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CENOZOIC MURICIDAE OF THE WESTERN ATLANTIC REGION
PART IV—*HEXAPLEX* AND *MUREXIELLA*

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CONTENTS

ILLUSTRATIONS

I. Abstract

This report covers two closely related genera of Muricinae, *Hexaplex* and *Murexiella,* including the subgenera *Hexaplex* (*Murexsul*) and *Murexiella* (*Subpterynotus*), in the Cenozoic of the western Atlantic region. A total of 28 species are treated systematically; of these twelve are referred to *Hexaplex* s.s., one to *Hexaplex* (*Murexsul*), fourteen to *Murexiella* s.s. and one to *Murexiella* (*Subpterynotus*). Of this number, only two species of *Hexaplex* s.s. and four of *Murexiella* s.s., or six species in all, occur in the Recent of the western Atlantic region and of these only three species are confined to Recent waters, the other three having fossil representatives also.

The genera *Hexaplex* s.s. and *Murexiella* s.s. are well represented in the Eocene of both the New World and the Old World; but the respective subgenera do not appear until the Miocene. *Subpterynotus* is evidently extinct in the western Atlantic, but there is one Recent species, probably Indo-Pacific in distribution, referable to the subgenus.

Seven new species are described herein: *Hexaplex* (*Hexaplex*) *texanus* from the Weches Formation of Texas, and *H.* (*H.*) *katherinae* from the Moodys Branch Marl of Mississippi and Louisiana, both Eocene in age; *H.* (*H.*) *etheringtoni,* from the Tuberá Group of Bolívar, Colombia, *H.* (*Murexsul*) *thalmanni* and *Murexiella* (*Murexiella*) *veracruzana,* both from the Agueguexquite Formation of Vera Cruz, Mexico, and *M.* (*M.*) *calhounensis,* from the Chipola Formation of Florida, all Miocene in age; and

M. (M.) petiti from the Pliocene Waccamaw Formation of South Carolina.

II. Introduction

HEXAPLEX: The species referred to the genus *Hexaplex* Perry, 1810, are those which bear five or more spinose to foliaceous varices. They have a short, recurved canal and on the whole, except for the number of varices, are much like the members of *Chicoreus*. The *Chicoreus* group, in all probability, is descended from an Eocene *Hexaplex* ancestor with or without the development of a phyllonotid intermediary species (see Vokes, 1967b).

The Eocene shells that are included here might, at first glance, seem to be little like the typical *Hexaplex,* but there is a strong resemblance between these Eocene species and the Recent *H. trunculus* (Linn.). The latter has been made the type of several nominal subgenera but the writer does not feel that the differences between *H. trunculus* and *H. cichoreum* (Gmelin), the type of *Hexaplex,* justify separation. The worker who disagrees may prefer to use the subgenus *Trunculariopsis* for the Eocene species herein treated.* There is a continuous evolutionary sequence in the European region between those Eocene species and the Recent ones, but in the New World there is a noticeable hiatus between the upper Eocene and upper Miocene species. There is one intermediate form, *H. veatchi* (Maury) from the lower Miocene of Florida, but it is an unusual shell and does not seem to be in the main evolutionary line.

The Eocene forms such as *H. vanuxemi* have been referred by some authors to the genus *Poirieria* Jousseaume, 1880, a group which also goes back to the Eocene, but the shells of that group are distinguished by having an almost smooth surface texture with no more than faint spiral ornamentation. Furthermore, the early development of the shell is different in the two groups. *Poirieria* is most nearly akin to the *Pterynotus* lineage. In the *Hexaplex* group the embryonic shell consists of four or five smooth (papillose in Recent specimens), conical whorls, whereas in *Poirieria* and *Pterynotus* the embryonic shell has only two bulbous whorls. The early post-nuclear whorls in *Pterynotus* and *Poirieria* have about six small varices which subsequently may be reduced to only three, as in *Pterynotus,* with the alternate ones becoming intervarical nodes. In *Poirieria* the original varices simply persist and there are no intervarical nodes. In the Eocene species of *Hexaplex* the post-nuclear development is like that of the *Poirieria* group in having small varices on the first post-nuclear whorl but these are from nine to twelve in number. In the later species of *Hexaplex* and in the *Chicoreus* group the early post-nuclear whorls are ornamented by a dozen small equal axial nodes. On subsequent whorls these are variously reduced to three, six, or some other number of varices, with the remainder becoming intervarical nodes.

The Recent species of *Hexaplex* which occur in great profusion along the western coast of tropical America have been referred to the genus "*Muricanthus.*" As the writer pointed out in a previous work (Vokes, 1964, p. 11), the correct type species for that genus is "*Murex saxatilis*" of authors, more properly known as "*Purpura*" *duplex* Röding, unequivocally congeneric with the type of *Hexaplex* s.s. Due to subsequent misinterpretation *Murex radix* Gmelin has generally been considered to be the type species of *Muricanthus* and thus the West Coast species have received this name. The writer feels that these West Coast members are not to be distinguished from *Hexaplex* s.s. and for this reason sees no need to establish *H. radix* as the type of a distinct supraspecific taxon. This opinion is not shared by certain West Coast workers, notably Keen, who has requested that the International Commission on Zoological Nomenclature suspend the Rules and declare *Murex radix* as the type species of *Muricanthus* Swainson (see Keen, 1964a, p. 237). As of this writing, the decision has not been published by the Commission but they have voted to approve her request.

The origin of the Neogene species of

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* Due to Baily's ill-advised action of 1960 in naming *Polyplex purpurescens* (= *H. trunculus*) as the type species of *Polyplex* Perry, 1810, there is technically an older name than *Truncullariopsis*. The writer has discussed this problem (Vokes, 1964, p. 12) and since that time Keen has appealed to the International Commission on Zoological Nomenclature to set aside Baily's designation as "inapplicable" (Keen, 1964b, p. 423). It is sincerely hoped that the Commission will so rule but at this writing no decision has been reached.

Hexaplex in the New World is something of a mystery. In the western Atlantic *H. fulvescens* appears in the late Miocene without any predecessor. Possibly contemporaneous with its appearance was the appearance on the coast of Ecuador of a species which Olsson (1964, pl. 29, fig. 5) figured as "*Muricanthus ambiguus* (Reeve)" from the late Neogene (*i.e.,* upper Miocene or Pliocene) Esmeraldas Formation. *H. ambiguus* is closely related to *H. fulvescens,* the primary difference being one of color pattern in the Recent specimens. *H. fulvescens* is an overall cream or light brown in color with fine dark brown spiral threads. *H. ambiguus* is marked by wide black spiral bands which are carried onto the varical spines making these spines completely black in color. In the fossil state this color difference is lacking and morphologically the two forms are close. *H. fulvescens* has a more elongated siphonal canal and spire and the shell is lighter and more delicately spined. Olsson's specimen is intermediate between *H. fulvescens* and *H. ambiguus* in general morphology and probably represents an intermediate stage of development. The spire is not as high as in *H. fulvescens* but it is not as low as that of *H. ambiguus* nor are the intermediate smaller spines, which give *H. ambiguus* its especially "prickly" aspect, so well developed. Presumably, it is a new species.

In the beds of the Tuberá Group of Punta Púa, Bolívar, Colombia, (probably also late Miocene in age) there is a third species herein described as *H. etheringtoni.* The type specimen shows traces of color pattern with three broad brown spiral bands much like the Recent west African *H. rosarium* (Röding). The Colombian shell is more like that species than any of the New World forms. As it is highly unlikely that the members of the genus migrated across the Pacific Ocean, in all probability the west African coast was the point of origin for the western Atlantic and eastern Pacific species. There are several species in the Miocene of the western European area that could have served as ancestor. The group probably came across in the tropical zone and spread northward into Florida and westward into the Pacific from the vicinity of northern South America.

The Recent species of *Hexaplex* are shallow water dwellers. The American West Coast species are commonly intertidal or a few fathoms in depth (Dushane and Poorman, 1967, p. 428-429). *H. fulvescens,* the common western Atlantic form, is found in depths up to 25 fathoms (Springer and Bullis, 1956, p. 28; Bullis and Thompson, 1965, p. 15) but the average depth is about 15 fathoms. On the west coast of Africa there are several forms of this genus which have received a number of scientific names but probably all are local variants of *H. rosarium* (Röding) or *H. duplex* (Röding). All of these are intertidal or inhabitants of very shallow water. The type of the genus, *H. cichoreum* (Gmelin) (= "*Murex*" *endivia* Lamarck), from the Indo-Pacific region, occurs on tidal flats in the Philippine Islands; *H. trunculus* (Linn.), the Mediterranean representative of the genus, is also a shallow water form.

MUREXSUL: The subgenus *Murexsul* Iredale, 1915, was proposed for an Australian species, but the western Atlantic *H.* (*Murexsul*) *thalmanni* E. H. Vokes, n. sp., is referable to this group. *Murexsul* is characterized by having strong spiral ornamentation and numerous varices that bear short frondose spines. The spine at the shoulder is only slightly larger than the other spines. The group is separated from *Hexaplex* s.s. by the much stronger spiral ornamentation, by the more elevated spire, and by the laminated nature of the varices. Each varix is composed of a series of overlapping laminae with the outer layer producing the largest spines. It also may be distinguished by the more "advanced" two-whorl type of nucleus (see Vokes, 1967b, p. 135) although the early post-nuclear development is of the *Hexaplex* type. *Murexsul* differs from the somewhat similar *Poirieria* (*Panamurex*) Woodring, 1959, in lacking any trace of labial denticulation on either inner or outer lip, whereas *Panamurex* has both.

Ponder (1968, p. 31) has recently suggested that *Murexsul* would be better included in the Tritonaliinae. His reasons for this assignment include the statement that Hutton's original figure of the radula "is misleading as it does not show the central tooth lying flat." However, Ponder's new il-

lustration of the radula (*ibid.,* pl. 1, fig. 1) is very little different from Hutton's drawing, the only significant change being that the central cusp is somewhat larger than the two outer pairs of cusps rather than, as Hutton had indicated, nearly equal in size to the lateral cusps. In this writer's opinion the radula of *M. octogonus* is still of the muricine type and not the tritonalian type. Ponder further added that the operculum of *M. octogonus* "tends to have a terminal nucleus in juveniles but this becomes sublateral in adults." There is a certain similarity between the outer surface of the operculum of *M. octogonus* and that of a *Tritonalia* but examination of the muscle attachment area of the two opercula shows them to be entirely different in construction. The inner side of the operculum of *M. octogonus* closely resembles that of *Chicoreus dilectus* (Adams), another muricine species which has an atypical operculum with a sublateral nucleus. Ponder's evidence also included the observation that "*Murexsul* possesses free accessory salivary glands which are characteristic of the Tritonaliinae and Thaisidae whereas in the Muricinae and Trophoninae they are bound to the true salivary gland" (*ibid.,* p. 31). In view of the more obvious affiliations of the shell, radula, and operculum with the Muricinae, it seems reasonable to this writer to continue to include *Murexsul* in its customary position.

MUREXIELLA: Although the species of *Murexiella* Clench and Pérez Farfante, 1945, superficially resemble those of *Hexaplex,* the group differs by the regularly oval aperture, lacking any trace of an anal notch, as well as by the presence of a complex webbing between the varical spines. The number of varices is particularly variable in all of the species of *Murexiella* and may be as few as four in certain species including *M. hidalgoi* (Crosse) the type, or as many as ten in some specimens of *M. macgintyi* (Smith).

In the New World, *Murexiella* is first found in the middle Eocene beds of Alabama with the species *M. mantelli* (Conrad). This species gave rise to a line that has continued through time almost without change. The group has never been large, there being only four Recent species in the western Atlantic, but *Murexiella* is not confined to the western Atlantic. There are several species on the west coast of tropical America, including *M. humilis* (Broderip) (see text fig. 1 for radula), *M. perita* (Broderip), and *M. diomedaea* (Dall). This latter species is quite closely related to *M. hidalgoi*, the type of the genus. The group has Indo-

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PLATE 1

Figures Page

1. *Hexaplex* (*Hexaplex*) *texanus* E. H. Vokes, n. sp. (× 4) 94
   PRI 3000 (holotype); height 13 mm, diameter 7 mm.
   Locality: Smithville, Texas. Weches Fm., middle Eocene.
2. *Hexaplex* (*Hexaplex*) *silvaticus* (Palmer) (× 4) 96
   USNM 645607; height 10.3 mm, diameter 6 mm.
   Locality: TU 924. Wautubbee Fm., middle Eocene.
3. *Hexaplex* (*Hexaplex*) *vanuxemi* (Conrad) (× 2) 94
   USNM 645606; height 23 mm, diameter 15 mm.
   Locality: TU 306. Gosport Sand, middle Eocene.
4. *Hexaplex* (*Hexaplex*) *katherinae* E. H. Vokes, n. sp. (× 2) 100
   PRI 4648 (holotype); height 21 mm, diameter 14.3 mm.
   Locality: Town Creek, Jackson, Mississippi. Moodys Branch Marl, upper Eocene.
5. "*Murex*" *angulatus* Meyer (× 5) 96
   USNM 638830 (holotype); height 9 mm, diameter 5.5 mm.
   Locality: Jackson, Mississippi. Moodys Branch Marl, upper Eocene.

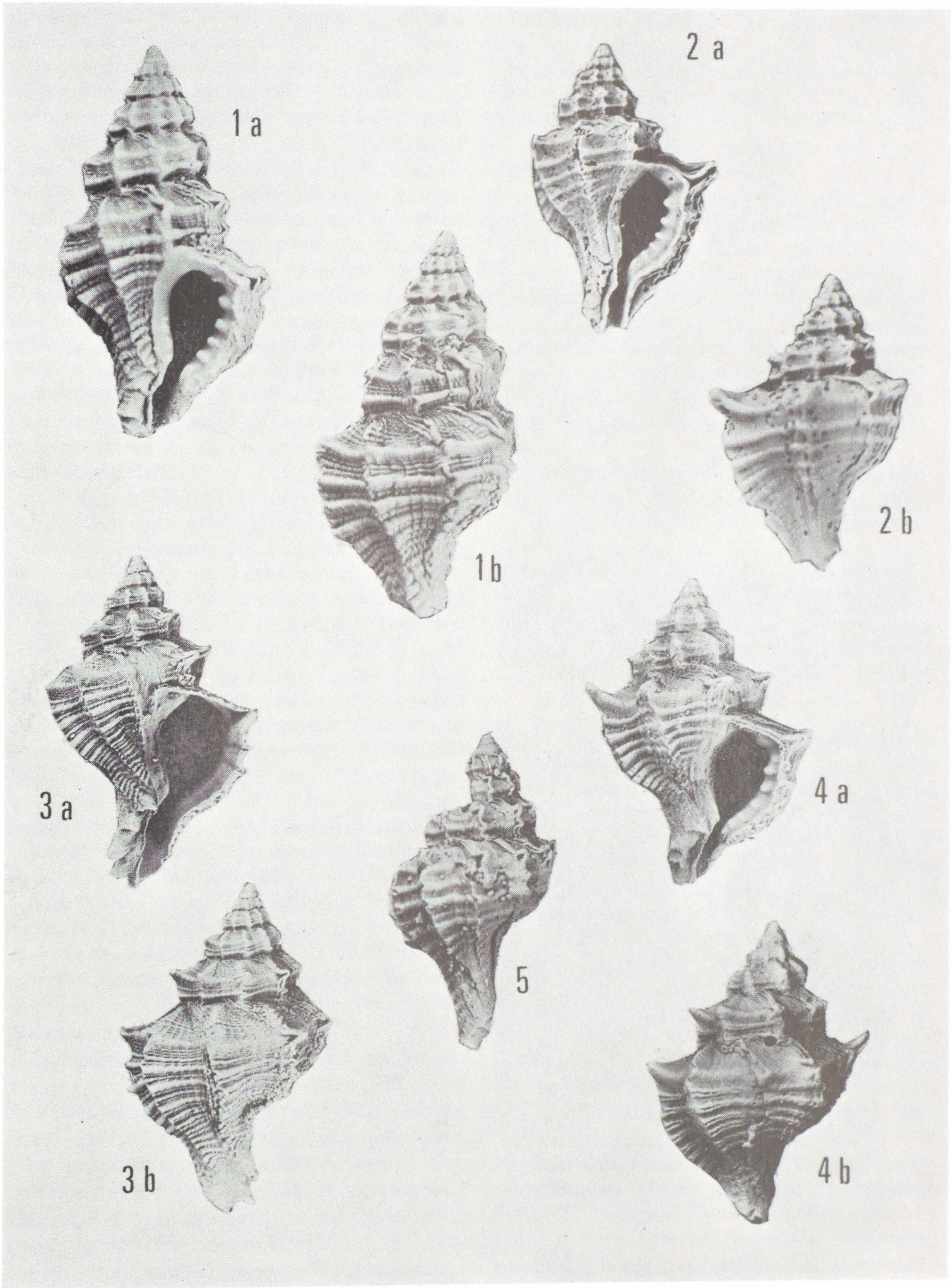
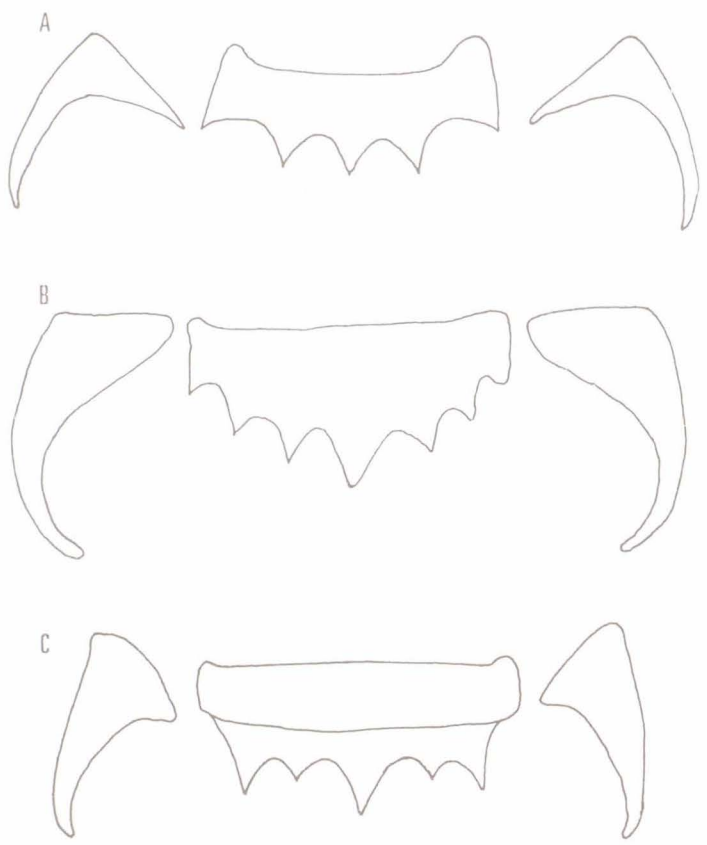


PLATE 1



Text figure 1. A) Radula of *Homalocantha zamboi* (Burch), Philippine Islands. B) Radula of *Murexiella hidalgoi* (Crosse), Barbados, B.W.I. C) Radula of *Murexiella humilis* (Broderip), Guaymas, Mexico. A and C approximately × 300, B approximately × 600.

Pacific representatives in *M. balteata* (Sowerby) from the Philippine Islands and *M. cirrosa* (Hinds) from the Indian Ocean, (the species figured by Habe, 1964, pl. 25, fig. 9 as *Murexul* [*sic*] *cirrosa* is not that species but probably is a *Murexiella*). There are also eastern Atlantic species such as *M. bojadorensis* (Locard) from west Africa.

M. hidalgoi, the type of *Murexiella* (see text fig. 1 for radula), is a relatively deep water species. Depth records range from 76 to 196 fathoms (Clench and Pérez Farfante, 1945, p. 51) and it seems to live in association with coral. The other western Atlantic species are also reef dwellers but live in depths less than 100 fathoms. The West Coast species in general are shallow water forms, but *M. diomedaea,* like *M. hidalgoi* which it so closely resembles, is a deeper water species, described from 85 fathoms.

In the middle Eocene of the Paris Basin there are several nominal species including "*Murex*" *frondosus* Lamarck, "*Murex*" *distans* Deshayes, and "*Murex*" *steuri* Cossmann, that are here referred to the genus *Murexiella.* This group was clearly a problem to Cossmann who first (1889) placed these species in the subgenus "*Muricidea* Swainson" (*i.e., Muricopsis,* see Vokes, 1964, p. 18) then (1903) changed to *Muricantha,* section *Favartia.* Subsequently (*in* Cossmann and Pissaro, 1911) he placed *M. frondosus* in *Murex* (*Poirieria*), and *M. distans* and *M. steuri* in *Murex* (*Favartia*). In this latter group Cossmann (1903) included "*Murex*" *absonus* Cristofori and Jan and "*Murex*" *mantelli* Conrad, both also here referred to *Murexiella.* The principal difference among the three French Eocene species mentioned above is in the number of varices per whorl. In view of the variability observed in the American species of *Murexiella* it is probable that these European forms are conspecific.

Woolacott (1957, p. 115) named the genus *Minnimurex* for "very small lamellose *Murex* with six to eight strong thick spiral ribs on the body and two (occasionally three) such ribs on the remaining varices; four to eight frilled varices . . . " The writer has not seen a specimen of *Minnimurex phantom,* the type species, but the illustration looks extraordinarily like *M. glypta* (Smith) from the Pleistocene and Recent of the Gulf of Mexico. Inasmuch as *Murexiella* has other Indo-Pacific representatives it does not seem necessary to erect another genus for this Australian form.

HOMALOCANTHA: Many species referred to the genus *Homalocantha* Mörch, 1852, possess a varical webbing much like that of *Murexiella.* Such species as "*Murex*" *secundus* Lamarck and "*Murex*" *lamberti* Poirier bear a strong resemblance to the type of *Murexiella.* The writer formerly placed the genus *Homalocantha* in the subfamily Tritonaliinae because of its purpuroid operculum (Vokes, 1964, p. 27). Since that time she has had the opportunity to study a radula from *Homalocantha zamboi* (Burch) and found that it is not the Tritonaliinae type but is muricine. (See text figure 1). Cernohorsky (1967, p. 130) also recently noted this radular difference and concluded that the genus *Homalocantha* should be placed near *Pterynotus* Swainson, as this latter group possesses the same type of tricuspid rhacidian tooth. In terms of general shell morphology, however, *Homalocantha* is far removed from *Pterynotus* but is similar to *Murexiella.* Therefore, this writer

suspects that the similar radular types in *Homalocantha* and *Pterynotus* are probably the result of parallelism, as both would seem to represent a "degenerate" condition.

Several species on the west coast of tropical America seem to be in an intermediate position between *Murexiella* and *Homalocantha.* This group includes *"Murex" oxycantha* Broderip, *"Murex" stearnsii* Dall (which is not the same species as *M. oxycantha*), and possibly *"Murex" vittatus* Broderip and *"Murex" lappa* Broderip (of which *Murex dipsacus* Broderip and *M. radicatus* Hinds may prove to be synonyms). These species morphologically would seem to be closest to *Murexiella* but they have the same "purpuroid" type of operculum found in *Homalocantha* and should be placed in the latter genus.

The genus *Homalocantha* is probably derived from a *Murexiella*-like ancestor. The European *Murexiella* species, *"Murex" subrudis* d'Orbigny (new name for *M. rudis* Deshayes, 1835, *non* Borson, 1826) would seem to have given rise to the *"Murex" heptagonatus* Bronn group of Miocene and Pliocene age, the first true *Homalocantha.* (The term "group" is used as there are several species included under the name *heptagonatus,* but there is no implication of subgenus). In the Miocene of Java there is another homalocanthid species, *"Murex" talahabensis* Martin, very closely related to *"Murex" heptagonatus* explaining the Indo-Pacific species of *Homalocantha.* Unfortunately, there is no pre-Pleistocene occurrence of *Homalocantha* known in the New World and the origin of the West Coast species is as yet unknown. (But see the discussion under *Murexiella crispangula* for a possible explanation.)

MAXWELLIA: Another West Coast group which formerly was made a subgenus of *Murexiella* by the writer (1964, p. 14) is *Maxwellia* Baily, 1950, (type species: *Murex gemma* Sowerby). But recent work by Emerson (1968, in press) has revealed that both of the species considered by the writer to be referable to *Maxwellia* have a radula of the *Aspella* type. Therefore, the subgenus *Maxwellia* should be removed from the Muricinae and placed in a new subfamily which Keen (personal communication) is planning to propose for *Aspella* and kindred genera.

SUBPTERYNOTUS: The writer (Vokes, 1964, p. 14) previously placed *Subpterynotus* Olsson and Harbison, 1953, in synonymy with *Pterynotus* Swainson but this assignment was based on a misunderstanding of the important characters. *Subpterynotus* does have three winglike varices as does the type of *Pterynotus* but this represents convergence rather than close relationship. The oval, almost entire aperture, lacking an anal notch, and the varices composed of coalesced webbed digitations indicates that this subgenus is more closely related to the members of *Murexiella.* The presence of the greatly extended siphonal canal and the consistent development of only three varices separates the form from *Murexiella* s.s.

The oldest members of this subgenus are found in the lower Miocene of Europe. The species *"Murex" subgranifer* Cossmann and Peyrot occurs in the Aquitanian and Burdigalian beds of France and differs from *"Murex" textilis,* the type of *Subpterynotus,* in not having the winged varices extending down the length of the extended siphonal canal. A descendant form, *"Murex" graniferus* Michelotti, occurs in the middle Miocene beds of central Europe and Italy. The latter is much more like *"Murex" textilis* and may even be the same species. The writer has not seen any specimens of *"Murex" graniferus* but only the illustrations given in Bellardi (1873, pl. 5, fig. 1) and Michelotti (1847, pl. 11, fig. 8) and she does not wish to place the two species in synonymy on this basis. In the western Atlantic the subgenus is represented only by the type species which was described from the Miocene of Santo Domingo. The exact stratigraphic position of the type is not known but the species occurs in the middle Miocene beds of Venezuela so that in all probability the type came from the middle Miocene of Santo Domingo. In the United States the form is known from the (?) lower Miocene until the species died out at the close of the Pliocene. There is one Recent species, *"Murex" exquisitus* Sowerby, described from an unknown locality which is referable to the subgenus.

Subpterynotus almost certainly arose from a *Murexiella* ancestor for the early whorls of *M. (S.) textilis* are identical with those of the other species of *Murexiella* and only

on the fifth post-nuclear whorl does the formation of three varices appear. In the oldest European forms the general aspect of the shell is less extreme than in the type and it is possible to visualize the change from a *Murexiella* ancestral form to the Miocene species by means of elongation of the canal and development of three varices.

III. Acknowledgments

This investigation was supported by the National Science Foundation (Grant Number G. B. 6048) and the writer wishes to acknowledge her gratitude to that institution. In addition she would like to thank the following persons who provided specimens or information vital to the study: Harvey R. Bullis, Jr., U. S. Fish and Wildlife Service; Thomas R. Waller and Joseph Rosewater, U. S. National Museum; Katherine V. W. Palmer, Paleontological Research Institution; Horace G. Richards, Academy of Natural Sciences of Philadelphia; Peter U. Rodda, Texas Bureau of Economic Geology; J. Wyatt Durham and Joseph H. Peck, Jr., Museum of Paleontology, University of California, Berkeley; Robert Chambers, Wagner Free Institute of Science, Philadelphia; Thomas L. McGinty, Boynton Beach, Florida; Richard E. Petit, Ocean Drive Beach, South Carolina; Laura B. Shy, Westminster, California; Ruth Purdy, San Diego, California; Mr. and Mrs. Robert C. Hoerle, West Palm Beach Florida; James E. Allen, Alexandria, Louisiana; F. Stearns MacNiel, Fort Myers, Florida; Anthony D'Attilio, New York, New York; Thomas J. Etherington, Puyallup, Washington; and James Moore, Bradenton, Florida. She also wishes to thank the members of the reading committee for their many valuable suggestions.

IV. Systematic Descriptions

Phylum Mollusca
Class Gastropoda
Subclass Prosobranchia
Order Neogastropoda
Suborder Stenoglossa
Family Muricidae
Subfamily Muricinae
Genus Hexaplex Perry, 1810
Subgenus Hexaplex s.s.

Purpura Röding, 1798, Museum Boltenianum, p. 139. Not *Purpura* Bruguière, 1789, Moll. Type species: *Murex trunculus* Linn., by subsequent designation, Winckworth, 1945.

Hexaplex Perry, 1810, Arcana, expl. to pl. 23 (genus without species); 1811, Conchology, pl. 8.
Type species: *Hexaplex foliacea* Perry (= *Murex cichoreum* Gmelin), by subsequent designation, Iredale, 1915.

Polyplex Perry, 1810, Arcana, expl. to pl. 23 (genus without species); 1811, Conchology, pl. 9.
Type species: *Polyplex purpurescens* Perry (= *Murex trunculus* Linn.), by subsequent designation, Baily, 1960.

Centronotus Swainson, 1833, Zool. Illus., (Ser.

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Plate 2

Figures — Page

1. *Hexaplex* (*Hexaplex*) *engonatus* (Conrad) (× 1¼) 97
USNM 645608; height 42.3 mm, diameter 26.6 mm.
Locality: Allen's Creek Branch of Satilpa Creek, Clark Co., Alabama.
Gosport Sand, middle Eocene.

2. *Hexaplex* (*Hexaplex*) *supernus* (Palmer) (× 2) 100
USNM 645610; height 20 mm, diameter 11 mm.
Locality: Danville Landing, Ouachita River, Louisiana.
Cook Mountain Fm., middle Eocene.

3. *Hexaplex* (*Hexaplex*) *marksi* (Harris) (× 2) 98
USNM 645609; height 26 mm, diameter 17 mm.
Locality: TU 99. Moodys Branch Marl, upper Eocene.

4. *Hexaplex* (*Hexaplex*) *colei* (Palmer) (× 2) 96
PRI 3002 (holotype); height 23 mm, diameter 13.5 mm.
Locality: Orangeburg, South Carolina. McBean Fm., middle Eocene.

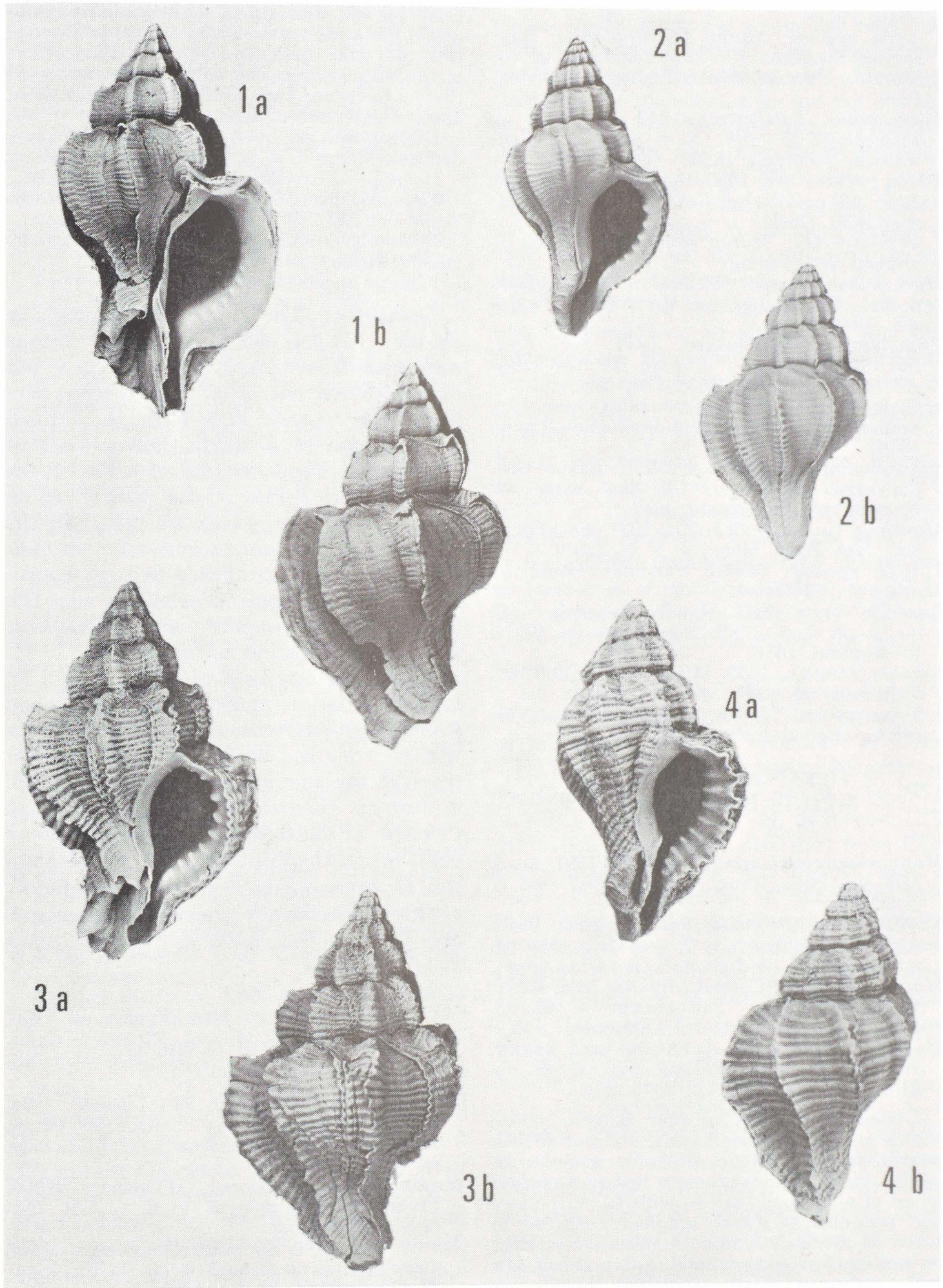

PLATE 2

2) v. 3, pl. 100. Not *Centronotus* Schneider, 1810, Pisces.
Type species: *Murex* (*Centronotus*) *eurystomus* Swainson (= *Murex saxatilis* of authors, = *Purpura duplex* Röding), by monotypy.

Muricanthus SWAINSON, 1840, Treatise on Malacology, p. 296. New name for *Centronotus* Swainson, 1833.

Bassia JOUSSEAUME, 1880, Le Naturaliste, Année 2, no. 42, p. 335. Not *Bassia* Quoy and Gaimard, 1830, Coel.
Type species: *Murex stainforthi* Reeve, by original designation.

Muricantha FISCHER, 1884, Man. de Conchyl., p. 641. Emendation for *Muricanthus* Swainson, 1840.

Truncularia MONTEROSATO, 1917, Soc. Zool. Ital., Boll., (Ser. 3) v. 4, p. 20. Not *Truncularia* Weigmann, 1832, Bryozoa.
Type species: *Murex trunculus* Linn., by tautonymy and subsequent designation, Lamy, 1919.

Truncullariopsis COSSMANN, 1921, Revue Crit. Paléozool., v. 25, p. 79. New name for *Truncularia* Monterosato, 1917.

Murithais GRANT and GALE, 1931, San Diego Soc. Nat. Hist., Mem., v. 1, p. 729.
Type species: *Murex trunculus* Linn., by original designation.

Bassiella WENZ, 1941, Handb. Paläzool., v. 6, no. 1, pt. 5, p. 1089. New name for *Bassia* Jousseaume, 1880.

Aaronia VERRILL, 1950, Mins. Conch. Club. So. California, no. 103, p. 4.
Type species: *Murex* (*Aaronia*) *strausi* Verrill, by original designation.

HEXAPLEX (HEXAPLEX) TEXANUS E. H. Vokes, n. sp.
Plate 1, figs. 1a, 1b

Murex vanuxemi Conrad. HEILPRIN, 1891, Acad. Nat. Sci. Phila., Proc., v. 42, p. 395 (*not* of Conrad).

Murex vanuxemi Conrad. PALMER, 1937, Bulls. Amer. Paleontology, v. 7, no. 32, p. 263 (in part only), pl. 35, figs. 2, 5 (*not* of Conrad).

Murex vanuxemi Conrad. BRANN and KENT, 1960, Bulls. Amer. Paleontology, v. 40, no. 184, p. 573 (in part, no. 3000 only).

Murex vanuxemi Conrad. PALMER and BRANN, 1966, Bulls. Amer. Paleontology, v. 48, no. 218, p. 784 (in part, no. 3000 only).

Diagnosis: Nucleus of four smooth conical whorls ending at a small varix. Six post-nuclear whorls in the holotype, probably more in an adult. Axial ornamentation on first post-nuclear whorl of nine small varices, with 12 on the second post-nuclear whorl, gradually reduced to seven on the body whorl. Spiral ornamentation on post-nuclear spire whorls of two strong ribs with numerous small, secondary threads; on the body whorl five strong spiral ribs with many irregular secondary threads. Axial ornamentation, in addition to the varices, of many fine growth lines which combine with the spiral threads to give a filigree surface to the shell. Aperture elongate-oval; inner lip with about five small denticles at the anterior part; outer lip with five strong denticles corresponding to the areas between the five external spiral ribs. On the apertural faces of the varices scabrous open spinelets, folding into the spiral ribs of the outer surface. Siphonal canal short, open, slightly recurved.

Dimensions of holotype: height 13 mm, diameter 7 mm.

Holotype: PRI 3000.

Type locality: Smithville, Bastrop County, Texas (= TU 243).

Occurrence: Weches Formation, Texas; early middle Eocene.

Figured specimen: PRI 3000 (holotype).

Discussion: The specimen figured by Palmer (1937, pl. 35, figs. 2, 5) as *Murex vanuxemi* from Smithville, Texas, is not *M. vanuxemi* but is a new species here named *H. texanus.* This form is confined to the Texas early middle Eocene beds of the Weches Formation, correlated with the lower Lisbon Formation by Stenzel, *et al.* (1957, p. 37). *H. vanuxemi* occurs in the younger Cook Mountain Formation in eastern Texas and in correlated beds in Louisiana and Mississippi, as well as the late middle Eocene Gosport Sand in Alabama and Yegua Formation in Texas.

H. texanus may be distinguished from *H. vanuxemi* by a much higher spire and stronger spiral ornamentation. This new species is marked by a series of small denticles at the anterior end of the inner lip; a feature comparable to that seen in *Poirieria* (*Panamurex*). In view of the more obvious relationship between *H. texanus* and *H. vanuxemi,* which is almost certainly a direct descendant, it seems more reasonable to place *H. texanus* in the same genus as *H. vanuxemi.*

HEXAPLEX (HEXAPLEX) VANUXEMI (Conrad)
Plate 1, figs. 3a, 3b

Murex vanuxemi CONRAD *in* MORTON, 1834, Syn. Organic Remains Cretaceous Group United States, Appendix, p. 5 (list only, nude name).

Murex vanuxemi Conrad. D'ORBIGNY, 1850, Prodrome Paléontologie, v. 2, p. 364 (list only, nude name).

Murex vanuxemi Conrad, 1865, Amer. Jour. Conch., v. 1, no. 3, p. 210, pl. 20, fig. 4 (as *M. vamuxemi* p. 16, list only).

Murex vanuxemi Conrad. DE GREGORIO, 1890, Ann. Géol. Paléontologie, livr. 7, p. 94, pl. 7, fig. 25 (after Conrad, 1865).

Not *Murex vanuxemi* Conrad. HEILPRIN, 1891, Acad. Nat. Sci. Phila., Proc., v. 42, p. 395 (= *Hexaplex texanus* Vokes, n. sp.).

Murex vanuxemi Conrad. COSSMANN, 1893, Ann. Géol. Paléontologie, livr. 12, p. 32.
Murex vanuxemi Conrad. HARRIS, 1895, Bulls. Amer. Paleontology, v. 1, no. 1, p. 47.
Murex vanuxemi Conrad. VAUGHAN, 1896, U. S. Geol. Surv., Bull. 142, p. 42.
Murex vanuxemi Conrad. PALMER, 1937, Bulls. Amer. Paleontology, v. 7, no. 32, p. 263, pl. 35, figs. 9, 12 (not figs. 2, 5 = *H. texanus*); pl. 84, fig. 1 (holotype).
Murex vanuxemi Conrad. HUNER, 1939, Louisiana Geol. Surv., Geol. Bull. 15, p. 113.
Murex vanuxemi Conrad. PALMER *in* HARRIS and PALMER, 1947, Bulls. Amer. Paleontology, v. 30, no. 117, p. 338 (in part, not pl. 44, figs. 10-13 = *H. katherinae* Vokes, n. sp.).
Murex vanuxemi Conrad. BRANN and KENT, 1960, Bulls. Amer. Paleontology, v. 40, no. 184, p. 572 (in part, not nos. 4648, 4649 = *H. katherinae* Vokes, n. sp., nor no. 3000 = *H. texanus* Vokes, n. sp.).
Murex vanuxemi Conrad. MOORE, 1962, Acad. Nat. Sci. Phila., Proc., v. 114, p. 106.
Murex vanuxemi Conrad. E. H. VOKES, 1964, Malacologia, v. 2, no. 1, p. 17.
Murex vanuxemi Conrad. PALMER and BRANN, 1966, Bulls. Amer. Paleontology, v. 48, no. 218, p. 784 (in part, no. 3001 only).

Diagnosis: "Fusiform; volutions 5; those of the spire angular in the middle, where there is a subspinose line, another line of equal size revolves below with a fine intermediate line; longitudinal ribs on the body whorl 7; whorls of the spire with close rugose revolving lines above the angle; body whorl with revolving squamose ribs and an intermediate squamose line; labrum thick, dentate within." (Conrad, 1865)

Dimensions of holotype: height 20 mm, diameter 12 mm.

Holotype: ANSP 13756.

Type locality: Claiborne Bluff, Alabama River, Monroe County, Alabama (= TU 78).

Occurrence: Cook Mountain Formation, Louisiana and Texas; Wautubbee Formation, Mississippi; early middle Eocene, Yegua Formation, Texas; Gosport Sand, Alabama; late middle Eocene (type).

Figured specimen: USNM 645606; height 23 mm, diameter 15 mm; locality TU 306. Other occurrences: TU locality nos. 85, 86, 98, 222, 907, 921, 923, 924.

Discussion: H. vanuxemi is the most widespread of the middle Eocene muricid species. It is particularly abundant in the Wautubbee Formation of Mississippi. Palmer (1937, p. 264) listed it from three Wautubbee localities (her numbers 728, 731, and 803). In the Tulane collections it is also represented from several other Mississippi localities.

The Wautubbee beds in Mississippi were divided into three members by Thomas (1942, p. 49). Two of these, the Archusa Marl and the Potterchitto, are highly fossiliferous, and the third has only plant remains. In the field, the writer has been unable to differentiate the two fossiliferous members, and the faunas are identical; therefore, the member names are not utilized in this paper. In Thomas's paper there appears one of the more remarkable examples of prescience in geology. That author stated (1942, p. 55): "A nearly complete Potterchitto section similar to the type section is exposed in a cut on the county road on the south side of Potterchitto Creek 0.4 miles west of the type locality . . . This section may be considered an alternative type section in case the other one is destroyed." Twenty years later Interstate Highway 20 was put right through the original type locality (= TU 86) and it literally is no longer in existence. However, the "alternative type section" is still available (= TU 923), as Thomas predicted. At this latter locality, *H. vanuxemi* is common, as it was at the original Potterchitto type locality and as it also is at another locality created by the presence of the Interstate Highway (TU 907) to the south of the former Potterchitto locality.

In addition to the Mississippi localities, *H. vanuxemi* occurs in the Hurricane Lentil of the Cook Mountain Formation of Texas (TU 222), the Saline Bayou Member of the Cook Mountain in Louisiana (TU 98), and the Gosport Sand of Alabama (TU 306). The species was described from Claiborne Bluff, Alabama, and Palmer also reported it from there but no specimens have been taken at this locality by the writer. In the collections of the Bureau of Economic Geology at the University of Texas there are specimens of *H. vanuxemi* from several Cook Mountain localities in Leon County, Texas, and from the Yegua Formation in Sabine County, Texas.

In her monograph on the Claiborne Gastropoda Palmer (1937, p. 263) included two forms under the name *Murex vanuxemi.* One of these, PRI 3001 from Claiborne, Alabama, is true *H. vanuxemi,* but the other, PRI 3000 from Smithville, Texas, is a different form and is here named a new species, *H. texanus.* In the monograph on the Jackson Gastropoda this same author (Palmer *in* Harris and Palmer, 1947, p. 338, pl. 44, figs. 10-13) included under the name *Murex vanuxemi* the upper Eocene descendant of

this species. In 1966 (*in* Palmer and Brann, p. 784) she separated the two forms but did not name the Jackson species. It is here given the name *H. katherinae.*

HEXAPLEX (HEXAPLEX)
SILVATICUS (Palmer)
Plate 1, figs. 2a, 2b, 5

[?] *Murex angulatus* MEYER, 1886, Alabama Geol. Surv., Bull. 1, pt. 2, p. 74, pl. 2, fig. 18. *Non Murex angulatus* Solander *in* Brander, 1766, *nec* Donovan, 1803, *nec* Risso, 1826, *nec* Woodward, 1833.

Murex vanuxemi silvaticus PALMER, 1937, Bulls. Amer. Paleontology, v. 7, no. 32, p. 264, pl. 35, figs. 10, 14.

Murex vanuxemi var. *silvaticus* Palmer. HUNER, 1939, Louisiana Geol. Surv., Geol. Bull. 15, p. 113.

[?] *"Murex" angulatus* Meyer. PALMER *in* HARRIS and PALMER, 1947, Bulls. Amer. Paleontology, v. 30, no. 117, p. 338, pl. 44, fig. 6.

Murex vanuxemi silvaticus Palmer. BRANN and KENT, 1960, Bulls. Amer. Paleontology, v. 40, no. 184, p. 573.

Hexaplex (Paziella) vanuxemi silvaticus (Palmer). GLIBERT, 1963, Inst. Roy. Sci. Nat. Belgique, Mem., (Ser. 10) fasc. 74, p. 9.

[?] *"Murex" angulatus* Meyer. PALMER and BRANN, 1966, Bulls. Amer. Paleontology, v. 48, no. 218, p. 780.

Murex vanuxemi silvaticus Palmer. PALMER and BRANN, 1966, Bulls. Amer. Paleontology, v. 48, no. 218, p. 784.

Diagnosis: "Nucleus consists of three to four, smooth whorls, conical. The nucleus is similar to that of *M. vanuxemi* Conrad. The Harris collection contains a large suite of the species in all stages of growth. There are seven, spinose varices. The varices are crossed by prominent, spiral ribs, two on the whorls of the spire and from six to eight on the body whorl, depending on the age of the specimen. The majority of specimens have the surface of the shell, between the primary ribs smooth, a few will have secondary spiral lines on the body whorl. The character of smoothness is the feature which differentiates this form from the parent species. *M. vanuxemi* is characteristically covered longitudinally with fine, close and regular, wavy lines of growth and frequently with spiral lines between the primary ribs on the whorls of the spire. The two forms are characteristically alike in shape, number of whorls, number of varices and conspicuously in the occurrence of two, prominent, revolving ribs on the whorls of the spire. *M. vanuxemi silvaticus* has the varices more spinose than *vanuxemi.* The smoothness of the interspaces on the body whorl of *silvaticus* is not limited to a growth stage but occurs throughout the life history. For this reason, the two forms are separated. *M. vanuxemi* has the longitudinal, fine lines in young stages as well as in the adult." (Palmer, 1937).

Dimensions of holotype: height (incomplete) 6 mm, diameter 5 mm.

Holotype: PRI 3003.

Type locality: Lapiniere Landing, Ouachita River, Ouachita Parish, Louisiana.

Occurrence: Cook Mountain Formation, Louisiana (type) and Texas; Wautubbee Formation, Mississippi; early middle Eocene. Gosport Sand, Alabama; late middle Eocene.

Figured specimens: Fig. 2, USNM 645607; height 10.3 mm, diameter 6 mm; locality TU 924. Fig. 5, USNM 638830 (holotype—*Murex angulatus* Meyer); height 9 mm, diameter 5.5 mm; locality, Jackson, Mississippi. Other occurrences: TU locality nos. 85, 98, 907, 921, 923.

Discussion: Although originally described as a variety of *Murex vanuxemi* by Palmer, this form is sufficiently different that the writer feels the two should be separated at the specific level. *H. vanuxemi* is marked by a peculiar filigree surface texture which is lacking in *H. silvaticus.* This difference in texture may be seen in the earliest stages and is not a function of size. The general aspect of the two species is similar, and they are undoubtedly closely related.

According to Palmer (1937, p. 265) this species occurs at St. Maurice, Louisiana (= TU 98), which is in the Saline Bayou Member of the Cook Mountain Formation; Moseley's Ferry on the Brazos River, Texas (= TU 61), the same as the type locality of the Stone City Beds (Stenzel, *et al.,* 1957, p. 10); Sabine River, Texas, Sec. 35, T5N, R13W, which Stenzel, *et al.* (*ibid.,* p. 61) stated is Cook Mountain in age; and from Lapiniere Landing, Ouachita River, Louisiana, also Cook Mountain in age. In addition to these localities there are numerous specimens in the Tulane collections from the Wautubbee Formation of Mississippi.

Meyer named a species *Murex angulatus* from the upper Eocene beds at Jackson, Mississippi, which seems to be the same as *H. silvaticus.* The form is known only from the type specimen which is not only a juvenile but also incomplete. The name *Murex angulatus* is preoccupied several times, but until better material is available, the form will be tentatively placed here in the synonymy of *H. silvaticus.*

HEXAPLEX (HEXAPLEX)
COLEI (Palmer)
Plate 2, figs. 4a, 4b

Murex colei PALMER, 1937, Bulls. Amer. Paleontology, v. 7, no. 32, p. 265, pl. 35, figs. 4, 6.

Murex colei Palmer. BRANN and KENT, 1960, Bulls. Amer. Paleontology, v. 40, no. 184, p. 570.

Murex colei Palmer. PALMER and BRANN, 1966, Bulls. Amer. Paleontology, v. 48, no. 218, p. 780.

Diagnosis: "Shell medium in size; spire elevated; nucleus broken; post-nuclear whorls consist of five whorls; convex; labrum thickened with the lamellae of the varix crenate within; columella smooth, with a denticle at the margin of the canal; canal constricted, medium in length; false umbilicus; seven varices on the body whorl; there are three primary, revolving ribs on the first whorls of the spire with five irregular, primary spiral ribs on the penultimate whorl; a secondary, spiral rib occurs between the primary over the whole surface of the whorls." (Palmer, 1937)

Dimensions of holotype: height 23 mm, diameter 13.5 mm.

Holotype: PRI 3002.

Type locality: about 3 miles WNW of Orangeburg, South Carolina (= TU 354).

Occurrence: McBean Formation, South Carolina (type); Weches Formation and Stone City Beds, Texas; early middle Eocene.

Figured specimen: PRI 3002 (holotype). Other occurrences; TU locality no. 354.

Discussion: H. colei is rare at the type locality; there are a few fragments in the Tulane collection from this site (TU 354) but they are poorly preserved. However, in the collections of the Academy of Natural Sciences of Philadelphia there are four specimens (no. 9168) of *H. colei* from Moseley's Ferry, on the Brazos River, Burleson County, Texas (= TU 61), from the Stone City Beds, and in the collections of the Bureau of Economic Geology at the University of Texas there is another specimen from Smithville, Texas (= TU 243), from the Weches Formation. These specimens are well preserved and demonstrate the relationship of the species to the other members of the *Hexaplex* group. The nuclear whorls are four in number, smooth, and conical. On the first post-nuclear whorl there are a dozen small varices but no spiral sculpture. On the second post-nuclear whorl these varices become flanged nodes and on the third and succeeding post-nuclear whorls these are reduced to six or seven flanged nodes per whorl. The spiral ornamentation appears on the second post-nuclear whorl as described by Palmer. In addition to the approximately eight denticles on the outer lip there is also a strong tooth at the anterior end of the labium, marking the juncture with the canal.

HEXAPLEX (HEXAPLEX) ENGONATUS (Conrad)

Plate 2, figs. 1a, 1b

Murex engonatus CONRAD, 1833, Amer. Jour. Sci., (Ser. 1) v. 1, no. 3, p. 30. (Said to be illustrated on pl. 16, fig. 2, but plates were not included with this publication. Republished in 1835 with plates but this one not included.)

Murex engonatus Conrad. CONRAD *in* MORTON, 1834, Syn. Organic Remains Cretaceous Group United States, Appendix, p. 5.

Fusus sexangulus CONRAD, 1834, Acad. Nat. Sci. Phila., Jour., v. 7, p. 144.

Fusus sexangulus Conrad. LEA, 1850, Acad. Nat. Sci. Phila., Proc. (for 1848), v. 4, p. 100.

Murex engonatus Conrad. LEA, 1850, Acad. Nat. Sci. Phila., Proc. (for 1848), v. 4, p. 102.

Murex engonatus Conrad. D'ORBIGNY, 1850, Prodrome Paléontologie, v. 2, p. 365.

Murex engonatus Conrad. CONRAD, 1865, Amer. Jour. Conch., v. 1, no. 1, p. 16 (including *Fusus sexangulus* in synonymy); *ibid.*, v. 1, no. 3, p. 210, pl. 20, fig. 10.

Murex engonatus Conrad. DE GREGORIO, 1890, Ann. Géol. Paléontologie, livr. 7, p. 94, pl. 7, fig. 24 (after Conrad, 1865).

Murex (*Pteronotus*) *engonatus* Conrad. DALL, 1890, Wagner Free Inst. Sci., Trans., v. 3, pt. 1, p. 142 (including *Fusus sexangulus* in in synonymy).

Murex engonatus Conrad. COSSMANN, 1893, Ann. Géol. Paléontologie, livr. 12, p. 32.

Murex engonatus Conrad. HARRIS, 1895, Bulls. Amer. Paleontology, v. 1, no. 1, p. 19 (including *Fusus sexangulus* in synonymy).

Fusus sexangulus Conrad. HARRIS, 1895, Bulls. Amer. Paleontology, v. 1, no. 1, p. 41.

Murex engonatus Conrad. VAUGHAN, 1896, U. S. Geol. Surv., Bull. 142, p. 42.

Murex engonatus Conrad. PALMER, 1937, Bulls. Amer. Paleontology, v. 7, no. 32, p. 267, pl. 36, figs. 9, 10, 13; pl. 84, fig. 6 (holotype).

Murex engonatus Conrad. BRANN and KENT, 1960, Bulls. Amer. Paleontology, v. 40, no. 184, p. 570.

Murex engonatus Conrad. MOORE, 1962, Acad. Nat. Sci. Phila., Proc., v. 114, p. 59.

Fusus sexangulus Conrad. MOORE, 1962, Acad. Nat. Sci. Phila., Proc., v. 114, p. 96.

Murex engonatus Conrad. PALMER and BRANN, 1966, Bulls. Amer. Paleontology, v. 48, no. 218, p. 781.

Diagnosis: "Shell thick, fusiform, transversely striated, umbilicated, with six angular varices on the body whorl, the striae passing over them; whorls six in number and the varices continued in direct lines to the apex; beak rather thick; canal narrow. Length: 1¼ inches." (Conrad, 1833)

Holotype: ANSP 31386 but not found (Moore, 1962, p. 59).

Type locality: Claiborne Bluff, Alabama River, Monroe County, Alabama, (= TU 78).

Occurrence: Cook Mountain Formation, Louisiana; Wautubbee Formation, Mississippi;

early middle Eocene. Gosport Sand, Alabama (type); late middle Eocene.

Figured specimen: USNM 645608; height 42.3 mm, diameter 26.6 mm; locality, Allen's Creek Branch of Satilpa Creek, Clark County, Alabama. Other occurrences: TU locality nos. 85, 907, 923.

Discussion: H. engonatus is a moderately common species in the Wautubbee Formation of Mississippi. Although it was described from the Gosport Sand of Alabama the writer has not found any specimens either at Claiborne (TU 78) or at Little Stave Creek, Alabama (TU 306), a famous Gosport locality. Cossmann (1893, p. 32) also noted that although the species was said to be from Claiborne he had never received a fragment. Vaughan (1896, p. 42) reported the species from a well at Mount Lebanon, Louisiana, from the lower Claiborne beds (*i.e.,* Cook Mountain Formation).

HEXAPLEX (HEXAPLEX) MARKSI (Harris)
Plate 2, figs. 3a, 3b

Murex marksi HARRIS, 1894, Arkansas Geol. Surv., Ann. Rept. for 1892, v. 2, p. 167, pl. 6, fig. 10.

Murex marksi Harris. HARRIS, 1897, Acad. Nat. Sci. Phila., Proc., v. 48, p. 473, pl. 18, fig. 15.

Murex marksi Harris. SCHUCHERT, *et al.,* 1905, U.S. Natl. Mus., Bull. 53, p. 420.

Murex (Phyllonotus) engonatus marksi Harris. PALMER *in* HARRIS and PALMER, 1947, Bulls. Amer. Paleontology, v. 30, no. 117, p. 339, pl. 44, figs. 14-17.

Murex (Phyllonotus) engonatus marksi Harris. BRANN and KENT, 1960, Bulls. Amer. Paleontology, v. 40, no. 184, p. 570.

Murex (Phyllonotus) engonatus marksi Harris. PALMER and BRANN, 1966, Bulls. Amer. Paleontology, v. 48, no. 218, p. 781.

Diagnosis: "Size and form as indicated by the figure; whorls 6; ornamented by, (a) six rather narrow and high costae on each whorl (not continuous from one whorl to another), and by, (b) strong revolving lines, about ten on the penultimate whorl and thirty on the body whorl; umbilicus small; canal nearly closed in front; labrum thickened within and bearing about ten teeth.

"On the humeral region there is a slight tendency to carination. Between this faint carina and the suture the revolving lines are comparatively obscure.

"This species is closely allied to Conrad's *Murex engonatus* from the Claiborne sands, from which it differs however in having a much smaller umbilicus, a trace of a carina, and ribs on varices non-continuous from whorl to whorl." (Harris, 1894)

Dimensions of holotype: height 23.5 mm, diameter 15 mm.

Holotype: USNM 135148.

Type locality: One mile northeast (in a well) of Pansy Post Office, Cleveland County, Arkansas.

Occurrence: Moodys Branch Marl, Louisiana, Mississippi and Arkansas (type); upper Eocene.

Figured specimen: USNM 645609; height 26 mm, diameter 17 mm; locality TU 99. Other occurrences: TU locality no. 917.

Discussion: The *H. engonatus* group presents a striking example of evolutionary change. The oldest species of the line is *H. engonatus* from middle Eocene beds. This species has five to six varices on the last whorl. *H. marksi,* the early Jackson species, has six to seven varices and is somewhat more inflated than the older form. In *H. supernus,* the late Jackson species, there

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PLATE 3

Figures — Page

1, 4. *Hexaplex (Hexaplex) fulvescens* Sowerby (× 1) 104
1. USNM 645612; height 95 mm, diameter 70 mm.
Locality: TU 797. Pinecrest Beds, upper Miocene.
4. USNM 678100; height 81 mm, diameter (including spines) 63.5 mm.
Locality: TU R-60. Recent.

2. *Hexaplex (Murexsul) thalmanni* E. H. Vokes, n. sp. (× 4) 106
USNM 645890 (holotype); height 13.5 mm, diameter 6.0 mm.
Locality: TU 638. Agueguexquite Fm., upper Miocene.

3, 5. *Hexaplex (Hexaplex) veatchi* (Maury) (× 2) 101
3. USNM 645611; height 30 mm, diameter 18.5 mm.
Locality: TU 951. Chipola Fm., (?) lower Miocene.
5. USNM 112069; height 21.8 mm, diameter 14 mm.
Locality: Ballast Point, Tampa Bay, Florida. Tampa Limestone, lower Miocene.

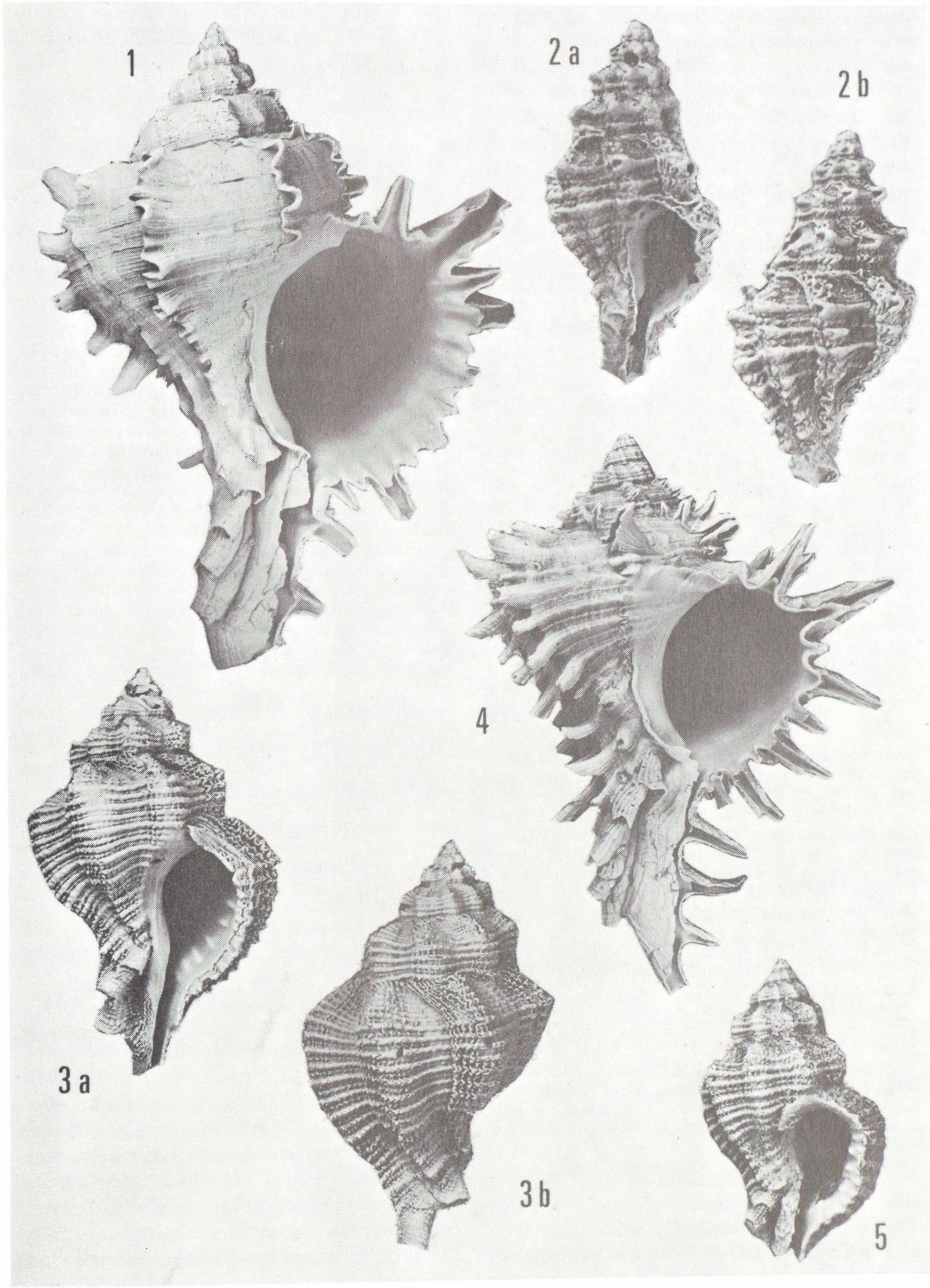

PLATE 3

are from eight to occasionally ten varices on the last whorl. In *H. engonatus* the varices are formed in a continuous line up the spire, whereas in both of the younger species the varices are slightly offset. Otherwise the three forms are much alike. All have spiral ornamentation consisting of fine equi-sized lines, and all have a denticulated outer lip.

H. marksi was reported from numerous localities in Louisiana and Mississippi by Harris and Palmer (1947, p. 341). It is relatively common at Montgomery Landing, on the Red River, Louisiana (TU 99). The type specimen, described from a well in southern Arkansas, is the only example known from that state.

HEXAPLEX (HEXAPLEX) SUPERNUS (Palmer)
Plate 2, figs. 2a, 2b

Murex (Phyllonotus) engonatus supernus PALMER *in* HARRIS and PALMER, 1947, Bulls. Amer. Paleontology, v. 30, no. 117, p. 341, pl. 44, figs. 1-5.
Murex (Phyllonotus) engonatus supernus Palmer. BRANN and KENT, 1960, Bulls. Amer. Paleontology, v. 40, no. 184, p. 570, 571.
Murex (Phyllonotus) engonatus supernus Palmer. PALMER and BRANN, 1966, Bulls. Amer. Paleontology, v. 48, no. 218, p. 782.

Diagnosis: "This variety differs from typical *M. engonatus* in having eight to nine longitudinal costae or varices on the body whorl with nine to ten on the penultimate whorl. *M. engonatus, s.s.*, has six similar costae. *M. engonatus marksi* has seven to eight axial costae on the body whorl with eight to nine on the penultimate whorl." (Palmer, 1947)

Dimensions of holotype: height 20.5 mm, diameter 11 mm.

Holotype: PRI 4653.

Type locality: Bayou Toro, Vernon Parish, Louisiana, (= TU 545).

Occurrence: Moodys Branch Marl (upper beds only), Louisiana and Mississippi; upper Eocene.

Figured specimen: USNM 645610; height 20 mm, diameter 11 mm; locality, Danville Landing, Ouachita River, Catahoula Parish, Louisiana. Other occurrences: TU locality no. 545.

Discussion: As discussed under *H. marksi,* this species is the end member of a well defined Eocene evolutionary sequence. It is less inflated than *H. marksi* but slightly more inflated than *H. engonatus.* Palmer (*in* Harris and Palmer, 1947, p. 342) reported this species from several localities in Louisiana but noted that she had only one specimen from Mississippi (her locality no. 785, Town Creek, Jackson, Mississippi).

HEXAPLEX (HEXAPLEX) KATHERINAE E. H. Vokes, n. sp.
Plate 1, figs. 4a, 4b

Murex vanuxemi Conrad. PALMER *in* HARRIS and PALMER, 1947, Bulls. Amer. Paleontology, v. 30, no. 117, p. 338 (in part), pl. 44, figs. 10-13 (*not* of Conrad).
Murex vanuxemi Conrad. BRANN and KENT, 1960, Bulls. Amer. Paleontology, v. 40, no. 184, p. 572 (in part, nos. 4648, 4649 only).
Murex sp. PALMER and BRANN, 1966, Bulls. Amer. Paleontology, v. 48, no. 218, p. 785.

Diagnosis: Nuclear whorls unknown, probably four; seven post-nuclear whorls in the adult. Axial ornamentation of seven varices on each post-nuclear whorl; varices having scabrous faces and one strong spine at the shoulder of the whorl. Spiral ornamentation of two strong ribs on early whorls, approximately nine on the body whorl; in some specimens certain of these ribs more pronounced than others but in the holotype all are equal. Ribs marked by a median groove. Axial ornamentation, in addition to varices, of many small growth lines which cross the ribs and give rise to a shagreened surface. Aperture oval; inner lip smooth, outer lip with six to eight strong denticles corresponding to the areas between the external spiral ribs. Siphonal canal short, open, recurved.

Dimensions of holotype: height 21 mm, diameter 14.3 mm.

Holotype: PRI 4648.

Type locality; Town Creek, Jackson, Hinds County, Mississippi (= TU 917).

Occurrence: Moodys Branch Marl, Mississippi (type) and Louisiana; upper Eocene.

Figured specimen: PRI 4648 (holotype). Other occurrences: TU locality nos. 99, 544.

Discussion: In her monograph on the Jackson Eocene Gastropoda Palmer (*in* Harris and Palmer, 1947, p. 338) included the Claiborne species *Murex vanuxemi* but noted that: "Although there are minor differences between the Claiborne and Jackson shells they apparently do not represent changes worthy of a special name." In 1966 (*in* Palmer and Brann, p. 784) she concluded that the two forms were distinctive and separated them but she did not name the Jackson species only citing it as "*Murex* sp." The present writer agrees with this separation and, therefore, it gives her great pleasure to name the Jackson species after this pre-eminent student of the Eocene faunas. *H. katherinae* is clearly a descendant of the middle Eocene *H. vanuxemi* but is a heavier, more coarsely ornamented shell.

HEXAPLEX (HEXAPLEX) VEATCHI (Maury)

Plate 3, figs. 3a, 3b, 5

Coralliophila magna DALL, 1890, Wagner Free Inst. Sci., Trans., v. 3, pt. 1, p. 155 (in part), pl. 11, fig. 12 only.

Coralliophila magna Dall. SCHUCHERT, *et al.*, 1905, U. S. Natl. Mus., Bull. 53, p. 163 (in part).

Murex veatchi MAURY, 1910, Bulls. Amer. Paleontology, v. 4, no. 21, p. 144, pl. 23, fig. 7.

Coralliophila magna Dall. DALL, 1915, U. S. Natl. Mus., Bull. 90, p. 78 (in part), pl. 7, fig. 7 only.

Coralliophila magna Dall. MANSFIELD, 1937, Florida Geol. Surv., Bull. 15, p. 138 (in part).

Not *Murex veatchi* PALMER, 1937, Bulls. Amer. Paleontology, v. 7, no. 32, p. 266 (= *Murex* [*Pterynotus*] *sabinola* Palmer, new name).

Urosalpinx veatchi (Maury). GARDNER, 1947, U. S. Geol. Surv. Prof. Paper 142-H, p. 532.

Murex veatchi Maury. BRANN and KENT, 1960, Bulls. Amer. Paleontology, v. 40, no. 184, p. 573.

Diagnosis: "Shell pyriform, small, with five somewhat convex whorls, transverse sculpture of numerous, prominent raised lines which show some tendency to alternate but in general are sub-equal, longitudinal sculpture of sub-equal varices (six on the last whorl) and of fine longitudinal raised lines which form with the spirals a very fine network, or honeycomb ornamentation. Aperture oval; canal open; outer lip lirate within." (Maury, 1910)

Dimension of lectotype: height 21 mm, diameter 13 mm.

Lectotype: PRI 3462 (designated by Brann and Kent, 1960, p. 573).

Type locality: "Bailey's Ferry, Florida." TU 554, east bank of Chipola River at power line crossing, (SW ¼ Sec. 17, T1N, R9W), Calhoun County, Florida (here designated).

Occurrence: Tampa Limestone, Florida; early lower Miocene. Chipola Formation, Florida; (?) late lower Miocene.

Figured specimens: Fig. 3, USNM 645611; height 30 mm, diameter 18.5 mm; locality TU 951. Fig. 5, USNM 112069; height 21.8 mm, diameter 14 mm; locality, Ballast Point, Tampa Bay, Florida. Other occurrences: TU locality nos. 554, 818, 820, 825, 827, 828, 830.

Discussion: Dall (1890, p. 155) described *Coralliophila magna* from the lower Miocene beds at Ballast Point as a large shell, having a maximum height of 60 mm. He figured two specimens, one of which (*ibid.*, pl. 11, fig. 11) he considered an "imperfect adult," the other (pl. 11, fig. 12) he cited as a "young and nearly perfect example." But the two specimens are not of the same species, nor even of the same genus. The larger specimen is to be referred to *Thais* (*Thaisella*), whereas the smaller is a *Hexaplex*. Inasmuch as Dall considered the large form to be the typical one, as evidenced by the name, as well as his statement about the "adult" and "young" shells, it seems obvious that the name *magna* should be applied to the larger species. In the type lot at the U. S. National Museum Dall's two figured specimens bear the numbers 112069 for the smaller one (fig. 12) and 112070 for the larger (fig. 11). Schuchert, *et al.*, (1905, p. 163) cited specimen number 112069 as a "cotype" and referred to both figures so that this cannot be construed as a selection of this specimen as a lectotype. Likewise, Mansfield (1937, p. 139) mentioned 112069 as a "smaller cotype" only. Therefore, the USNM specimen bearing the number 112070 is here designated as the lectotype of *Coralliophila magna* Dall. Although the 1890 illustration is of a poor specimen, in 1915 Dall refigured the species and illustrated a much better specimen (1915, pl. 10, fig. 6) which bears the number USNM 165091. At the same time he refigured the 1890 illustration of the *Hexaplex* species.

In the meantime Maury (1910) named a Chipola species, *Murex veatchi*. The original illustration is poor and it is not surprising that the correlation between Dall's "young" *magna* and Maury's *M. veatchi* has been overlooked. Gardner (1947, p. 532) assigned Maury's species to the genus *Urosalpinx*, stating that "the species has not been recognized in the material under observation." On the basis of the type material this is reasonable assignment, the writer herself was of the same opinion until better specimens were collected which revealed that Maury had been correct in what must have been an almost intuitive assignment. This species is placed in the genus *Hexaplex* somewhat arbitrarily. It has six rounded varices with slightly scabrous faces. When worn, as with the lectotype, these varices take on the appearance of low rounded axial ridges. Comparison of Dall's specimen (here refigured, pl. 3, fig. 5) with well preserved specimens of the Chipola species shows that the two forms are identical. This is one of the few examples of a species known to be in common in the two formations. But, as *H. veatchi* seems most closely related to the Eocene species

H. colei (Palmer), its presence in the older formation is not completely unexpected.

There being two specimens in the type lot of *Murex veatchi,* Brann and Kent (1960, p. 573) selected Maury's figured specimen as the lectotype. The exact locality of the type is not known. Maury cited only "Bailey's Ferry, Chipola River." At Bailey's Ferry *per se* there is no Chipola Formation present. The Chipola first appears about one-half mile downstream from the old ferry crossing. The locality where most of the early Chipola material was collected has been universally referred to as "one mile below Bailey's Ferry" but actually this spot is only about one-half mile from the crossing. No specimens of *H. veatchi* have been collected by the writer at the "one mile below" locality (= TU 457) but several specimens have been found at another locality about one-quarter mile farther down the river at TU 554; therefore, this locality is here designated as the type locality for *H. veatchi.*

Hexaplex (Hexaplex) etheringtoni E. H. Vokes, n. sp.
Plate 4, fig. 2

Diagnosis: Shell small for the modern group; eight whorls in the holotype. Early whorls poorly preserved but axial ornamentation on first two post-nuclear whorls of approximately 12 small nodes, reduced to six varices with no intervaricals nodes by the fourth post-nuclear whorl. Spiral ornamentation of numerous fine threads of irregular strength; on the body whorl about ten of the slightly stronger threads. Certain of the stronger threads coincide with faint raised spiral ribs. Where the spiral ornamentation crosses the varices small pointed spines appear, the raised ribs corresponding to the larger spines and the larger threads to small spinelets. Five major spines, that at the shoulder and two at the anterior end of the body whorl being the stronger and two intermediate ones smaller. In advance of these spines are numerous prickly spinelets. In addition to the spines on the body whorl there are four large spines on the extended anterior canal, with numerous smaller spinelets. Aperture broken, but inner lip smooth and adhering to the columellar wall. Siphonal canal long, straight, distal ends of previous canals only slightly divergent.

Dimensions of holotype: height 62 mm, diameter (incomplete) 32 mm.

Holotype: UCMP 33837.

Type locality: Punta Púa, about 15 miles northeast of Cartegena, Dept. of Bolívar, Colombia.

Occurrence: Tuberá Group, Bolívar, Colombia; (?) upper Miocene.

Figured specimen: UCMP 33837 (holotype).

Discussion: H. etheringtoni is based on a single specimen from the collections of the Museum of Paleontology, University of California, Berkeley. It was collected by Thomas J. Etherington at Punta Púa, near Cartegena, Departamento de Bolívar, Colombia, and hence comes from the Tuberá Group which, however, contains beds of lower, middle, and upper Miocene age. Other fossils from this same locality suggest that the fauna at this spot is of upper Miocene age, correlating with the Agueguexquite Formation of Mexico. This new species is different from the other western Atlantic species of *Hexaplex, H. fulvescens,* but is close to the eastern Atlantic *H. rosarium* (Röding) from West Africa. The holotype retains faint traces of three spiral brown color bands identical to the Old World forms (including *H. cichoreum* and *H. trunculus,* as well as the West African group) but

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PLATE 4

Figures — Page

1, 3, 4. *Hexaplex (Hexaplex) fulvescens* (Sowerby) (× 1) 104
1. USNM 645612; height 95 mm, diameter 70 mm.
Locality: TU 797. Pinecrest Beds, upper Miocene.
3. USNM 645613; height 64 mm, diameter 43.5 mm.
Locality: TU 797. Pinecrest Beds, upper Miocene.
4. USNM 678100; height 81 mm, diameter (including spines) 63.5 mm.
Locality: TU R-60. Recent.

2. *Hexaplex (Hexaplex) etheringtoni* E. H. Vokes, n. sp. (× 1¼) 102
UCMP 33837 (holotype); height 62 mm, diameter (incomplete) 32 mm.
Locality: Punta Púa, Dept. of Bolívar, Colombia. Tuberá Group,
(?) upper Miocene.

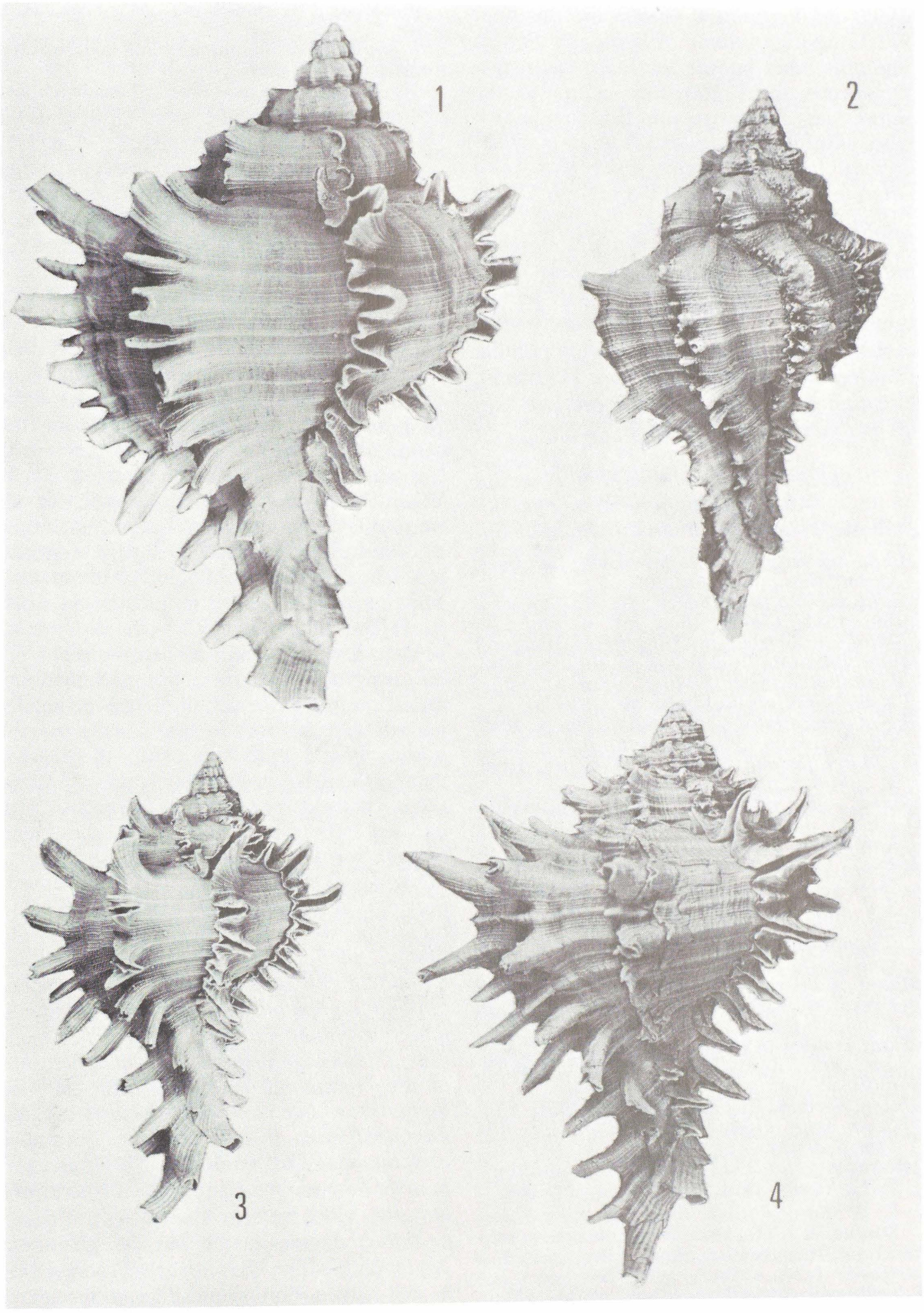

PLATE 4

which no longer are present in the New World species, either Atlantic or Pacific. The only other known South American pre-Pleistocene fossil *Hexaplex* occurs in the Esmeraldas Formation of Ecuador and is more akin to *H. fulvescens* than to *H. etheringtoni.* It is the species which was called "*Muricanthus ambiguus* (Reeve)" by Olsson (1964, p. 138, pl. 29, fig. 5), however it is not that species. Just where *H. etheringtoni* falls with reference to these more typical New World forms is not certain. Presumably it represents a different line of evolution possibly giving rise to the peculiar *Chicoreus* (*Phyllonotus*) *brassica* (Lamarck), discussed by the writer in the previous part of this series (Vokes, 1967b, p. 160).

Hexaplex (Hexaplex) fulvescens (Sowerby)

Plate 3, figs. 1, 4; Plate 4, figs. 1, 3, 4

Murex fulvescens G. B. Sowerby, Jr., 1834, Conch. Illus., pl. 62, fig. 30.

Murex turbinatus Lamarck. G. B. Sowerby, Jr., 1841, Conch. Illus., pl. 62, fig. 30; *Murex* catalogue, p. 7 (*not* of Lamarck).

Murex spinicosta "Valenciennes" Kiener, 1843, Coquilles Vivantes, v. 7, p. 49, pl. 41, fig. 1. *Non Murex spinicosta* Bronn, 1828.

Murex spinicostata "Valenciennes" Reeve, 1845, Conch. Icon., v. 3, *Murex*, pl. 4, fig. 18.

[?] *Murex pudicus* Reeve, 1845, Conch. Icon., v. 3, *Murex*, pl. 29, fig. 137.

Murex spinicostatas [*sic*] "Valenciennes." Holmes, 1860, Post-Pleiocene Fossils South Carolina, p. 61, pl. 10, fig. 2.

Murex (*Phyllonotus*) *fulvescens* Sowerby. Maury, 1922, Bulls. Amer. Paleontology, v. 9, no. 38, p. 96.

Murex (*Muricanthus*) *fulvescens* Sowerby. Clench and Pérez Farfante, 1945, Johnsonia, v. 1, no. 17, p. 42, pl. 22.

Murex (*Poirieria*) *burryi.* Clench and Pérez Farfante, 1945, Johnsonia, v. 1, no. 17, p. 47, pl. 24, figs. 1-3.

Murex fulvescens Sowerby. Olsson and Harbison, 1953, Acad. Nat. Sci. Phila., Mon. 8, p. 7.

Murex pomum Gmelin. Rowett, 1957, Gulf Coast Assoc. Geol. Soc., Trans., v. 7, p. 154 (*not* of Gmelin).

[*Hexaplex* (*Hexaplex*)] *fulvescens* (Sowerby). E. H. Vokes, 1964, Malacologia, v. 2, no. 1, p. 13.

Diagnosis: "M. testa ovato-elongata, subfusiformi, tenuissime striata, fulva, varicibus et costis rubescentibus; anfractibus convexis; varicibus octo rotundatis, rectis, spinosis; ultimo anfractu superne longioribus; canali elongato, muricato, bispinoso; umbilico angusto." (Kiener, 1843)

Dimensions of holotype (*M. spinicosta*): height 85 mm.

Holotype: (*M. spinicosta*): Mus. Nat. Hist. Paris.

Type locality: South Carolina (designated by Kiener, 1843, p. 50).

Occurrence: Pinecrest Beds, Florida; upper Miocene. Unnamed formations, Louisiana, Florida, South Carolina; Pleistocene. Recent, Texas to South Carolina (type), northern Yucatán.

Figured specimens: Fig. 1, USNM 645612; height 95 mm, diameter 70 mm; locality TU 797. Fig. 3, USNM 645413; height 64 mm, diameter 43.5 mm; locality TU 797. Fig. 4, USNM 678100; height 81 mm, diameter (including spines) 63.5 mm; locality TU R-60. Other occurrences: TU locality nos. 1, 578, 728, 729, 730, 769, 796, 933, R-61.

Discussion: "Murex" fulvescens was first figured by Sowerby in the *Conchological Illustrations* which appeared in parts from 1832 to 1841. The first ten plates of the genus *Murex* were issued in 1834, comprising plates 58 to 67 of the complete work. When these parts were issued, each was accompanied by a plate explanation, but when the work was completed, a page containing "Directions to the Binder" was included which stated that "the lists printed on small paper and published with each part are to be cancelled." In almost all cases, the binders diligently destroyed these lists and so obliterated the record of certain of the originally named species, for in the catalogues of species bound with the plates there were many changes in nomenclature. Among those changed was *Murex fulvescens* (pl. 62, fig. 30) which was given the name "*Murex turbinatus* Lam." in the 1841 Catalogue (p. 7), the name *M. fulvescens* appearing in parentheses after it. Shortly thereafter, Kiener (1843) published the *Murex* portion of his *Iconographie des Coquilles Vivantes* including a species "*Murex spinicosta* Valenc." He gave a reference to Sowerby's figure but did not mention *M. fulvescens* or *M. turbinatus.* Because of the "burial" of Sowerby's name *M. fulvescens,* the later name *M. spinicosta* became associated with this species for a number of years until Dall (1889, p. 198) exhumed it in a footnote observing that *M. fulvescens* was the older name. Not only is *M. fulvescens* the older name but *M. spinicosta* is preoccupied by *M. spinicosta* Bronn, 1828, a well-known European Miocene species.

Hexaplex fulvescens first appears in the upper Miocene Pinecrest Beds of southern Florida. It is never exceedingly abundant but is well represented at several different

Miocene localities in the vicinity of Lake Okeechobee. It has not been found in any Pliocene beds but reappears in the Pleistocene in Florida, Louisiana, and South Carolina. Maury (1922, p. 96) reported this species in the Pleistocene of Louisiana from wells in Terrebonne Parish, at depths as great as 2150 feet. It also occurs in the late Pleistocene (possibly post-Pleistocene) beds beneath the city of New Orleans, Louisiana (TU 1). Road fill dredged from a depth of 15 to 30 feet contained specimens of *H. fulvescens* which were reported by Rowett (1957, p. 154) as "*Murex pomum.*"

Holmes (1860, p. 61) reported "*Murex spinicostatas*" from the "Post-Pleiocene" beds of South Carolina and added a curious note that "dead shells of this species are often found upon the sea beaches and are supposed to belong to sub-marine Post-Pleiocene beds, as they are fossil in appearance, and we know of no living specimen having yet been discovered upon our coast" (*ibid.,* p. 62). Inasmuch as the type locality is the coast of South Carolina (Kiener, 1843, p. 50), this is a strange remark. Furthermore, in 1945, Clench and Pérez Farfante reported several localities off the South Carolina coast but added that the species "apparently is quite rare." This is not correct, for in certain areas it is remarkably common. When Pensacola Bay was being dredged during the winter of 1958, it was possible to pick up recently dead shells by the bushel basket, as indeed many persons did. No live material was found to the writer's knowledge. In 1961, Hurricane "Carla" smashed into the Texas coast and near Galveston thousands of specimens of live *H. fulvescens* were washed ashore. It is found frequently off the mouth of the Mississippi River. All of these localities would lead one to suspect that perhaps the species is confined to subsaline environments but on the U. S. Navy "Texas Tower" 12 miles off Panama City, Florida (TU R-60), in 17 fathoms, *H. fulvescens* thrives, evidently eating the *Ostrea frons* and *Pteria colymbus* which cover the structure. The U. S. Fish and Wildlife Service R/V *Oregon* dredged specimens of *H. fulvescens* at no less than 55 stations in the western Atlantic (Springer and Bullis, 1956, p. 28; Bullis and Thompson, 1965, p. 15) in depths ranging from 6 to 43 fathoms; however, the majority of the records are about 15 fathoms.

Clench and Pérez Farfante (1945, p. 47, pl. 24, figs. 1-3) named a species *Murex (Poirieria) burryi,* from a single specimen taken off Fort Walton, Florida. This shell is merely a juvenile specimen of *H. fulvescens,* as was noted by Abbott (1954, p. 203). The small specimen named *Murex pudicus* by Reeve (1845, pl. 29, fig. 137) from Santo Domingo is probably also a juvenile specimen of *H. fulvescens.*

HEXAPLEX (HEXAPLEX) STRAUSI (Verrill)

Murex (Aaronia) strausi VERRILL, 1950, Mins. Conch. Club So. California, no. 103, p. 4, text fig.

[*Hexaplex (Hexaplex)*] *strausi* (Verrill). E. H. VOKES, 1964, Malacologia, v. 2, no. 1, p. 13.

Diagnosis: "This shell differs so greatly from all other known species of *Murex* that I feel it should be the type of a new subgenus, as well as a new species. Its outstanding characteristics are the absence of all spines on the first three whorls, the very conspicuous ribs; the numerous thickly-spined varices extending diagonally or at an angle to the axis of the shell; the short stubby or "chunky" form with the last whorl almost globular; the distinct notch or channel at the upper angle of the aperture; the short upturned canal and the coloration.

"First three whorls with no spines but with strong varices and conspicuous concentric ribs. Fourth whorl with low spines on the last four or five varices, those increasing in size and number on the fifth whorl. Last whorl with ten low varices extending from the shoulder to the extremity of each varice [*sic*] being in line with the posterior end of the varice preceding it. Each varice with eight almost straight spines 4 to 6 mm in length, broadened or fan-shaped at the tips and with their base forming strong elevated concentric ribs. Each spine and the spaces between them with numerous raised ridges extending from one varice to another between the larger ribs. Canal short, broad, inclined to the left and with the extremity sharply upturned and bearing four blunt spines. A conspicuous groove or channel at the upper angle of aperture. Young specimens have no spines but the varices bear prominent nodules with interconnecting ribs and small ridges as in the adults. In these young shells the notch in the aperture is more pronounced than in the adults.

"Color, both adults and young, rich cinnamon-brown with spines and ribs seal-brown, the tips of spines almost black. Canal ochraceous. Interior of aperture and lip white. Operculum horny, thickened at center and with a thin membraneous edge. Surface with numerous concentric lines." (Verrill, 1950)

Holotype: not found.

Type locality: Dominica, B.W.I.
Occurrence: Recent only.

Discussion: No subsequent authors have discovered this species since its description by Verrill. From Verrill's illustration the shell is very much like specimens of the *H. radix* complex from the West Coast of tropical America. Verrill stated that the specimens were taken in a fish trap in 75 to 100 fathoms which is considerably deeper than the usual range of this group.

Subgenus MUREXSUL Iredale, 1915

Murexsul IREDALE, 1915, New Zealand Inst., Trans. Proc., v. 47, p. 471.
Type species: *Murex octogonus* Quoy and Gaimard, by original designation.

HEXAPLEX (MUREXSUL) THALMANNI E. H. Vokes, n. sp.
Plate 3, figs. 2a, 2b

Diagnosis: Nuclear whorls unknown; six postnuclear whorls in holotype. Spiral sculpture on early whorls consisting of three equal ribs; on body whorl three primary ribs and between each pair of these a weaker secondary thread. Between the suture and the primary rib at the shoulder two secondary threads; between the anterior-most rib and the pillar also two secondary threads. Where the three primary ribs cross the varices small spines are produced, that at the shoulder only slightly larger than the others. Axial sculpture of eight varices on the penultimate whorl and six varices on the body whorl; varices composed of multiple laminae. Between the varices numerous axial growth lines, giving a shagreened texture to the shell surface. Aperture small, oval; columellar wall smooth. Siphonal canal short, recurved.

Dimensions of holotype: height 13.5 mm, diameter 6.0 mm.

Holotype: USNM 645890.

Type locality: TU 638, Mexico Highway 180, 14 miles east of junction with side road into Coatzacoalcos, Vera Cruz, Mexico.

Occurrence: Agueguexquite Formation, Vera Cruz, Mexico; upper Miocene.

Figured specimen: USNM 645890 (holotype).

Discussion: This species, the sole example of the *Murexsul* group known from the fossil record in the New World, occurs in the Agueguexquite Formation of Mexico. The fauna of the Agueguexquite is poorly known, the only two works to date (Perrilliat Montoya: 1960, 1963) covering a total of 64 species of Mollusca. However, the fauna is tremendous, there being at least eight species of Muricinae alone known from a single locality (TU 638). Five of these species are new, with two of that number being described in the present work. A sixth species, *Murex olssoni,* was recently described by the writer (Vokes, 1967a, p. 84) and the other two species represent forms known from the upper Miocene of Florida. They are *Murexiella macgintyi faceta* (Vokes), discussed in this paper, and *Poirieria* (*Panamurex*) *alaquaensis* (Mansfield) which will be covered in a future publication.

Perrilliat Montoya concluded that the Agueguexquite Formation was of middle Miocene age; however, other authors have referred the formation to the late Miocene. Thalmann (1935, p. 116), in the original description, noted that the fauna was closely connected with that of the Choctawhatchee Formation (now Group) of Florida. This latter observation is corroborated by the presence of the two muricine species mentioned above which also occur in the Choctawhatchee Group. As the writer discussed in a previous work (Vokes, 1967a, p. 84), she is of the opinion that the age of the formation is late Miocene.

It is apparent that the Tulane Agueguexquite locality (TU 638) represents very shallow deposition for many of the specimens have every appearance of being almost beach-worn, especially the cones and olives. There are numerous pieces of fine gravel intermingled with the fossils. As a result it is difficult to obtain well-preserved type specimens, and the two new species in this paper are no exception. There are four specimens in the type lot of *M. thalmanni* but only the holotype is complete and it is somewhat worn.

Genus MUREXIELLA Clench and Pérez Farfante, 1945
Subgenus MUREXIELLA s. s.

Murexiella CLENCH and PÉREZ FARFANTE, 1945, Johnsonia, v. 1, no. 17, p. 49.
Type species: *Murex hidalgoi* Crosse, by original designation.

Minnimurex WOOLACOTT, 1957, Roy. Zool. Soc. New South Wales, Proc., (1955-1956), p. 115.
Type species: *Minnimurex phantom* Woolacott, by original designation.

MUREXIELLA (MUREXIELLA) MANTELLI (Conrad)
Plate 5, figs. 1a, 1b

Murex mantelli CONRAD, 1834, Acad. Nat. Sci. Phila., Jour., v. 7, p. 154.
Murex mantelli Conrad. CONRAD *in* MORTON, 1834, Syn. Organic Remains Cretaceous Group United States, Appendix, p. 5.
Murex mantelli Conrad. LEA, 1850, Acad. Nat. Sci. Phila., Proc. (for 1848), v. 4, p. 102.
Murex conradi D'ORBIGNY, 1850, Prodrome Paléontologie, v. 2, p. 364. Unnecessary new name for *Murex mantelli* Conrad.
Murex mantelli Conrad. CONRAD, 1865, Amer. Jour. Conch., v. 1, no. 1, p. 16; *ibid.*, v. 1, no. 3, p. 210, pl. 20, fig. 11.
Murex mantelli Conrad. DE GREGORIO, 1890, Ann. Géol. Paléontologie, livr. 7, p. 95, pl. 7, fig. 28 (after Conrad, 1865).
Murex mantelli Conrad. COSSMANN, 1893, Ann. Géol. Paléontologie, livr. 12, p. 32.
Murex mantelli Conrad. HARRIS, 1895, Bulls. Amer. Paleontology, v. 1, no. 1, p. 27.
Murex (*Muricantha*, Sect. *Favartia*) *mantelli* Conrad. COSSMANN, 1903, Essais Paléoconch. Comp., v. 5, p. 29, pl. 1, fig. 12.
Murex (*Phyllonotus*, Sect. *Favartia*) *mantelli* Conrad. PALMER, 1937, Bulls. Amer. Paleontology, v. 7, no. 32, p. 269, pl. 35, figs. 13, 15-17; pl. 84, fig. 10 (holotype).
Murex (*Phyllonotus*) *mantelli* Conrad. BRANN and KENT, 1960, Bulls. Amer. Paleontology, v. 40, no. 184, p. 571.
Murex mantelli Conrad. MOORE, 1960, Acad. Nat. Sci. Phila., Proc., v. 114, p. 73.
[*Murexiella* (*Murexiella*)] *mantelli* (Conrad). E. H. VOKES, 1964, Malacologia, v. 2, no. 1, p. 13.
Murex (*Phyllonotus*) *mantelli* Conrad. PALMER and BRANN, 1966, Bulls. Amer. Paleontology, v. 48, no. 218, p. 782.

Diagnosis: "Shell subfusiform; body whorl inflated; with six angular varices, crossed by prominent equidistant lines, expanding on the varices, and terminating in very short, foliated, obtuse spines; between the lines is a fine stria; fine longitudinal striae passing over the spiral lines; spire short; aperture ovate; channel nearly closed; beak larger than the spire, reflected." (Conrad, 1834)

Dimensions of holotype: height 26 mm, diameter 19 mm.

Holotype: ANSP 14231.

Type locality: Claiborne Bluff, Alabama River, Monroe County, Alabama (= TU 78).

Occurrence: Gosport Sand, Alabama; late middle Eocene.

Figured specimen: ANSP 14231 (holotype). Other occurrences: TU locality no. 78.

Discussion: M. mantelli is the first representative of the *Murexiella* line in the New World and is remarkably like the Recent forms of that group. Few Eocene species are so closely related to their modern descendants but the distinguishing features of the group, such as the small round aperture, lacking any trace of an anal canal, and the presence of the webbing between the digitations of the varices, are identical in the Eocene and Recent species. *M. mantelli* is apparently confined to the Gosport Sand and, so far as the writer is aware, is known only from the type locality.

MUREXIELLA (MUREXIELLA) SP.
Plate 5, figs. 2a, 2b

Diagnosis: Nuclear whorls missing; five post-nuclear whorls in the single specimen known. Spiral ornamentation on early post-nuclear whorls consisting of two strong ribs; on body whorl four strong spiral ribs and a weaker fifth one at the base of the anterior canal; each spiral rib marked by a median groove. Axial ornamentation on each whorl, including the body whorl, of eight varices, composed of multiple laminae. Where the spiral ribs cross the varices short spines produced, each connected with the next by the laminae of the varices. Aperture and siphonal canal broken away.

Occurrence: Red Bluff Clay, Mississippi; lower Oligocene.

Figured specimen: USNM 498089; height (incomplete) 10.8 mm, diameter 8 mm; locality, USGS 5263, Chickasawhay River, one mile below Shubuta, Mississippi. (Type locality of the Red Bluff Clay.)

Discussion: The specimen here figured from the Red Bluff Clay is to be named in a forthcoming work on the Oligocene of Mississippi by F. S. MacNeil; therefore, it will only be mentioned at this time. Nevertheless, it is too important a specimen to omit. This species is the first to show the median groove on the spiral ribs that is characteristic of most of the later species of *Murexiella* such as *M. macgintyi, M. glypta,* and *M. levicula.* This single specimen is the only known Oligocene representative of the *Murexiella* line.

MUREXIELLA (MUREXIELLA) CRISPANGULA (Heilprin)
Plate 6, figs. 1a, 1b

Murex larvaecosta HEILPRIN, 1887, Wagner Free Inst. Sci., Trans., v. 1, p. 106, pl. 15, fig. 37.
Murex crispangula HEILPRIN, 1887, Wagner Free Inst. Sci., Trans., v. 1, p. 107, pl. 15, fig. 38.
Murex (*Chicoreus*) *larvicosta* [*sic*] Heilprin. DALL, 1890, Wagner Free Inst. Sci., Trans., v. 3, pt. 1, p. 140.
Murex (*Chicoreus*) *crispangula* Heilprin. DALL, 1890, Wagner Free Inst. Sci., Trans., v. 3, pt. 1, p. 140.

Murex larvaecosta Heilprin. DALL, 1903, Wagner Free Inst. Sci., Trans., v. 3, pt. 6, p. 1566.
Murex crispangula Heilprin. DALL, 1903, Wagner Free Inst. Sci., Trans., v. 3, pt. 6, p. 1566.
Murex (*Muricantha*, Sect. *Favartia*) *larvicosta* [*sic*] "Dall." COSSMANN, 1903, Essais Paléoconch. Comp., v. 5, p. 30.
Chicoreus larvaecosta (Heilprin). DALL, 1915, U. S. Natl. Mus., Bull. 90, p. 75.
Chicoreus crispangula (Heilprin). DALL, 1915, U. S. Natl. Mus., Bull. 90, p. 75, pl. 5, fig. 14.
Murex (*Chicoreus*) *larvaecosta* Heilprin. MANSFIELD, 1937, Florida Geol. Surv., Bull. 15, p. 129, pl. 5, fig. 9.
Murex (*Chicoreus*) *crispangula* Heilprin. MANSFIELD, 1937, Florida Geol. Bull. 15, p. 130.

Diagnosis: "Shell strongly angulated, markedly rugose; spire elevated, of about five volutions; varices six (on the body-whorl), sharp, deflected obliquely toward the base of the shell; surface of shell very strongly lined, the lines of three series, primary, secondary, and tertiary; those of the first series about ten on the body-whorl, very prominently elevated on the varices, becoming spinose toward the base of the shell and on the apertural varix; aperture slightly exceeding one-half the length of shell, the very narrowly-constricted canal gently deflected." (Heilprin, 1887)

Dimensions of holotype: (*M. crispangula*) height 1.6 inches, diameter .7 inches; (*M. larvaecosta*) height 1.6 inches, diameter .9 inches.

Holotype: (*M. crispangula*) Wagner Free Inst. Sci. 867; (*M. larvaecosta*) Wagner Free Inst. Sci. 866.

Type locality: Ballast Point, Tampa Bay, Hillsborough County, Florida.

Occurrence: Tampa Limestone, Florida; early lower Miocene.

Figured specimen: USNM 214442; height 42.5 mm, diameter 24 mm; locality, Ballast Point, Tampa Bay, Florida (specimen figured by Dall, 1915, pl. 5, fig. 14).

Discussion: Heilprin named two species as *"Murex larvaecosta"* and *"Murex crispangula"* from the Tampa Limestone at Ballast Point, Florida, but the writer cannot accept this separation for she feels that the two forms represent but a single species. Heilprin (1887, p. 107) stated that *M. crispangula* might "be readily distinguished from *M. larvaecosta,* which it somewhat resembles, by its narrower outline, the smaller number of and greater sharpness of its obliquely directed varices, and its generally rugose surface." In view of the usual variation in the number of varices characteristic of *Murexiella* this distinction has little validity and the other characters he mentioned seem due more to flaws in preservation than real differences in the shells. The holotype of *M. larvaecosta* is an incomplete specimen and if the missing siphonal canal were restored the proportions would be comparable in the two type specimens. The name *"Murex larvaecosta"* has one page priority over that of *"Murex crispangula"*; however, as "first reviser" the writer has se-

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PLATE 5

Figures

1. *Murexiella* (*Murexiella*) *mantelli* (Conrad) (× 2) 107
ANSP 14231 (holotype); height 26 mm, diameter 19 mm.
Locality: Claiborne Bluff, Alabama River, Alabama. Gosport Sand, middle Eocene.

2. *Murexiella* (*Murexiella*) sp. (× 4) 107
USNM 498089; height (incomplete) 10.8 mm, diameter 8 mm.
Locality: Chickasawhay River, one mile below Shubuta, Mississippi. Red Bluff Clay, lower Oligocene.

3. *Murexiella* (*Murexiella*) *petiti* E. H. Vokes, n. sp. (× 2) 116
USNM 645893 (holotype); height 21 mm, diameter 15 mm.
Locality: TU 558. Waccamaw Fm., Pliocene.

4. *Murexiella* (*Murexiella*) *calhounensis* E. H. Vokes, n. sp. (× 1½) 110
USNM 645891 (holotype); height 31.9 mm, diameter 17.7 mm.
Locality: TU 555. Chipola Fm., (?) lower Miocene.

5. *Murexiella* (*Murexiella*) *veracruzana* E. H. Vokes, n. sp. (× 4) 116
USNM 645894; height (incomplete) 12.7 mm, diameter (incomplete) 7 mm.
Locality: TU 638. Agueguexquite Fm., (?) upper Miocene.

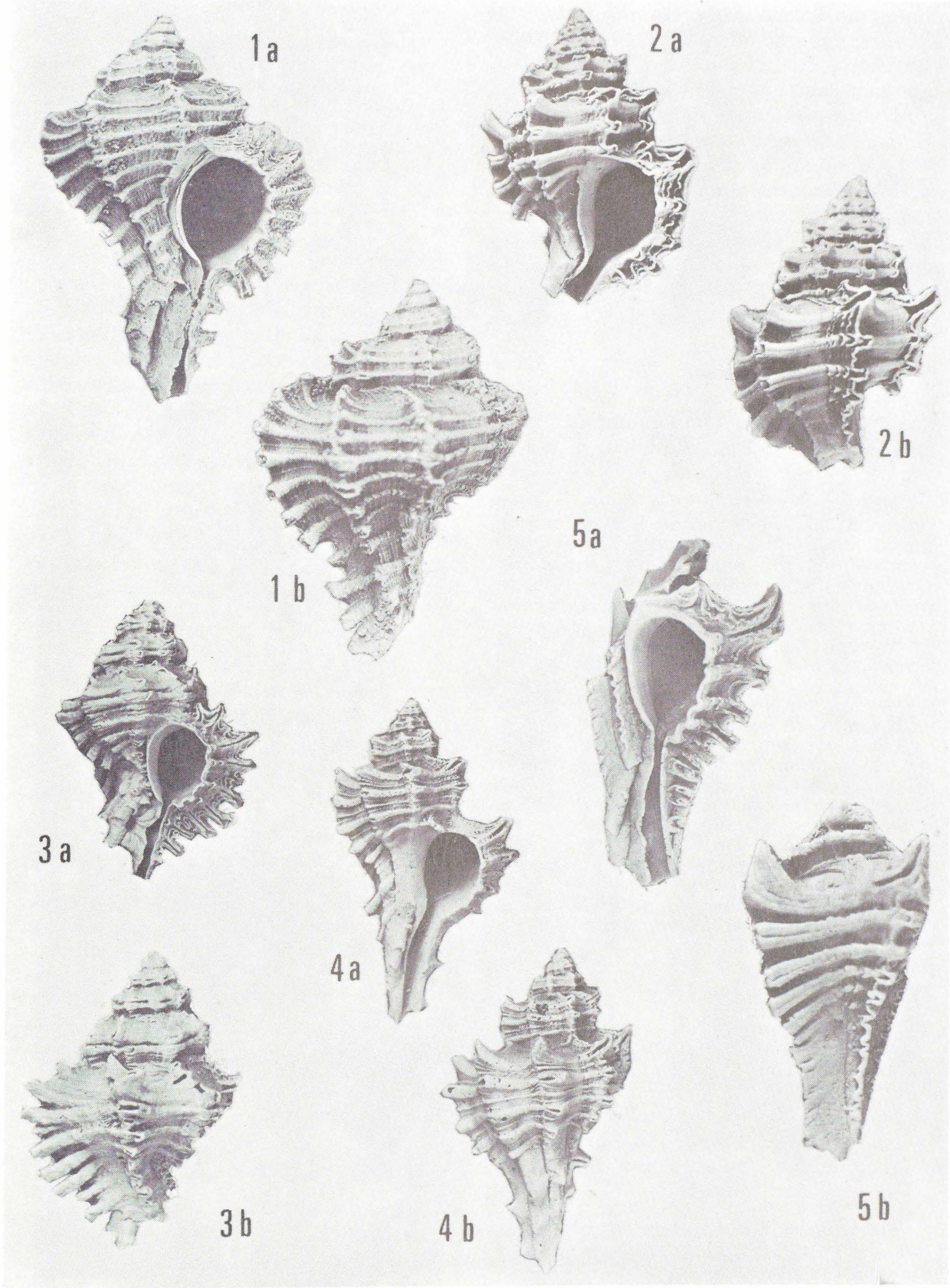

PLATE 5

lected the second name for she is of the opinion that the etymology of the name "*larvaecosta*" is obscure but "*crispangula*" is a good description of the form.

M. crispangula and its descendant form, *M. calhounensis* Vokes, n. sp., may prove to be ancestral to the West Coast species of *Homalocantha* discussed in the Introduction. Morphologically both are close to the European "*Murex*" *heptagonatus* Bronn, which would seem to be the first *Homalocantha.* As there is no other explanation for the presence of these isolated West Coast representatives, perhaps parallel development is not unreasonable.

MUREXIELLA (MUREXIELLA) CALHOUNENSIS E. H. Vokes, n. sp.
Plate 5, figs. 4a, 4b

Diagnosis: Early whorls of holotype worn but embryonic shell apparently 1½ smooth, bulbous whorls; five post-nuclear whorls. Spiral sculpture on early whorls of two strong ribs alternating with three secondary riblets; on body whorl five strong spiral ribs with two more on extended siphonal canal. Between each pair of major spirals a single secondary riblet flanked by a tertiary thread on either side. Axial ornamentation on first post-nuclear whorl consisting of about ten small varices, reduced to eight on second post-nuclear whorl, and to seven on each succeeding whorl. Where each spiral element crosses the varices pointed spines produced, proportional to the rank of the spiral rib; that spine at the shoulder only slightly stronger than the others. Numerous small axial growth lines crossing the spiral ornamentations give a scabrous appearance to entire shell surface. Aperture broken, but probably round and almost entire; siphonal canal long and straight, not recurved at distal end.

Dimensions of holotype: height 31.9 mm, diameter 17.7 mm.

Holotype: USNM 645891.

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

Occurrence: Chipola Formation, Florida; (?) late lower Miocene.

Figured specimen: USNM 645891 (holotype). Other occurrences: TU locality nos. 547, 818.

Discussion: This new species is represented by a single imperfect specimen and some fragments; however, it is sufficiently different from all other species of *Murexiella* so that there is no doubt about its validity. It most nearly resembles the somewhat older *M. crispangula* (Heilprin) from the Tampa Limestone but differs in having a more attenuated anterior canal, a flatter shoulder angle, and less pronounced interdigital webbing on the varices. In this latter trait it especially suggests the West Coast *Homalocantha oxycanta* (Broderip), further strengthening the idea presented immediately above under *M. crispangula.*

MUREXIELLA (MUREXIELLA) SHILOHENSIS (Heilprin)
Plate 6, figs. 2-4

Murex shilohensis HEILPRIN, 1888, Acad. Nat. Sci. Phila., Proc., v. 39, p. 404.

Murex shilohensis Heilprin. DALL, 1890, Wagner Free Inst. Sci., Trans., v. 3, pt. 1, p. 141.

Murex shilohensis Heilprin. WHITFIELD, 1894, U. S. Geol. Surv., Mon. 24, p. 97, pl. 17, fig. 1 (holotype).

Muricidea shilohensis (Heilprin). MARTIN, 1904, Maryland Geol. Surv., Miocene, p. 202, pl. 51, figs. 4-6.

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PLATE 6

Figures — Page

1. *Murexiella* (*Murexiella*) *crispangula* (Heilprin) (× 1½) 107
   USNM 21442; height 42.5 mm, diameter 24 mm.
   Locality: Ballast Point, Tampa Bay, Florida. Tampa Limestone, lower Miocene.

2-4. *Murexiella* (*Murexiella*) *shilohensis* (Heilprin) 110
   2. (× 4) USNM 645892; height 11.5 mm, diameter 7.5 mm.
      Locality: TU 825. Chipola Fm., (?) lower Miocene.
   3. (× 3) ANSP 4081 (holotype); height 18 mm, diameter 10 mm.
      Locality: Shiloh, New Jersey. Kirkwood Fm., middle Miocene.
   4. (× 3) USNM 645614; height 19 mm, diameter 11 mm.
      Locality: TU 729. Pinecrest Beds, upper Miocene.

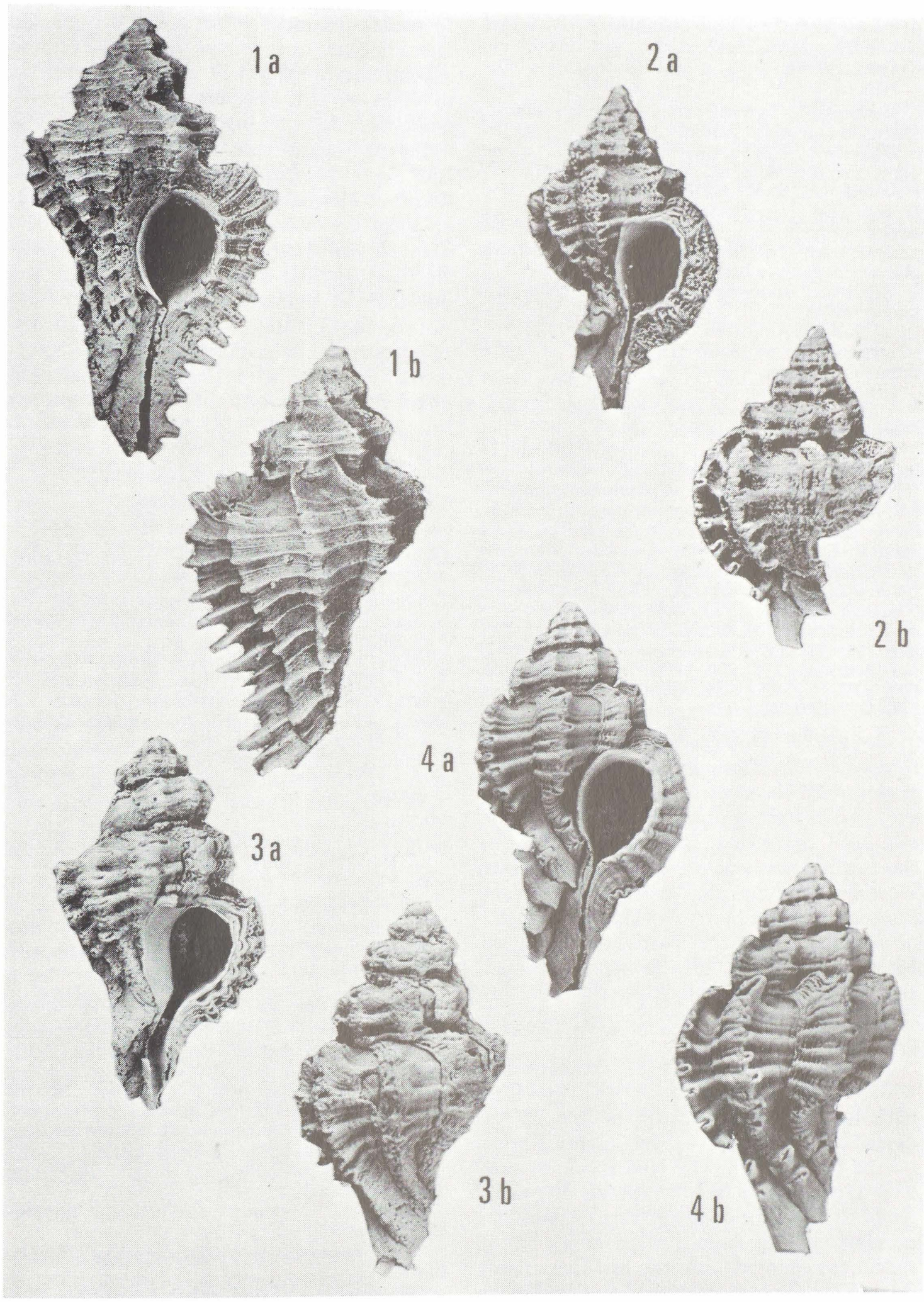

PLATE 6

Muricidea shilohensis (Heilprin). RICHARDS and HARBISON, 1942, Acad. Nat. Sci. Phila., Proc., v. 94, p. 211, pl. 19, fig. 11 (holotype).

Diagnosis: "Whorls about seven, angular, flattened on the shoulder, which is crossed diagonally by the variceal ridges; varices about eight on the body-whorl, subequal, spinosely elevated on the shoulder angulations, and crossed by four subequal revolving ridges, which appear double on the crests of the varices; only two such ridges on the whorls above the body-whorl.

"Aperture somewhat more than half the length of the shell, key-hole shaped, with the canal broadly reflected." (Heilprin, 1888)

Dimensions of holotype: height 18 mm, diameter 10 mm.

Holotype: ANSP 4081.

Type locality: Ayre's Pits, near Shiloh, Cumberland County, New Jersey.

Occurrence: Chipola Formation, Florida; (?) late lower Miocene. Kirkwood Formation, New Jersey; Calvert Formation, Maryland; middle Miocene. Pinecrest Beds, Florida; upper Miocene. Caloosahatchee Formation, Florida; Waccamaw Formation, South Carolina; Pliocene.

Figured specimens: Fig. 2, USNM 645892; height 11.5 mm, diameter 7.5 mm; locality TU 825. Fig. 3, ANSP 4081 (holotype). Fig. 4, USNM 645614; height 19 mm, diameter 11 mm; locality TU 729. Other occurrences: TU locality nos. 79, 200, 202, 457, 519, 525, 527, 529b, 547, 554, 558, 726, 728, 736, 755, 767, 770, 797, 827.

Discussion: This species has been figured three different times but none of the illustrations have been of sufficiently good quality to enable recognition of the form. It was not until the writer saw the holotype that she realized this was the same species which is widespread in the upper Miocene and Pliocene of southern Florida. The inadequate illustrations are partially due to the basic poor quality of the type specimen; therefore, another shell from the Pinecrest Beds of Florida is also figured for comparison.

M. shilohensis is much like *M. macgintyi* with which it occurs but is a smaller form with less frondose varices. The species was described as having "about eight" varices on the body whorl. The type specimen does have eight varices but the species in general tends to have six or seven varices, with the number varying from five to eight. Of 50 specimens counted, only one had five varices, 20 had six, 24 had seven, and five had eight. There seems to be a tendency toward reduction of varices through geologic time. The type specimen with eight varices is middle Miocene in age. Most of the upper Miocene specimens have seven varices and the Pliocene ones have six. However, in any lot the number will still vary from six to eight so that this cannot be used as a guide for determining geologic age.

In the Tulane collections from the (?) late lower Miocene Chipola Formation of northern Florida there are several specimens of a species which seems to be identical with *M. shilohensis.* All of these specimens are juveniles and most are poorly preserved but there is one good example in the lot (pl. 6, fig. 2) and it demonstrates no differences from the geologically younger specimens. Perhaps better adult material will disprove this identity but for the present time it will be included here.

MUREXIELLA (MUREXIELLA) MACGINTYI (Smith)

Plate 7, figs. 3a, 3b

Murex macgintyi M. SMITH, 1938, Nautilus, v. 51, p. 88, pl. 6, fig. 11.

Tritonalia mcgintyi [*sic*] (Smith). M. SMITH, 1939, Illus. Cat. Recent Species Rock Shells, p. 16, pl. 12, fig. 20.

Murex (Favartia) macgintyi Smith. CLENCH and PÉREZ FARFANTE, 1945, Johnsonia, v. 1, no. 17, p. 52, pl. 27, figs. 1-4.

Murex (Favartia) macgintyi Smith. OLSSON and HARBISON, 1953, Acad. Nat. Sci. Phila., Mon. 8, p. 246, pl. 36, fig. 5.

Murex (Murexiella) macgintyi Smith. E. H. VOKES, 1963, Tulane Stud. Geol., v. 1, no. 4, p. 157.

[*Murexiella (Murexiella)*] *macgintyi* (Smith). E. H. VOKES, 1964, Malacologia, v. 2, no. 1, p. 13.

Diagnosis: "Whorls five, plus smooth shining nucleus of about two whorls, suture impressed; about seven spiral raised ridges with slightly branching terminations which are recurved, hollow inside near the tips; aperture moderately large, oval in shape; canal slightly oblique, partially closed, recurved at terminus.

"This species is allied to *M. glyptus* Smith. One very characteristic feature is the pinched appearance of the posterior portion of the body whorl. Beyond this pinched portion is a pair of axial ridges which are somewhat separated from the others." (Smith, 1938)

Dimensions of holotype: height 20.7 mm, diameter 18 mm.

Holotype: McGinty Collection, Boynton Beach, Florida.

Type locality: Clewiston, Hendry County, Florida.

Occurrence: Caloosahatchee Formation, Florida; Waccamaw Formation, South Carolina; Pliocene. Recent, east and west Florida coasts, Bahamas.

Figured specimen: Holotype. Other occurrences: TU locality nos. 68, 79, 202, 203, 519,

527, 529b, 536, 539b, 541, 558, 579, 726, 767, 770.

Discussion: M. macgintyi is relatively common in the Pliocene beds of southern Florida and also occurs in the equivalent beds of the Waccamaw Formation in South Carolina. It is living off the east and west coasts of Florida and in the Bahamas. From the records given by Clench and Pérez Farfante (1945, p. 52) it lives in moderately deep water today, ranging from 13 to 100 fathoms. This suggests an explanation for the presence of *M. macgintyi* in the Pliocene and its total absence in the Pleistocene of the same area. *M. glypta* (Smith), which lives today in much shallower water, is almost lacking in the Pliocene but is widespread in the Pleistocene. From this it can be inferred that the Florida Peninsula was under perhaps 50 fathoms of water during the Pliocene but had shallowed to less than 20 fathoms during the Pleistocene, a logical assumption in the light of its present dry position.

M. macgintyi is the Recent member of an evolutionary line that goes back almost without change to the middle Eocene species *M. mantelli,* making the *Murexiella* group one of the more conservative of the muricine genera. Even more than the other species of *Murexiella, M. macgintyi* is variable in the number of varices on the body whorl. In 90 specimens counted, the number varied from four to ten, with the greatest number being six (41 specimens) and then seven (26 specimens). *M. macgintyi* is exceedingly close to the Italian Pliocene species *M. absona* (Cristofori and Jan), the primary distinction between the two forms being that *M. absona* is somewhat more globose in outline and much more elaborately frondose. This latter species is common in the Astian beds of Italy and has received a number of sub-specific and varietal names. In view of the considerable variation in the group as a whole, and this form in particular, most of these names are probably superfluous.

MUREXIELLA (MUREXIELLA) MACGINTYI FACETA (Vokes)

Plate 7, figs. 1a, 1b, 2

Murex (*Chicoreus*?) *burnsii* Whitfield. DALL, 1890, Wagner Free Inst. Sci., Trans., v. 3, pt. 1, p. 141 (in part only, not including Tampa reference).

Murex shilohensis var. *burnsi* WHITFIELD, 1894 (post-March), U. S. Geol. Surv., Mon. 24, p. 98, pl. 17, fig. 2. *Non Murex burnsii* Aldrich, 1894 (Jan.).

Not *Murex burnsii* Dall. DALL, 1903, Wagner Free Inst. Sci., Trans., v. 3, pt. 6, p. 1566 (= *Murex* [*Panamurex*] *heilprini* Cossmann).

Chicoreus burnsii (Whitfield). DALL, 1915, U. S. Natl. Mus., Bull. 90, p. 75 (in part = *Panamurex heilprini*).

Murex (*Chicoreus*) aff. *burnsii* Whitfield. GARDNER and ALDRICH, 1919, Acad. Nat. Sci. Phila., Proc., v. 71, p. 18.

Muricidea burnsi (Whitfield). RICHARDS and HARBISON, 1942, Acad. Nat. Sci. Phila., Proc., v. 94, p. 212, pl. 19, fig. 10 (holotype).

Murex (*Murexiella*) *macgintyi facetus* E. H. VOKES, 1963, Tulane Stud. Geol., v. 1, no. 4, p. 157, pl. 2, figs. 4a, 4b.

[*Murexiella* (*Murexiella*)] *macgintyi facetus* (Vokes). E. H. VOKES, 1964, Malacologia, v. 2, no. 1, p. 13.

Diagnosis: "Shell moderate in size, body whorl greatly inflated. Nucleus of 1½ smooth, rounded whorls; six post-nuclear whorls in the adult. Spiral sculpture consists of sharply raised ribs, two in number on the early whorls, five on the body whorl. Axial sculpture consists of six to seven varices; where the spiral ribs cross the varices long, recurved, foliaceous, open spines are produced. In addition, one spine is formed where no rib is present between the suture and the shoulder, and two spines are produced on the extended siphonal canal. The intervarical space is patterned with microscopic spiral lirae and growth lines which give a reticulate surface. The varices are formed of finely laminate layers, creating a complex webbing between the spines. Aperture subcircular; labium completely free, erect, and smooth; the outer lip bearing six grooves corresponding to the varical spines. Siphonal canal moderately long and recurved, the succession of previous canals forming an anterior fasciole." (Vokes, 1963)

Dimensions of holotype: height 24 mm, diameter 18 mm.

Holotype: USNM 644376.

Type locality: TU 520, canal 0.9 mile east of Brighton, Highlands County, Florida (incorrectly given in original description as 1/3 mile).

Occurrence: Kirkwood Formation, New Jersey; middle Miocene. Duplin Marl, North Carolina and South Carolina; Jackson Bluff Formation and Pinecrest Beds, Florida; Agueguexquite Formation, Vera Cruz, Mexico; upper Miocene.

Figured specimens: Fig. 1, USNM 644376 (holotype—*M. macgintyi faceta*). Fig. 2, USNM 111626 (holotype—*M. burnsii* Whitfield); height (incomplete) 12 mm, diameter 9 mm; locality, Jericho, New Jersey. Other occurrences: TU locality nos. 60, 200, 523, 525, 638, 728, 729, 730, 736, 756, 769, 796.

Discussion: The nomenclatorial history of this species was discussed by the writer with the original description of *M. macgintyi*

faceta (Vokes, 1963, p. 157), but it seems desirable to repeat it here. In 1890 (p. 141) Dall listed a species from the Tampa Limestone which he identified as "*Murex* (*Chicoreus?*) *burnsii* Whitfield." He did not describe the form and as Whitfield's species was not published until 1894 it can only be considered a *nomen nudum.* Early in 1894, shortly before Whitfield's paper finally appeared, a second species was given the name *Murex burnsii* by Aldrich. The following year, after the appearance of Whitfield's paper, Aldrich (1895, p. 14) noted that "Prof. W. H. Dall has changed *M. shilohensis* Heilp. var. *burnsi* Whitf. into a distinct species and this necessitates a change of name in ours." Whereupon he proposed the name *Murex* (*Pteronotus*) *grandispinosa* for his *M. burnsii.* Inasmuch as the Dall usage was a nude name and could not, therefore, preoccupy Aldrich's name this was an unnecessary change. This confusion is further augmented by the fact that the Tampa shell to which Dall was originally referring is not *M. burnsii* Whitfield but is a juvenile specimen of *Poirieria* (*Panamurex*) *heilprini* (Cossmann) (new name for *Murex spinulosa* Heilprin, 1887, *non* Deshayes, 1835).

In view of the poor condition of Whitfield's type specimen of *Murex burnsi* the writer concluded that it was preferable to name *M. macgintyi faceta* as a new subspecies of which *Murex burnsi* Whitfield was probably a synonym rather than to rename the preoccupied taxon. *M. macgintyi faceta* may be distinguished from *M. macgintyi* s. s. by a more inflated body whorl and shorter spire in the subspecies. Both forms are widespread in southern Florida: *M. macgintyi* in the Pliocene beds and the subspecies *faceta* in the upper Miocene. *M. macgintyi faceta* occurs in northern Florida in the Jackson Bluff Formation, in North Carolina in the Duplin Marl (USNM Coll.), and Gardner and Aldrich (1919, p. 18) reported a species "aff. *burnsi*" from the Duplin equivalent near Mayesville, South Carolina. The type of *Murex burnsi* Whitfield is from the middle Miocene Kirkwood Formation, near Jericho, New Jersey. In addition to the northern localities, one specimen has been collected by the

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Plate 7

Figures Page

1-2. *Murexiella* (*Murexiella*) *macgintyi faceta* (E. H. Vokes) 113
1. (× 2) USNM 644376 (holotype); height 24 mm, diameter 18 mm.
Locality: TU 520. Pinecrest Beds, upper Miocene.
2. (× 3) USNM 111626 (holotype—*Murex burnsi* Whitfield); height (incomplete) 12 mm, diameter 9 mm.
Locality: Jericho, New Jersey. Kirkwood Fm., middle Miocene.

3. *Murexiella* (*Murexiella*) *macgintyi* (Smith) (× 2) 112
Holotype; height 20.7 mm, diameter 18 mm.
Locality: Clewiston, Florida. Caloosahatchee Fm., Pliocene.

4-5. *Murexiella* (*Murexiella*) *glypta* (Smith) (× 2) 117
4. Holotype; height 25.3 mm, diameter 14 mm.
Locality: Clewiston, Florida. Caloosahatchee Fm., Pliocene.
5. USNM 645895; height 17 mm, diameter 9.5 mm.
Locality: TU 580. Unnamed post-Caloosahatchee formation, Pleistocene.

6. *Murexiella* (*Murexiella*) *graceae* (McGinty) (× 2) 118
Holotype; height 21.5 mm, diameter 16 mm.
Locality: Belle Glade, Florida. Unnamed post-Caloosahatchee formation, Pleistocene.

7. *Murexiella* (*Murexiella*) *levicula* (Dall) (× 3) 119
USNM 93271 (lectotype); height 18 mm, diameter 10 mm.
Locality: Off Cape San Blas, Florida. Recent.

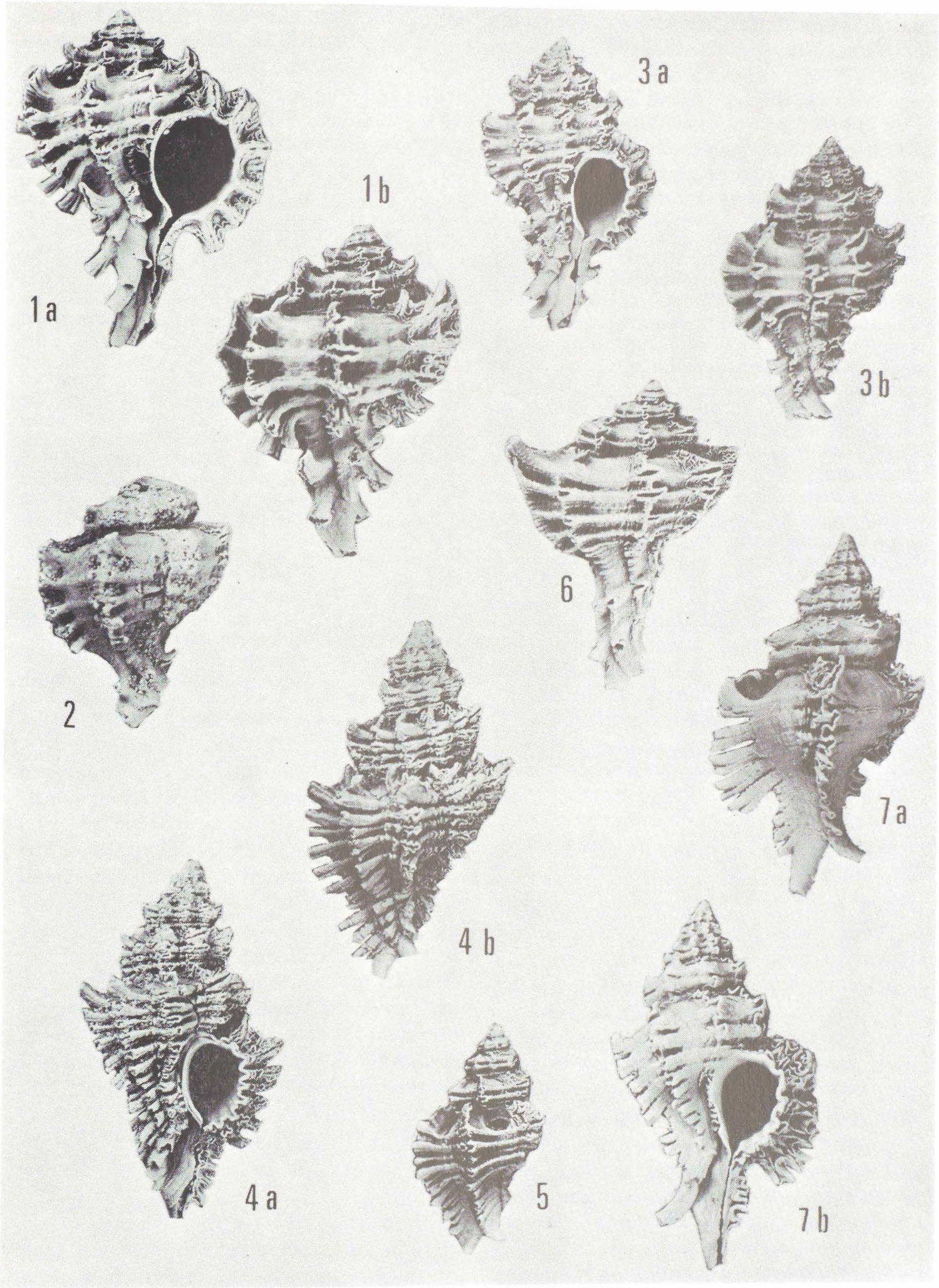

PLATE 7

writer from the Agueguexquite Formation of Vera Cruz, Mexico (TU 638).

MUREXIELLA (MUREXIELLA) VERACRUZANA E. H. Vokes, n. sp.
Plate 5, figs. 5a, 5b

Diagnosis: Nature of early whorls and total number of whorls not known. Axial ornamentation on body whorl consisting of five sharp, straight varices. Spiral ornamentation on body whorl of five flattened ribs marked by a strong median groove in each. Where the spiral ribs cross the varices, small open spines produced which are noticeably square in cross-section; spines connected by a laminated webbing. One small spine between shoulder spine and suture with no corresponding spiral rib; shoulder spine larger than all other spines. Varices extending the length of the anterior canal and bearing small spinelets but no trace of spiral ornamentation on canal. Aperture small, oval, almost entire. Outer lip with five crenulations corresponding to the five major varical spines. Inner lip smooth, standing free from columellar wall. Siphonal canal long, straight, probably recurved at extreme tip but broken in holotype.

Dimensions of holotype: height (incomplete) 12.7 mm, diameter (incomplete) 7 mm.

Holotype: USNM 645894.

Type locality: TU 638, quarry on south side of Mexico Highway 180, 14 miles east of junction with side road into Coatzacoalcos, Vera Cruz, Mexico.

Occurrence: Agueguexquite Formation, Vera Cruz, Mexico; upper Miocene.

Figured specimen: USNM 645894 (holotype).

Discussion: Even though known from only two spireless specimens, this new species from the Agueguexquite Formation of Vera Cruz, Mexico, is considered sufficiently critical to be included herein. It is evidently most closely related to the Recent *M. levicula* (Dall), differing from that species in having a longer, straighter anterior canal, and in not having the spiral ribs obsolete in the intervarical areas. This latter trait is dependent upon the size of the specimen in *M. levicula,* the juveniles still possessing intervarical ribbing, so it is possible that a larger specimen of *M. veracruzana* might resemble *M. levicula* even more closely. (Then again it may be a case of "ontogeny recapitulating phylogeny" with the young *M. levicula* duplicating the ancestral *M. veracruzana.*) Nevertheless, the greatly lengthened siphonal canal would serve to distinguish the Miocene form.

MUREXIELLA (MUREXIELLA) PETITI E. H. Vokes, n. sp.
Plate 5, figs. 3a, 3b

Diagnosis: Shell markedly biconic; six whorls in the holotype, nucleus lacking. Spiral ornamentation consisting of two strong ribs on each of the spire whorls and five such ribs on the body whorl, becoming almost obsolete in the intervarical areas of the adult shell. In addition, on the body whorl a few small threads irregularly placed. Axial ornamentation of small equal varices, seven to each turn. Where the spiral ribs cross the varices, small foliaceous open spines are produced, five major spines on the body whorl and two more on the siphonal canal; between the shoulder spine and the suture two smaller spines developed, although no corresponding spiral ribs appear in the intervarical areas. Spines connected by a laminar webbing. Aperture round, almost entire; outer lip slightly crenulated by infolding into apertural spines; inner lip smooth and standing well forward from the columellar wall. Siphonal canal short, recurved, almost closed over by a thin plate, but remaining open by a narrow slit.

Dimensions of holotype: height 21 mm, diameter 15 mm.

Holotype: USNM 645893.

Type locality: TU 558, borrow pits, north end of Crescent Beach Airport, Crescent Beach, Horry County, South Carolina.

Occurrence: Waccamaw Formation, South Carolina; Pliocene.

Figured specimen: USNM 645893 (holotype).

Discussion: This new species, based on a unique specimen from the Waccamaw Formation of South Carolina, may be ancestral to *M. levicula* (Dall) for both share the same tendency toward a smooth intervarical area as opposed to the strongly ribbed area of the similar *M. glypta.* However, there is another candidate for an ancestral *M. levicula* in the Agueguexquite Formation of Vera Cruz, Mexico, in the species named herein as *M. veracruzana. M. petiti* is undoubtedly closely related to *M. glypta* but may be distinguished by the smoother intervarical areas, the more inflated body whorl, the more sloping shoulder, and the more constricted siphonal canal of the new species.

Murexiella is rare in the Waccamaw Formation, there being known but one adult *M. glypta* and one *M. petiti,* plus three juveniles which the writer is reluctant to assign to one or the other of the two species. All of these specimens were collected by Mr. Richard E. Petit of Ocean Drive Beach,

South Carolina, who kindly furnished the holotype of *M. petiti.*

MUREXIELLA (MUREXIELLA) GLYPTA (Smith)

Plate 7, figs. 4a, 4b, 5

Murex glyptus M. SMITH, 1938, Nautilus, v. 51, p. 89, pl. 6, fig. 10.
Tritonalia cellulosa levicula Dall. M. SMITH, 1939, Illus. Cat. Recent Species Rock Shells, p. 16, pl. 13, fig. 8 (*not* of Dall).
Murex cellulosus leviculus Dall. CLENCH and PÉREZ FARFANTE, 1945, Johnsonia, v. 1, no. 17, p. 56, pl. 28, figs. 1-3 (*not* of Dall).
Murex (*Favartia*) *cellulosus leviculus* (Dall). ABBOTT, 1954, American Seashells, p. 205, pl. 25j (*not* of Dall).
"Unnamed species." E. H. VOKES, 1964, Malacologia, v. 1, no. 1, p. 13.

Diagnosis: "Nucleus of holotype imperfect, whorls about seven; suture well impressed; spiral sculpture consisting upon the body whorl of about twelve rounded ribs, arranged arc shaped from axial rib to rib, often marked with a division line in the center, the major termination of the axial sculpture turned backward from the direction of growth, openings beneath away from the recurved points. The eight axial eminences are sharp and largely formed by foliated processes. Aperture small, oval in shape; canal slightly oblique, almost closed." (Smith, 1938)

Dimensions of holotype: height 25.3 mm, diameter 14 mm.

Holotype: Univ. Alabama, Mus. Nat. Hist.

Type locality: Clewiston, Hendry County, Florida.

Occurrence: Caloosahatchee Formation, Florida; Waccamaw Formation, South Carolina; Pliocene. Unnamed post-Caloosahatchee formation, Florida; Pleistocene. Recent, Gulf of Mexico.

Figured specimens: Fig. 4, holotype. Fig. 5, USNM 645895; height 17 mm, diameter 9.5 mm; locality TU 580. Other occurrences: TU locality nos. 529b, 536, 558, 727, 759, 767, 803, R-99.

Discussion: This species has been confused with *M. levicula* (Dall) but the two forms are easily distinguished by the smooth intervarical areas of *M. levicula* as opposed to the strongly ribbed intervarical areas of *M. glypta.* The Recent *M. glypta* was well figured by Clench and Pérez Farfante (1945, pl. 28, figs. 1-3) under the name "*Murex cellulosus leviculus.*" A second distinguishing characteristic is the completely different nuclear types of the two species. *M. glypta* has a bulbous nucleus consisting of only 1½ whorls as does *M. hidalgoi,* the type of the genus, whereas *M. levicula* has a nucleus of four conical whorls more like that seen in the primitive muricine species (see discussion in Vokes, 1967b, p. 135 for further details).

The number of varices per whorl is highly variable in all of the species of *Murexiella.* In *M. glypta* it varies from five to eight without regard to the size of the shell. The spiral ribs are very strong and are often marked with a median groove. In *M. levicula* these spiral ribs are developed only on the varices but the median groove is even more pronounced than in *M. glypta.*

M. glypta is never abundant in the fossil record but is moderately widespread in the Pleistocene deposits of southern Florida. The type was said to be from the Caloosahatchee Formation at Clewiston, Florida. All citations of "Caloosahatchee Formation" are questionable due to recent work on the stratigraphy which has shown there to be three formations included in what was formerly called "Caloosahatchee." According to Thomas L. McGinty, a long time friend and associate of the late Maxwell Smith, the type probably did come from true Caloosahatchee beds (personal communication) but the species is rare in the Caloosahatchee, there being no more than some half dozen specimens known from unequivocal Caloosahatchee localities. There is also a single specimen from the correlative Waccamaw Formation of South Carolina (TU 558).

In general, the Pliocene specimens of *M. glypta* attain a larger size and are more ornately sculptured than those from the Pleistocene beds, the holotype being a particularly elegant specimen. The largest Pliocene shell (except for the holotype) seen by the writer measures 23 mm (TU 529b) and 20 mm seems to be the average adult size. The largest specimen of Pleistocene *M. glypta* seen measures 19.7 mm (TU 201) but this is an unusually large specimen and the average Pleistocene shell is about 15 mm in height. A Pleistocene specimen is figured (pl. 7, fig. 7) for comparison with the more elaborate type. Although the two shells have a dissimilar aspect, the writer can find no basis to distinguish the younger one as a different species. The differences are only of degree of development of the ornamentation with the type representing an extreme condition. Probably the Pliocene shells represent a somewhat deeper water environment than the Pleistocene ones.

In the Recent fauna, *M. glypta* is known to occur on the Yucatán Banks at a depth of about 17 fathoms (TU R-99) and the specimens figured by Clench and Pérez Farfante were said to come from Sanibel Island and Destin, Florida, in depths ranging from 4 to 14 fathoms. Other records are subject to question considering the confusion with *M. levicula.*

MUREXIELLA (MUREXIELLA) PUNTAGORDANUM (Weisbord)

Murex (Favartia) puntagordanum WEISBORD, 1962, Bulls. Amer. Paleontology, v. 42, no. 193, p. 292, pl. 26, figs. 7, 8.

Diagnosis: "Shell small, with a little over five whorls including the nucleus. Nucleus smooth, consisting of about 1¼ whorls, the tip loosely coiled and somewhat immersed, the last turn narrow and rounded. Post-nuclear whorls shouldered, the sculpture consisting of axial folds which later develop into varices, and spiral riblets of which there are three to five on the whorls of the spire. On the body whorl there are six high narrow varices and seven or eight strong, elevated, flat-topped primary spiral ribs separated by deep interspaces in either side of which there is a spiral thread close to the primary rib. On the whorls of the spire, the spiral riblets are narrow and tend to bifurcate on the crest of the axial folds and varices. On the ramp above the shoulder, spiral lineations are wanting or obsolescent throughout although the varices continue across the ramp to the suture. All of the six axials on the body whorl are true varices, and these are built up by incremental growth laminae into short spines whose tips are bent backward, the spines being channeled below the tip with the hollows open toward the aperture. These spines or pointed arches are produced on the narrow crest of the varices at the crossing or intercept of the spiral primary rib, and thus there are as many spines as there are spiral ribs on each varix. Surface of shell traversed with growth lamellae and it is these which, by incrementation at the varix, produce the "cellular" structure or spines. Aperture asymmetrically oval, the entrance to the siphonal canal wide, the posterior outlet covered over by the callus of the parietal shield. Outer lip with about seven denticles along the inner margin, the varix rising from the rim. Previous siphonal canal prominent, convex, bordered by an unbilicate [*sic*] depression. Present siphonal canal broken at the anterior end, but is probably relatively short." (Weisbord, 1962)

Dimensions of holotype: height (incomplete) 13 mm, diameter 8 mm.

Holotype: PRI 26202.

Type locality: North flank of Punta Gorda anticline, Cabo Blanco, Dist. Federal, Venezuela.

Occurrence: Playa Grande Formation (Maiquetía Member), upper Miocene or Pliocene; Dist. Federal, Venezuela.

Discussion: Weisbord compared his species "*Murex*" *puntagordanum* with Clench and Pérez Farfante's illustration of "*Murex cellulosus leviculus*" (1945, pl. 27, figs. 1-3) but, as is discussed under the preceding species, these pictures are of *Murexiella glypta,* not *M. levicula.* Indeed, *M. puntagordanum* does resemble these illustrations and in all probability *M. puntagordanum* is the same species as *M. glypta.* Unfortunately, the type specimen of *M. puntagordanum* is so poorly preserved that it is impossible to be absolutely certain of this synonymy and until better material is available, *M. puntagordanum* will be retained as a valid species.

MUREXIELLA (MUREXIELLA) GRACEAE (McGinty) Plate 7, fig. 6

Tritonalia graceae MCGINTY, 1940, Nautilus, v. 58, p. 84, pl. 10, figs. 2, 2a.

"Tritonalia" graceae McGinty. E. H. VOKES, 1963, Tulane Stud. Geol., v. 1, no. 4, p. 160.

Diagnosis: "Shell small, spire low, about 5 whorls (nucleus lost), suture appressed, indistinct; whorls shouldered; about 7 foliated ribs or varices; ribs spined, stronger and some recurved on the crown; double row of basal spines in the siphonal region; aperture truncate-oval; canal straight, longer than the aperture." (McGinty, 1940)

Dimensions of holotype: height 21.5 mm, diameter 16 mm.

Holotype: McGinty Collection, Boynton Beach, Florida.

Type locality: Belle Glade, West Palm Beach County, Florida.

Occurrence: Unnamed post-Caloosahatchee formation, Florida; Pleistocene.

Figured specimen: Holotype. Other occurrences: TU locality nos. 725, 727, 751.

Discussion: M. graceae is a rare species known only from the vicinity of the type locality. It is related to the more common *M. macgintyi* but, as was noted above, that species is not known from the Pleistocene beds in which *M. graceae* occurs. It is assumed, therefore, that *M. graceae* was an inhabitant of an environment different from that of *M. macgintyi.* This species occurs in what is known as the "Belle Glade facies" of Olsson's Unit A (*in* Olsson and Petit, 1964, p. 521), characterized by a fauna peculiar to the area. The ecological significance of this facies is not known at the present time.

M. graceae differs from *M. macgintyi* in

having a much lower, almost flat, spire, with a crown of long shoulder spines, and a long, nearly straight, siphonal canal.

MUREXIELLA (MUREXIELLA) LEVICULA (Dall)

Plate 7, figs. 7a, 7b

Ocinebra (*Favartia*) *cellulosa* var.(?) *levicula* DALL, 1889, Harvard Mus. Comp. Zool., Bull., v. 18, p. 211, pl. 16, fig. 1 (as *Ocinebra* (*Favartia*) *cellulosa* Conrad, young).

Not *Tritonalia cellulosa levicula* Dall. M. SMITH, 1939, Illus. Cat. Recent Species Rock Shells, p. 16, pl. 13, fig. 8 (= *Murexiella glypta*).

Not *Murex cellulosus leviculus* Dall. CLENCH and PÉREZ FARFANTE, 1945, Johnsonia, v. 1, no. 17, p. 56, pl. 28, figs. 1-3 (= *M. glypta*).

Murex (*Favartia*) *cellulosus* Conrad. ABBOTT, 1954, American Seashells, p. 204 (in part), fig. 45b (*not* of Conrad).

Not *Murex* (*Favartia*) *cellulosus leviculus* (Dall). ABBOTT, 1954, American Seashells, p. 205, pl. 25j (= *M. glypta*).

Diagnosis: "This form differs from the typical *cellulosa* in being somewhat smaller and more slender, and with one less varix on the average and with the varices thinner, somewhat more branched, and each forming a sharp-edged rather than a broadish rounded ridge. The revolving ribs are feebler, and in nearly all the specimens entirely obsolete over most of the space between the varices on the last whorl. This gives the shell a very different aspect, but a tendency to such a condition is seen in some specimens of *cellulosa* and other apparently allied species." (Dall, 1889)

Dimensions of lectotype: height 18 mm, diameter 10 mm.

Lectotype: USNM 93271 (here designated).

Type locality: *Albatross* Station 2372, about 60 miles south of Cape San Blas, Florida, in 27 fathoms.

Occurrence: Recent only, from Cape Lookout, North Carolina (?), to Cape San Blas, Florida.

Figured specimen: USNM 93271 (lectotype). Other occurrences: TU locality no. R-61.

Discussion: M. levicula was not figured as such by Dall and as a consequence there has been confusion over its identity. Dall did figure a specimen which he cited as "*Ocinebra* (*Favartia*) *cellulosa* Conrad, young" which seems almost certainly to be this species. This same illustration was refigured by Abbott (1954, fig. 45b) as "*Murex* (*Favartia*) *cellulosa*" (stated to be reduced ½ when actually it is enlarged more than 3×). All other references to "*levicula*" are really to *M. glypta,* a similar species of comparable distribution. The two species may be immediately distinguished by the smooth intervarical areas of *M. levicula,* as noted by Dall in the original description. *M. glypta* has strong spiral ribs over the intervarical areas. One might suspect that this is simply a matter of variability but the nuclear whorls of the two species are completely different as was discussed under *M. glypta* and there seems no doubt that we have two valid species.

Although *M. levicula* was described as a variety of "*Ocinebra cellulosa*" the two forms are only superficially alike. "*Murex*" *cellulosus* Conrad should be referred to the genus *Favartia* Jousseaume, 1880, (type species: *Murex breviculus* Sowerby). This latter taxon has been referred by authors, including the writer (Vokes, 1964, p. 29), to the genus *Aspella* but subsequent work on the radula shows that the type of *Favartia* is muricine. A recent paper by Radwin and Wells (1968, fig. 4) shows the radula of "*Murex*" *cellulosus* to be the same as *F. brevicula.*

In the original description of this species Dall (1889, p. 211) stated that the specimens came from *Albatross* Station 2609, off Cape Lookout, North Carolina. The label with the specimen here designated as lectotype reads: "Station 2372, about 60 miles south of Cape San Blas, Florida, in 27 fathoms." There are several specimens in the writer's collection from the vicinity of Cedar Key and Anna Maria Key, on the west coast of Florida, dredged from 20 fathoms. There are also several specimens from TU R-61, off Panama City, Florida, in 10 fathoms. The northeastern Gulf of Mexico, therefore, seems to be the principal locality for this species and Dall's North Carolina reference may be in error.

As with the other species of *Murexiella, M. levicula* has a variable number of varices per whorl. In general the larger shells tend to have only four or five varices and the smaller ones to have five to seven. The largest specimen seen measures 19 mm in height.

MUREXIELLA (MUREXIELLA) HIDALGOI (Crosse)

Murex hidalgoi CROSSE, 1869. Jour. de Conchyl., v. 17, p. 408; CROSSE, 1871, *ibid.*, v. 19, p. 68, pl. 1, fig. 4.

Murex (*Murexiella*) *hidalgoi* Crosse. CLENCH and PÉREZ FARFANTE, 1945, Johnsonia, v. 1, no. 17, p. 50, pl. 26, figs. 1-4.

[*Murexiella* (*Murexiella*)] *hidalgoi* (Crosse). E. H. VOKES, 1964, Malacologia, v. 2, no. 1, p. 13.

Diagnosis: "T. brevissime fusiformis, parum crassa sed solidula, paululum translucida, unicolor, albida; spira sat elongata; sutura profunde impressa; anfr. 7½-8 sexvaricosi, primi subangulati, vix aut non spinosi, antepenultimus et penultimus varicibus in spinas longiusculas, excavatas desinentibus instructi, costis 2 validis spiraliter muniti, ultimus spiram superans (::22:14), transversim costis 5 validis minutissime squamosis, versus marginem externum in spinas desinentibus et costulis minoribus, in interstitiis sitis, separatis impressus, et spinis quinqueseriatum dispositis et varicibus correspondentibus ornatus, serie prima spinarum subincurva, majore, e costa suturae magnis vicina oriunda; apertura ovata, parva, subintegra, intus laevigata, alba, in canalem longiusculum, fere clausum, subrecurvum, utrinque sat breviter spinosulum desinens; pesist, albidum, subcontinuum, margine columellari laevigato, subarcuato, leviter prominulo, externo ad limbum subundosa, mox extus, occursu varicis, in alam aperturae latitudinem superantem, et interstitiis spinarum lineis undosis elegantissime sculptam producto." (Crosse, 1869)

Dimensions of holotype: height 36 mm, diameter (including spines) 27 mm.

Holotype: Collection of Patricio Paz of Madrid (Clench and Pérez Farfante, 1945, p. 51) now in the Madrid Museum (Dance, 1966, p. 297).

Type locality: Guadeloupe, Lesser Antilles (designated by Clench and Pérez Farfante, 1945, p. 51).

Occurrence: Recent only, Gulf of Mexico and Lesser Antilles.

Discussion: M. hidalgoi is not a rare species but it lives only in moderately deep water. Depth records ranging from 76 to 196 fathoms were recorded by Clench and Pérez Farfante (1945, p. 51). Those authors gave only the Lesser Antilles for locality but the U. S. Fish and Wildlife Service dredged the species at two stations in the Gulf of Mexico (Springer and Bullis, 1956, p. 28) and James Moore of Palmetto, Florida, has dredged numerous specimens in the vicinity of Anna Maria Key, off western Florida in about 100 fathoms (personal communication).

Subgenus SUBPTERYNOTUS Olsson and Harbison, 1953

Subpterynotus OLSSON and HARBISON, 1953, Acad. Nat. Sci. Phila., Mon. 8, p. 246.
Type species: *Murex textilis* Gabb, by original designation.

MUREXIELLA (SUBPTERYNOTUS) TEXTILIS (Gabb)
Plate 8, figs. 1-3

Murex cf. *pinnatus* Swainson. MOORE, 1853, Geol. Soc. London, Quart. Jour., v. 9, p. 131.
Murex (*Pteronotus*) *textilis* GABB, 1873, Amer. Phil. Soc., Trans., (N. S.) v. 15, pt. 1, p. 202.
Murex textilis Gabb. GUPPY, 1876, Geol. Soc. London, Quart. Jour., v. 32, p. 522, pl. 29, fig. 1.
Murex (*Pteronotus*) *textilis* Gabb. DALL, 1890, Wagner Free Inst. Sci., Trans., v. 3, pt. 1, p. 142, pl. 9, fig. 4. (On plate expl. p. 187 as *Pteronotus textilis.*)
Murex (*Pteropurpura*) *textilis* Gabb. DALL, 1892, Wagner Free Inst. Sci., Trans., v. 3, pt. 2, p. 243.
Murex (*Pteropurpura*) *textilis* Gabb. COSSMANN, 1903, Essais Paléoconch. Comp., v. 5, p. 20.
Murex (*Pteropurpura*) *textilis* Gabb. PILSBRY, 1922, Acad. Nat. Sci. Phila., Proc., v. 73, p. 353, pl. 28, fig. 4 (holotype).
Murex (*Subpterynotus*) *textilis* Gabb. OLSSON and HARBISON, 1953, Acad. Nat. Sci. Phila., Mon. 8, p. 247, pl. 36, figs. 7, 7a.
Murex (*Subpterynotus*) *textilis* Gabb. DUBAR, Florida Geol. Surv., Bull. 40, p. 197, pl. 11, fig. 8.
[*Pterynotus* (*Pterynotus*)] *textilis* (Gabb). E. H. VOKES, 1964, Malacologia, v. 2, no. 1, p. 14.
Murex (*Subpterynotus*) *textilis* Gabb. JUNG, 1965, Bulls. Amer. Paleontology, v. 49, no. 223, p. 521, pl. 69, figs. 8, 10.

Diagnosis: "Shell compressed triangular; whorls eight, the first nuclear, the next three cancellate and showing little or no trace of varices, which show themselves on the next (fifth) distinctly for the first time, suture deep, caused by the great convexity of the whorls. Body whorl broad and flat above, then very convex near the top and tapering very gradually in advance. The three varices are thick at their bases, broad, acute and slightly recurved on the margin. Between each pair of varices there is one large prominent node, placed longitudinally, too broad to be called a rib. The entire surface is covered by about a dozen revolving ribs, except on the faces of the varices, where corresponding grooves take their places. Crossing these, the lines of growth are developed into minute erect plates, placed at equal distances and arching over all the ribs and intermediate, alternating lines, so as to produce under a lens, the effect of a lace, or loosely woven web. Aperture small, ovate; inner lip acute; outer lip faintly grooved internally; canal about twice as long as mouth and nearly, or entirely arched over." (Gabb, 1873)

Dimensions of holotype: height 30.5 mm, diameter 16 mm.

Holotype: ANSP 3257.

Type locality: Dominican Republic, exact locality unknown.

Occurrence: Chipola Formation, Florida; (?) late lower Miocene. Unknown formation, Dominican Republic; (?) middle Miocene. Unnamed formation, Paraguaná Peninsula, Venezuela; late middle Miocene. Pinecrest Beds and Jackson Bluff Formation, Florida; upper

Miocene. Caloosahatchee Formation, Florida; Pliocene.

Figured specimens: Fig. 1, ANSP 3257 (holotype). Fig. 2, USNM 645615; height 67 mm, diameter 28 mm; locality TU 519. Fig. 3, USNM 645938; height 15 mm, diameter 7 mm; locality TU 951. Other occurrences: TU locality nos. 60, 68, 79, 202, 203, 520, 536, 579, 583, 726, 728, 729, 730, 745, 755, 767, 769, 770, 797.

Discussion: M. textilis was described from the Miocene of Santo Domingo without an indication of the exact locality or stratigraphic horizon, as were all of Gabb's species from that island. It was first figured by Guppy (1876, pl. 29, fig. 1) from the material in the collections of the Geological Society of London made by J. S. Heneken, again without any further data. No specimens were found by Maury (1917) nor any subsequent workers and so its Dominican locality is still unknown. Jung (1965, p. 521) reported this species from the late middle Miocene beds of the Paraguaná Peninsula of Venezuela indicating the possibility that the Dominican specimen may have come from the Gurabo Formation but there is no definite correlation between the two occurrences especially in view of the fact that a single small specimen of *M. textilis* has been found in the Chipola Formation of northwestern Florida (TU 951) suggesting that the Dominican shell may be from older beds.

Except for this single Chipola specimen (pl. 8, fig. 3) the species first occurs in the United States in the Pinecrest Beds of southern Florida and the Jackson Bluff Formation of northern Florida, both late Miocene in age. It is found throughout the Pliocene but died out at the end of that epoch. There is no known Recent analogue. Sowerby (1904, p. 176) described a Recent species, "*Murex*" *exquisitus,* without locality, which is the only living member of the *Subpterynotus* line, but it more closely resembles the European lower Miocene species of *Subpterynotus, M. subgranifer* (Cossmann and Peyrot, 1923) and probably is an Indo-Pacific form.

When Olsson and Harbison (1953, p. 247) named *M. textilis* as the type species of *Subpterynotus* they stated that the new subgenus differed from *Pterynotus* "in having a perfectly straight anterior canal." This is the case in almost all specimens seen but it is a result of abrasion, for a few specimens such as the one figured here (pl. 8, fig. 2) show that the distal end of each siphonal canal diverges from the previous canal in a typical *Murexiella* manner. *M. textilis* seems to have lived in a moderately high energy environment for the anterior canal is usually broken off, as in the type specimen (pl. 8, fig. 1). The Caloosahatchee shell here figured shows that the canal was broken during the animal's lifetime and was repaired. In over 125 specimens examined from Florida not one had the apical whorls preserved, all were eroded away. Fortunately the type specimen has well-preserved early whorls and from it can be seen that the neanic whorls are formed in the manner of the typical *Murexiella* with numerous varices per whorl. Only on the fifth post-nuclear whorl does the development of three varices and three intervarical nodes take place.

V. Locality Data

The following are Tulane University fossil locality numbers:

1. Unnamed formation, material dredged from depth of 15 to 30 ft. for construction of Interstate 10, south of Lake Pontchartrain, between Downman Road and Paris Road, New Orleans, Orleans Parish, Louisiana.
60. Choctawhatchee Fm., borrow pits at Jackson Bluff, Ochlockonee River (NW ¼ Sec. 21, T1S, R4W), Leon Co., Florida.
61. Stone City Beds, type locality, Stone City Bluff on Brazos River, at crossing of bridge of Texas Highway 21, Burleson Co., Texas.
68. Caloosahatchee Fm., North St. Petersburg, 70th Ave. at 9th St. N., Pinellas Co., Florida.
78. Gosport Sand, Claiborne Bluff, east bank of Alabama River, south of bridge of U. S. Highway 84, Monroe Co., Alabama.
79. Caloosahatchee Fm. and unnamed post-Caloosahatchee formation mixed, spoil banks north and south side of Caloosahatchee River, at Ortona Lock (Sec. 27, T42S, R30E), Glades Co., Florida.
85. Wautubbee Fm., roadcut on county road four miles northeast of Rose Hill, Jasper Co., Mississippi.
86. Wautubbee Fm., roadcut on east side on Mississippi Highway 15, 0.8 mile north of junction with U. S. Highway 80, Newton Co., Mississippi. (Note: Interstate 20 has subsequently covered this locality and it is no longer available.)
98. Cook Mountain Fm. (Saline Bayou Member), type locality, Saline Bayou, at railroad trestle near St. Maurice, Winn Parish, Louisiana.
99. Moodys Branch Marl, Montgomery Landing (also known as Creola Bluff), west bank of Red River (Sec. 20, T8N, R5W), Grant Parish, Louisiana.

200. Pinecrest Beds, borrow pits about one mile southwest of Acline (Sec. 29, T41S, R23E), Charlotte Co., Florida.
201. Unnamed post-Caloosahatchee formation, spoil banks at pit just south of Belle Glade, Palm Beach Co., Florida.
202. Caloosahatchee Fm., south bank of Caloosahatchee River, about two miles west of La Belle (SE ¼ Sec. 12, T43S, R28E), Hendry Co., Florida.
203. Caloosahatchee Fm., north bank of Caloosahatchee River, about two miles east of Fort Denaud (SW ¼ Sec. 11, T43S, R28E), Hendry Co., Florida.
222. Cook Mountain Fm. (Hurricane Lentil), type locality, Hurricane Bayou, 3.3 miles north of Crockett courthouse, on Texas Farm Road 2022, Houston Co., Texas.
226. Red Bluff Clay, Chickasawhay River at Hiwannee, 3½ miles south of Shubuta (Sec. 28, T10N, R7W, St. Stephans Base and Meridian), Wayne Co., Mississippi. (Given in previous papers as the type locality of the Red Bluff Clay, but subsequent work has proved that locality to be about two miles north of TU 226).
243. Weches Fm., Colorado River, 625 ft. downstream from bridge of Texas Highway 71 at Smithville, Bastrop Co., Texas.
306. Gosport Sand, Little Stave Creek, northeast of Jackson, Clarke Co., Alabama.
354. McBean Fm., roadcut on U. S. Highway 21, 1.9 miles north of junction with U. S. Highway 178 Bypass, at Orangeburg, Orangeburg Co., South Carolina.
457. Chipola Fm., west bank of Chipola River, about ½ mile below Ten Mile Creek (SW ¼ Sec. 17, T1N, R9W), Calhoun Co., Florida. (Same as USGS 2213, 2564, and 3419, "One mile below Bailey's ferry.")
519. Caloosahatchee Fm., Harney Pond Canal spoil banks, at Florida Highway 78, northwest side of Lake Okeechobee (NW ¼ Sec. 18, T40S, R33E), Glades Co., Florida.
520. Pinecrest Beds, spoil banks, canal 0.9 mile east of Brighton on Florida Highway 70 (Sec. 25, T37S, R32E), Highlands Co., Florida. (Incorrectly given in previous papers as "1/3 mile east of Brighton.")
523. Pinecrest Beds, Harney Pond Canal spoil banks, six miles northwest of Florida Highway 78, Brighton Indian Reservation (NW ¼ Sec. 22, T39S, R32E), Glades Co., Florida.
525. Pinecrest Beds, U. S. Highway 41, at "Forty-mile Bend," Dade Co., Florida.
527. Caloosahatchee Fm., north shore Lake Okeechobee, Pumping Station no. 127 (NE ¼ Sec. 35, T39S, R33E), Glades Co., Florida.
529b. Caloosahatchee Fm., north bank of Caloosahatchee River, about two miles west of La Belle (SE ¼ Sec. 12, T43S, R28E), Hendry Co., Florida.
536. Caloosahatchee Fm., south bank of Caloosahatchee River about one mile east of La Belle (Sec. 3 & 4, T43S, R29E), Hendry Co., Florida. (Designated as type locality of the Caloosahatchee Fm. by Olsson *in* Olsson and Petit, 1964, p. 519.)
539b. Caloosahatchee Fm., Shell Creek (lower beds), about eight miles east of Cleveland (Sec. 30, T40S, R25E), Charlotte Co., Florida.
541. Caloosahatchee Fm., Miami Canal spoil banks, two miles north of pumping station at Broward County line, Palm Beach Co., Florida.
544. Moodys Branch Marl, Bunker Hill, on south side of Ouachita River (N ½ Sec. 24, T12N, R4E), about eight miles southeast of Columbia, Caldwell Parish, Louisiana.
545. Moodys Branch Marl, east bank of Bayou Toro (SE ¼, NW ¼, Sec. 6, T3N, R11W), Vernon Parish, Louisiana.
547. Chipola Fm., west bank of Chipola River, about 2000 ft. above the mouth of Four Mile Creek (SW ¼ Sec. 29, T1N, R9W), Calhoun Co., Florida.
554. Chipola Fm., east bank of Chipola River, at power line crossing (SW ¼ Sec. 17, T1N, R9W), Calhoun Co., Florida.
555. Chipola Fm., east bank of Chipola River, about 1000 ft. above the mouth of Four Mile Creek (SW ¼ Sec. 29, T1N, R9W), Calhoun Co., Florida.
558. Waccamaw Fm., borrow pits at north end of Crescent Beach Airport, Crescent Beach, Horry Co., South Carolina.
578. Unnamed post-Caloosahatchee formation, "Rim Ditch" spoil banks, ½ mile south of Florida Highway 68 (Sec. 8, T35S, R38E), St. Lucie Co., Florida.
579. Caloosahatchee Fm., Miami Canal spoil banks, four miles north of pumping station

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Plate 8

Figures — Page

1-3. *Murexiella* (*Subpterynotus*) *textilis* (Gabb) ---------- 120

1. (× 2) ANSP 3257 (holotype); height 30.5 mm, diameter 16 mm. Locality: Dominican Republic. Unknown formation, Miocene.
2. (× 1½) USNM 645615; height 67 mm, diameter 28 mm. Locality: TU 519. Caloosahatchee Fm., Pliocene.
3. (× 3) USNM 645938; height 15 mm, diameter 7 mm. Locality: TU 951. Chipola Fm., (?) lower Miocene.

PLATE 8

at Broward County line, Palm Beach Co., Florida.
580. Unnamed post-Caloosahatchee formation, North New River Canal spoil banks, one mile south of South Bay, Palm Beach Co., Florida.
583. Caloosahatchee Fm., Miami Canal spoil banks, seven miles north of pumping station at Broward County line, Palm Beach Co., Florida.
638. Agueguexquite Fm., roadcut and quarry on Mexico Highway 180, 14 miles east of junction with side road into Coatzacoalcos, Vera Cruz, Mexico.
725. Unnamed post-Caloosahatchee formation, North New River Canal spoil banks, three miles south of South Bay, at Okeelanta, Palm Beach Co., Florida.
726. Caloosahatchee Fm., Hendry County rockpit, ½ mile north of Florida Highway 80, three miles west of La Belle (SE ¼ Sec. 14, T43S, R28E), Hendry Co., Florida.
727. Unnamed post-Caloosahatchee formation, borrow pits 2.2 miles east of U. S. Highway 27, 15 miles south of South Bay, Palm Beach Co., Florida.
728. Pinecrest Beds, spoil banks on west side of Kissimmee Canal and east side of Kissimmee River, just across from U. S. Corps of Engineers Structure 65-D (Sec. 33, T36S, R33E), Okeechobee Co., Florida.
729. Pinecrest Beds, spoil banks on west side of Kissimmee Canal and east side of Kissimmee River, approximately ½ mile south of U. S. Corps of Engineers Structure 65-D (S ½ Sec. 33, T36S, R33E), Okeechobee Co., Florida.
730. Pinecrest Beds, embankment of Seaboard Airline Railroad, just west of Kissimmee River (NW ¼ Sec. 20, T36S, R33E), Highlands Co., Florida.
736. Pinecrest Beds, spoil banks on south side of Florida Highway 70 and east side of Kissimmee River, Okeechobee Co., Florida.
745. Caloosahatchee Fm., Miami Canal spoil banks, 10.8 miles north of pumping station at Broward County line, Palm Beach Co., Florida.
755. Caloosahatchee Fm., Miami Canal spoil banks, 17.4 miles north of pumping station at Broward County line, Palm Beach Co., Florida.
756. Pinecrest Beds, spoil banks west side of Elkcan Waterway, Port Charlotte Development, 2.3 miles southeast of Port Charlotte Railroad Station (formerly Murdock) and 1.7 miles east of U. S. Highway 41 (Sec. 10, T40S, R22E), Charlotte Co., Florida.
759. Unnamed post-Caloosahatchee formation, spoil banks north side of Caloosahatchee River, two miles west of Ortona Lock (NE ¼ Sec. 29, T42S, R30E), Glades Co., Florida.
767. Caloosahatchee Fm. and unnamed post-Caloosahatchee formation mixed, spoil banks north side of Caloosahatchee River, five miles west of Ortona Lock (NW ¼ Sec. 36, T42S, R29E), Glades Co., Florida.
769. Pinecrest Beds, spoil banks east side of Kissimmee River, 1½ to two miles south of U. S. Corps of Engineers Structure 65-D (NE ¼ Sec. 35, T36S, R33E), Okeechobee Co., Florida.
770. Pinecrest Beds and Caloosahatchee Fm. mixed, spoil banks west side of Kissimmee River, 1½ to 3½ miles north of Florida Highway 70 (Secs. 10, 14, 15, and 28, T37S, R33E), Highlands Co., Florida.
796. Pinecrest Beds, material exposed during construction of "Alligator Alley," 12.8 miles east of Florida Highway 29 (T49S, R32E), Collier Co., Florida.
797. Pinecrest Beds, material exposed during construction of "Alligator Alley," 13.3 miles east of Florida Highway 29 (T49S, R32E), Collier Co., Florida.
803. Unnamed post-Caloosahatchee formation, spoil banks south side of Caloosahatchee River, two miles west of Ortona Lock (NE ¼ Sec. 29, T42S, R30E), Glades Co., Florida.
818. Chipola Fm., Farley Creek, 0.1 mile west of bridge of Florida Highway 275 (SW ¼ Sec. 21, T1N, R9W), Calhoun Co., Florida.
820. Chipola Fm., Farley Creek, at bridge of Florida Highway 275 (SW ¼ Sec. 21, T1N, R9W), Calhoun Co., Florida.
825. Chipola Fm., Farley Creek, at abandoned mill about ¼ mile west of bridge of Florida Highway 275 (SW ¼ Sec. 21, T1N, R9W), Calhoun Co., Florida.
827. Chipola Fm., Farley Creek, about ½ mile west of bridge of Florida Highway 275 (SE ¼ Sec. 20, T1N, R9W), Calhoun Co., Florida.
828. Chipola Fm., Farley Creek, just upstream from mouth of unnamed tributary about ¾ mile downstream from bridge of Florida Highway 275 (SE ½ Sec. 20, T1N, R9W), Calhoun Co., Florida.
830. Chipola Fm., Ten Mile Creek, at power line crossing about one mile west of Chipola River (SE ¼ Sec. 12, T1N, R10W), Calhoun Co., Florida.
907. Wautubbee Fm., southwest corner of junction of Mississippi Highway 15 and Interstate 20, behind Texaco Station, just north of Newton, Newton Co., Mississippi.
917. Moodys Branch Marl, Town Creek, just east of Gulf, Mobile, and Ohio Railroad bridge; about one block east of State Street and two blocks north of U. S. Highway 80, Jackson, Hinds Co., Mississippi.
921. Wautubbee Fm., fill behind Sinclair Truck Stop, northwest corner of intersection of Mississippi Highway 15 and Interstate 20 (material probably from cut for I-20); just north of Newton, Newton Co., Mississippi.
923. Wautubbee Fm., hill on south side of county road paralleling Interstate 20 along north side, 0.3 mile west of Mississippi Highway 15, just north of Newton, Newton Co., Mississippi.
924. Wautubbee Fm., roadcut 2.7 miles east of Mississippi Highway 15 at Newton, on

road to Poplar Springs Church, Newton Co., Mississippi.

951. Chipola Fm., about 1¼ miles west of Chipola River (SE ¼ Sec. 12, T1N, R10W), Calhoun Co., Florida.

The following are Tulane University Recent locality numbers:

R-60. Steel pilings, "Texas Tower–Stage I," 12 miles off Panama City, Bay Co., Florida. 17 fathoms.

R-61. Steel pilings, "Texas Tower–Stage II," 1½ miles off Panama City, Bay Co., Florida. 10 fathoms.

R-99. Dredged off northeastern Yucatán Peninsula, Long. 86° 34′ W, Lat. 21° 41′ N, 17 fathoms.

VI. Literature Cited

Abbott, R. T., 1954, American Seashells. New York. 541 p., 40 pls., 100 text figs.

Aldrich, T. H., 1895, New or little known Tertiary Mollusca from Alabama and Texas: Bulls. Amer. Paleontology, v. 1, no. 2, p. 53-82, pls. 2-6.

Baily, J. L., Jr., 1960, The type of *Polyplex* Perry: Nautilus, v. 74, p. 28-31.

Bellardi, Luigi, 1873, I Molluschi dei terreni Terziari del Piemonte e della Liguria; Parte I: R. Accad. Sci. Torino, Mem. (Ser. 2), v. 27, p. 1-264, pls. 1-15.

Brann, D. C., and L. S. Kent, 1960, Catalogue of the type and figured specimens in the Paleontological Research Institution: Bull. Amer. Paleontology, v. 40, no. 184, p. 1-996, 1 pl.

Bullis, H. R., Jr., and J. R. Thompson, 1965, Collections by the exploratory fishing vessels *Oregon, Silver Bay, Combat,* and *Pelican* made during 1956-1960 in the southwestern north Atlantic: U. S. Fish and Wildlife Serv., Spec. Sci. Rept.—Fisheries no. 510, 130 p.

Cernohorsky, W. O., 1967, The Muricidae of Fiji (Mollusca: Gastropoda) Part I—Subfamilies Muricinae and Tritonaliinae: Veliger, v. 10, no. 2, p. 111-132, pls. 14, 15, text figs. 1-11, 1 map.

Clench, W. J., and I. Pérez Farfante, 1945, The genus *Murex* in the western Atlantic: Johnsonia, v. 1, no. 17, 58 p., 29 pls.

Cossmann, A. E. M., 1889, Catalogue illustré des fossiles de l'Éocène des environs de Paris: Soc. Roy. Malac. Belg., Ann., v. 24 (fasc. 4), p. 1-385, pls. 1-12.

Cossmann, A. E. M., 1893, Notes complémentaires sur la faune éocènique de l'Alabama: Ann. Géol. Paléontologie, livr. 12, 51 p., 2 pls.

Cossmann, A. E. M., 1903, Essais de paléoconchologie comparée, v. 5. Paris. 215 p., 9 pls.

Cossmann, A. E. M., and Georges Pissarro, 1911, Iconographie complète des coquilles fossiles de l'Éocène des environs de Paris: v. 2, pls. 10-45. [Volume 2 issued in parts: pls. 1-9 in 1907, pls. 10-45 in 1911, pls. 46-65 + index in 1913.]

Dall, W. H., 1889, Report on the Mollusca (Blake Expedition); Part II, Gastropoda: Harvard Mus. Comp. Zool., Bull. 18, Report 29, 492 p., 31 pls.

Dall, W. H., 1890, Contributions to the Tertiary fauna of Florida: Wagner Free Inst. Sci., Trans., v. 3, pt. 1, p. 1-200, pls. 1-12.

Dall, W. H., 1915, A monograph of the molluscan fauna of the *Orthaulax pugnax* zone of the Oligocene of Tampa, Florida: U. S. Natl. Mus., Bull. 90, 173 p., 26 pls.

Dance, S. P., 1966, Shell collecting. London. 344 p., 35 pls.

Dushane, Helen, and Roy Poorman, 1967, A checklist of Mollusks for Guaymas, Mexico: Veliger, v. 9, no. 4, p. 413-441.

Emerson, W. K., 1968, Remarks on the taxonomic placement of *Maxwellia* Baily, 1950, and related taxa: Veliger, in press.

Gardner, Julia, 1947, The molluscan fauna of the Alum Bluff Group of Florida, Part 8: U. S. Geol. Surv., Prof. Paper 142-H, p. 483-656, pls. 52-62.

Gardner, Julia, and T. H. Aldrich, 1919, Mollusca from the upper Miocene of South Carolina with descriptions of new species: Acad. Nat. Sci. Phila., Proc., v. 71, p. 17-53, pls. 1-4.

Guppy, R. J. L., 1876, On the Miocene fossils of Haiti: Geol. Soc. London, Quart. Jour., v. 32, p. 516-532, pls. 28, 29.

Habe, Tadashige, 1964, Shells of the western Pacific in colour, v. 2. Osaka, Japan. 233 p., 66 pls.

Harris, G. D., and K. V. W. Palmer, 1946-1947, The Mollusca of the Jackson Eocene of the Mississippi embayment (Sabine River to the Alabama River): Bulls. Amer. Paleontology, v. 30, no. 117 (in 2 parts), p. 1-563, pls. 1-65.

Heilprin, Angelo, 1887, Explorations on the west coast of Florida. . . : Wagner Free Inst. Sci., Trans., v. 1, 134 p., 19 pls.

Holmes, F. S., 1860, Post-Pleiocene fossils of South Carolina. Charleston, South Carolina. 122 p., 28 pls.

Jung, Peter, 1965, Miocene Mollusca from the Paraguaná Peninsula, Venezuela: Bulls. Amer. Paleontology, v. 49, no. 223, p. 385-652, pls. 50-79, 2 tables, 2 text figs.

Keen, A. M., 1964a, *Purpura, Ocenebra,* and *Muricanthus* (Gastropoda): Request for clarification of status. Z.N.(S.) 1621: Bull. Zool. Nomenclature, v. 21, pt. 3, p. 235-239.

Keen, A. M., 1964b, Six misidentified type-species in the superfamily Muricacea (Gastropoda). Z.N.(S.) 1623: Bull. Zool. Nomenclature, v. 21, pt. 6, p. 422-428.

Kiener, L. C., 1843, Spécies général et iconographie des coquilles vivantes . . . Famille des canalifères, troisieme partie, Genre Rocher. Paris. 130 p., 47 pls.

Maury, C. J., 1910, New Oligocene [Miocene] shells from Florida: Bulls. Amer. Paleontology, v. 4, no. 21, p. 119-164, pls. 18-26.

Maury, C. J., 1922, Recent Mollusca of the Gulf of Mexico and Pleistocene and Pliocene species from the Gulf States. Pt. 2. Scaphop-

oda, Gastropoda, Amphineura and Cephalopoda: Bulls. Amer. Paleontology, v. 9, no. 38, p. 33-173.

Michelotti, Giovanni, 1847, Déscription des fossiles des terrains Miocenes de l'Italie Septentrionale: Nat. Verhand. Holland. Maat. Wetens. Haarlem (Ser. 2) v. 3, no. 2, p. 1-409, pls. 1-17.

Moore, E. J., 1962, Conrad's Cenozoic fossil marine mollusk type specimens at the Academy of Natural Sciences of Philadelphia: Acad. Nat. Sci. Phila., Proc., v. 114, p. 23-120, pls. 1-2.

Olsson, A. A., 1964, Neogene mollusks from northwestern Ecuador. Paleontological Research Institution, Ithaca, New York. 256 p., 38 pls.

Olsson, A. A., and Anne Harbison, 1953, Pliocene Mollusca of southern Florida, with special reference to those from North Saint Petersburg: Acad. Nat. Sci. Phila., Monograph 8, 457 p., 65 pls.

Olsson, A. A., and R. E. Petit, 1964, Some Neogene Mollusca from Florida and the Carolinas: Bulls. Amer. Paleontology, v. 47, no. 217, p. 509-574, pls. 77-83.

Palmer, K. V. W., 1937, The Claibornian Gastropoda, and dibranchiate Cephalopoda of the southern United States: Bulls. Amer. Paleontology, v. 7, no. 32, p. 1-548, pls. 1-90.

Palmer, K. V. W., and D. C. Brann, 1966, Catalogue of the Paleocene and Eocene Mollusca of the southern and eastern United States. Part II—Gastropoda: Bulls. Amer. Paleontology, v. 48, no. 218, p. 467-1057, pls. 4, 5.

Perrilliat Montoya, M. C., 1960, Moluscos de la Cuenca Salina del Istmo de Tehuantepec, Mexico: Paleontologia Mexicana, no. 8, 38 p., 4 pls., 2 text figs., 1 table.

Perrilliat Montoya, M. C., 1963, Moluscos de la Formación Agueguexquite (Miocene medio) del Istmo de Tehuantepec, Mexico: Paleontologia Mexicana, no. 14, 45 p., 6 pls.

Ponder, W. F., 1968, Nomenclatural notes on some New Zealand Rachiglossan gastropods with descriptions of five new species: Records of Dominion Mus., v. 6, no. 4, p. 29-47, pls. 1-5.

Radwin, G. E., and H. W. Wells, 1968, Comparative radular morphology and feeding habits of muricid gastropods from the Gulf of Mexico: Bull. Marine Sci., v. 18, no. 1, p. 72-85, figs. 1-20, 2 tables.

Rowett, C. L., 1957, A Quaternary molluscan assemblage from Orleans Parish, Louisiana: Gulf Coast Assoc. Geol. Soc., Trans., v. 7, p. 153-164, figs. 1-9.

Sowerby, G. B., Jr., 1834-1841, Conchological Illustrations, pls. 58-67 (issued in 1834); pls. 187-199 (issued in 1841); *Murex*: A catalogue of Recent species, 9 p., included.

Sowerby, G. B., Jr., 1879, Thesaurus Conchyliorum, v. 4, *Murex*, 55 p., 24 pls.

Sowerby, G. B., III, 1904, Descriptions of six new species of marine Mollusca from the collection of the late Admiral Keppel: Malac. Soc. London, Proc., v. 6, no. 3, p. 174-177, illustrated.

Springer, Stewart, and H. R. Bullis, Jr., 1956, Collections by the *Oregon* in the Gulf of Mexico: U. S. Fish and Wildlife Serv., Spec. Sci. Rept.-Fisheries no. 196, 134 p.

Stenzel, H. B., E. K. Krause, and J. T. Twining, 1957, Pelecypoda from the type locality of the Stone City Beds (middle Eocene) of Texas: Univ. Texas Publ. 5704, 237 p., 22 pls., 4 tables, 31 text figs.

Thalmann, H. E., 1935, Miocene Agueguexquite Formation in the Isthmus of Tehuantepec region [Abstract]: Geol. Soc. Amer., Proc. for 1934, p. 116.

Thomas, E. P., 1942, The Claiborne: Mississippi Geol. Surv., Bull. 48, p. 1-96, figs. 1-26, profiles A-E, pls. 1, 2.

Vaughan, T. W., 1896, A brief contribution to the geology and paleontology of northwestern Louisiana: U. S. Geol. Surv., Bull. 142, p. 1-65, pls. 1-4.

Vokes, E. H., 1963, Notes on Cenozoic Muricidae from the western Atlantic region with descriptions of new taxa: Tulane Stud. Geol., v. 1, no. 4, p. 151-163, pls. 1-2.

Vokes, E. H., 1964, Supraspecific groups in the subfamilies Muricinae and Tritonaliinae (Gastropoda: Muricidae): Malacologia, v. 2, no. 1, p. 1-41, pls. 1-3.

Vokes, E. H., 1967a, Observations on *Murex messorius* and *Murex tryoni*, with the description of two new species of *Murex*: Tulane Stud. Geol., v. 5, no. 2, p. 81-90, pls. 1-4.

Vokes, E. H., 1967b, Cenozoic Muricidae of the western Atlantic region. Part III—*Chicoreus* (*Phyllonotus*): Tulane Stud. Geol., v. 5, no. 3, p. 133-166, pls. 1-6, 1 table.

Whitfield, R. P., 1894, Mollusca and Crustacea of the Miocene formations of New Jersey: U. S. Geol. Surv., Monograph 24, 193 p., 24 pls.

Woolacott, Lee, 1957, Notes on Australian shells, no. 2: Roy. Zool. Soc. New South Wales, Proc. for 1955-1956, p. 112-116, pl. 3.

November 22, 1968