

CERITHIIDAE AND POTAMIDIDAE (MOLLUSCA: GASTROPODA)
FROM THE CHIPOLA FORMATION OF NORTHWESTERN FLORIDA

SHIRLEY E. HOERLE*
WEST PALM BEACH, FLORIDA

CONTENTS

	Page
I. ABSTRACT	1
II. INTRODUCTION	1
III. ACKNOWLEDGMENTS	2
IV. SYSTEMATIC DESCRIPTIONS	3
V. LOCALITY DATA	21
VI. LITERATURE CITED	22

ILLUSTRATIONS

PLATE 1	9
PLATE 2	19

I. ABSTRACT

This report covers 21 members of the families CERITHIIDAE and POTAMIDIDAE from the Chipola Formation, late lower Miocene, from northwestern Florida. Nine of Dall's species are reviewed; of these five have the generic assignment changed and one is placed in synonymy. Twelve species are added to the fauna of the Chipola Formation, two having been previously reported from elsewhere: *Terebralia dentilabris* (Gabb) and

Potamides suprasulcatus (Gabb) from Santo Domingo. Ten species are new: *Cerithium peregrinum*, *Cerithium vokesorum*, *Hemicerithium craticulum*, *Hemicerithium pagodum*, *Hemicerithium akriton*, *Tenuicerithium absonum*, *Tenuicerithium ascensum*, *Cerithiopsis inopinus*, *Bittium serenum*, and *Alabina turbatrix*.

II. INTRODUCTION

The cerithiids of the Chipola Formation have been a group long neglected by previous authors. Dall (1892) recorded nine species:

*Research Associate, Paleontological Research Institution, Ithaca, New York.

EDITORIAL COMMITTEE FOR THIS PAPER:

- THOMAS L. MCGINTY, Boynton Beach, Florida.
EMILY H. VOKES, Tulane University, New Orleans, Louisiana.
DRUID WILSON, U. S. Geological Survey, Washington, D.C.

two *Cerithium*, five "*Bittium*," one "*Clava*," and one *Alaba*, from a limited amount of material. Since that time the cerithiids have been ignored except by Maury (1910) who mistakenly described a *Terebralia* as *Pyrazisinus*. The specimens she figured had complete apertures, which conceal the armature, a feature peculiar to the genus *Terebralia*. If the plaits on the columella and the interior protuberances are not visible the shell may be easily misidentified as *Pyrazisinus*. Gardner's monograph on the Molluscan Fauna of the Alum Bluff Group of Florida (1926-1947) mentioned only one Chipola species, *Alaba chipolana* Dall. She entirely overlooked the other members of the group. Cerithiids, particularly *Tenuicerithium* and one species of *Alabina*, abound at nearly every locality in the Chipola Formation. In the present study the writer has made no attempt to assign the various species to new subgenera but rather has tried to recognize only the existing subgenera and treat the genera in a broad manner.

The genus *Cerithium* originated in the Triassic Period and reached its maximum development during the Eocene epoch. The Recent species are found mainly in warm and temperate seas, often in the high tidal zone, or in mangrove swamps and mud flats. *Cerithium* s.s. is characterized by its turreted outline and numerous varices scattered at intervals along the many-whorled spire. The aperture is circular to oblique and prolonged into a short, recurved canal. Spiral cords cross axial riblets, forming nodes at their points of intersection. The heaviest varix is opposite the flaring outer lip. In the subgenus *Thericium* the characteristics are not as pronounced; the outer lip is only slightly expanded, the canal less recurved and the varix opposite the outer lip is weaker. Two new species described in this paper, *Cerithium peregrinum* and *Cerithium vokesorum*, and Dall's *Cerithium chipolana* are placed in the subgenus *Thericium*.

"*Bittium*" *chipolanum* and "*Bittium*" *permutabile* of Dall are here reassigned to the genus *Tenuicerithium*. They possess the essential features of *Tenuicerithium* as outlined by Cossmann: slender, tapered shell with large aperture and expanded outer lip; arcuate columella and a short, broad, not-recurved

canal. The genus apparently became extinct during the Miocene epoch.

"*Bittium*" *cossmanni* Dall is removed from the genus *Bittium* and placed in *Hemicerithium*. The morphological characteristics of the species are more in accord with *Hemicerithium* than with *Bittium*. There are numerous varices on the spire; the columella is excavated; the canal is short and slightly oblique; the outer lip is nearly vertical and without inflection. The genus apparently appeared first in the Cretaceous. *Hemicerithium monachus* (Crosse and Fischer), the only Recent species, is confined to the Australian seas.

Clava chipolana Dall is reassigned to the subgenus *Ochetoclava* as *Clava* s.s. has a longer anterior canal and a shorter posterior sinus than *Ochetoclava* and is not represented by either fossil or Recent species in America.

It is unfortunate that Dall was so repetitive in his use of "Chipola," or a derivative, for his specific names. Boss, Rosewater and Ruhoff (1968, p. 4) state, "The frequency with which certain names were used by Dall is interesting because, at least in part, it reflects upon his associations and the areas of his scientific concentration. The names which were used more than ten times are listed in the order of their decreasing frequency: *chipolana-us* (53); *floridana-us* (33); *californica-us* (25);" Of the ten species of cerithiids he named from the Chipola Formation five are *chipolana-um*. Nothing can be done to amend this repetition as no two genera are the same. The names remain valid.

The genus *Triphora* is intentionally omitted in this paper. The writer feels that at the present time there is not adequate material at hand for a comprehensive study of the group. Further collecting is needed.

III. ACKNOWLEDGMENTS

The writer gratefully acknowledges the assistance of Drs. Harold E. and Emily H. Vokes of Tulane University, for without their encouragement, advice and unlimited patience this study could not have been completed. The writer is indebted to them for the excellent photographs and also the loan of

Tulane University specimens to supplement those in her own collection. Gratitude is expressed to Druid Wilson for providing the accurate data of Dall's type localities.

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IV. SYSTEMATIC DESCRIPTIONS

Phylum MOLLUSCA

Class GASTROPODA

Subclass PROSOBRANCHIA

Order MESOGASTROPODA

Superfamily CERITHIACEA

Family CERITHIIDAE Fleming, 1822

Subfamily CERITHIINAE Fleming, 1822

Genus CERITHIUM Bruguière, 1789

Cerithium BRUGUIÈRE, 1789, Encycl. Méth. (Vers), v. 1, p. XV (genus without species); 1792, *ibid.*, p. 467. Type species: *Cerithium adansonii* Bruguière (= *Cerithium erythraeonense* Lamarck, 1822), by virtual tautonymy.

Discussion: As has been noted by several authors (e.g., Woodring, 1928, p. 333; Olsson and Harbison, 1953, p. 281), the type species of *Cerithium* Bruguière has been in a state of confusion for many years. Bruguière, 1789, did not designate a type for his genus *Cerithium*. However, Bruguière, 1792, did cite Adanson's "Le Cerite" (= *C. adansonii* Bruguière) in synonymy.

Lamarck, 1799, chose *Murex aluco* Linné for the type species. This shell belongs to the *Pseudovertagus* group. Lamarck apparently recognized his error as two years later he redescribed the genus and named *Cerithium nodulosum* Bruguière as the type species. A few authors credit Adanson [pre-Linnean] for the genus, several prefer Lamarck, but the majority recognize Bruguière.

Cossmann referred the genus to Bruguière but chose *Cerithium nodulosum* for the geno-

type. He placed special emphasis on the projecting tooth on the anterior of the outer lip and the manner in which it crosses the canal. This is a variable feature. The tooth may be strongly developed or totally absent on individuals of the same species.

Fisher-Piette (1942, p. 250-253, pl. 8, figs. 16a, b) clarified the muddle. *Cerithium adansonii* Bruguière is the same species as *Cerithium erythraeonense* Lamarck, 1822, from the Red Sea. Therefore, *Cerithium adansonii* Bruguière (= "Le Cerite" of Adanson) is a valid species and no longer enigmatical. Bruguière inferred, by placing *C. adansonii* in synonymy, that he selected that species for the genotype of *Cerithium* s. s. A ruling by the International Commission on Zoological Nomenclature would be beneficial in further clarifying the confusion of the previous years.

Subgenus THERICIUM Monterosato, 1890

Theridium MONTEROSATO, 1890, Naturalista Sicil., year 9, no. 7, p. 163. Type species: *Cerithium vulgatum* Bruguière, by original designation.

CERITHIUM (THERICIUM) CHIPOLANUM
Dall

Plate 1, figs. 2, 3

Cerithium chipolanum DALL, 1892, Wagner Free Inst. Sci., Trans., v. 3, pt. 2, p. 285, pl. 22, fig. 7. *Cerithium chipolana* Dall. WOOD, 1910, Annals N. Y. Acad. Sci., v. 20, no. 1, pt. 1, p. 45.

Diagnosis: "Shell of the general type of *G. thomasiae* Sowerby, but small, with three very small, smooth, compact nuclear whorls and eight subsequent rounded whorls; transverse sculpture of numerous small, rounded ribs extending across the whorl, and which are relatively stronger and more irregular, though less numerous, on the early whorls; the varices are quite irregular, some being strongly marked and others feeble; spiral sculpture of three or four primary, little-elevated, flattish threads, separated by wider interspaces, in which are two to four fine secondary threads; there are no beads or nodules, but the primaries appear conspicuous where they cross the ribs; similar sculpture extends over the base; aperture not much expanded, with a moderate callus and subsutural ridge on the body, a short, recurved canal and arched pillar." (Dall, 1892)

Dimensions of holotype: height 10.0 mm, diameter 4.5 mm.

Holotype: USNM 113372.

Type locality: USGS 2213, one mile below Bailey's Ferry, Chipola River, Calhoun County, Florida (=TU 457).

Occurrence: Chipola Formation, Florida; late lower Miocene.

Figured specimens: Fig. 2, USNM 646939; height 15.0 mm, diameter 6.0 mm; locality TU 555. Fig. 3, USNM 646940; height 17.2 mm, diameter 7.4 mm; locality TU 549. Other occurrences: TU locality nos. 459, 547.

Discussion: *C. chipolanum* is not common in the Chipola marls and, as far as can be determined, is found only along the Chipola River within a geographic range of one mile. The majority of the specimens were recovered from TU 555. At this locality the shells are in a better than usual state of preservation and many retain traces of color pattern between the varices. This condition also was observed in specimens of *Tenuicerithium chipolanum*.

This species is variable, as can be noted by a comparison of figs. 2 and 3, plate 1. The first five post-nuclear whorls have numerous axial riblets crossed by three rounded spiral cords, usually forming small beads at their intersections. Subsequently the sculpture may change. The spiral cords may become flattened and broad, and anteriorly the axial ribs feeble, making a pattern of elongated nodes around the medial portion of the whorl. The outer lip is thickened to form a varix and is lirate within, the lirae corresponding to the primary spiral cords. One strong varix, opposite the aperture, is present on all specimens.

Although the type material purportedly came from "One mile below Bailey's Ferry" (= TU 457), after intensive field work neither Tulane University nor the writer's collection contains any specimens of *C. chipolanum* from this locality.

CERITHIUM (THERICIUM) PEREGRINUM

S. E. Hoerle, n. sp.

Plate 1, fig. 4

Diagnosis: Nuclear whorls lost, ten flat to rounded teleoconch whorls in the adult. Periphery about half-way between distinct, appressed sutures. On the early whorls eleven axial riblets, reaching from suture to suture, later axials diminishing in length, on terminal whorl becoming little more than long nodes immediately in front of the suture. One broad varix opposite outer lip. Spiral sculpture consisting of narrow flat cords, with one or two intercalated

threads over entire shell. Small nodes formed on the body whorl where the spiral cords cross the nearly obsolete axials. Aperture broadly ovate, outer lip flaring and projecting forward, ascending to form a deep posterior sinus. Inner lip with heavy callus and subsutural ridge. Anterior canal short, broad, oblique, recurved to left.

Dimensions of holotype: height 24.3 mm, diameter 10.5 mm.

Holotype: USNM 646941.

Type locality: TU 546, Ten Mile Creek, about 1½ miles west of Chipola River (NW ¼ Sec. 12, T1N, R10W), Calhoun County, Florida (?=USGS 2212, "one mile west of Bailey's Ferry").

Occurrence: Chipola Formation, Florida; late lower Miocene.

Figured specimen: USNM 646941 (holotype). Other occurrences: TU locality no. 830.

Discussion: *C. peregrinum* is described from one nearly complete specimen and one fragment, but the sculpture is so distinctive that it cannot be confused with any other species from the Chipola Formation. *C. microlineatum* Gabb, 1873, from the Gurabo Formation of Santo Domingo has a similar sculpture but the shell is proportionately more slender and considerably larger. Another related Santo Domingo species, *C. gurabense* Maury, 1917, has a more slender outline and is not as constricted at the base of the body whorl. *C. peregrinum* shows a definite relationship with the two above mentioned species; however, the significant characteristics are sufficiently dissimilar to warrant the new specific name.

CERITHIUM (THERICIUM) VOKESORUM

S. E. Hoerle, n. sp.

Plate 1, fig. 5

Diagnosis: Shell slender, tapering, consisting of ten or eleven slightly rounded whorls and a nucleus of 2+ whorls. Axial riblets unevenly spaced, extending from suture to suture, usually eight or nine to a turn, every fourth or fifth one a little heavier. Small beads may be formed where the three primary flat spirals cross the axial riblets. Small, smooth, flattened threads present in the interspaces. Sutures deep but not channeled, bordered posteriorly by one small cord. Three raised, heavy, smooth cords encircling the base. Aperture small, ovate-rounded with a shallow posterior sinus. Inner lip with callus and small subsutural fold. Outer lip with varix and projecting edge, deeply jagged within to correspond with primary spirals. Canal short, recurved, truncated. The strongest varix opposite the outer lip.

Dimensions of holotype: height 18.5 mm, diameter 6.0 mm.

Holotype: USNM 646942.

Type locality: TU 825, Farley Creek at abandoned mill about ¼ mile west of bridge of Florida Highway 275 (SW ¼ Sec. 21, T1N, R9W), Calhoun County, Florida.

Occurrence: Chipola Formation, Florida; late lower Miocene.

Figured specimen: USNM 646942 (holotype). Other occurrences: TU locality nos. 457, 458, 459, 547, 548, 554, 818, 820b, 821, 826, 827, 828, 950, 999.

Discussion: Present collections indicate that *C. vokesorum* is confined to the areas of the Chipola River and Farley Creek. Only a limited number of individuals have been taken from each locality listed. The largest example in the Tulane University collections (TU 548) is an eroded specimen measuring 22.0 mm, others are considerably smaller. The outer lips and canals are fragile and consequently more often than not badly broken. The greatest variability is found in the strength of the primary spiral ribs, which at times are so weak that no beading is discernible and the axial riblets appear almost smooth.

The writer takes great pleasure in naming this new species *Cerithium vokesorum* in honor of Dr. Harold E. and Mrs. Emily H. Vokes whose untiring patience, constant encouragement and invaluable assistance have made this paper possible.

CERITHIUM (SUBGENUS ?) BURNSII
Dall

Plate 1, fig. 1

Cerithium burnsi DALL, 1892, Wagner Free Inst. Sci., Trans., v. 3, pt. 2, p. 280, pl. 14, fig. 12.

Cerithium (Ptychocerithium) burnsi Dall. COSS-MANN, 1906, Essais Paléoconch. Comp., v. 7, p. 142.

Diagnosis: "Shell solid, strong, nuclear whorls lost, with ten or more subsequent whorls; spiral sculpture of seven or eight revolving, flattened threads, with narrower, channelled interspaces, variable in size; one at the periphery, another on which the suture is wound, and one or two more on the base, being larger than the rest; the surface of the specimens is somewhat worn, but there are hardly any indications of fine spiral striation; the spirals on the last whorl are somewhat wavy, that

on the basal margin and those near the suture on the last whorl have some tendency to become nodulated; transverse sculpture of about eight narrow, strong, rounded ribs extending across the whorls and angulated at the intersection of the peripheral spiral; one of these on each whorl is a little larger than the others, but the only conspicuous varix is that at the end of the first third of the last whorl; suture distinct, appressed; base somewhat excavated; pillar short, arched, simple; canal narrow, deep, recurved; body with a strong callus with its edge free; outer lip thickened, arched, with faint sulci inside corresponding to the sculpture; at the junction with the body is a moderate sinus and sub-sutural, elevated ridge which enters the throat some distance." (Dall, 1892)

Dimensions of holotype: height 55 mm, diameter 20 mm.

Holotype: USNM 113354.

Type locality: USGS 2211, Alum Bluff (lower bed), Apalachicola River (NE ¼ Sec. 24, T1N, R8W), Liberty County, Florida (= TU 453). [Incorrectly reported in Dall, 1892, p. 280, as "Upper beds."]

Occurrence: Chipola Formation, Florida; late lower Miocene.

Figured specimen: USNM 646938; height 64.6 mm, diameter 22.7 mm; locality TU 825. Other occurrences: TU locality nos. 458, 459, 547, 554, 555, 821, 830, 950, 951, 999, 1019, 1050.

Discussion: Dall (1892, p. 280) described *C. burnsi* from "Newer or Chesapeake Miocene of the upper bed at Alum Bluff on the Chattahoochee River, Florida." The type was labeled with USGS 2211, which is the number for the lower bed of Alum Bluff on the Apalachicola River. This locality is confirmed by remaining traces of the matrix which is a red sand. The upper bed is of gray marl. (Druid Wilson, 1970, *in litt.*)

While this species cannot be considered a common shell at any one locality in the Chipola Formation it is rather widely distributed, being collected from the banks of Farley Creek and Ten Mile Creek as well as the Chipola River, also the lower bed at Alum Bluff. The majority of the specimens are not complete and seldom are the earlier whorls preserved, as the shell tapers to an almost needle-like point. One fragmentary specimen retains the nucleus of 2+ whorls and five gradually enlarging whorls with about fifteen faint axial riblets crossed by eight or nine spiral threads, making a reticulate pattern. The teleconch whorls are

in accord with Dall's description. Adjoining the main siphonal canal is a small residual canal, curving backwards and to the left, situated directly anterior to the final varix which is opposite the outer lip.

C. burnsii is the largest of the Chipola cerithiids and is distinguished by its moderately long, sharply recurved anterior canal, the slit-like posterior sinus formed by the ascending outer lip and the upturned remnant of a former canal.

Cossmann (1906, pp. 82, 142) assigned *C. burnsii* to the subgenus *Ptychocerithium*. The writer does not agree with his opinion. Neither should it be placed in the subgenus *Thericium* nor *Cerithium* s.s. Because of the unusual feature of the residual canal, possibly a new subgenus should be erected for this species.

Genus HEMICERITHIUM Cossmann, 1893

Hemicerithium COSSMANN, 1893, Jour. de Conchyl., v. 41, p. 302. Type species: *Cerithium imperfectum* Deshayes, by original designation.

HEMICERITHIUM COSSMANNI (Dall)

Plate 2, fig. 3

Bittium cossmanni DALL, 1892, Wagner Free Inst. Sci., Trans., v. 3, pt. 2, p. 273, pl. 21, fig. 16.
Hemicerithium cossmanni (Dall). COSSMANN, 1906, Essais Paléoconch. Comp., v. 7, p. 103.
Hemicerithium cossmanni (Dall). GLIBERT, 1962, Mém. Inst. Roy. Sci. Nat. Belg., (Ser. 2) fasc. 69, p. 212.

Diagnosis: "Shell subconic, with two and a half smooth, rounded nuclear whorls and six or seven rapidly increasing, inflated subsequent whorls; varices numerous, usually two or three on each of the larger whorls, with three small, peripheral, wavelike, transverse riblets between each pair of varices, or the riblets may be obsolete; spiral sculpture of fine striae with wider interspaces, forming fine, flattish threads, with one wider flat thread just in front of the periphery, and in advance of that one another on which the suture is wound; suture very distinct, deep, subappressed; periphery nearer the anterior suture; base spirally threaded, rounded; aperture wide, pillar very short and feeble, canal short, wide; outer lip arched, slightly thickened, not lirate within, a thin wash of callus on the inner lip." (Dall, 1892)

Dimensions of holotype: height 11.0 mm, diameter 5.5 mm.

Holotype: USNM 113331.

Type locality: USGS 2213, one mile below Bailey's Ferry, Chipola River, Calhoun County, Florida (=TU 457).

Occurrence: Chipola Formation, Florida; late lower Miocene.

Figured specimen: USNM 646951; height 14.4 mm, diameter 6.4 mm; locality TU 825. Other occurrences: TU locality nos. 70, 196, 456, 457, 458, 459, 546, 547, 548, 549, 554, 555, 655, 711, 806, 818, 820b, 821, 826, 828, 830, 950, 951, 998, 999, 1020, 1021, 1050.

Discussion: Cossmann, in his discussion of *Hemicerithium* (1906, p. 103), stated: "Une espèce absolument typique, dans l'Aquitainien de la Florida: *Bittium cossmanni* Dall, ma coll." "*Bittium*" *cossmanni* is certainly better placed in the genus *Hemicerithium*, as the specimens under discussion do not have the characteristics that distinguish the genus *Bittium*. These would include an anal sinus, a sharp edge on the inner lip, the body whorl smaller than the penult and the sculpture reticulated.

Hemicerithium cossmanni is a common species in the Chipola Formation. Adult specimens, with nine whorls, vary in length from 14.0 mm to 19.0 mm. Regardless of size the sculpture and subconic outline remain the same as in Dall's description. The early post nuclear whorls are identical to those of *H. akriton*, n. sp., as they also are carinated and ornamented with tiny nodes on the periphery. The heavy varices do not appear until the third or fourth whorl. Dall stated that the lip is slightly thickened but in none of the over 900 specimens examined by the writer has this been verified. Perhaps the lip was broken at a heavy varix, this often happens, which could have given him that impression. The stronger varices appear as bulges inside the aperture.

HEMICERITHIUM AKRITON

S. E. Hoerle, n. sp.

Plate 2, fig. 1

Diagnosis: Shell conic; nine to ten teleoconch whorls in adult plus 2½ nuclear whorls. Periphery of whorls on anterior third, outlined by eight or nine strong, elongate nodes reaching from medial portion of whorl to anterior suture. Posterior slope concave

to flat, sculptured by irregularly spaced, revolving, flat threads. Sutures distinct, appressed, undulated by nodes of preceding whorl. Base of shell flat to slightly convex, sculptured by numerous flat threads of varying widths, narrow interspaces. Aperture subquadrate; columella with a wash of callus; canal short, truncate.

Dimensions of holotype: height 18.4 mm, diameter 12.3 mm.

Holotype: USNM 646950.

Type locality: TU 820b, Farley Creek (lower beds), at bridge of Florida Highway 275 (SW ¼ Sec. 21, T1N, R9W), Calhoun County, Florida.

Occurrence: Chipola Formation, Florida; late lower Miocene.

Figured specimen: USNM 646950 (holotype). Other occurrences: TU locality nos. 546, 547, 555, 818, 821, 825, 826, 999.

Discussion: The spiral sculpture of *H. akriton* is exceedingly variable. A few specimens (particularly those from TU 555) have a wide sub-sutural collar, others may have a rounded cord preceding the suture, and many have neither feature. The size of an adult (nine to ten whorls) ranges between 16.0 mm and 20.0 mm, although some specimens may occasionally reach 25.0 mm. At this stage the outline of the body whorl changes, becoming more rounded with the nodes becoming more feeble. The base acquires a convexity not seen in an average size individual. The compact "Christmas tree" outline and the wavy suture are criteria to differentiate this species from other members of the *Hemicerithium*.

A species of *Hemicerithium* that may be ancestral to *H. akriton* occurs in the Tampa Limestone. Dall (1915, p. 89, pl. 13, fig. 10) described and figured "*Bittium*" *adela* from a single juvenile specimen. Further collecting produced five topotypes, which are in the U. S. National Museum. Examination of these specimens clearly shows that the whorls of *H. adela* always have an anterior slope, the sutures are grooved, and the shell does not attain the size of *H. akriton*. The holotype of "*Bittium*" *adela* is refigured here, pl. 2, fig. 2, for comparison.

HEMICERITHIUM CRATICULUM

S. E. Hoerle, n. sp.

Plate 2, fig. 4

Diagnosis: Shell small; 2+ glassy nuclear whorls, eight to ten bicarinate teleoconch whorls; periphery

on anterior half of whorl. Six to eight raised spiral threads on posterior flattened slope; five threads between carinae, middle one slightly stronger; three or four threads on short concave anterior slope, and one heavy cord upon which the subappressed suture is laid. Numerous faint axial riblets over entire shell, giving the intercarinal spaces a latticed appearance. Occasional heavy varices, about two per turn on later spire whorls and body whorl. Body whorl terminated by the sutural cord; base somewhat flattened with eight to ten alternating fine and heavy revolving threads. Aperture subquadrate, canal short and oblique.

Dimensions of holotype: height 10.8 mm, diameter 3.7 mm.

Holotype: USNM 646952.

Type locality: TU 998, Ten Mile Creek, about 1¼ miles west of Chipola River (SE ¼ Sec. 12, T1N, R10W), Calhoun County, Florida.

Occurrence: Chipola Formation, Florida; late lower Miocene.

Figured specimen: USNM 646952 (holotype). Other occurrences: TU locality nos. 70, 546, 806, 817, 821, 825, 951.

Discussion: The majority of the specimens of this unusual species were taken from localities on Ten Mile Creek, TU 546 yielding 116 specimens. *H. craticulum* may be distinguished from other members of the genus by its angular outline, strong carinae, and its lattice-like sculpture. The columella is slightly excavated and occasionally covered by a wash of callus.

HEMICERITHIUM PAGODUM

S. E. Hoerle, n. sp.

Plate 2, fig. 5

Diagnosis: Shell small, slender, elongated; nucleus 2+ rounded glassy whorls, eight to ten angulated post-nuclear whorls with submedian periphery. Posterior slope slightly concave and undulated by faint axial riblets (about ten), which increase in size anteriorly and become obsolete after crossing the periphery. Heavier varices may be scattered along the spire. Anterior slope short and steep. Suture distinct but not channeled. Spiral sculpture consisting of microscopic threads with equal-sized interspaces; one heavier thread outlining the periphery forming nodes at points of intersection with varices. Another heavier thread just behind the suture and terminating the body whorl, forming a carina, base constricted. Aperture subquadrate; arcuate columella with a wash of callus; canal short, oblique and truncated.

Dimensions of holotype: height 8.5 mm, diameter 3.2 mm.

Holotype: USNM 646953.

Type locality: TU 825, Farley Creek at abandoned mill about ¼ mile west of bridge of Florida Highway 275 (SW ¼ Sec. 21, T1N, R9W), Calhoun County, Florida.

Occurrence: Chipola Formation, Florida; late lower Miocene.

Figured specimen: USNM 646953 (holotype).

Other occurrences: TU locality nos. 458, 459, 547, 548, 554, 555, 821, 826.

Discussion: *H. pagodum* is the least common of the four species of *Hemicerithium* in the Chipola Formation and is confined to collections from Farley Creek and the Chipola River. Although this new species has a superficial resemblance to *H. cossmanni* in its spiral sculpture and peripheral nodes, the outline of the two species is entirely different. The

PLATE 1

Figures	Page
1. <i>Cerithium burnsii</i> Dall (X 1½)	5
USNM 646938; height 64.6 mm, diameter 22.7 mm.	
Locality: TU 825. Chipola Fm., lower Miocene.	
2, 3. <i>Cerithium (Thericium) chipolanum</i> Dall	3
2. (X 3) USNM 646939; height 15.0 mm, diameter 6.0 mm.	
Locality: TU 555. Chipola Fm., lower Miocene.	
3. (X 3) USNM 646940; height 17.2 mm, diameter 7.4 mm.	
Locality: TU 549. Chipola Fm., lower Miocene.	
4. <i>Cerithium (Thericium) peregrinum</i> S. E. Hoerle, n. sp. (X 2)	4
USNM 646941 (holotype); height 24.3 mm, diameter 10.5 mm.	
Locality: TU 546. Chipola Fm., lower Miocene.	
5. <i>Cerithium (Thericium) vokesorum</i> S. E. Hoerle, n. sp. (X 3)	4
USNM 646942 (holotype); height 18.5 mm, diameter 6.0 mm.	
Locality: TU 825. Chipola Fm., lower Miocene.	
6. <i>Rhinoclavis (Ochetoclava) chipolana</i> (Dall) (X 3)	12
USNM 646943; height 22.4 mm, diameter 7.6 mm.	
Locality: TU 825. Chipola Fm., lower Miocene.	
7, 8. <i>Potamides suprasulcatus</i> (Gabb)	17
7. (X 2) USNM 646944; height 30.4 mm, diameter 15.4 mm.	
Locality: TU 459. Chipola Fm., lower Miocene.	
8. (X 3) USNM 646945; height 11.0 mm, diameter 5.1 mm.	
Locality: TU 459. Chipola Fm., lower Miocene.	
9-11. <i>Terebralia dentilabris</i> (Gabb)	20
9. (X 3) USNM 646946; height 16.7 mm, diameter 7.6 mm.	
Locality: TU 459. Chipola Fm., lower Miocene.	
10. (X 1½) USNM 646947; height 49.0 mm, diameter 21.6 mm.	
Locality: TU 459. Chipola Fm., lower Miocene.	
11. (X 1½) USNM 646948; height 53.7 mm, diameter 23.5 mm.	
Locality: TU 459. Chipola Fm., lower Miocene.	

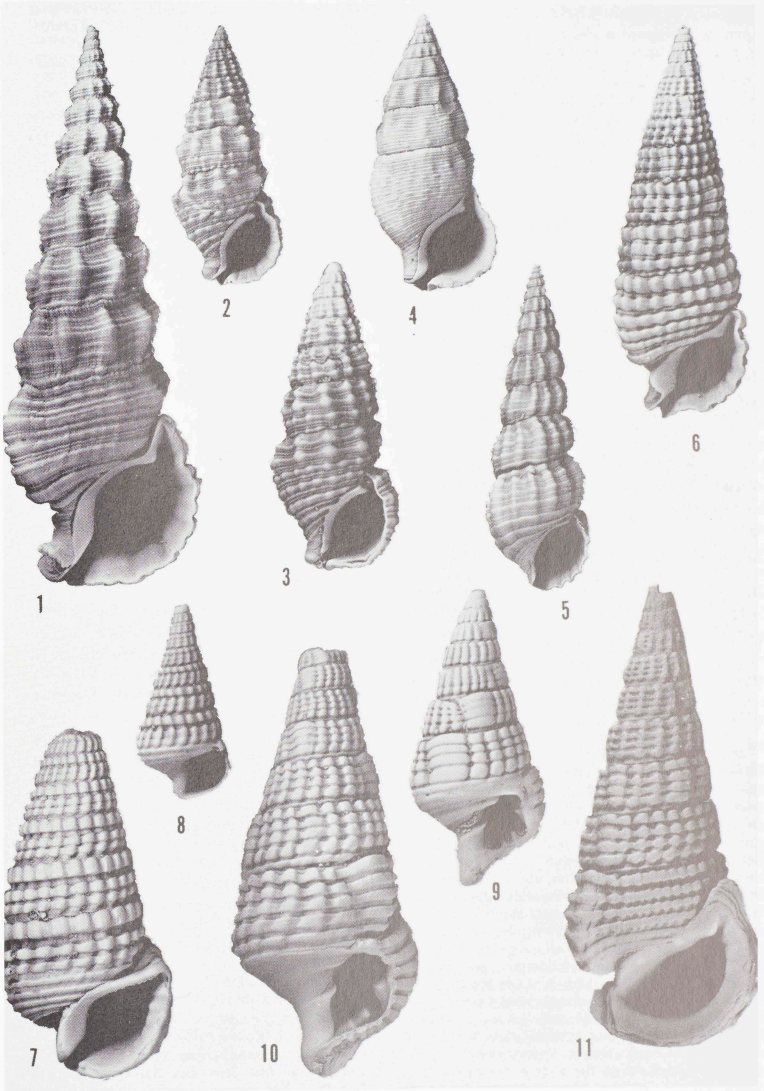


PLATE 1

whorls of *H. pagodum* have an angular appearance, while those of *H. cossmanni* are rounded. Also, *H. pagodum* always retains its slender, delicate form and small size. The only noticeable variability is in the peripheral nodes. On the majority of specimens the nodes are slightly upturned but a few specimens have the nodes projecting at a 90 degree angle to the axis. The revolving threads cannot be seen without magnification. The thin, flaring lip is always broken back, including the figured specimen.

Genus TENUICERITHIUM
Cossmann, 1896

Tenuicerithium COSSMANN, 1896, Cat. Illus. Coq. Foss. Éocène Paris, Append. 2, in Soc. Roy. Malac. Belg., Ann., v. 31, p. 30. Type species: *Cerithium fragile* Deshayes, by original designation.

TENUICERITHIUM CHIPOLANUM (Dall)

Plate 2, figs. 6, 7

- Bittium chipolanum* DALL, 1892, Wagner Free Inst. Sci., Trans., v. 3, pt. 2, p. 272, pl. 21, fig. 15.
Bittium chipolanum var. *burnsii* DALL, 1892, Wagner Free Inst. Sci., Trans., v. 3, pt. 2, p. 272, pl. 21, fig. 18.
Tenuicerithium chipolanum (Dall). COSSMANN, 1906, Essais Paléoconch. Comp., v. 7, p. 142.
Tenuicerithium chipolanum (Dall). GLIBERT, 1962, Mém. Inst. Roy. Sci. Nat. Belg., (Ser. 2) fasc. 69, p. 197.

Diagnosis: "Shell acute, with four larval, at first smooth, afterward spirally threaded, rounded whorls, and about ten subsequent flattened whorls, widest immediately behind the suture; surface spirally grooved, with the interspaces wider than the grooves, and one especially wide one usually at the periphery; transverse sculpture of about sixteen nearly straight, rounded riblets, usually beginning in front of the suture and growing wider and stronger to the periphery, where they cease abruptly, or they may be obsolete or entirely absent; they are usually faint or absent on the last whorl, even when they are strong on the rest of the shell; base strongly, spirally grooved and threaded, with a single swollen, ill-defined varix about half a turn behind the outer lip; there are no varices on the other whorls except in rare cases; suture distinct, applied below the periphery so that a single thread intervenes behind the suture and in front of the ends of the ribs; canal short, straight, wide, shallow; outer lip thin, not

reflected; inner lip slightly callous; pillar somewhat curved, slender; throat slightly or not at all lirate." (Dall, 1892)

Dimensions of holotype: height 13.0 mm, diameter 3.75 mm.

Holotype: USNM 113328.

Type locality: USGS 2213, one mile below Bailey's Ferry, Chipola River, Calhoun County, Florida (=TU 457).

Occurrence: Chipola Formation, Florida; late lower Miocene.

Figured specimens: Fig. 6, USNM 646954; height 14.4 mm, diameter 5.0 mm; locality TU 825. Fig. 7, USNM 646955; height 13.6 mm, diameter 4.4 mm; locality TU 825. Other occurrences: TU locality nos. 70, 196, 457, 458, 459, 546, 547, 548, 549, 554, 555, 655, 787, 806, 817, 818, 820b, 821, 826, 827, 828, 830, 950, 951, 998, 999, 1020, 1021, 1050.

Discussion: Dall (1892, p. 272) named a variety of *T. chipolanum* as "*Bittium*" *chipolanum burnsii* (holotype USNM 113329) and stated that the latter is a more slender shell with several varices and with the body whorl proportionally smaller. Examination of only a few specimens could easily lead one to believe there are two distinct species. The writer had nearly 8,000 specimens from thirty localities at her disposal; a study of which clearly indicated that there is a great variability as to the number and placement of the heavy varices on *T. chipolanum* (compare pl. 2, figs. 6 and 7). As no specific differences can be discerned, variety *burnsii* is here placed in synonymy with *T. chipolanum* s. s.

T. chipolanum is by far the most common member of the subfamily Cerithiinae, being found at nearly every locality thus far collected. It is easily distinguished by the straight sided, slightly overhanging whorls, the expanded outer lip with a suggestion of a posterior sinus and the short, broad canal.

TENUICERITHIUM PERMUTABILE (Dall)

Plate 2, fig. 12

- Bittium permutabile* DALL, 1892, Wagner Free Inst. Sci., Trans., v. 3, pt. 2, p. 272, pl. 21, fig. 17.
Tenuicerithium permutabile (Dall). COSSMANN, 1906, Essais Paléoconch. Comp., v. 7, p. 142.
Tenuicerithium permutabile (Dall). GLIBERT, 1962, Mém. Inst. Roy. Sci. Nat. Belg., (Ser. 2) fasc. 69, p. 198.

Diagnosis: "Shell acute, with two very minute, smooth, rounded nuclear whorls and about ten subsequent, also rounded, whorls, with the periphery almost midway between the sutures; suture closely appressed, distinct, not marginate, varices irregular, generally two or three in number, distributed along the spire; spiral sculpture of numerous fine, close-set, sometimes alternated, rounded threads; transverse sculpture of about nine prominent, rounded riblets, bigger at the periphery, narrowing and becoming feeble each way toward the suture; base spirally threaded, aperture with a feeble canal, short and twisted pillar and non-lirate throat; outer lip thin, simple, arched forward; inner lip slightly washed with callus; last varix strong and prominent." (Dall, 1892)

Dimensions of holotype: height 13.5 mm, diameter 3.75 mm.

Holotype: USNM 113330.

Type locality: USGS 2213, one mile below Bailey's Ferry, Chipola River, Calhoun County, Florida (=TU 457).

Occurrence: Chipola Formation, Florida; late lower Miocene.

Figured specimen: USNM 646960; height 12.6 mm, diameter 3.8 mm; locality TU 546. Other occurrences: TU locality nos. 457, 458, 459, 547, 548, 549, 554, 555, 806, 817, 820b, 821, 825, 826, 951, 998, 1020, 1021, 1050.

Discussion: Cossmann (1906, p. 142) mentioned two species in the "Aquitanian" beds of Florida that are typical of the genus *Tenuicerithium* Cossmann, 1896: "*Bittium*" *chipolanum* and "*Bittium*" *permutabile*. The writer feels no hesitation in agreeing with Cossmann's assignment. Both species have a large aperture, outer lip expanded forward and a short, broad, not recurved anterior canal.

The number and placement of axial riblets as well as the number of spiral cords are not constant from individual to individual. The periphery may be medial or slightly sub-medial giving a dissimilar aspect in profile. *T. permutabile* is common on the Chipola River, Farley Creek and lower beds of Ten Mile Creek. Over 5,000 specimens were collected from the river locality TU 555. This species has not been taken from the higher beds along Ten Mile Creek.

TENUICERITHIUM ABSONUM

S. E. Hoerle, n. sp.

Plate 2, fig. 10

Diagnosis: Shell consisting of ten to twelve whorls, plus 2½ nuclear whorls; early six or seven

teleoconch whorls flat-sided and sutures deeply grooved; remaining whorls rounded and sutures moderately grooved. Early post-nuclear whorls of shell ornamented with about ten narrow, evenly spaced, axial riblets crossed by two, increasing to three, rounded spiral cords. After sixth or seventh turn sculpture changes abruptly; whorls expanding rapidly, spiral cords decreasing in strength and increasing in number, thirteen on the final turn; axial riblets replaced by heavy varices, three or four to a whorl. Aperture subovate with a feeble canal, outer lip thin and flaring, inner lip with a wash of callus.

Dimensions of holotype: height 13.2 mm, diameter 4.8 mm.

Holotype: USNM 646958.

Type locality: TU 555, east bank of Chipola River, about 1000 feet above Four Mile Creek (SW ¼ Sec. 29, T1N, R9W), Calhoun County, Florida.

Occurrence: Chipola Formation, Florida; late lower Miocene.

Figured specimen: USNM 646958 (holotype). Other occurrences: TU locality no. 547.

Discussion: *T. absonum* resembles *T. permutabile* in the later whorls; however, the early whorls are entirely dissimilar. In outline *T. absonum* is stouter and more rugose and the first six or seven post-nuclear whorls are flat-sided and the sutures are deeply grooved. The axial riblets extend from suture to suture in the new species whereas in *T. permutabile* they fade both posteriorly and anteriorly on the whorls. Over 500 specimens of *T. absonum* were collected at two closely approximate localities (TU 555 and TU 547). These same two localities yielded an abundance of *T. permutabile*. There is evidence of a close relationship between the two species and undoubtedly *T. absonum* is an offshoot of *T. permutabile*. Apparently the conditions were optimum for trying a new line, but for an unknown reason, *T. absonum* was restricted to a limited geographic area.

TENUICERITHIUM ASCENSUM

S. E. Hoerle, n. sp.

Plate 2, fig. 11

Diagnosis: Shell turritiform, moderately stout. Nucleus unknown; nine post-nuclear whorls in adult. Axial sculpture consisting of seven to nine short, heavy varices; medially positioned on early whorls, posteriorly positioned on later whorls, giving a knobby shouldered outline in profile. Spiral cords broad, rounded; two on early whorls, gradually increasing to seven on penultimate and body whorl. Only the three posterior cords, on later whorls, cross

the short axial riblets, coalescing on summits; deep pit-like interspaces between axial knobs. Three widely spaced flat spiral cords on constricted base. Aperture large, subovate; outer lip expanding forward; inner lip callused; canal broad, short, not recurved.

Dimensions of holotype: height 9.7 mm, diameter 3.9 mm.

Holotype: USNM 646959.

Type locality: TU 459, east bank of Chipola River, steep bank about 1500 feet above the mouth of Taylor Lake Branch (NW ¼ Sec. 29, T1N, R9W), Calhoun County, Florida.

Occurrence: Chipola Formation, Florida; late Lower Miocene.

Figured specimen: USNM 646959 (holotype).

Discussion: *Tenuicerithium ascensum* is known from one locality only (TU 459) and is represented by 27 specimens, the majority of which show some degree of corrosion. The step-like outline of the whorls and the pit-like interspaces between the abbreviated varices are the criteria that enable this new species to be separated from all other cerithiids of the Chipola Formation. Although the holotype is somewhat atypical of the species (the intervarical areas are not as excavated), it is the best preserved of the lot and is selected for that reason. The type specimen and a juvenile of the species were found inside a large *Melongena* and consequently were in better condition. TU 459 apparently was near the mouth of a river, as the associated fauna from the locality shows the effects of tumbling and a goodly amount of corrosion. The matrix is of a gravelly nature and mainly quartz pebbles.

Genus RHINOCLAVIS Swainson, 1840

Rhinoclavis SWAINSON, 1840, Treatise Malac., pp. 157, 315. Type species: *Cerithium vertagus* (Linné), by subsequent designation, Herrmannsen, 1848.

Subgenus OCHETOCLAVA Woodring, 1928

Ochetoclava WOODRING, 1928, Carnegie Inst. Washington, Publ. 385, p. 334. Type species: *Cerithium gemmatum* Hinds, by original designation.

RHINOCLAVIS (OCHETOCLAVA) CHIPOLANA (Dall)

Plate 1, fig. 6

Clava chipolana DALL, 1892, Wagner Free Inst. Sci., Trans., v. 3, pt. 2, p. 290, pl. 22, fig. 8.

Diagnosis: "Shell small for the genus, with two extremely minute, smooth nuclear whorls and thirteen to fifteen subsequent sculptured whorls; the tip of the spire is very acute, from about the seventh whorl it is enlarged more rapidly in proportion; the early whorls have about seven sharply elevated narrow ribs, extending across the whorls, with wider interspaces, over which run three strap-like spirals with about equal channelled interspaces, prominent but not nodulous at the intersections; the ribs gradually get more numerous and close-set, so that the reticulations are about square, and between the spirals a small intercalary thread appears which becomes wavy on the last whorl; the varix occurs at the end of the first third of the last whorl, and beyond it the ribs are obsolete; the last whorl has six prominent and as many intercalary spirals behind the base, which has three or four somewhat smaller rippled primaries and an equal number of intercalary simple threads; outer lip thickened, not reflected, slightly sulcate in harmony with the external spirals; body with a well-marked subsutural ridge and notch outside of it, and with a moderate callus; pillar short, with a thick, elevated callus and a strong plait about the middle; canal short, reflected; varix swollen, not very prominent; suture appressed, distinct." (Dall, 1892)

Dimensions of holotype: height 22.0 mm, diameter 7.5 mm.

Holotype: USNM 114281.

Type locality: USGS 2211, Alum Bluff (lower bed), Apalachicola River, Liberty County, Florida (=TU 453).

Occurrence: Chipola Formation, Florida; late Lower Miocene.

Figured specimen: USNM 646943; height 22.4 mm, diameter 7.6 mm; locality TU 825. Other occurrences: TU locality nos. 70, 196, 453, 456, 457, 458, 459, 546, 547, 548, 549, 554, 555, 655, 711, 806, 817, 820b, 821, 826, 830, 950, 951, 998, 999, 1020, 1049, 1050.

Discussion: *R. chipolana* is related to the Mio-Pliocene species *R. caloosaensis* (Dall). The latter is a larger shell with less pronounced sculpture and a tendency to wider spiral cords, particularly the one anterior to the suture, thus giving the whorls the appearance of having a subsutural band. The early whorls, (six or seven) of *R. chipolana* are sharply tapered and have only seven to nine

axial riblets (on *R. caloosaensis* the riblets are close set) crossed by three spiral threads, the medial and anterior spiral threads forming nodes at the points of intersection. The axial riblets increase in number and the spiral cords become heavier until the whorls are covered by a reticulated pattern and appear flat-sided. Secondary spiral threads may be intercalated between the primary spirals on later whorls and one beaded thread lies just behind the suture. Low varices may or may not be scattered over the spire.

In the fauna of the Oak Grove Sand, which is probably only a facies of the Chipola Formation, there is another species of *Rhinoclavis* much like *R. chipolana*. This species, originally named *Cerithiopsis ogilvies* Maury (1910, p. 27, pl. 7, fig. 3), is a much smaller and more slender shell with notable differences in its ornamentation. The primary spiral cords on *R. chipolana* are heavy and broad, whereas those on *R. ogilvies* have the appearance of beads on a string. Ofttimes the posterior cord of the *Chipola* species has a tendency to be the largest of the three. If any of the primary spiral cords on *R. ogilvies* are enlarged, it is invariably the anterior one. Examination of 29 lots of *Chipola* specimens shows that the placement of the intercalary threads on the spire whorls is not a constant feature, as some of the whorls may be completely devoid of ornamentation between the primary cords. The small threads on the Oak Grove specimens are more consistent in their appearance and relatively more prominent. The flange-like projection of the callus on the inner lip, which is so pronounced on the *Chipola* species, is more subdued on the Oak Grove specimens. A comparison of pl. 1, fig. 6, with pl. 2, fig. 18, will show that, although the two forms are similar, the differences do warrant the recognition of two species. *R. ogilvies* is the only cerithiid that is present in the fauna of the Oak Grove Sand (Maury also described a 4 mm species of *Bittium*, which has not been found) but it is a moderately common gastropod in what is a predominantly pelecypod fauna.

Woodring (1928, p. 335) stated, "This subgenus [*Ochetoclava*] is represented in the Miocene deposits of Florida and the Carib-

bean region and even in the Pliocene of Florida, but probably is extinct there" Subsequent collecting to date has not refuted Dr. Woodring's statement.

Subfamily CERITHIOPSINAE

H. and A. Adams, 1853

Genus CERITHIOPSIS Forbes and Hanley, 1853

Cerithiopsis FORBES and HANLEY, 1853, History of British Mollusca, v. 3, p. 364. Type species: *Murex tubercularis* Montagu, by monotypy.

CERITHIOPSIS INOPINUS

S. E. Hoerle, n. sp.

Plate 2, fig. 14

Diagnosis: Shell small, slender, slightly tapered; nine to ten whorls in adult plus nucleus of four whorls. Initial whorl of nucleus smooth, other three marked with faint axial riblets. Teleoconch sculpture consisting of numerous axial ribs crossed by rounded spiral cords, forming a cancellate pattern; two spiral cords on first post-nuclear whorl, increasing to three on successive whorls. Body whorl terminated by a fourth spiral cord, not noded by the axial ribs. Sutures narrow, grooved. Incremental axial sculpture on constricted base; one obscure cord encircling end of pillar. Aperture subovate; outer lip flaring anteriorly, inner lip slightly callused. Siphonal canal short, open, truncated anteriorly.

Dimensions of holotype: height 4.0 mm, diameter 1.3 mm.

Holotype: USNM 646962.

Type locality: TU 555, east bank of Chipola River about 1000 feet above Four Mile Creek (SW ¼ Sec. 29, T1N, R9W), Calhoun County, Florida.

Occurrence: Chipola Formation, Florida; late lower Miocene.

Figured specimen: USNM 646962 (holotype). Other occurrences: TU locality no. 547.

Discussion: This new species is the sole representative of the genus *Cerithiopsis* in the Chipola Formation. Maury (1910, p. 27, pl. 7, fig. 3) named a species *Cerithiopsis ogilvies*, and gave the locality as "Oak Grove and Bailey's Ferry". In her description she stated that the shell had "varices about nine in all, only the two on the body-whorl being pronounced". *Cerithiopsis* have no strong varices on the body whorl or on the spire, no sutural sinus nor subsutural ridge on the labium and do not have a recurved canal,

thus her generic assignment is in error. Her figure depicts a small and delicate shell very reminiscent of *Rhinochlamys chipolana*, a common species in the Chipola fauna. Maury's species is further discussed in this paper with *Rhinochlamys chipolana*. (See pl. 2, fig. 18 for comparison with *Cerithiopsis inopinus*.)

C. inopinus has been collected from two localities only (TU 555 and TU 547). Both localities were coral reefs (possibly an extension of the same reef) and many unusual species, found nowhere else in the marls, have been taken from this limited area.

Genus BITTIUM Leach
in Gray, 1847

Bittium LEACH in GRAY, 1847 (Oct.), Ann. Mag. Nat. Hist., v. 20, p. 270. Type species: *Murex reticulatus* Montagu, by subsequent designation, Gray, 1847 (Nov.)

BITTIUM SERENUM
S. E. Hoerle, n. sp.

Plate 2, fig. 16

Diagnosis: Shell small and slender with three rounded nuclear whorls and seven to nine slightly rounded whorls in adult. Cancellate pattern formed on the teleoconch by four heavy spiral cords crossing numerous axial riblets, about twenty to a turn; a more slender cord lying just behind the distinct suture. Sutural cord terminating the body whorl; another cord of equal strength paralleled by three more of diminishing strength on the contracted base. Aperture broadly elliptical with a small posterior sinus and a short shallow anterior canal. Outer lip thin, nearly straight above and flaring anteriorly, not lirate within; inner lip with a band of callus and slightly reflected anteriorly. One strong varix opposite the outer lip.

Dimensions of holotype: height 4.9 mm, diameter 1.5 mm.

Holotype: USNM 646964.

Type locality: TU 546, Ten Mile Creek, about 1½ miles west of Chipola River (NW ¼ Sec. 12, T1N, R10W), Calhoun County, Florida (?=USGS 2212, "one mile west of Bailey's Ferry").

Occurrence: Chipola Formation, Florida; late lower Miocene.

Figured specimen: USNM 646964 (holotype). Other occurrences: TU locality nos. 70, 458, 459, 547, 554, 555, 655, 825, 951, 998, 1021.

Discussion: *Bittium serenum* is the only recognized member of the genus *Bittium*

found to date in the Chipola marls. Its distribution is widespread: Ten Mile Creek, Farley Creek and the Chipola River; however, it is uncommon at every locality with the exception of TU 546 where over 400 specimens were collected. The sculpture of this neat little shell is remarkably stable compared to the variability of the other cerithiids from the Chipola Formation. All specimens examined have only the one strong varix, which is opposite the outer lip, and the same precise cancellate sculpture.

Genus SEILA A. Adams, 1861

Seila A. ADAMS, 1861, Ann. Mag. Nat. Hist., (Ser. 3), v. 7, p. 131. Type species: *Seila dextroversus* (Adams and Reeve) by subsequent designation, Dall, 1889.

SEILA ADAMSII
(H. C. Lea)

Plate 2, fig. 17

Cerithium terebrale G. B. ADAMS, 1840, Boston Jour. Nat. Hist., v. 3, p. 320, pl. 3, fig. 7. (Not *C. terebrale* Lamarck, 1804).

Cerithium adamsii H. C. LEA, 1845, Amer. Phil. Soc., Trans., (Ser. 2), v. 9, extras p. 42.

Seila adamsii H. C. Lea. DALL, 1892, Wagner Free Inst. Sci., Trans., v. 3, pt. 2, p. 267.

Seila adamsii variety *attenuata* DALL, 1892, Wagner Free Inst. Sci., Trans., v. 3, pt. 2, p. 268.

Cerithium terebellum and *terebrale* C. B. Adams. CLENCH and TURNER, 1950, Occas. Papers on Mollusks, v. 1, no. 15, p. 349, pl. 37, figs. 5-7.

Diagnosis: Shell elongate, slender, flat-sided with three plus rounded nuclear whorls plus twelve to fourteen teleoconch whorls in adult specimens. Three elevated, flat topped, revolving cords on each whorl; interspaces equal to width of cords, bearing numerous incrementals. Body whorl with four spiral cords; aperture subquadrate; short, truncated canal bent to left; siphonal canal broad and deep. Concave base marked by growth lines only and bounded by a single, small spiral cord emerging from the aperture.

Dimensions of lectotype: height .46 inch, diameter .13 inch (Clench and Turner, 1950, p. 350).

Lectotype: Harvard MCZ 156200.

Type locality: New Bedford, Massachusetts (Clench and Turner, 1950, p. 350).

Occurrence: Chipola Formation, Florida; late lower Miocene. Pinecrest Beds, Florida; upper Miocene. Caloosahatchee Formation, Florida; Pliocene. Unnamed post-Caloosahatchee formation, Florida; Pleistocene. Recent, Massachusetts to West Indies.

Figured specimen: USNM 113318 (Lectotype—*Seila attenuata* Dall); height 5.0 mm, diameter 1.6 mm; locality USGS 2213. Other occurrences: TU locality nos. 458, 546, 547, 548, 554, 555, 825.

Discussion: Dall (1892, p. 268) mentioned that "variety *attenuata*", found in the Chipola beds, "differs from the type [*S. adamsii*] only in its smaller size and slightly more cylindrical form." Except for the above statement, which Dall made in his discussion of *S. adamsii*, no further description nor any figure is available for the species. There are two lots of fragmented specimens in the U. S. National Museum, bearing the label *S. adamsii* var. *attenuata* Dall: one lot of 33 fragments from USGS locality 2211 (lower bed, Alum Bluff), with the number USNM 114263; one lot of 28 fragments from USGS locality 2213 (one mile below Bailey's Ferry), with the number USNM 113318. As all of the specimens in both lots were part of the "original type lot" available to Dall, and as the material from USGS 2211 is in very poor condition, a specimen from USGS 2213 is here selected as lectotype (pl. 2, fig. 17), even though Schuchert and Dall (1905, p. 569) indicated that the specimens from USGS 2211 were to be considered as "cotypes."

There appears to be no significant differences in *S. adamsii* and *S. attenuata*, therefore the writer places *S. attenuata* in synonymy with *S. adamsii*. Adult specimens of *S. adamsii* may vary in height but the strength of the spiral cords, their relation to each other and to the width of the interspaces remain constant.

S. adamsii has been collected from the Chipola River and Farley Creek localities; however, only one specimen has been found on Ten Mile Creek. This species has survived since lower Miocene time and in the Recent fauna is recorded from Massachusetts to the West Indies.

Subfamily DIASTOMATINAE

Crosse and Fischer, 1893

Genus ALABA H. and A. Adams, 1853

Alaba H. and A. ADAMS, 1853, Genera Recent Moll., v. 1, p. 241. Type species: *Rissoa melanura*

C. B. Adams, 1850 [= *Eulima incerta* (Orb., 1842)], by subsequent designation, Nevill, 1885.

ALABA CHIPOLANA Dall

Plate 2, fig. 15

Alaba chipolana DALL, 1892, Wagner Free Inst. Sci., Trans., v. 3, pt. 2, p. 292, pl. 21, fig. 9.

Alaba chipolana Dall. GARDNER, 1947, U. S. Geol. Surv. Prof. Paper 142-H, p. 580, pl. 54, fig. 17.

Diagnosis: "Shell small, smooth, with two very minute nuclear and eight or nine subsequent well-rounded whorls; sculpture only of faint incremental lines, obscure malleations and faint varices; the varices are irregular in number, sometimes as many as three on one whorl, but they are little elevated; the penultimate varix is usually more pronounced in the adult than any of the others; aperture sub-ovate, outer lip slightly thickened inside, simple; basal part rounded, with a faint sinus at the end of the pillar; body without perceptible callus; pillar straight, slender, perceptibly axially twisted." (Dall, 1892)

Dimensions of holotype: height 6.0 mm, diameter 2.75 mm.

Holotype: USNM 113384.

Type locality: USGS 2213, one mile below Bailey's Ferry, Chipola River, Calhoun County, Florida (=TU 457).

Occurrence: Chipola Formation, Florida; late lower Miocene.

Figured specimen: USNM 646963; height 5.7 mm, diameter 2.8 mm; locality TU 555. Other occurrences: TU locality nos. 70, 458, 459, 546, 547, 548, 554, 820b, 821, 825, 951, 998.

Discussion: Gardner (1947, p. 580) suggested that there might be a subspecies associated with *A. chipolana*, "a somewhat smoother and more slender form." After examination of over 600 specimens from 13 localities the writer concludes the atypical forms are well within the range of variability. They have the same impressed suture, lack of spiral sculpture, one or many varices, straight pillar, thin outer lip and patulous aperture. The majority of specimens have the labrum broken back to the last varix and thus the lip appears to be "slightly thickened inside." A few adult specimens have no noticeable varices and conversely a juvenile may have six to eight. Usually there is at least one varix a short distance behind the outer lip.

Genus ALABINA Dall, 1902

Alabina DALL, 1902, Nautilus, v. 15, p. 127. Type species: *Bittium cerithioides* Dall, by original designation.

Subgenus CALOOSALBA

Olsson and Harbison, 1953

Caloosalba OLSSON and HARBISON, 1953, Acad. Nat. Sci. Phila., Mon. 8, p. 293. Type species: *Bittium adamsii* Dall, by original designation.

ALABINA (CALOOSALBA) BOIPLIX

(Dall)

Plate 2, fig. 13

Bittium (Stylifernia) boiplex DALL, 1892, Wagner Free Inst. Sci., Trans., v. 3, pt. 2, p. 275, pl. 21, fig. 14.

Aneurychilus (Alabina) boiplex (Dall). COSS-MANN, 1906, Essais Paléoconch. Comp., v. 7, p. 181, pl. 12, figs. 8, 9.

Obortio (Alabina) boiplex (Dall). GLIBERT, 1962, Mém. Inst. Roy. Sci. Nat. Belg., (Ser. 2) fasc. 69, p. 189.

Diagnosis: "Shell small, slender, acutely pointed, strongly sculptured, with two minute, smooth and ten subequal rounded whorls; earlier whorls with only spiral sculpture, which later becomes sharp, elevated threads alternating in strength, with three strong spirals on the base, on the posterior of which the distinct, appressed suture is applied; the spiral sculpture crosses numerous concavely-arched riblets, which may be strong or obsolete; there are also numerous well-marked, rounded varices irregularly distributed both in position and number; the whorls are well rounded, the aperture ovate, with hardly a trace of canal; a short, arched pillar, thin, simple outer lip, and no lirations in the throat." (Dall, 1892)

Dimensions of holotype: height 8.5 mm, diameter 1.75 mm.

Holotype: USNM 113343.

Type locality: USGS 2213, one mile below Bailey's Ferry, Chipola River, Calhoun County, Florida (=TU 457).

Occurrence: Chipola Formation, Florida; late lower Miocene.

Figured specimen: USNM 646961; height 6.8 mm, diameter 2.0 mm; locality TU 546. Other occurrences: TU locality nos. 70, 196, 456, 457, 458, 459, 547, 548, 554, 555, 655, 787, 806, 817, 820b, 821, 823, 825, 830, 951, 998, 1020, 1021, 1048, 1050.

Discussion: *A. boiplex* is a most profuse member of the family Cerithiidae and is particularly abundant along Ten Mile Creek, TU 546 yielding nearly 3,000 specimens. A typical *A. boiplex* has a small nucleus of 2½ whorls and two or three angulated post-nuclear whorls, the remaining eight or nine are

well rounded, with distinct sutures bordered in front and behind by a small cord. The early post-nuclear whorls have only the medial and anterior spiral cords and not the three heavy ones that are indicative of this species in the later stages. The posterior half of these early whorls are ornamented by spiral threads and it is not until the third or fourth whorl that one of the threads becomes strengthened to form a cord equalling the other two primary cords. The numerous bowed riblets extend from suture to suture and small beads are formed where they are intersected by the cords. A variable number of rounded varices may be scattered along the spire. The sculpture may be strong or faint but the distinguishing features are the three primary cords, the rounded whorls and the typical *Alabina* sub-circular aperture with a mere suggestion of an anterior canal.

ALABINA (CALOOSALBA) TURBATRIX

S. E. Hoerle, n. sp.

Plate 2, figs. 8, 9

Diagnosis: Shell small and tapered with a nucleus of 2½ whorls plus eight to ten teleoconch whorls. Ten to fourteen straight axial riblets, evenly distributed on each turn; feeble on the posterior half of the whorl, stronger anteriorly, extending from suture to suture. The posterior half of each whorl flat to concave, ornamented by three to five microscopic threads; one strong cord midway on whorl forming the periphery, paralleled anteriorly by another of equal strength. In the interspace one or two spiral threads and a slightly heavier thread between the anterior spiral cord and sutural cord. Sharp tubercles formed by the intersection of axial riblets and primary spiral cords. Suture appressed and distinct. Axial riblets tending to fade on the body whorl, as do the coarse spiral threads. The last whorl rounded in profile and terminated basally by the sutural cord, paralleled by a subsutural cord. Aperture subcircular, outer lip thin and extending forward, forming a mere suggestion of an anterior canal. A few heavy varices on last two whorls only.

Dimensions of holotype: height 5.5 mm, diameter 1.9 mm.

Holotype: USNM 646956.

Paratype: USNM 646957; height 4.9 mm, diameter 1.8 mm.

Type locality: TU 546, Ten Mile Creek, about 1½ miles west of Chipola River (NW ¼ Sec. 12, T1N, R10W), Calhoun County, Florida (?=USGS 2212, "one mile west of Bailey's Ferry").

Occurrence: Chipola Formation, Florida; late lower Miocene.

Figured specimens: Fig. 8, USNM 646956 (holotype). Fig. 9, USNM 646957 (paratype); locality same as holotype. Other occurrences: TU locality nos. 70, 196, 458, 459, 547, 554, 555, 655, 787, 821, 825, 830, 951, 998, 1020, 1021.

Discussion: *A. turbatrix* is found with its congener *A. boioplex* but not in the same profusion, having a ratio of about 1:4. The new species is a more tapered shell than *A. boioplex* and has fewer whorls in adult specimens. The axial riblets are not arcuate as on *A. boioplex* and are feeble on the posterior half of the whorls. The heavier varices, one or several, are confined to the last two whorls only. The profile of the whorls is biangular instead of rounded. The two species of *Alabina* are closely related but the stable features of each are distinctive enough to warrant the recognition of this new species.

Family POTAMIDIDAE

H. and A. Adams, 1854

Genus POTAMIDES Brongniart, 1810

Potamides BRONGNIART, 1810, Ann. Mus. Hist. Nat. (Paris), v. 15, pp. 367-368. Type species: *Potamides lamarckii* Brongniart, by monotypy.

POTAMIDES SUPRASULCATUS (Gabb)

Plate 1, figs. 7, 8

Cerithium suprasulcatus GABB, 1873, Amer. Philos. Soc., Trans., (N. S.), v. 15, p. 237.

Potamides ormei MAURY, 1917, Bulls. Amer. Paleontology, v. 5, no. 29, p. 126, pl. 22, fig. 8.

Potamides suprasulcatus (Gabb). PILSBRY, 1922, Acad. Nat. Sci. Phila., Proc., v. 73, p. 373, pl. 29, figs. 10, 11 (holotype).

Potamides ormei var. *infraliteratus* SPEIKER, 1922, Johns Hopkins Univ., Studies in Geology, no. 3, p. 58, pl. 2, fig. 11.

Potamides infraliteratus Speiker. OLSSON, 1932, Bulls. Amer. Paleontology, v. 19, no. 68, p. 193, pl. 23, figs. 5, 12.

Potamides suprasulcatus (Gabb). WOODRING, 1959, U. S. Geol. Surv. Prof. Paper 306-B, p. 176, pl. 28, figs. 3-6.

Potamides suprasulcatus (Gabb). JUNG, 1965, Bulls. Amer. Paleontology, v. 49, no. 223, p. 490, pl. 64, figs. 11, 12.

Diagnosis: "Shell broad, spire moderately elevated, whorls numerous, increasing rapidly in width flat on the sides; suture channeled. Surface plain or marked by a few lines in advance and by a deep revolving groove a short distance below the suture. Aperture subquadrate, canal very small, no folds; outer lip strongly produced on the base, adjoining the canal. Length about 1.5 in., width .7 in." (Gabb, 1873)

Shell stout, whorls flat-sided, rapidly enlarging. Early whorls (nucleus lost) with a narrow subsutural spiral band paralleled by a broader band, and cut by numerous straight to slightly arcuate axial riblets extending from suture to suture. Both axial and spiral sculpture changing in appearance with the growth of the shell. Posterior band becoming heavier and noded by the axials; adjacent groove widening and deepening; anterior spiral band dividing medially by a narrow undulating groove; axial riblets becoming close-set strong nodes, aligning with those on the posterior spiral band in a somewhat arcuate pattern; both of the afore-mentioned grooves and the groove posterior to the narrow sutural cord overrun by tertiary threads. On later whorls, in profile, the noded subsutural band extending a little beyond the anterior spirals; the base marked by revolving cords, the cords becoming less undulatory as the axial riblets fade; the tertiary threads disappearing and only incrementals present between the basal cords. Inner and outer lips much thickened; inside of outer lip with a series of grooves corresponding in number and position to the heavy spiral cords. Aperture obliquely elliptical, the slightly ascending labrum forming a small posterior sinus. Heavily callused labium detached from the shell anteriorly. Siphonal canal short and oblique.

Dimensions of holotype: height 29.5 mm, diameter 17.3 mm (Pilsbry, 1922, p. 374).

Holotype: ANSP 2600.

Type locality: Dominican Republic, exact locality unknown.

Occurrence: ? Tabara Formation, Dominican Republic; Oligocene. Chipola Formation, Florida; late lower Miocene. Zorritos Formation, Peru; Daule Formation, Columbia; Progreso Formation, Ecuador; unnamed formation, Venezuela; Culebra Formation, Panamá; Brasso Formation, Trinidad; Miocene.

Figured specimens: Fig. 7, USNM 646944; height (incomplete) 30.4 mm, diameter 15.4 mm, TU locality 459. Fig. 8, USNM 646945; height (incomplete) 11.0 mm, diameter 5.1 mm, TU locality 459. Other occurrences: TU locality nos. 70, 196, 548, 555, 950.

Discussion: *P. suprasulcatus* has a meager representation from the higher beds of Ten Mile Creek and is completely absent in the lower beds. The greatest number of specimens were taken from TU 459, a Chipola River locality. Living members of the genus *Pota-*

PLATE 2

Figures	Page
1. <i>Hemicerithium akriton</i> S. E. Hoerle, n. sp. (X 2)	6
USNM 646950 (holotype); height 18.4 mm, diameter 12.3 mm.	
Locality: TU 820b. Chipola Fm., lower Miocene.	
2. <i>Hemicerithium adela</i> (Dall) (X 4)	7
USNM 165104 (holotype); height 9.2 mm, diameter 4.6 mm.	
Locality: Ballast Point, Tampa Bay, Florida. Tampa Limestone, lower Miocene.	
3. <i>Hemicerithium cosmmani</i> (Dall) (X 3)	6
USNM 646951; height 14.4 mm, diameter 6.4 mm.	
Locality: TU 825. Chipola Fm., lower Miocene.	
4. <i>Hemicerithium craticulum</i> S. E. Hoerle, n. sp. (X 5)	7
USNM 646952 (holotype); height 10.8 mm, diameter 3.7 mm.	
Locality: TU 998. Chipola Fm., lower Miocene.	
5. <i>Hemicerithium pagodum</i> S. E. Hoerle, n. sp. (X 8)	7
USNM 646953 (holotype); height 8.5 mm, diameter 3.2 mm.	
Locality: TU 825. Chipola Fm., lower Miocene.	
6, 7. <i>Tenuicerithium chipolanum</i> (Dall)	10
6. (X 4) USNM 646954; height 14.4 mm, diameter 5.0 mm.	
Locality: TU 825. Chipola Fm., lower Miocene.	
7. (X 4) USNM 646955; height 13.6 mm, diameter 4.4 mm.	
Locality: TU 825. Chipola Fm., lower Miocene.	
8, 9. <i>Alabina (Caloosalba) turbatrix</i> S. E. Hoerle, n. sp.	16
8. (X 8) USNM 646956 (holotype); height 5.5 mm, diameter 1.9 mm.	
Locality: TU 546. Chipola Fm., lower Miocene.	
9. (X 8) USNM 646957 (paratype); height 4.9 mm, diameter 1.8 mm.	
Locality: TU 546. Chipola Fm., lower Miocene.	
10. <i>Tenuicerithium absonum</i> S. E. Hoerle, n. sp. (X 4)	11
USNM 646958 (holotype); height 13.2 mm, diameter 4.8 mm.	
Locality: TU 555. Chipola Fm., lower Miocene.	
11. <i>Tenuicerithium ascensum</i> S. E. Hoerle, n. sp. (X 5)	11
USNM 646959 (holotype); height 9.7 mm, diameter 3.9 mm.	
Locality: TU 459. Chipola Fm., lower Miocene.	

(continued next page)

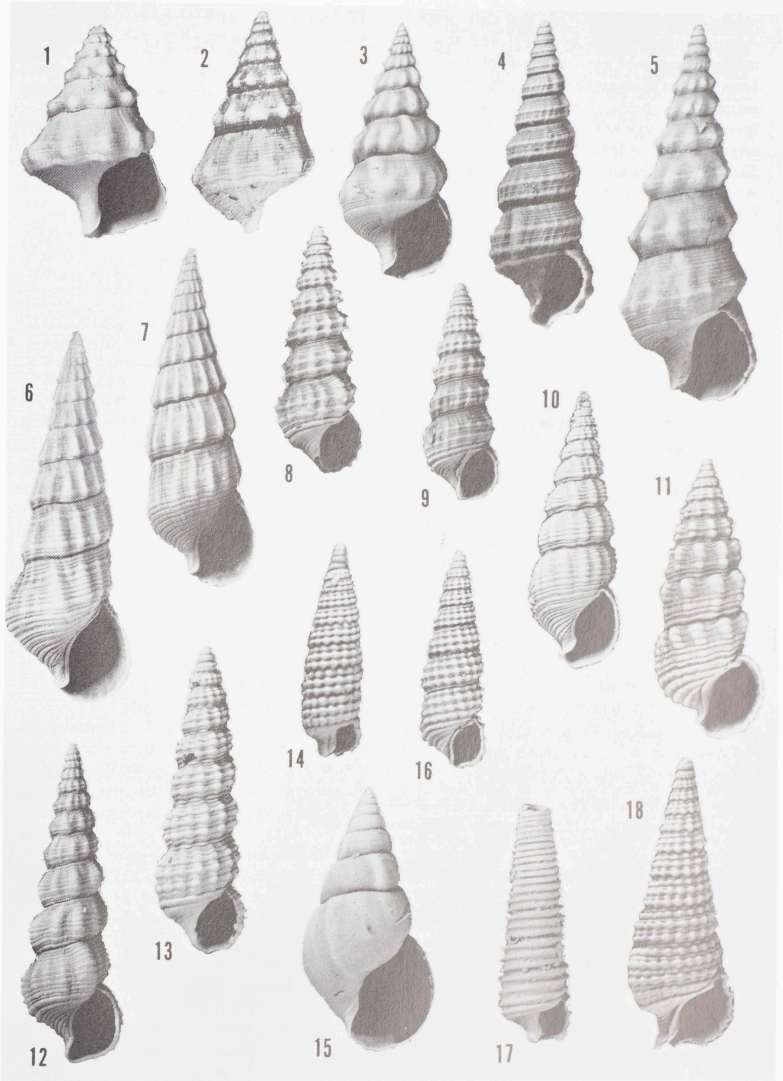


PLATE 2

mides are habitants of brackish water. Accompanying fauna from TU 459 show a marked degree of corrosion, which tends to bear out the premise that this locality was an estuary. *P. suprasulcatus* is a widespread species, although not necessarily abundant at any one locality. It has been found in Panamá, Santo Domingo and parts of northern South America. The occurrence of this species in the Chipola Formation is its first recorded appearance in Florida. Jung (1965, p. 490) gave ANSP 1314 as the number of the holotype. This is in error, as the number he cited belongs with the type of *P. roumaini* Pilsbry.

Genus TEREBRALIA Swainson, 1840

Terebralia SWAINSON, 1840, Treat. Malac., p. 315.
Type species: *Strombus palustris* Linné, by subsequent designation, Sacco, 1895.

TEREBRALIA DENTILABRIS (Gabb)

Plate 1, Figs. 9-11

Cerithium dentilabre GABB, 1873, Amer. Philos. Soc., Trans. (N. S.), v. 15, p. 237.

Pyrazisinus harrisi MAURY, 1902, Bulls. Amer. Paleontology, v. 3, no. 15, p. 376, pl. 28, figs. 2, 2a.

Potamides dentilabrum Gabb. MAURY, 1917, Bulls. Amer. Paleontology, v. 5, no. 29, pt. 1, p. 126.

Potamides dentilabris (Gabb). PILSBRY, 1922, Acad. Nat. Sci. Phila., Proc., v. 73, p. 374, pl. 29, figs. 6, 7.

Terebralia dentilabris (Gabb)? WOODRING, 1959, Geol. Surv. Prof. Paper 306-B, p. 178.

Diagnosis: "Shell large, heavy, spire elevated, suture distinct, whorls flattened on the sides, bearing a few very faint varices. Surface marked by not very strong longitudinal ribs or undulations; these are crossed by four or five strong revolving ribs, flat on top and with concave interspaces, giving the surface

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- | | | |
|-----|---|----|
| 12. | <i>Tenuicerithium permutabile</i> (Dall) (X 4) | 10 |
| | USNM 646960; height 12.6 mm, diameter 3.8 mm. | |
| | Locality: TU 546. Chipola Fm., lower Miocene. | |
| 13. | <i>Alabina (Caloosalba) boiPLEX</i> (Dall) (X 8) | 16 |
| | USNM 646961; height 6.8 mm, diameter 2.0 mm. | |
| | Locality: TU 546. Chipola Fm., lower Miocene. | |
| 14. | <i>Cerithiopsis inopinus</i> S. E. Hoerle, n. sp. (X 10) | 13 |
| | USNM 646962 (holotype); height 4.0 mm, diameter 1.3 mm. | |
| | Locality: TU 555. Chipola Fm., lower Miocene. | |
| 15. | <i>Alaba chipolana</i> Dall (X 8) | 15 |
| | USNM 646963; height 5.7 mm, diameter 2.8 mm. | |
| | Locality: TU 555. Chipola Fm., lower Miocene. | |
| 16. | <i>Bittium serenum</i> S. E. Hoerle, n. sp. (X 8) | 14 |
| | USNM 646964 (holotype); height 4.9 mm, diameter 1.5 mm. | |
| | Locality: TU 546. Chipola Fm., lower Miocene. | |
| 17. | <i>Seila adamsii</i> (H. C. Lea) (X 8) | 14 |
| | USNM 113318 (lectotype- <i>Seila adamsii</i> var. <i>attenuata</i> Dall); height 5.0 mm, diameter 1.6 mm. | |
| | Locality: USGS 2213. Chipola Fm., lower Miocene. | |
| 18. | <i>Rhinoclavis ogilvies</i> (Maury) (X 4) | 13 |
| | USNM 646973; height 12.6 mm, diameter 5.0 mm. | |
| | Locality: TU 91. Oak Grove Sand, lower Miocene. | |

a coarse but pretty regular cancellate appearance. Aperture sub-quadrate, with two strong folds on the columella, one in the middle, the other behind; outer lip with one large tubercular tooth in the middle and one in advance. These folds and teeth are absent in the young shell." (Gabb, 1873)

Dimensions of holotype: height 49.5 mm, diameter 21.0 mm (Pilsbry, 1922, p. 374).

Holotype: ANSP 2502.

Type locality: Dominican Republic, exact locality unknown.

Occurrence: Culebra Formation, Panamá; early Miocene. Chipola Formation, Florida; late lower Miocene. Unknown formation, Dominican Republic; Miocene.

Figured specimens: Fig. 9, USNM 646946; height 16.7 mm, diameter 7.6 mm. Fig. 10, USNM 646947; height 49.0 mm, diameter 21.6 mm. Fig. 11, USNM 646948; height 53.7 mm, diameter 23.5 mm; locality TU 459. Other occurrences: TU locality nos. 458, 547, 548, 555.

Discussion: The nucleus is lost on all specimens of *T. dentilabris* examined by the writer. The early post-nuclear whorls have axial ornamentation only. With the growth of the shell four equal-width broad, band-like spiral cords, separated by channeled grooves, gradually appear on the whorls, the posterior band the first to be marked off. One small, smooth, spiral cord lies posteriorly to the deeply indented suture. The basal portion of the flaring outer lip is produced to the left and meets the columella to form an enclosed circular anterior canal. Specimens with perfect apertures can easily be mistaken for *Pyraxisinus* as was demonstrated by Maury (1902, p. 376). The strong plaits on the columella and the internal nodes at each heavy varix are not visible if the aperture is complete. Many specimens are broken back to the last varix, which is usually opposite the outer lip, and only then can the armature be seen.

The majority of specimens examined show a degree of erosion on the early whorls. The genus *Terebralia* of the Recent lives in estuaries and lagoons where the water is brackish. The matrix at locality TU 459 from where the greatest number of specimens were collected, is mainly comprised of a gravelly material and nearly all of the associated fauna have a tumbled beachworn appearance. This suggests a shoreline or the mouth of a river. The geographic range for this species along the Chipola River is less than one mile and no

specimens are known from localities other than this limited area. There are no Recent species of *Terebralia* from the western Atlantic or Caribbean waters. The fossil specimens from the Chipola Formation are the first representatives of this genus in the south-eastern United States.

V. LOCALITY DATA

The following are Tulane University fossil localities. Except as noted all are in the Chipola Formation, Calhoun County, Florida.

70. Ten Mile Creek, at bridge of Florida Highway 73 (NW ¼ Sec. 12, T1N, R10W).
91. Oak Grove Sand, (type locality), west bank of Yellow River, about 100 yards below bridge at Oak Grove, (NE ¼ Sec. 20, T5N, R23W), Okaloosa Co., Florida.
196. Ten Mile Creek, about ¼ mile upstream from bridge of Florida Highway 73 (NE ¼ Sec. 11, T1N, R10W).
453. Alum Bluff (lower beds), Apalachicola River (NE ¼ Sec. 24, T1N, R8W), Liberty Co., Florida.
456. Ten Mile Creek, about ¼ mile downstream from bridge of Florida Highway 73 (NW ¼ Sec. 12, T1N, R10W).
457. West bank of Chipola River, about ½ mile below Ten Mile Creek (SW ¼ Sec. 17, T1N, R9W).
458. East bank of Chipola River, above Farley Creek (SW ¼ Sec. 20, T1N, R9W).
459. East bank of Chipola River, steep bank about 1500 feet above the mouth of Taylor Lake Branch (NW ¼ Sec. 29, T1N, R9W).
546. Ten Mile Creek, about 1½ miles west of Chipola River (NW ¼ Sec. 12, T1N, R10W).
547. West bank of Chipola River, about 2000 ft. above Four Mile Creek (SW ¼ Sec. 29, T1N, R9W).
548. West bank of Chipola River (NW ¼ Sec. 29, T1N, R9W).
549. East bank of Chipola River, about ¼ mile below Four Mile Creek (NE ¼ Sec. 32, T1N, R9W).
554. East bank of Chipola River at power line crossing (SW ¼ Sec. 17, T1N, R9W).
555. East bank of Chipola River, about 1000 ft. above Four Mile Creek (SW ¼ Sec. 29, T1N, R9W).
655. Ten Mile Creek, about 0.1 mile downstream from bridge of Florida Highway 73 (NW ¼ Sec. 12, T1N, R10W).
711. West bank of Chipola River, about ¼ mile up from mouth of Farley Creek (SW ¼ Sec. 20, T1N, R9W).

787. Ten Mile Creek, south bank about 1½ miles west of Chipola River (SE ¼ Sec. 12, T1N, R10W).
806. West bank of Chipola River, about one mile below power line crossing (NW ¼ Sec. 20, T1N, R10W).
817. South side of Ten Mile Creek, large gully on the property of Mr. A. Sexton (1967) (SE ¼ Sec. 12, T1N, R10W).
818. Farley Creek, 0.1 mile west of bridge of Florida Highway 275 (SW ¼ Sec. 21, T1N, R9W).
- 820b. Farley Creek (lower beds), at bridge of Florida Highway 275 (SW ¼ Sec. 21, T1N, R9W).
821. Farley Creek, 0.1 mile east of bridge of Florida Highway 275 (SW ¼ Sec. 21, T1N, R9W).
823. Farley Creek, south bank about 2000 ft. east of bridge on Florida Highway 275 (SE ¼ Sec. 21, T1N, R9W).
825. Farley Creek at abandoned mill about ¼ mile west of bridge of Florida Highway 275 (SW ¼ Sec. 21, T1N, R9W).
826. Farley Creek, about 0.1 mile west of abandoned mill which is ¼ mile west of bridge of Florida Highway 275 (on section line between Sec. 20 & 21, T1N, R9W).
827. Farley Creek, about ½ mile west of bridge of Florida Highway 275 (SE ¼ Sec. 20, T1N, R9W).
828. Farley Creek, just upstream from mouth of unnamed tributary about ¾ mile downstream from bridge of Florida Highway 275 (SE ¼ Sec. 20, T1N, R9W).
830. Ten Mile Creek, at power line crossing about one mile west of Chipola River (SE ¼ Sec. 12, T1N, R10W).
950. Chipola River, west bank about 2000 ft. above Farley Creek (SW ¼ Sec. 20, T1N, R9W).
951. Ten Mile Creek, about 1¼ miles west of Chipola River (SE ¼ Sec. 12, T1N, R10W).
998. Ten Mile Creek, about 1¼ miles west of Chipola River (SE ¼ Sec. 12, T1N, R10W).
999. Farley Creek, about 1000 yds. downstream from bridge of Florida Highway 275 (SW ¼ Sec. 21, T1N, R9W).
1019. East bank Chipola River, about 2000 ft. downstream from power line crossing (NW ¼ Sec. 20, T1N, R9W).
1020. Small tributary (not shown on USGS topographic map) on east bank of Chipola River about ½ mile below power line crossing (NE ¼ Sec. 20, T1N, R9W).
1021. Ten Mile Creek, north bank, about 2200 ft. east of bridge on Florida Highway 73 (NW ¼ Sec. 12, T1N, R10W).
1048. Farley Creek, south bank, about 0.8 mile east of bridge on Florida Highway 275 (NE ¼ Sec. 21, T1N, R9W).
1049. Farley Creek, south bank, about 1.0 mile east of bridge on Florida Highway 275 (NE ¼ Sec. 21, T1N, R9W).
1050. West bank of Chipola River at power line crossing (SW ¼ Sec. 17, T1N, R9W).

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