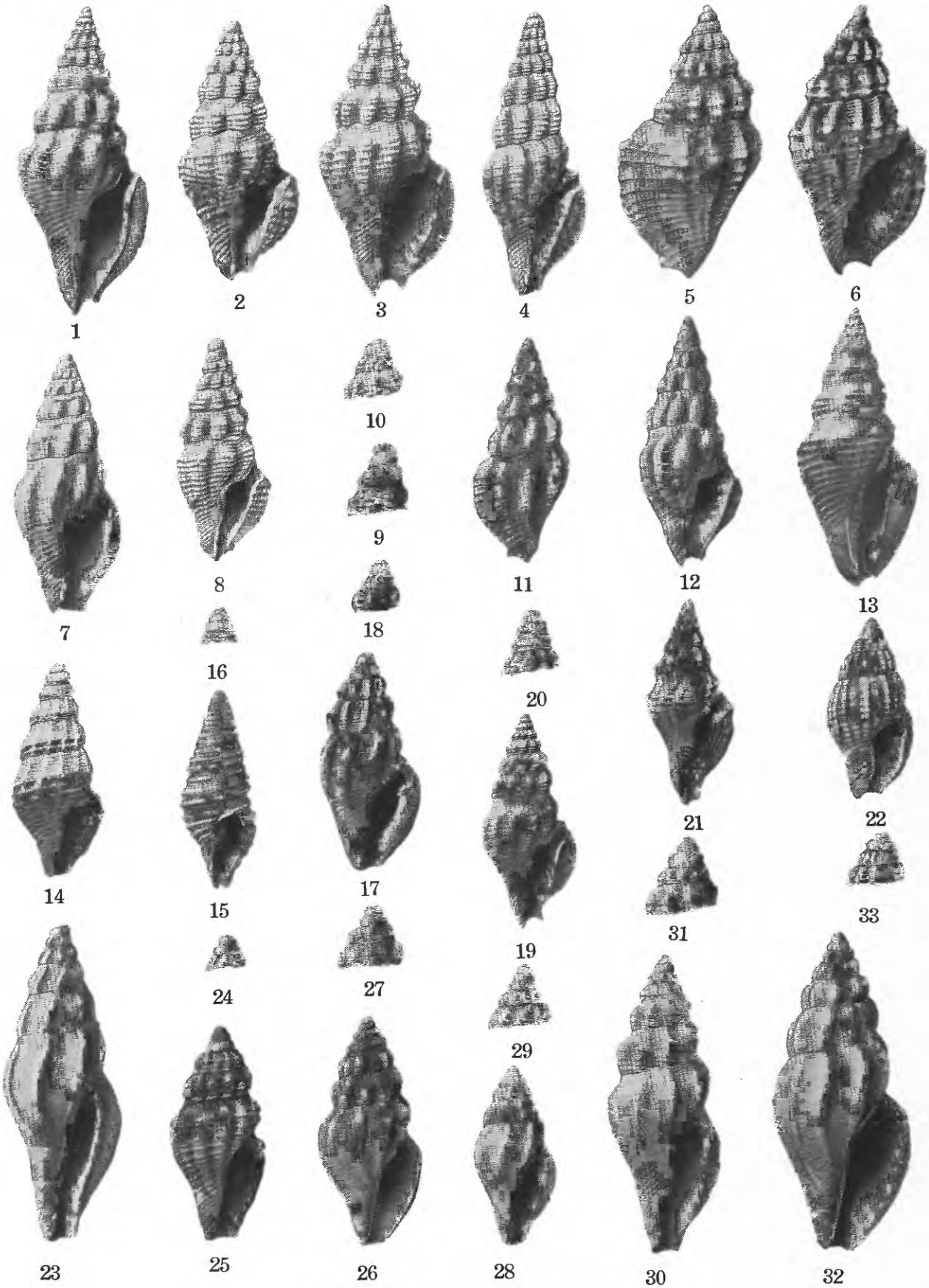


TURRITIDAE OF THE ALUM BLUFF GROUP.

PLATE XLII

FIGURE 1. *Lioglyphostoma rusum* Gardner, n. sp. (p. 346). Apertural view of holotype; height 14.7 millimeters; maximum diameter 6.0 millimeters.

FIGURE 2. *Glyphostoma peri-eilema* Gardner, n. sp. (p. 348). Apertural view of holotype; height 8.0 millimeters; maximum diameter 3.5 millimeters.

FIGURE 3. *Glyphostoma tiarophoron* Gardner, n. sp. (p. 349). Apertural view of holotype; height 9.2 millimeters; maximum diameter 4.3 millimeters.

FIGURE 4. *Glyphostoma ischnon* Gardner, n. sp. (p. 349). Apertural view of holotype; height 15.0± millimeters; maximum diameter 4.8 millimeters.

FIGURES 5, 6. *Glyphostoma nannophues* Gardner, n. sp. (p. 352).

5. Rear view of holotype.
6. Apertural view of holotype; height 5.9 millimeters; maximum diameter 3.0 millimeters.

FIGURE 7. *Lioglyphostoma tyro* Gardner, n. sp. (p. 345). Apertural view of holotype; height 8.0 millimeters; maximum diameter 3.1 millimeters.

FIGURE 8. *Glyphostoma belonoides* Gardner, n. sp. (p. 351). Apertural view of holotype; height 7.2 millimeters; maximum diameter 2.9 millimeters.

FIGURE 9. *Glyphostoma harrisi* Maury (p. 347). Protoconch of specimen from the Chipola formation, 1 mile below Baileys Ferry, Calhoun County, × 10.

FIGURE 10. *Glyphostoma tiarophoron* Gardner, n. sp. (p. 349). Protoconch of holotype, × 10.

FIGURES 11, 12. *Glyphostoma typhon* Gardner, n. sp. (p. 350).

11. Rear view of paratype; height 5.0 millimeters; maximum diameter 2.2 millimeters.
12. Apertural view of holotype; height 5.5 millimeters; maximum diameter 2.4 millimeters.

FIGURE 13. *Glyphostoma aldrichi* Maury (p. 352). Apertural view of specimen from Oak Grove sand, Oak Grove, Okaloosa County, in Aldrich collection; height 13.0± millimeters; maximum diameter 5.5 millimeters.

FIGURE 14. *Nannodiella nemorensis* (Maury) (p. 355). Apertural view of specimen from Oak Grove sand, Oak Grove, Okaloosa County, in Aldrich collection; height 4.0 millimeters; maximum diameter 1.8 millimeters.

FIGURES 15, 16. *Microdrillia hebetika* Gardner, n. sp. (p. 356).

15. Apertural view of holotype; height 4.3 millimeters; maximum diameter 1.6 millimeters.
16. Protoconch of paratype, × 10.

FIGURES 17, 18. *"Cythara" anthera* Gardner, n. sp. (p. 344).

17. Apertural view of holotype; height 4.0 millimeters; maximum diameter 2.0 millimeters.
18. Protoconch of holotype, × 10.

FIGURES 19, 20. *Glyphostoma xeston* Gardner, n. sp. (p. 354).

19. Apertural view of holotype; height 10.7 millimeters; maximum diameter 4.6 millimeters.
20. Protoconch of paratype, × 10.

FIGURE 21. *Glyphostoma chipolanum* Gardner, n. sp. (p. 353). Apertural view of holotype; height 9.8 millimeters; maximum diameter 4.0 millimeters.

FIGURE 22. *Bela nassoides* Gardner, n. sp. (p. 356). Apertural view of holotype; height 5.5 millimeters; maximum diameter 2.6 millimeters.

FIGURES 23, 24. *"Cythara" basilissa* Gardner, n. sp. (p. 344).

23. Apertural view of holotype; height 10.0 ±millimeters; maximum diameter 3.7 millimeters.
24. Protoconch of holotype.

FIGURE 25. *"Mangelia" sextoni* Gardner, n. sp. (p. 340). Apertural view of holotype; height 3.8 millimeters; maximum diameter 1.6 millimeters.

FIGURE 26, 27. *"Mangelia" cryptopleura* Gardner, n. sp. (p. 341).

26. Apertural view of holotype; height 7.1 millimeters; maximum diameter 3.1 millimeters.
27. Protoconch of holotype, × 10.

FIGURES 28, 29. *"Cythara" chariessa* Gardner, n. sp. (p. 342).

28. Apertural view of holotype; height 5.8 ±millimeters; maximum diameter 2.5 millimeters.
29. Protoconch of paratype, × 10.

FIGURES 30, 31. *"Cythara" barbadoides* Gardner, n. sp. (p. 343).

30. Apertural view of holotype; height 9.5 millimeters; maximum diameter 3.4 millimeters.
31. Protoconch of holotype, × 10.

FIGURES 32, 33. *"Cythara" isabellae* (Maury) (p. 343).

32. Apertural view of specimen from Chipola formation, 1 mile below Baileys Ferry, Calhoun County; height 10.0 millimeters; maximum diameter 4.0 millimeters.
33. Protoconch of topotype, × 10.

PLATE XLIII

[The type specimens have been remeasured and some of the dimensions here given differ from those in the original descriptions]

FIGURE 1. *Conus demiurgus* Dall (p. 358). Rear view of immature paratype; height 37.0 millimeters; maximum diameter 20.0 millimeters. (After Dall.)

FIGURE 2. *Conus isomitratus* Dall (p. 358). Apertural view of holotype; height 28.0 millimeters; maximum diameter 17.5 millimeters. (After Dall.)

FIGURE 3. *Conus sulculus* Dall (p. 359). Apertural view of holotype; height 39.0 millimeters; maximum diameter 22.0 millimeters. (After Dall.)

FIGURE 4. *Conus dodona* Gardner, n. sp. (p. 359). Apertural view of holotype; height 33.8 millimeters; maximum diameter 19.0 millimeters.

FIGURE 5. *Conus proteus* Hwass (p. 360). Apertural view of a recent specimen from the West Indies (U. S. Nat. Mus. No. 18519); height 25.6 millimeters; maximum diameter 13.8 millimeters.

FIGURE 6. *Conus chipolanus* Dall (p. 360). Apertural view of holotype; height 32.0 millimeters; maximum diameter 15.0 millimeters. (After Dall.)

FIGURE 7. *Conus floridanus* Gabb (p. 360). Apertural view of a specimen from the Choctawhatchee formation of Florida (U. S. Nat. Mus. No. 370104); height 42.0 millimeters; maximum diameter 19.5 millimeters. (After Mansfield.)

FIGURE 8. *Conus marylandicus* Green (p. 360). Apertural view of type from "Maryland"; dimensions: "length an inch and a half, and half as broad." (After Green.)

FIGURE 9. *Conus corrugatus* Gardner, n. sp. (p. 360). Apertural view of holotype; height 15.5 millimeters; maximum diameter 7.9 millimeters.

FIGURE 10. *Conus fusiformis* Gardner, n. sp. (p. 361). Apertural view of holotype; height 13.8 millimeters; maximum diameter 5.4 millimeters.

FIGURE 11. *Conus harveyensis* Mansfield (p. 361). Apertural view of holotype from the upper Miocene (Choctawhatchee) of Harveys Creek, Leon County, Fla. (U. S. Nat. Mus. No. 370102); height 21.0 millimeters; maximum diameter 10.5 millimeters. (After Mansfield.)

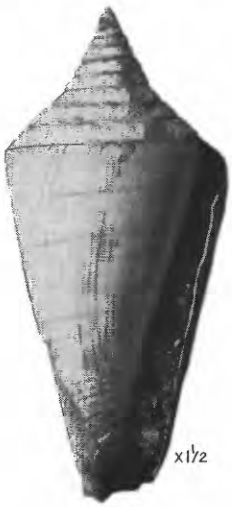
FIGURE 12. *Conus turbinopsis* Gardner, n. sp. (p. 361). Apertural view of holotype; height 20.0 millimeters; maximum diameter 12.0 millimeters.

FIGURES 13, 14. *Conus waltonensis* Aldrich (p. 362).

13. Apertural view of topotype; height 22.3 millimeters; maximum diameter 13.5 millimeters.
14. Apertural view of topotype; height 17.2 millimeters; maximum diameter 10.0 millimeters.

FIGURE 15. *Conus waltonensis anodosus* Gardner, n. subsp. (p. 362). Apertural view of holotype; height 20.0± millimeters; maximum diameter 12.0 millimeters.

FIGURE 16. *Conus submoniliferus* Gardner, n. sp. (p. 363). Apertural view of holotype; height 40.0 millimeters; maximum diameter 25.5 millimeters.



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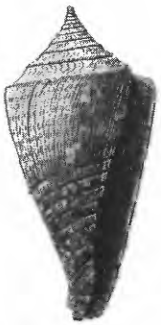
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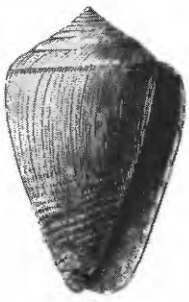
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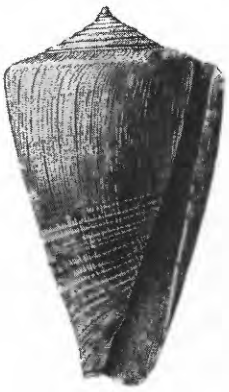
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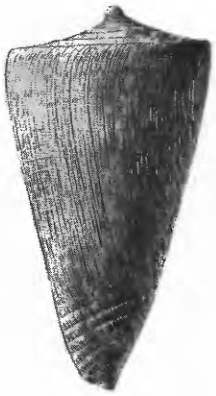
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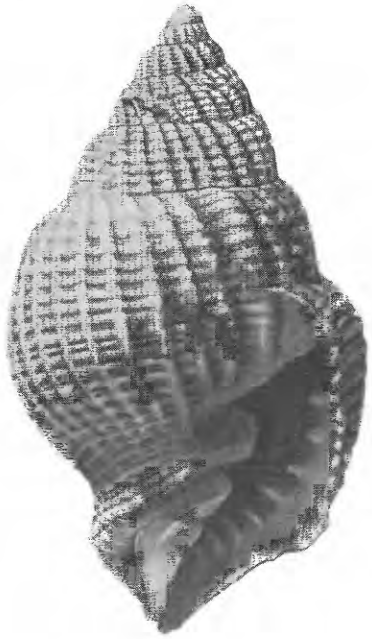

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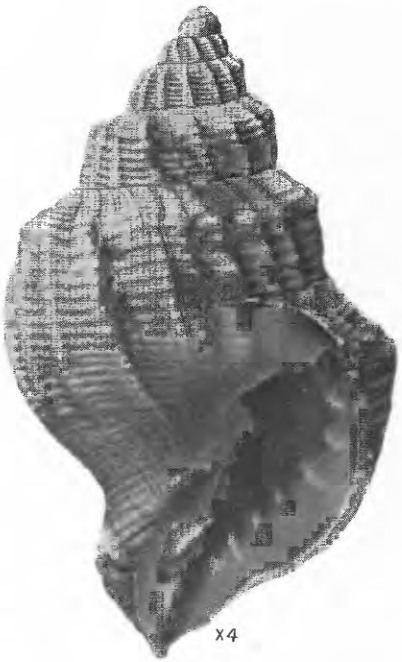

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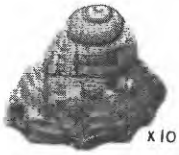

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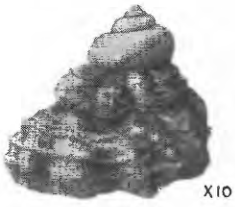

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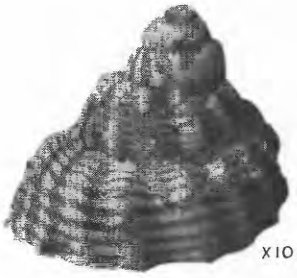

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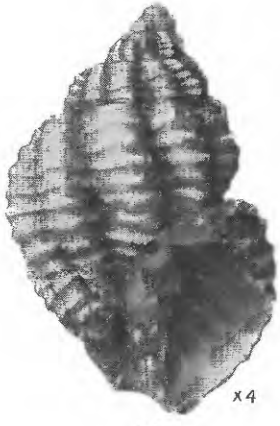

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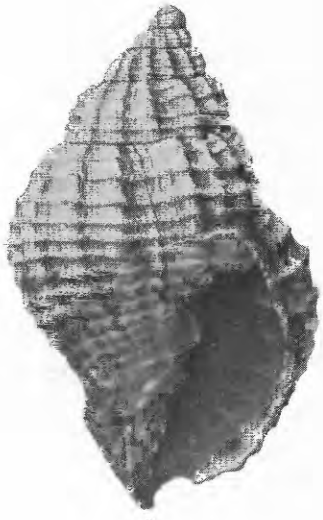


7

CANCELLARIDAE OF THE ALUM BLUFF GROUP.

PLATE XLIV

FIGURES 1, 2. *Cancellaria defuniak* Gardner, n. sp. (p. 365).
1. Apertural view of holotype; height 21.7 millimeters; maximum diameter 12.4 millimeters.
2. Tip of paratype, × 10.

FIGURES 3, 4. *Cancellaria subtiarophora* Gardner, n. sp. (p. 366).
3. Apertural view of holotype; height 22.8 millimeters; maximum diameter 13.3 millimeters.
4. Tip of paratype, × 10.

FIGURES 5, 6. *Cancellaria waltoniana* Gardner, n. sp. (p. 366).
5. Apertural view of holotype; height 14.0 millimeters; maximum diameter 8.5 millimeters.
6. Tip of paratype, × 10.

FIGURES 7, 8. *Cancellaria druidarum* Gardner, n. sp. (p. 367).
7. Apertural view of holotype; height 16.8 millimeters; maximum diameter 9.8 millimeters.
8. Tip of paratype, × 10.

FIGURES 9, 10. *Cancellaria stibara* Gardner, n. sp. (p. 368).
9. Apertural view of holotype; height 7.5 millimeters; maximum diameter 5.6 millimeters.
10. Tip of paratype, × 10.

FIGURE 11. *Cancellaria mitrodita* Gardner, n. sp. (p. 369). Apertural view of holotype; height 14.2 millimeters; maximum diameter 8.5 millimeters.

FIGURES 12, 13. *Cancellaria pinguis* Gardner, n. sp. (p. 370).
12. Apertural view of holotype; height 11.3 millimeters; maximum diameter 7.8 millimeters.
13. Tip of paratype, × 10.

FIGURES 14, 15. *Cancellaria spherotopleura* Gardner, n. sp. (p. 370).
14. Apertural view of holotype; height 13.8 millimeters; maximum diameter 8.7 millimeters.
15. Apertural view of paratype; height 13.8 millimeters; maximum diameter 7.5 millimeters.

867196 O—50——13 (142-F)

PLATE XLV

FIGURE 1. *Cancellaria bifoliata* Aldrich (p. 371). Apertural view of topotype; height 9.1 millimeters; maximum diameter 5.3 millimeters.

FIGURE 2. *Cancellaria aldrichi* Gardner, n. sp. (p. 372). Apertural view of holotype; height 18.7 millimeters; maximum diameter 10.6 millimeters.

FIGURES 3, 4. *Cancellaria paramoorei* Gardner, n. sp. (p. 372).

3. Apertural view of holotype; height 19.0± millimeters; maximum diameter 11.9 millimeters.
4. Tip of paratype, × 10.

FIGURE 5. *Cancellaria desmotis* Gardner, n. sp. (p. 373). Apertural view of holotype; height 14.7 millimeters; maximum diameter 7.8 millimeters.

FIGURES 6, 7. *Cancellaria ancycla* Gardner, n. sp. (p. 374).

6. Apertural view of holotype; height 19.0± millimeters; maximum diameter 10.9 millimeters.
7. Tip of paratype, × 10.

FIGURES 8, 9. *Cancellaria runchaena* Gardner, n. sp. (p. 375).

8. Apertural view of holotype; height 21.9 millimeters; maximum diameter 14.3 millimeters.
9. Tip of paratype, × 10.

FIGURE 10. *Cancellaria venusta* Tuomey and Holmes (p. 375). Apertural view of specimen from the Caloosahatchee River, Fla. (U. S. Nat. Mus. No. 97355); height 14.0 millimeters; maximum diameter 7.4 millimeters. (After Dall.)

FIGURES 11, 12. *Cancellaria* (*Trigonostoma*) *sphenoidostoma* Gardner, n. sp. (p. 376).

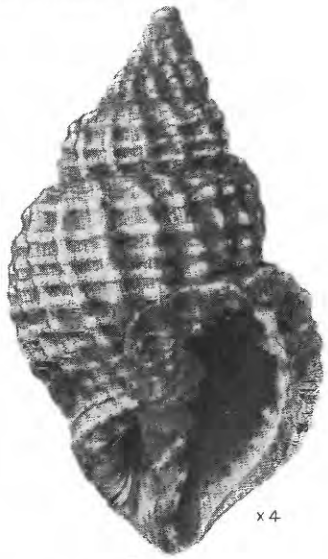
11. Apertural view of holotype; height 7.9 millimeters; maximum diameter 4.4 millimeters.
12. Tip of paratype, × 10.

FIGURES 13, 14. *Cancellaria* (*Narona*) *atraktoides* Gardner, n. sp. (p. 376).

13. Apertural view of holotype; height 10.0 millimeters; maximum diameter 5.0 millimeters.
14. Tip of paratype, × 10.

FIGURES 15, 16. *Cancellaria* (*Aphera*) *waltonensis* (Aldrich) (p. 377).

15. Apertural view of topotype; height 15.4 millimeters; maximum diameter 8.6 millimeters.
16. Tip of topotype, × 10.



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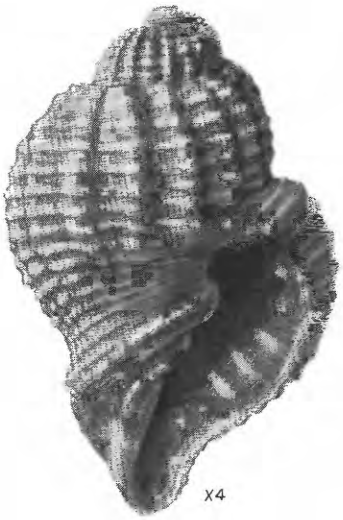

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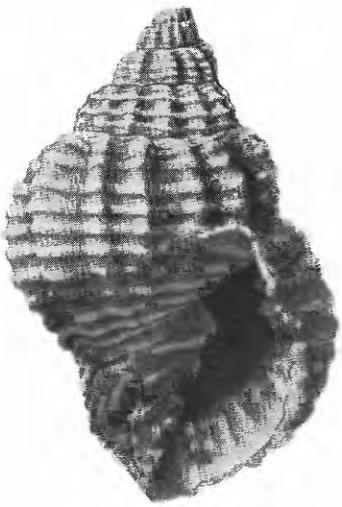

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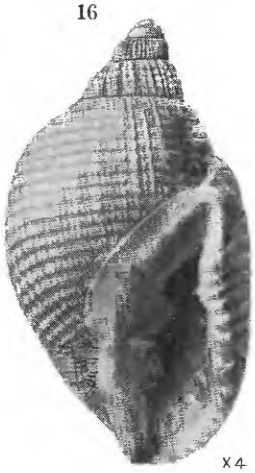

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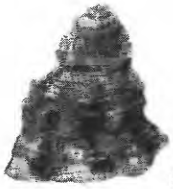

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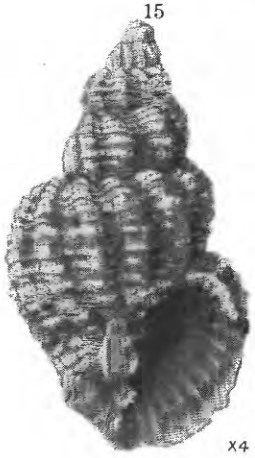

5

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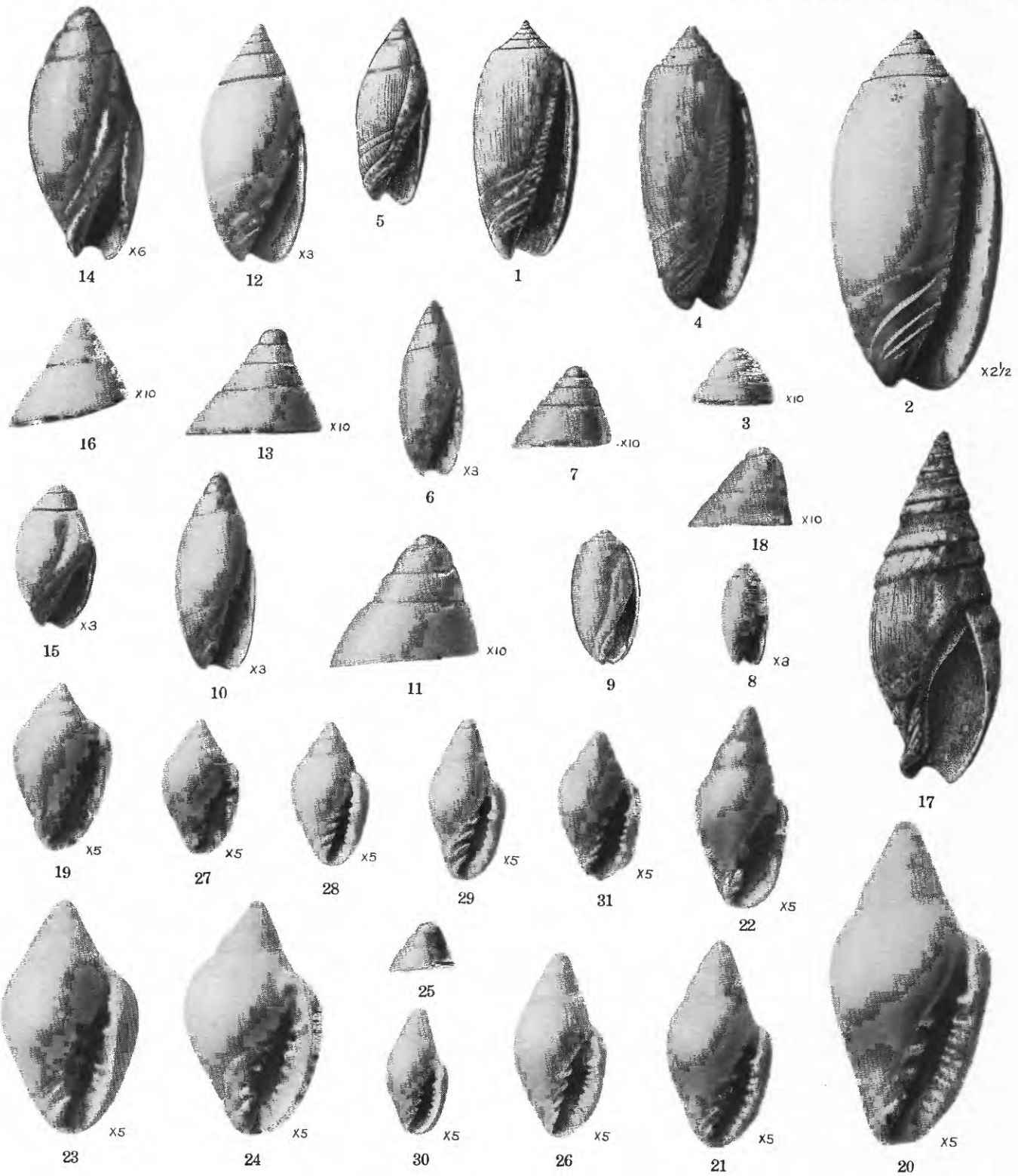
13

CANCELLARIDAE OF THE ALUM BLUFF GROUP.



OLIVIDAE AND MARGINELLIDAE OF THE ALUM BLUFF GROUP.

PLATE XLVI

FIGURE 1. *Oliva liodes* Dall (p. 378). Apertural view of holotype; height 27.0 millimeters; maximum diameter 11.5 millimeters. (After Dall.)

FIGURES 2, 3. *Oliva liodes waltoniana* Gardner, n. subsp. (p. 379).
2. Apertural view of holotype; height 29.3 millimeters; maximum diameter 13.4 millimeters.
3. Tip of paratype, × 10.

FIGURE 4. *Oliva sayana* Ravenel (p. 380). Apertural view of specimen from the Choctawhatchee formation of Florida (U. S. Nat. Mus. No. 370028); height 51.0 millimeters; maximum diameter 20.4 millimeters. (After Mansfield.)

FIGURE 5. *Olivella eutacta* Dall (p. 381). Apertural view of holotype; height 15.0 millimeters; maximum diameter 5.5 millimeters (After Dall.)

FIGURES 6, 7. *Olivella cotinados* Gardner, n. sp. (p. 382).
6. Apertural view of holotype; height 10.5 millimeters; maximum diameter 3.7 millimeters.
7. Tip of holotype, × 10.

FIGURES 8, 9. *Olivella oryzoides* Gardner, n. sp. (p. 382).
8. Apertural view of holotype; height 5.8 millimeters; maximum diameter 2.7 millimeters.
9. Apertural view of paratype, × 10.

FIGURES 10, 11. *Olivella cofacorys* Gardner, n. sp. (p. 383).
10. Apertural view of holotype; height 11.6 millimeters; maximum diameter 4.7 millimeters.
11. Tip of holotype, × 10.

FIGURES 12, 13. *Olivella eleutheria* Gardner, n. sp. (p. 383).
12. Apertural view of holotype; height 14.2 millimeters; maximum diameter 6.2 millimeters.
13. Tip of holotype, × 10.

FIGURE 14. *Olivella mutica* Say (p. 384). Apertural view of specimen from the Choctawhatchee formation of Florida (U. S. Nat. Mus. No. 370028); height 7.0 millimeters; maximum diameter 3.3 millimeters. (After Mansfield.)

FIGURES 15, 16. *Olivella dasa* Gardner, n. sp. (p. 384).
15. Apertural view of holotype; height 9.0± millimeters; maximum diameter 4.6 millimeters.
16. Tip of paratype, × 10.

FIGURES 17, 18. *Ancilla chipolana* Dall (p. 385).
17. Apertural view of holotype; height 25.5 millimeters; maximum diameter 9.5 millimeters. (After Dall.)
18. Tip of topotype, × 10.

FIGURE 19. *Marginella* (*Serrata*) *chipolana* Maury (p. 388). Apertural view of topotype; height 6.1 millimeters; maximum diameter 3.5 millimeters.

FIGURE 20. *Marginella* (*Serrata*) *euancycla* Gardner, n. sp. (p. 388). Apertural view of holotype; height 11.6 millimeters; maximum diameter 5.7 millimeters.

FIGURE 21. *Marginella* (*Serrata*) *xanthophaës* Gardner, n. sp. (p. 389). Apertural view of holotype; height 7.2 millimeters; maximum diameter 3.7 millimeters.

FIGURE 22. *Marginella* (*Serrata*) *denticulatoides* Maury (p. 389). Apertural view of topotype; height 7.2 millimeters; maximum diameter 3.4 millimeters.

FIGURE 23. *Marginella* (*Serrata*) *brithia* Gardner, n. sp. (p. 390). Apertural view of holotype; height 8.3 millimeters; maximum diameter 4.8 millimeters.

FIGURES 24, 25. *Marginella* (*Serrata*) *vadosa* Gardner, n. sp. (p. 390).
24. Apertural view of holotype; height 8.2 millimeters; maximum diameter 4.8 millimeters.
25. Tip of paratype, × 10.

FIGURE 26. *Marginella* (*Serrata*) *vadosa ischna* Gardner, n. subsp. (p. 391). Apertural view of holotype; height 6.6 millimeters; maximum diameter 3.3 millimeters.

FIGURE 27. *Marginella* (*Serrata*) *coloba* Gardner, n. sp. (p. 392). Apertural view of holotype; height 5.0 millimeters; maximum diameter 2.9 millimeters.

FIGURE 28. *Marginella* (*Serrata*) *coloba conoispira* Gardner, n. subsp. (p. 392). Apertural view of holotype; height 5.8 millimeters; maximum diameter 3.1 millimeters.

FIGURE 29. *Marginella* (*Serrata*) *nanna* Gardner, n. sp. (p. 393). Apertural view of holotype; height 4.5 millimeters; maximum diameter 2.1 millimeters.

FIGURE 30. *Marginella* (*Serrata*) *critha* Gardner, n. sp. (p. 393). Apertural view of holotype; height 5.7 millimeters; maximum diameter 2.7 millimeters.

FIGURE 31. *Marginella* (*Serrata*) *eurystoma* Gardner, n. sp. (p. 394). Apertural view of holotype; height 5.2 millimeters; maximum diameter 3.0 millimeters.

867196 O—50——14 (142-F)

PLATE XLVII

FIGURE 1. *Marginella* (*Volvarina*) *oryzoides* Gardner, n. sp. (p. 394). Apertural view of holotype; height 5.9 millimeters; maximum diameter 2.7 millimeters.

FIGURE 2. *Marginella* (*Volvarina*) *bella tersa* Mansfield (p. 395). Apertural view of holotype; height 8.3 millimeters; maximum diameter 3.7 millimeters. (After Mansfield.)

FIGURE 3. *Marginella* (*Volvarina*) *bella hosfordensis* Mansfield (p. 395). Apertural view of holotype; height 6.6 millimeters; maximum diameter 4.0 millimeters. (After Mansfield.)

FIGURE 4. *Marginella* (*Volvarina*) *bella* Conrad (p. 395). Apertural view of specimen from the upper Miocene at Wilmington, N. C. (U. S. Nat. Mus. No. 325384); height 10.2 millimeters; maximum diameter 5.2 millimeters.

FIGURE 5. *Marginella* (*Egouena*) *apalachee* Gardner, n. sp. (p. 395). Apertural view of holotype; height 9.0 millimeters; maximum diameter 5.1 millimeters.

FIGURE 6. *Marginella* (*Egouena*) *contracta* Conrad (p. 396). Apertural view of specimen from the upper Miocene at the Natural Well, N. C. (U. S. Nat. Mus. No. 325385); height 10.2 millimeters; maximum diameter 5.7 millimeters.

FIGURE 7. *Marginella* (*Egouena*) *virginiana* Conrad (p. 396). Apertural view of specimen from the lower Pliocene at Neill's Eddy Landing, Cape Fear River, N. C. (U. S. Nat. Mus. No. 325382); height 7.7 millimeters; maximum diameter 4.7 millimeters.

FIGURE 8. *Marginella* (*Egouena*) *lipara lepta* Gardner, n. subsp. (p. 396). Apertural view of holotype; height 7.0 millimeters; maximum diameter 3.7 millimeters.

FIGURE 9. *Marginella* (*Egouena*) *lipara* Gardner, n. sp. (p. 396). Apertural view of holotype; height 8.0 millimeters; maximum diameter 4.4 millimeters.

FIGURE 10. *Marginella* (*Egouena*) *capsa* Gardner, n. sp. (p. 397). Apertural view of holotype; height 6.2 millimeters; maximum diameter 3.7 millimeters.

FIGURES 11–14. *Marginella* (*Egouena*) *oviformis* Conrad (p. 397).

11. Apertural view of holotype (Acad. Nat. Sci. Philadelphia Coll. No. 1617); height 32.4 millimeters; maximum diameter 20.3 millimeters.
12. Rear view of holotype.
13. Apertural view of specimen from the collections of the Wagner Free Institute of Science, locality unknown; height 33.3 millimeters; maximum diameter 20.4 millimeters.
14. Rear view of the same specimen.

FIGURE 15. *Marginella* (*Egouena*) *aurora* Dall (p. 397). Apertural view of holotype; height 27.0 millimeters; maximum diameter 15.0 millimeters. (After Dall.)

FIGURE 16. *Marginella* (*Egouena*) *eleutheria* Gardner, n. sp. (p. 397). Apertural view of holotype; height 14.0 millimeters; maximum diameter 8.4 millimeters.

FIGURE 17. *Marginella* (*Egouena*) *eleutheria dasa* Gardner, n. subsp. (p. 398). Apertural view of holotype; height 10.5 millimeters; maximum diameter 7.0 millimeters.

FIGURES 18, 19. *Marginella* (*Egouena*) *apicina* Menke (p. 398).

18. Apertural view of specimen from the upper Miocene 1½ miles north of Suffolk (U. S. Nat. Mus. No. 325383); height 13.9 millimeters; maximum diameter 9.0 millimeters.
19. Rear view of the same specimen.

FIGURE 20. *Marginella* (*Egouena*) *precursor* Dall (p. 398). Apertural view of holotype; height 17.4 millimeters; maximum diameter 12.3 millimeters. (After Dall.)

FIGURE 21. *Marginella* (*Persicula*) *calhounensis* Maury (p. 399). Apertural view of topotype; height 6.8 millimeters; maximum diameter 5.0 millimeters.

FIGURE 22. *Marginella* (*Persicula*) *progravida* Gardner, n. sp. (p. 399). Apertural view of holotype; height 7.0 millimeters; maximum diameter 5.2 millimeters.

FIGURE 23. *Marginella* (*Persicula*) *gravida* Dall (p. 399). Apertural view of holotype; height 7.8 millimeters; maximum diameter 5.3 millimeters. (After Dall.)

FIGURE 24. *Marginella* (*Persicula*) *majuscula* Gardner, n. sp. (p. 399). Apertural view of holotype; height 7.9 millimeters; maximum diameter 5.1 millimeters.

FIGURE 25. *Marginella* (*Gibberula*) *dryados* (Maury) (p. 400). Apertural view of topotype; height 4.3 millimeters; maximum diameter 2.8 millimeters.

FIGURE 26. *Marginella* (*Gibberula*) *chondra* Gardner, n. sp. (p. 400). Apertural view of holotype; height 3.3 millimeters; maximum diameter 2.2 millimeters.

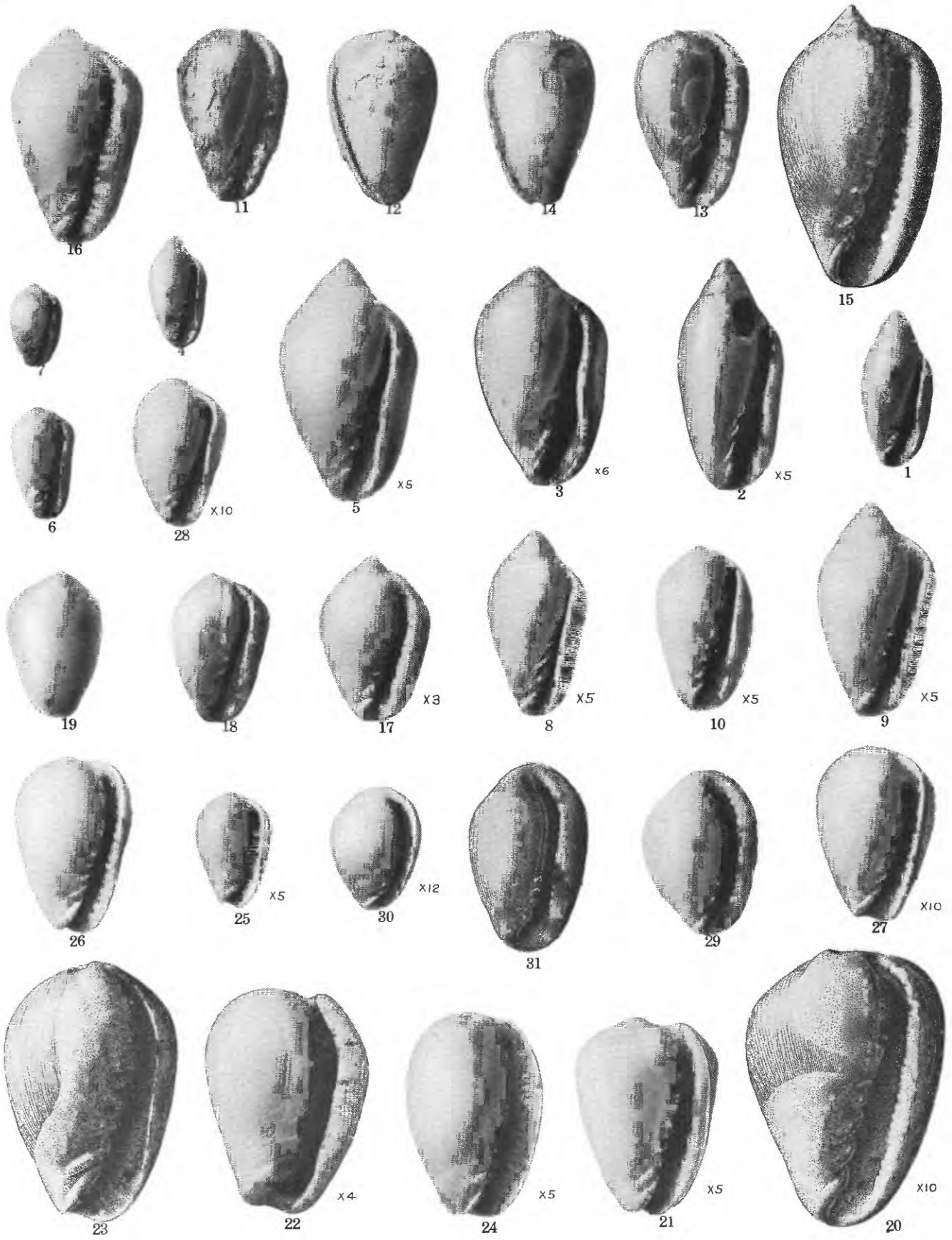
FIGURE 27. *Marginella* (*Gibberula*) *waltoniana* Gardner, n. sp. (p. 401). Apertural view of holotype; height 3.3 millimeters; maximum diameter 2.25 millimeters.

FIGURE 28. *Marginella* (*Gibberula*) sp. (p. 401). Apertural view; height 2.8 millimeters; maximum diameter 1.8 millimeters.

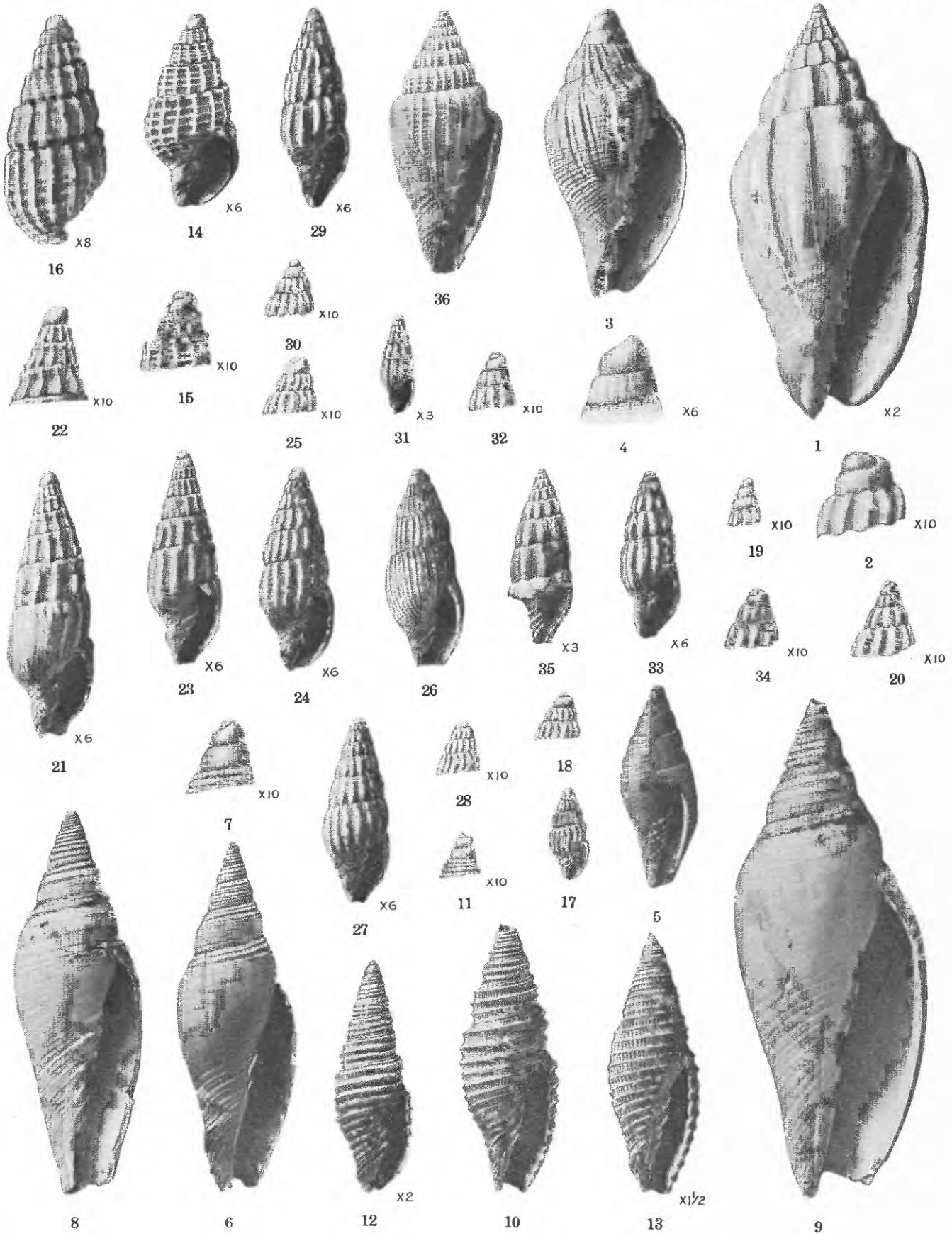
FIGURE 29. *Cypraeolina defuniak* Gardner, n. sp. (p. 402). Apertural view of holotype; height 2.5 millimeters; maximum diameter 1.8 millimeters.

FIGURE 30. *Cypraeolina pyrenoides* Gardner, n. sp. (p. 403). Apertural view of holotype; height 2.0 millimeters; maximum diameter 1.5 millimeters.

FIGURE 31. *Cypraeolina dacria* (Dall) (p. 402). Apertural view of holotype; height 5.0 millimeters; maximum diameter 3.3 millimeters. (After Dall.)



MARGINELLIDAE OF THE ALUM BLUFF GROUP.



VOLUTIDAE AND MITRIDAE OF THE ALUM BLUFF GROUP.

PLATE XLVIII

FIGURES 1, 2. *Lyria pycnopleura* Gardner, n. sp. (p. 404).
1. Apertural view of holotype; height 39.0 millimeters; maximum diameter 18.5 millimeters.
2. Tip of paratype, × 10.

FIGURES 3, 4. *Caricella (Atraktus) pycnoplecta* Gardner, n. sp. (p. 405).
3. Apertural view of holotype; height 27.0± millimeters; maximum diameter 12.3 millimeters.
4. Tip of paratype, × 10.

FIGURE 5. *Mitra acteoglypha* Gardner, n. sp. (p. 406). Apertural view of holotype; height 19.0± millimeters; maximum 7.0 millimeters.

FIGURES 6, 7. *Mitra (Pleioptygma) prodroma* Gardner, n. sp. (p. 407).
6. Apertural view of holotype; height 68.0± millimeters; maximum diameter 22.5 millimeters.
7. Tip of paratype, × 10.

FIGURES 8, 9. *Mitra (Pleioptygma) carolinensis* Conrad (p. 407).
8. Apertural view of paratype from the upper Miocene of the Natural Well, Duplin County, N. C. (Acad. Nat. Sci. Philadelphia No. 1618); height 73.0 millimeters; maximum diameter 24.0 millimeters.
9. Apertural view of paratype from the upper Miocene of the Natural Well, Duplin County, N. C. (Acad. Nat. Sci. Philadelphia No. 1618); height 96.0± millimeters; maximum diameter 35.0 millimeters.

FIGURES 10, 11. *Mitra (Tiara) mitrodita* Gardner, n. sp. (p. 408).
10. Apertural view of holotype; height 27.0± millimeters; maximum diameter 8.8 millimeters.
11. Tip of paratype, × 10.

FIGURE 12. *Mitra (Tiara) desmia* Gardner, n. sp (p. 409). Apertural view of holotype; height 21.5± millimeters; maximum diameter 7.0 millimeters.

FIGURE 13. *Mitra (Tiara) stephensoni* Mansfield (p. 409). Apertural view of holotype; from the upper Miocene (Choctawhatchee) of Hosford, Liberty County, Fla.; height 31.0 millimeters; maximum diameter 11.0 millimeters. (After Mansfield.)

FIGURES 14, 15. *Vexillum (Uromitra) climax* Gardner, n. sp. (p. 410).
14. Apertural view of holotype; height 6.3 millimeters; maximum diameter 2.9 millimeters.
15. Tip of holotype, × 10.

FIGURE 16. *Vexillum hosfordense libertiense* (Mansfield) (p. 411). Rear view of holotype (U. S. Nat. Mus. No. 370073) from the Choctawhatchee of Hosford, Liberty County, Fla.; height 5.5 millimeters; maximum diameter 2.6 millimeters. (After Mansfield.)

FIGURES 17, 18. *Vexillum (Uromitra) climacoton* Gardner, n. sp. (p. 411).
17. Apertural view of holotype; height 3.6 millimeters; maximum diameter 1.6 millimeters.
18. Tip of holotype, × 10.

FIGURE 19. *Vexillum (Uromitra) barnardense* (Maury) (p. 412). Tip of topotype, × 10.

FIGURE 20. *Vexillum (Uromitra) scopuli* (Maury) (p. 413). Tip of topotype, × 10.

FIGURES 21–23. *Vexillum (Uromitra) triptum* Gardner, n. sp. (p. 413).
21. Apertural view of holotype; height 8.3 millimeters; maximum diameter 2.6 millimeters.
22. Tip of holotype, × 10.
23. Apertural view of paratype; height 6.5 millimeters; maximum diameter 2.3 millimeters.

FIGURES 24, 25. *Vexillum (Uromitra) ctenotum* Gardner, n. sp. (p. 414).
24. Apertural view of holotype; height 6.0 millimeters; maximum diameter 2.2 millimeters.
25. Tip of holotype, × 10.

FIGURE 26. *Vexillum (Uromitra) wandoense* (Holmes) (pp. 412, 414). Apertural view of specimen from the Waccamaw formation of Tillys Lake, Waccamaw River, S. C. (U. S. Nat. Mus. No. 112321); height 6.0 millimeters; maximum diameter 2.3 millimeters.

FIGURES 27, 28. *Vexillum (Uromitra) hamadryas* Gardner, n. sp. (p. 415).
27. Apertural view of holotype; height 5.5 millimeters; maximum diameter 2.0 millimeters.
28. Tip of paratype, × 10.

FIGURES 29, 30. *Vexillum (Uromitra) cnestum* Gardner, n. sp. (p. 416).
29. Apertural view of holotype; height 6.1 millimeters; maximum diameter 2.0 millimeters.
30. Tip of holotype, × 10.

FIGURES 31, 32. *Vexillum (Uromitra) mangilopse* Gardner, n. sp. (p. 416).
31. Apertural view of holotype; height 6.1 millimeters; maximum diameter 2.1 millimeters.
32. Tip of holotype, × 10.

FIGURES 33, 34. *Vexillum (Uromitra) mikkulum* Gardner, n. sp. (p. 417).
33. Apertural view of holotype; height 4.9 millimeters; maximum diameter 1.8 millimeters.
34. Tip of holotype, × 10.

FIGURE 35. *Vexillum (Uromitra) amblipleura* Gardner, n. sp. (p. 418). Apertural view of holotype; height 12.0± millimeters; maximum diameter 4.0 millimeters.

FIGURE 36. *Conomitra apalachee* Gardner, n. sp. (p. 420). Apertural view of holotype; height 24.8 millimeters; maximum diameter 10.5 millimeters.

INDEX

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