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CENOZOIC MURICIDAE OF THE WESTERN ATLANTIC REGION PART IX - *PTERYNOTUS, POIRIERIA, ASPELLA, DERMOMUREX, CALOTROPHON, ACANTHOLABIA,* AND *ATTILIOSA;* ADDITIONS AND CORRECTIONS

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CONTENTS

I. ABSTRACT

A total of 124 names have been applied to western Atlantic species referred herein to the muricid genera *Pterynotus, Poirieria, Aspella, Dermomurex, Calotrophon, Acantholabia* and *Attiliosa.* Of these, 97 are valid and are treated systematically; an additional two are cited as "species." These include the following numbers of taxa: *Pterynotus* – 24; *Poirieria* – 35; *Aspella* – 4; *Dermomurex* – 25; *Calotrophon* – 6; *Acantholabia* – 2; *Attiliosa* – 3. There are 43 species in the Recent fauna, but only 29 are confined to the Recent, the remainder are both living and fossil. Of the 97 valid taxa, 12 are new species and are named herein. These are: *Pterynotus (Pterynotus) praepatagiatus,* from the Chipola Formation; *Poirieria (Panamurex) gibsonsmithi,* from the Cantaure Formation and *Poirieria (Panamurex) improcerus,* from the Cantaure and Caujarao formations; *Poirieria (Panamurex) rutschi,* from the Punta Gavilán Formation; *Dermomurex (Dermomurex) sarkini,* from the Moín Formation; *Dermomurex (Takia) portelli,* from the Suwannee Limestone and River Bend Formation; *Calotrophon venezuelanus,* from the Mare Formation; *Poirieria (Paziella) petuchi, Poirieria (Panamurex) eugeniae, Dermomurex (Dermomurex) worsfoldi, Dermomurex (Dermomurex) sarasuae* and *Dermomurex (Dermomurex) binghamae,* all from the Recent.

II. INTRODUCTION

This study concludes the revision of the Cenozoic Muricinae of the western Atlantic begun in Part VIII (Vokes, 1990). It includes material originally published in parts V (Vokes, 1970), VI (Vokes, 1975) and VII (Vokes, 1976b), as well as additional papers appearing since each of the respective parts were published (principally Vokes, 1989b). As with the preceding portion of this series (Part VIII: Vokes, 1990) this is an attempt to bring together all of the species of these genera with the most up to date information on their stratigraphic occurrences.

However, there is a great difference in the amount of new information for these species in contrast to those covered in Part VIII. Only 500 new fossil localities have been added since 1970 and of this number only 325 represent macrofossil collections from the Western Hemisphere (a large number are purely microfossil collections, and many are macrofossil localities in Australia, New Zealand and France). Of these 325 localities almost half (152) are in the Dominican Republic, representing the major thrust of our work in the period since 1976.

Likewise, the changes in stratigraphic

correlation essentially begin in 1972 with Akers' important paper, so that for species treated after that date, the stratigraphic information originally cited generally does not require correction.

Therefore, this revision will consist mainly of new or recently described taxa, together with certain minor changes in taxonomy and stratigraphic data. For an overview of the current status of stratigraphic correlation the reader is referred to that portion in Part VIII (Vokes, 1990, pp. 2-5). Since publication of Part VIII there has been only one significant addition to the stratigraphy of the western Atlantic and that is the naming of strata in the vicinity of Sarasota, Florida, which formerly had been called the "Pinecrest Beds" or the "Pinecrest Formation" by various authors for the last 25 years.

This paleontologically important unit has been named formally the Fruitville Formation (Waldrop and Wilson, 1990). As pointed out by Scott (1990, p. [2]), this is yet another biostratigraphic unit and is just as unacceptable under the terms of the *Code of Stratigraphic Nomenclature* as all that have preceded it (Caloosahatchee, Pinecrest, Tamiami, Buckingham, Bermont, *et al.*). But, given the nature of southern Florida geology, where outcrops essentially are non-existent and lateral correlation is impossible without the included fossils being considered as a part of the lithology of the formation, I will accept this name in the spirit of improved communication as is done for all of the other names currently in use in southern Florida.

Although the age of the beds at Sarasota has been assumed to be Middle Pliocene since Akers' (1974) report, Jones *et al.* (1991) now have provided a definitive study on the age of the entire section exposed at the APAC pit, utilizing an array of dating methods, including macro- and micro- invertebrate and vertebrate remains, paleomagnatism, and strontium isotope chronostratigraphy. It is their conclusion that the lowermost strata (Unit 11 of Petuch, 1982a, *et seq.*) may be as old as Early Pliocene and the main mollusk-bearing beds (Units 5-10) are Middle Pliocene, as previously considered, representing a single marine transgressive event. The so-called "black layer" (Unit 4) represents the regressive stage of non-marine deposition and is followed by deposition of younger beds (Units 1-3), which are correlative with the Plio-Pleistocene Caloosahatchee Formation.

These authors did not record the presence of any Bermont Formation equivalent at the APAC quarry but, as Waldrop and Wilson (1990, p.[29]) note, the presence of *Caloosarca aequalitas* (Tucker and Wilson) indicates beds of this age are present at least in portions of the pit. This is further corroborated by the description of *Murex violetae* Petuch (1991, p. 24, pl. 4, fig. 5), which is a synonym of the Bermont species *Murex anniae* Smith (i.e, *Haustellum anniae*, see Vokes, 1990, p. 21), and *Muricanthus trippae* Petuch (1991, p. 26, pl. 4, figs. 3, 4), which is a synomym of *Hexaplex fulvescens* (Sowerby), otherwise confined to post-Caloosahatchee formations (see Vokes, 1990, p. 79). (It is also possible that either or both of these species are based upon mislocated specimens; as noted by Vokes, 1990, p. 79, large numbers of Pleistocene *H. fulvescens* have been collected at Largo, Pinellas County, some 50 miles north of the Sarasota locality.)

III. ACKNOWLEDGMENTS

As with Part VIII, to thank all of the people who have assisted in this study, I would have to thank everyone I know. Therefore, as before, I would like to begin by expressing my gratitude to all of my colleagues, professional and amateur, who, through the years, have provided information, specimens, and hospitality in their homes and museums. But for the preparation of this paper, I do want to add a special note of thanks to certain individuals. In particular, David T. Dockery, III, Mississippi Bureau of Geology, generously shared material he collected both in the U.S. Coastal Plain and in the Tertiary of France, and Liz Nesbitt and David R. Lindberg loaned me all of the Caribbean fossil muricid material in the collections of the Museum of Paleontology, University of California, Berkeley. Eliezar de C. Rios, Museu Oceanográfico, Rio Grande do Sul, Brazil, loaned many Brazilian specimens for study and illustration. Hortensia Sarasua, Academia de Ciencias de Cuba, provided a most useful collection of muricids taken from the sands dredged to make the harbor at Marianao, La Habana,

Cuba. The single largest addition of material was the loan of the Venezuelan fossil material collected over a period of years by Mr. and Mrs. Jack Gibson Smith, formerly of Caracas, now of Surrey, England. This collection is deposited at the Naturhistorisches Museum, Basel, Switzerland, and was made available through the kindness of the Gibson Smith's and Peter Jung.

A number of friends have loaned (or given) material, both fossil and Recent, to be figured or studied for this work, as well as valuable information on occurrences. They include: Richard E. Petit, North Myrtle Beach, South Carolina; Susan B. Stephens, Sanibel, Florida; Gary W. Schmelz, Naples, Florida; Harry G. Lee, Jacksonville, Florida; Emilio F. Garcia, Lafayette, Louisiana; Roland Houart, Ezemaal, Belgium; James Allen, Alexandria, Louisiana; and Christopher L. Garvie, Houston, Texas. In particular I am grateful to Kevan and Linda Sunderland, Sunrise, Florida, Eugenia I. Wright, Phoenix, Arizona, and Pat Bingham, West Palm Beach, Florida, who provided several type or figured specimens.

Colleagues at many institutions were most helpful in providing information and lending specimens, including: Alfredo Figueiras, Universidad de Republica de Uruguay, Montevideo; Antonio Carlos S. Fernandes, Museu Nacional, Rio de Janeiro, Brazil; Roger W. Portell, Florida Museum of Natural History, Gainesville; Thomas J. Rossbach, University of North Carolina, Chapel Hill; and Andrew K. Rindsberg, Geological Survey of Alabama, Tuscaloosa. The members of the staff of the U. S. National Museum (Thomas R. Waller and Warren Blow, Paleobiology; M. G. Harasewych and Raye N. Germon, Recent Mollusca), the Academy of Natural Sciences of Philadelphia (George M. Davis, David G. Robinson, Andria Garback, and David S. Wiedner), Museum of Comparative Zoology, Harvard University (Silvard P. Kool and Felicita d'Escrivan), San Diego Museum of Natural History (the late George E. Radwin, Anthony D'Attilio, and Regina Wetzer), Carnegie Museum of Natural History, Pittsburgh (Albert Kollar), and the Muséum National d'Histoire Naturelle, Paris (Philippe Bouchet and J.P. Pointier) all assisted in every way possible.

Once again Hubert C. Skinner took on the formidable task of editing the manuscript (however, I still hold him blameless for any errors that have crept through). Zuzana Hruska of the Tulane University Coordinated Instrumentation Facility provided the SEM photomicrographs. And, finally, my deepest thanks go to my husband Harold E. Vokes, field assistant, photographer, curatorial aid, and sympathetic listener.

ABBREVIATIONS FOR REPOSITORY INSTITUTIONS

AMNH – American Museum of Natural History, New York, New York, USA
ANSP – Academy of Natural Sciences, Philadelphia, Pennsylvania, USA
BMNH – British Museum (Natural History), London, England
CM – Carnegie Museum of Natural History, Pittsburgh, Pennsylvania, USA
DMNH – Delaware Museum of Natural History, Wilmington, Delaware, USA
FSBC – Florida Department of Natural Resources, St. Petersburg, Florida, USA
GSA – Geological Survey of Alabama, Tuscaloosa, Alabama, USA
LACM – Los Angeles County Museum of Natural History, Los Angeles, California, USA
MCZ – Museum of Comparative Zoology, Harvard University, Cambridge, Massachussets, USA
MHNG – Muséum d'Histoire Naturelle, Geneva, Switzerland
MNHN – Muséum National d'Histoire Naturelle, Paris, France
MNRJ – Museu Nacional de Rio de Janeiro, Brazil
MORG – Museu Oceanográfico, Rio Grande do Sul, Brazil
NMB – Naturhistorisches Museum, Basel, Switzerland
NMV – National Museum of Victoria, Melbourne, Australia
PRI – Paleontological Research Institution, Ithaca, New York, USA
SDSNH – San Diego Natural History Museum, San Diego, California, USA
TBEG – Texas Bureau of Economic Geology, Austin, Texas, USA
TU – Tulane University, New Orleans, Louisiana, USA
UNAM – Universidad Nacional Autonoma de Mexico, Instituto de Geologia, Mexico, D.F., Mexico

UNC – Department of Geology, University of North Carolina, Chapel Hill, North Carolina, USA
UCMP – Museum of Paleontology, University of California, Berkeley, California, USA
UF – Florida Museum of Natural History, University of Florida, Gainesville, Florida, USA
USNM – United States National Museum of Natural History, Washington, D.C., USA
WFIS – Wagner Free Institute of Science, Philadelphia, Pennsylvania, USA

IV. SYSTEMATIC DESCRIPTIONS

As in Part VIII, information on synonymies and localities given in earlier parts of this series generally will not be repeated. Only references that have appeared since the original treatment, or citations that have changed in some way will be included. Most references to Recent occurrences will not be included, except for the ones in two important books on the Muricidae (Radwin and D'Attilio, and Fair), which both appeared in 1976. This will not be absolute but in the interest of brevity it seems of little value to repeat material that is unchanged.

Family MURICIDAE Rafinesque, 1815
Subfamily MURICINAE Rafinesque, 1815
Genus PTERYNOTUS Swainson, 1833
Subgenus PTERYNOTUS s.s.

Pterynotus SWAINSON, 1833, Zool. Illus., (Ser. 2) v. 3, expl. to pl. 100.

Type species: *Murex pinnatus* Swainson, 1822, by subsequent designation, Swainson, *ibid.*, pl. 122.

Discussion: The name of the species that is the type of the genus *Pterynotus* was known for a short time (between 1967 and 1985) as *Pterynotus alatus* (Röding, 1798), as a result of Cernohorsky's discussion of the problem (1967, p. 122). Briefly, the problem is this: Röding named the species as *Purpura alata*, based upon Martini, 1777, figs. 1036, 1037. However, in the period when most workers considered almost all species of Muricinae as "*Murex*," this taxon was considered to be a secondary homonym of *Murex alatus* Gmelin, 1791, and the later name *Murex pinnatus* Swainson, 1822, was applied to this well-known shell. Cernohorsky correctly pointed out that, as Röding's species was named originally in the genus *Purpura*, when transferred into the genus *Pterynotus*, as most modern workers would do, the secondary homonomy would no longer apply. This does not consider the fact that the name *Murex pinnatus* Swainson had been utilized since 1822 for this form.

The problem of rejecting well-known and long established names of species by little-known senior synonyms is one that the International Commission on Zoological Nomenclature wrestled with for years. In the 1985 edition of the *Code of Zoological Nomenclature* it was concluded: "The Principle of Priority is to be used to promote stability and is not intended to be used to upset a long-accepted name . . . An author who considers that the application of the Principle of Priority would disturb stability is to maintain existing usage and refer the case to the Commission for a ruling" [Art. 23(b)].

However, in the case of *Murex pinnatus*, this course was rendered unnecessary by the additional proviso that "a junior secondary homonym replaced before 1961 is permanently invalid" [Art. 59(b)]. Thus, *Purpura alata* Röding, 1798, a junior secondary homonym of *Murex alatus* Gmelin, 1791, and replaced by *Murex pinnatus* Swainson, 1822, is considered permanently invalid. Once again the name *Murex pinnatus* is the correct taxon for the type species of the genus *Pterynotus*.

In a review of the genus *Pterynotus* Harasewych and Jensen (1979) noted that there are at least four distinct lineages, which they believe provide insight into the evolution of the group, although they did not advocate separate subgenera. This situation arises in numerous genera and "Species Groups" have been used for this sort of distinction (*e.g.*, Ponder and Vokes, 1988, for *Murex* s.s.; Vokes, 1990, for *Chicoreus* s.s.). All four of these lineages are present in the fossil record of the western Atlantic, and it is deemed useful to present the same separation herein. As Harasewych and Jansen indicate, only three of the four groups are present today in the western Atlantic, but there are two fossil species that belong to the typical group of *P. pinnatus*. However, there also is a fifth group, here given as the "Species Group of *Pterynotus tricarinatus*," which does not

occur anywhere in the Recent fauna (or, at least, has yet to be discovered).

Species Group 1: *Pterynotus guesti*

Discussion: This is, as stated by Harasewych and Jensen (1979, p. 2), the most primitive *Pterynotus* line, clearly showing affinities to early species of the genus *Paziella*, which I consider to be the ancestor of the entire *Poirieria-Pterynotus* "clan" (as used by Vokes, 1971a, p. 42).

PTERYNOTUS (PTERYNOTUS) MATTHEWSENSIS (Aldrich)
Plate 1, figures 1, 2

Pterynotus (Pterynotus) matthewsensis (Aldrich). VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 8, pl. 1, fig. 1.

Pterynotus matthewsensis (Aldrich). HARASEWYCH and JENSEN, 1979, Nemouria, no. 22, p. 3.

Holotype: USNM 638751; height (incomplete) 13 mm, diameter 8.2 mm.

Type locality: Matthews Landing Marl Member, Porters Creek Formation; Matthews Landing, Alabama River, Wilcox County, Alabama.

Occurrence: Matthews Landing Marl Member, Porters Creek Formation, Alabama.

Figured specimens: Fig. 1, PRI 24532; height 17.3 mm, diameter 7 mm; locality, Matthews Landing, Alabama River, Wilcox County, Alabama. Fig. 2, USNM 462672; height 11.8 mm, diameter (including spines) 5.8 mm; locality, Alabama River, at Dixon's Creek, Wilcox County, Alabama. Additional locality: TU 735.

Discussion: Pterynotus matthewsensis is not especially rare; we have collected several specimens near Kimbrough, Alabama (TU 735) and, at a site near the type locality on the Alabama River, David T. Dockery III of the Mississippi Bureau of Geology, collected over 20 specimens. All of these are relatively small, and the type remains the largest example seen.

The additional material reveals a "primitive" four whorl conical protoconch, with about seven thin lamellar varices on each of the first three teleoconch whorls. On the fourth whorl of the teleoconch this number is reduced to three varices per whorl. Comparing this Paleocene species with the Recent *P. guesti* (below), one can truly appreciate the conservative nature of the *Pterynotus* line.

PTERYNOTUS (PTERYNOTUS) STENZELI Vokes
Plate 1, figure 3

Pterynotus (Pterynotus) stenzeli VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 8, pl. 1, fig. 5.

Pterynotus stenzeli Vokes. HARASEWYCH and JENSEN, 1979, Nemouria, no. 22, p. 3.

Holotype: TBEG 36637; height 19 mm, diameter 11.3 mm.

Type locality: TBEG 173-T-19, Weches Formation; four miles [6.4 km] west of Chireno, hill on Texas Highway 21, Nacogdoches County, Texas [? = TU 1262].

Occurrence: Weches Formation, Texas.

Figured specimen: TBEG 36637 (holotype). Additional localities: TU localities 993, 1258, 1262, 1527.

Discussion: Although we have collected several additional specimens (mostly broken) of *P. stenzeli*, nothing can be added to the original description. As Harasewych and Jensen (1979, p. 3) observed, this Early Eocene species is closely related to the Recent *P. guesti*. Virtually the only difference is the protoconch, which in *P. stenzeli* is multispiral (three and one-half whorls) and in the Recent species is paucispiral (one and one-half whorls). Although the illustration of the holotype of *P. guesti* (reproduced here, pl. 1, fig. 4) does not show them especially well, there are also five to seven denticles on the inner side of the outer lip as in *P. stenzeli*.

PTERYNOTUS (PTERYNOTUS) GUESTI Harasewych and Jensen
Plate 1, figure 4

Pterynotus (Pterynotus) guesti HARASEWYCH and JENSEN, 1979, Nemouria, no. 22, p. 3, figs. 6 (holotype), 13 (distribution), 14 (protoconch).

Pterynotus guesti Harasewych and Jensen. ABBOTT and DANCE, 1982, Compendium of Seashells, p. 141 (holotype, color photograph); PETUCH, 1987, New Caribbean Moll. Faunas, p. 20, pl. 8, figs. 1, 2 (both holotype).

Holotype: DMNH 122258; height 28.6 mm.

Type locality: East-southeast of Key West, Florida, in 275 meters.

Occurrence: Recent only (known only from the type locality).

Figured specimen: DMNH 122258 (holotype; photograph courtesy of M.G. Harasewych).

Discussion: Described from deep water off the coast of Florida, this "living fossil" is one of two Recent species [the other being

the Japanese *P. vespertilio* (Kira, 1959)] that closely resemble the Paleogene species discussed above. These two Recent species are similar especially in coloration, which is a light tan with darker blotches on the varices. This can be seen in the color photographs of both species figured by Abbott and Dance (1982, p. 141).

At present there are no examples of this morphotype known between the Paleogene and the Recent, which reflects the fact that the line moved into deeper water after the Eocene and has been living there ever since.

Species Group 2: *Pterynotus "tricarinatus"*

Discussion: In the Eocene of the Paris Basin there are numerous species of *Pterynotus*. In this array we can see representatives of each of the Species Groups under discussion here. None are the earliest examples of their group but to see them all occurring together is unique to the Paris Basin fauna. Among these species we see the following: *P. tripteroides* (Lamarck, 1822), of the *phyllopterus* group; *P. micropterus* (Deshayes, 1835), of the *pinnatus* group; *P. bispinosus* (Sowerby, 1823), of the subgenus *Pterochelus;* and *P. fusoides* (Deshayes, 1865), which *may* have given rise to the subgenus *Purpurellus*. But the most common group of species can not be referred to any of the lines, and they are here placed in a separate group around the central species, the well known *P. tricarinatus* (Lamarck, 1803).

The several members of this group, including typical "*tricarinatus*" [= *Purpura*

PLATE 1

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1, 2. *Pterynotus (Pterynotus) matthewsensis* (Aldrich) 5
1. (X 3) PRI 24532; height 17.3 mm, diameter 7 mm.
Locality: Matthews Landing, Alabama River, Wilcox County, Alabama; Matthews Landing Marl Member, Porters Creek Formation.
2. (X 4) USNM 462672; height 11.8 mm, diameter (including spines) 5.8 mm.
Locality: Alabama River, at Dixon's Creek, Wilcox County, Alabama; Matthews Landing Marl Member, Porters Creek Formation.

3. *Pterynotus (Pterynotus) stenzeli* Vokes (X 3) 5
TBEG 36637 (holotype); height 19 mm, diameter 11.3 mm.
Locality: TBEG 173-T-19, Nacogdoches County, Texas [? = TU 1262]; Weches Formation.

4. *Pterynotus (Pterynotus) guesti* Harasewych and Jensen (X 2) 5
DMNH 122258 (holotype); height 28.6 mm.
Locality: East-southeast of Key West, Florida, in 275 meters; Recent.
(Photograph courtesy of M. G. Harasewych)

5. *Pterynotus (Pterynotus) sabinola* (Palmer) (X 4) 9
PRI 3012 (holotype); height 16 mm, diameter 9 mm.
Locality: Stone City, Sabine River, Sabine County, Texas; Stone City Beds.

6. *Pterynotus (Pterynotus) propeposti* (Mansfield) (X 1 1/2) 8
USNM 49545 (holotype); height 43 mm, diameter 20 mm.
Locality: Blackwater Creek, at crossing of Seaboard Airline Railroad, Hillsborough County, Florida; Suwannee Limestone.

7. *Pterynotus (Pterynotus) aurorae* Garvie (X 2) 8
USNM 455527 (holotype); height 25 mm, diameter 12 mm.
Locality: Greggs Landing, Alabama River, Monroe County, Alabama; Bells Landing Marl Member, Tuscahoma Formation.

8. *Pterynotus (Pterynotus) weisbordi* (Palmer) (X 1 1/2) 8
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Locality: TU 99, Louisiana; Moodys Branch Formation.

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Locality: TU 1215, Dominican Republic; Gurabo Formation.

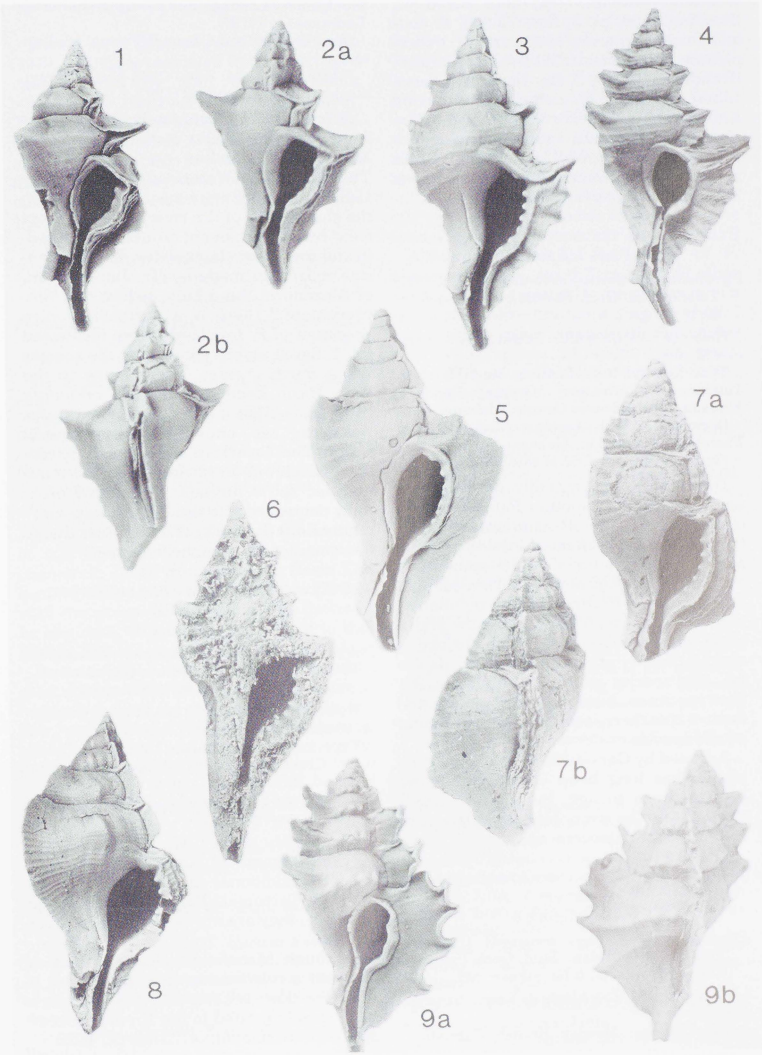

PLATE 1

crenulata Röding, 1798; both based on Brander, 1766, pl. 3, figs. 77, 79], *P. contabulatus* (Lamarck, 1803), and *P. tricuspidatus* (Deshayes, 1835) [= *Murex asper* Brander, 1766, pl. 3, fig. 78; not *M. asper* Linné, 1758], are characterized by having a denticulate aperture that folds into the shoulder spine to a much lesser degree than in the group of *P. guesti*. The shells are relatively scabrous, but not as much as in the group of *P. pinnatus*.

PTERYNOTUS (PTERYNOTUS) AURORAE Garvie
Plate 1, figure 7

Pterynotus (Pterynotus) aurorae GARVIE, 1991, Tulane Stud. Geol. Paleont., v. 24, no. 4, p. 89, pl. 1, figs. 3, 4.

Holotype: USNM 455527; height 25 mm, diameter 12 mm.

Type locality: Bells Landing Marl Member, Tuscahoma Formation; Greggs Landing, Alabama River, Monroe County, Alabama.

Occurrence: Bells Landing Marl Member, Tuscahoma Formation, Alabama.

Figured specimen: USNM 455527 (holotype).

Discussion: The recently described *P. aurorae* is unlike the other Paleocene species of *Pterynotus*, *P. matthewsensis*, in that it lacks the elongated infolding of the apertural lip into the shoulder spine. The overall morphology of the shell is most akin to the French Eocene species mentioned above, with a denticulate aperture and a small fold at the shoulder. The surface is also marked by numerous spiral cords. So far, this species is known only from the type specimen, but it is so completely distinctive that there is no question of it being a valid species.

As noted by Garvie, the Tuscahoma Formation has long been considered to be Early Eocene in age, but Siesser (1983) showed that the nannoplankton place it in zone NP.9, of Paleocene age.

PTERYNOTUS (PTERYNOTUS) WEISBORDI
(Palmer)
Plate 1, figure 8

Pterynotus (Pterynotus) weisbordi (Palmer). VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 10, pl. 1, fig. 3 (holotype).

Holotype: PRI 4657; height 33.5 mm, diameter 15 mm.

Type locality: Moodys Branch Formation; Montgomery Landing, Red River, Grant Parish, Louisiana (= TU 99).

Occurrence: Moodys Branch Formation, Louisiana.

Figured specimen: Allen Coll.; height 38 mm, diameter 19 mm; locality TU 99.

Discussion: Unfortunately, the famous fossil collecting locality on the Red River at Montgomery Landing no longer exists. The Red River Waterway Project of the U.S. Corps of Engineers has resulted in the sharp bend of the river, formerly kept clear by erosion, being reduced to a silted-in and overgrown backwater. In the extensive collections made by Mr. James Allen, of Alexandria, Louisiana, before this "improvement," there is a particularly nice specimen of *P. weisbordi*, here illustrated (pl. 1, fig. 8), which shows that the species has a much greater resemblance to the Paris Basin Eocene species *P. crenulata* (Röding, 1798) [= *P. tricarinatus* Lamarck, see above] than previously noted. The American species differs from the French one in having finer, more numerous, spiral threads. Although I originally compared it to the French Eocene *P. tripteroides* (Lamark, 1822) this was due to the worn condition of the holotype.

PTERYNOTUS (PTERYNOTUS) PROPEPOSTI
(Mansfield)
Plate 1, figure 6

Pterynotus (Pterynotus) propeposti (Mansfield). VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 11, pl. 1, fig. 4 (holotype).

Holotype: USNM 49545; height 43 mm, diameter 20 mm.

Type locality: Suwannee Limestone; Blackwater Creek, at crossing of Seaboard Airline Railroad, Hillsborough County, Florida.

Occurrence: Suwannee Limestone, Florida.

Figured specimen: USNM 49545 (holotype).

Discussion: Roger W. Portell, of the Florida Museum of Natural History, has collected additional specimens of *P. propeposti* at Terramar, Polk County, Florida; however, they are not as well preserved as the type.

Although Mansfield's choice of names suggests a relationship to *P. postii*, this is no more than generic and the species is most closely related to the French Eocene species *P. contabulatus* (Lamarck, 1803).

Species Group 3: *Pterynotus phaneus*

Discussion: Harasewych and Jensen (1979, p. 3) have indicated that this group is characterized by thin delicate shells, which lack scabrous surface ornament. They add that the subgeneric name *Timbellus* (type species: *Murex latifolius* Bellardi, 1872) has been proposed for this morphotype but I agree with them that the species should be retained within *Pterynotus* s.s.

PTERYNOTUS (PTERYNOTUS) SABINOLA (Palmer)
Plate 1, figure 5

Pterynotus (Pterynotus) sabinola (Palmer). VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 9, pl. 1, fig. 2 (holotype).

Holotype: PRI 3012; height 16 mm, diameter 9 mm.

Type locality: Stone City Beds; Sabine River, Sabine County, Texas.

Occurrence: Stone City Beds, Texas; Cook Mountain Formation, Texas and Louisiana.

Figured specimen: PRI 3012 (holotype).

Discussion: Although Harasewych and Jensen (1979, p. 3) would trace the lineage of this Species Group to *P. tripteroides* (Lamarck, 1822), from the Paris Basin Eocene, I believe the latter is better placed with the group of *P. phyllopterus* (below). In any case, this line does go back to the Middle Eocene, in the guise of *P. sabinola*.

As anticipated, because most of the outcrop area in which this fossil occurs is now beneath the waters of Toledo Bend Reservoir, no additional material of this species has come to light and there is nothing new to be said about it.

PTERYNOTUS (PTERYNOTUS) ALICULUS Vokes
Plate 1, figure 9

Pterynotus (Pterynotus) aliculus VOKES, 1989, Bulls. Amer. Paleontology, v. 97, no. 332, p. 53, pl. 5, fig. 9.

Holotype: USNM 365141; height 10.3 mm, diameter 5.4 mm.

Type locality: TU 1215, Gurabo Formation; Rio Gurabo, bluffs on both sides, from the ford on Los Quemados-Sabaneta road upstream to approximately 1 km above the ford, Dominican Republic.

Occurrence: Gurabo Formation, Dominican Republic.

Figured specimen: USNM 365141 (holotype).

Discussion: Pterynotus aliculus is based upon a single specimen from the more shallow-water, coralline portion of the Gurabo Formation. In the original description it was compared to the Recent *P. xenos* Harasewych, 1982, another relatively shallow-water (60-70 meters) Recent species of *Pterynotus*. However, I believe the latter species is better placed with the Species Group of *P. phyllopterus*, pointing out the wisdom is not attempting to separate these various species into subgeneric taxa.

Although placed in the group of *P. phaneus*, this species differs from all other members in the group by the presence of a series of ball-like knobs circling the shell. I know of no other species of *Pterynotus* with this ornament, although some specimens of *P. phaneus* do have fairly strong intervarical ridges.

PTERYNOTUS (PTERYNOTUS) PHANEUS (Dall)
Plate 2, figures 1, 2

Pterynotus (Pterynotus) phaneus (Dall). VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 14, pl. 3, fig. 3 (holotype); ABBOTT, 1974, American Seashells, ed. 2, p. 175 (in part), not fig. 1856 (holotype, *Murex tristichus* Dall = *P. havanensis*); HARASEWYCH and JENSEN, 1979, Nemouria, no. 22, p. 4 (in part), figs. 1 (holotype, *Murex pygmaeus* Bush = *P. bushae* Vokes), 2 (holotype, *P. phaneus*), 4, 5, 17 (radula).

Pterynotus phaneus (Dall). RADWIN and D'ATTILIO, 1976, Murex Shells of the World, p. 100 (in part), not pl. 9, fig. 3 (= *P. havanensis*); FAIR, 1976, The Murex Book, p. 67, pl. 13, fig. 165 (holotype); ABBOTT and DANCE, 1982, Compendium of Seashells, p. 140 (color photograph).

Synonym:

Murex (Pteronotus) pygmaeus BUSH, 1893, Harvard Mus. Comp. Zool., Bull., v. 23, p. 213, pl. 1, figs. 3, 4.

Pterynotus (Pterynotus) bushae VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 13, pl. 3, fig. 2 (new name for *Murex pygmaeus* Bush, 1893, *non Muricites pygmäus* Schlotheim, 1820).

Pterynotus bushae Vokes. FAIR, 1976, The Murex Book, p. 28, pl. 13, fig. 163 (holotype, *Murex pygmaeus*).

Holotype: USNM 93256 (*Murex phaneus* Dall); height 17 mm, diameter 7 mm.

Type locality: *Albatross* Station 2662, off St. Augustine, Florida, in 434 fathoms [794 meters].

Occurrence: Recent only, eastern coast of North America.

Figured specimens: Fig. 1, USNM 93256 (holotype, *P. phaneus*). Fig. 2, MCZ 6918 (holotype, *Murex pygmaeus*); height 16 mm, diameter 8.5 mm; locality, *Blake* Station 319, off Charleston, South Carolina, in 262 fathoms [479 meters].

Discussion: The three species of *Pterynotus* described from the deeper water off the eastern United States have been placed in synonymy by Abbott (1974, p. 175), Radwin and D'Attilio (1976, p. 100), and Harasewych and Jensen (1979, p. 4). I accept their synonymy of *P. bushae* with *P. phaneus;* however, there is one fundamental difference between these two and the third species, *P. havanensis,* in that the early teleoconch whorls in the latter have six lamellar varices per whorl (see pl. 2, fig. 3), in contrast to only three in the others (pl. 2, figs. 1, 2). Also, the shell ornamentation is more pronounced in *P. phaneus/bushae.*

Because of the confusion between the two species, locality information in the above references is not reliable but it appears that *P. phaneus* occurs from South Carolina to Quintana Roo, Mexico, and *P. havanensis* occurs from Florida to northern South America.

PTERYNOTUS (PTERYNOTUS) HAVANENSIS
Vokes
Plate 2, figures 3, 6

Pterynotus (Pterynotus) havanensis VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 13, pl. 3, fig. 1 (new name for *Murex tristi-*

PLATE 2

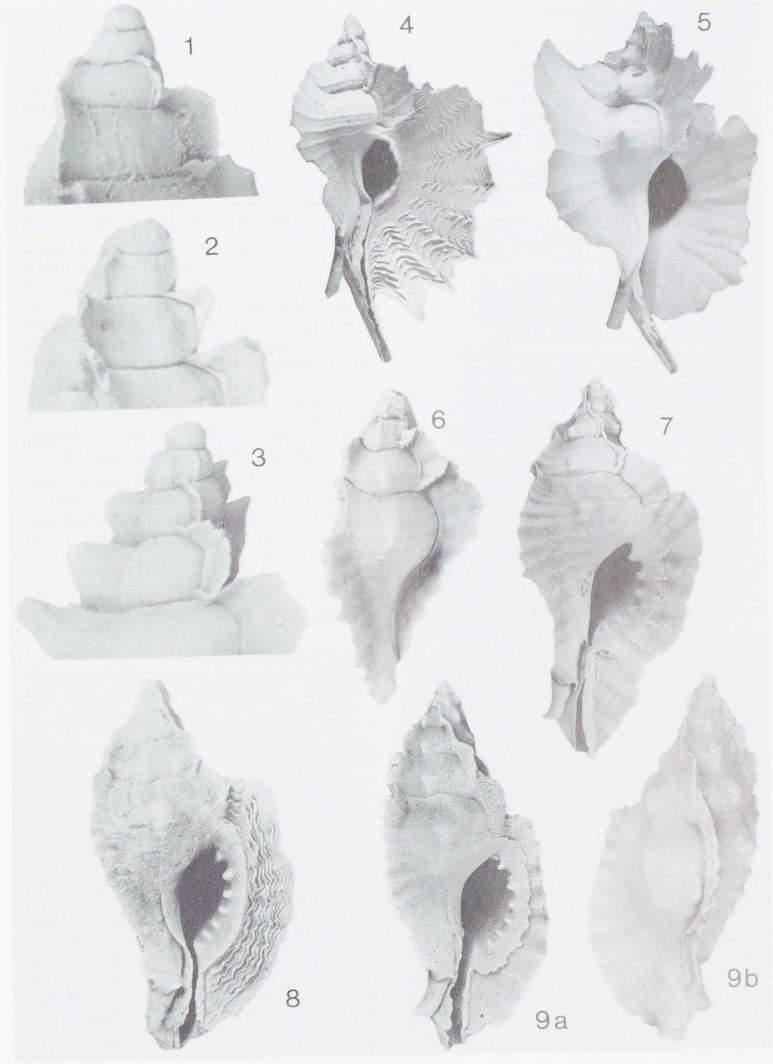

PLATE 2

chus Dall, 1889, *non M. tristichus* Beyrich, 1854).

Pterynotus (Pterynotus) phaneus (Dall). ABBOTT, 1974, American Seashells, ed. 2, p. 175 (in part), fig. 1856 (holotype, *M. tristichus*); HARASEWYCH and JENSEN, 1979, Nemouria, no. 22, p. 4 (in part), figs. 3 (holotype, *M. tristichus*), 16 (protoconch, *P. havanensis*) only.

Pterynotus phaneus (Dall). RADWIN and D'ATTILIO, 1976, Murex Shells of the World, p. 100 (in part), pl. 9, fig. 3.

Pterynotus havanensis Vokes. FAIR, 1976, The Murex Book, p. 47, pl. 13, fig. 164 (holotype, *M. tristichus*).

Holotype: MCZ 7308 (holotype, *Murex tristichus* Dall); height 15.5 mm, diameter 10 mm.

Type locality: *Blake* Station 51, off Havana, Cuba, in 400 fathoms [732 meters].

Occurrence: Moín Formation, Costa Rica; Recent, eastern North America to Colombia.

Figured specimens: Fig. 3, MCZ 7308 (holotype, *Murex tristichus*). Fig. 6, USNM 462673; height (incomplete) 13.8 mm, diameter (incomplete) 7 mm; locality TU 1240.

Discussion: As noted above, I consider *P. havanensis* to be separable from *P. phaneus* by the more numerous varices on the early teleoconch whorls in *P. havanensis*. This is well illustrated in the drawing given by Harasewych and Jensen (1979, fig. 16), which is said to be *P. phaneus* but is actually *P. havanensis* (compare pl. 2, figs. 1, 3). In these shells in which all species look alike, minor differences such as these assume greater importance. In addition, the shell surface in *P. havanensis* is smoother than the more ornamented *P. phaneus*, but both species have denticulations on the inner side of the outer lip and in most the margins of the varices are drawn out into five digitations, corresponding to the spaces *between* the denticulations.

Hitherto this species has not been reported south of Havana, Cuba. In my collection there is a single specimen of *P. havanensis* taken in the Golfo de Urabá, Colombia, at 100 meters, which considerably extends the range. This is further corroborated by a broken specimen (pl. 2, fig. 6), which appears to be *P. havanensis* (although without the early whorls one cannot be sure) from the Pleistocene Moín Formation, Costa Rica (TU 1240).

PTERYNOTUS (PTERYNOTUS) RADWINI
Harasewych and Jenson
Plate 2, figure 4

Pterynotus (Pterynotus) radwini HARASEWYCH and JENSEN, 1979, Nemouria, no. 22, p. 11, figs. 10 (holotype), 13 (distribution), 18 (radula).

Pterynotus radwini Harasewych and Jensen. ABBOTT and DANCE, 1982, Compendium of Seashells, p. 141 (holotype, color photograph); PETUCH, 1987, New Caribbean Moll. Faunas, p. 62, pl. 10, figs. 10, 11 (both holotype).

Pterynotus (Timbellus) radwini Harasewych and Jensen. PETUCH, 1988, Neogene Hist. Trop. Amer. Moll., p. 155, pl. 33, figs. 3, 4 (both holotype).

Holotype: DMNH 122424; height 30.9 mm.

Type locality: R/V *Pillsbury* Station P-610, east of Turneffe Islands, Belize, in 296-329 meters.

Occurrence: Recent only (known only from type locality).

Figured specimen: DMNH 122424 (holotype; photograph courtesy of M.G. Harasewych).

Discussion: Based upon a single spectacular specimen, this species is distinguished from the following equally large species by the presence of strong spiral cords that lead to elongate digitations along the varical margin.

PTERYNOTUS (PTERYNOTUS) LIGHTBOURNI
Harasewych and Jensen
Plate 2, figure 5

Pterynotus (Pterynotus) lightbourni HARASEWYCH and JENSEN, 1979, Nemouria, no. 22, p. 8, figs. 7-9 (holotype, paratypes), 13 (distribution), 15 (protoconch).

Pterynotus lightbourni Harasewych and Jensen. ABBOTT and DANCE, 1982, Compendium of Seashells, p. 141 (holotype, color photograph).

Holotype: DMNH 122259; height 33.8 mm.

Type locality: Off St. David's, Bermuda, in 275-600 meters.

Occurrence: Recent only (known only from the type locality).

Figured specimen: DMNH 122259 (holotype; photograph courtesy of M.G. Harasewych).

Discussion: Known only from the three specimens in the original type lot, this deep-water species is said to be distinguished from other members of the group by the appearance of three light brown color patches along the outer margin of the

aperture. The color photograph of the holotype given by Abbott and Dance (1982, p. 141) does not indicate that these patches are very prominent. The shell appears to be monochromatic, as are all other members of this Species Group.

Species Group 4: *Pterynotus pinnatus*

Discussion: Harasewych and Jensen (1979) did not include the "typical" group in their treatment, as there are no living examples of this line in the New World. Nevertheless, there are two fossil examples, one species each from the Early Miocene Chipola Formation and from the Late Miocene-Early Pliocene Gurabo Formation. Although the Chipola species is the oldest representative of the line in the New World, there is a Cuisian (Early/Middle Eocene) form described from the Aquitaine Basin of France, "*Marchia*" [*sensu* Radwin and D'Attilio, 1976] *antiqua* Merle, 1989, which indicates the line probably originated in the Old World.

PTERYNOTUS (PTERYNOTUS) PRAEPATAGIATUS
Vokes, n. sp.
Plate 3, figures 1-3

Pterynotus pinnatus (Swainson). VOKES, 1972, Tulane Stud. Geol. Paleont., v. 10, no. 1, p. 29, text-fig. 2 (not of Swainson).

Description: Protoconch of four or five conical whorls (none complete in the type material), ending at a sharply recurved varix; seven teleoconch whorls in the adult. Axial ornamentation on the first two teleoconch whorls of nine foliaceous lamellae, becoming seven raised ridges on third and fourth whorls; on the fifth teleoconch whorl every other one of these ridges becoming a swollen varix, with the alternating ridge remaining as an intervarical node (three varices alternating with nodes on each whorl). Varices formed by multiple layers of shell material, the adapertual face laciniated by spiral ornamentation. The outermost layer of the varices extended as a single lamellar flange, widest along the anterior portion. In addition to major axial sculpture, shell surface covered by numerous growth lamellae, on the order of 20 between each pair of varices; each elaborately fimbriated by invisible spiral threads as well as by the visible spiral cords, giving the entire shell surface the appearance of being covered by a net. Spiral ornamentation on first teleoconch whorl of three small cords; by third teleoconch whorl these alternating with smaller intercalated secondary cords, the latter gradually becoming equal in strength to the major cords. Body whorl and siphonal canal with about 20 almost equi-sized spiral cords, plus random intercalated secondary cords and several secondary cords on the subsutural slope and distal end of the siphonal canal. Suture appressed, the growth lamellae from the succeeding whorl forming a frilled cover hiding the exact line of suture. Aperture elongate-oval; inner lip smooth, appressed at posterior end, with an expanded flare reaching to the intervarical node of the adjacent whorl; inner side of outer lip with about nine small denticles. Siphonal canal moderately long, recurved at the distal end, with previous canals diverging at an angle; almost closed but open by a narrow slit.

Holotype: USNM 646949; height 34.4 mm, diameter 16.2 mm.

Type locality: TU 830, Chipola Formation; Tenmile Creek, at power line crossing about one mile [1.6 km] west of Chipola River (SE 1/4 Sec. 12, T1N, R10W), Calhoun County, Florida.

Etymology of name: From the resemblance to the Recent *P. patagiatus* (Hedley, 1912).

Occurrence: Chipola Formation, Florida.

Figured specimens: Fig. 1, USNM 646949 (holotype). Fig. 2, USNM 462674 (paratype A); height 21.8 mm, diameter 12.2 mm; locality TU 951. Fig. 3, Schmelz Coll. (paratype B); height 35.5 mm, diameter 15.8 mm; locality TU 951.

Discussion: On the basis of a single incomplete specimen from Tenmile Creek, this species was referred (Vokes, 1972) to the Recent Indo-Pacific type of the genus, *P. pinnatus*, noting that the occurrence was most unlikely. Since that report, two additional specimens have been collected by Gary Schmelz, Naples, Florida (paratypes A and B) and from paratype A it can be seen that, although the Chipola specimens do bear an strong resemblance to *P. pinnatus*, there is a marked difference in the development of the early teleoconch whorls (*not* the protoconchs, which are probably the same).

As may be seen in the illustrations, the first two teleoconch whorls in *P. pinnatus* (pl. 3, fig. 6) have about six small lamellar varices. Then on the third teleoconch whorl the number is reduced to only three varices per whorl, with a strong intervarical node between each pair. In the Chipola species (pl. 3, fig. 2c) the first two teleoconch whorls have about nine lamellar varices, then on the third and fourth

whorls there are about seven varices. These are reduced to three per whorl only at about the fifth teleoconch whorl. In this aspect the Chipola species is more similar to the Recent *P. patagiatus* (Hedley, 1912) from eastern Australia than to *P. pinnatus;* however, the protoconch in the Australian species has one and one-half bulbous whorls (pl. 3, fig. 4c). The general shape of the shell in the Chipola species is also similar to *P. patagiatus,* with more inflated whorls and a more recurved siphonal canal than in *P. pinnatus.*

The usual evolutionary development of species in the Muricinae is from a multiwhorl protoconch to a paucispiral one. Because of this and the similar early teleoconch this new species appears more closely related to the Australian species than to *P. pinnatus.*

Thus, we see yet another Tertiary western Atlantic muricine species with its closest Recent relatives living today in Australia (see Vokes, 1974). This, undoubtedly, is due to the "relict" nature of the Australian mollusk fauna rather than to any extraordinary inter-ocean transport.

PTERYNOTUS (PTERYNOTUS) NEOTRIPTERUS
Vokes
Plate 3, figure 5

Pterynotus (Pterynotus) neotripterus VOKES, 1989, Bulls. Amer. Paleontology, v. 97, no. 332, p. 54, pl. 5, figs. 2, 3.

Holotype: USNM 323880; height 40.2 mm, diameter 18 mm.

Type locality: TU 1277, Gurabo Formation; Río Gurabo, both sides, upstream from the horsetrail to 0.5 km above the trail, or approximately 2 km (airline) to 2.5 km above the ford on Los Quemados-Sabaneta road, Dominican Republic.

Occurrence: Gurabo Formation, Dominican Republic.

Figured specimen: USNM 323880 (holotype). Additional localities: TU 1211, 1219, 1225, 1231, 1250.

Discussion: Known from eight specimens collected in the more shallow water portions of the Gurabo Formation, Dominican Republic, *P. neotripterus* is the second New World representative of the typical *Pterynotus* group. It differs from the new species above, *P. praepatagiatus,* in the longer siphonal canal, with a varical flange extending along its entire length. As the name implies, this species is akin to the Recent Indo-Pacific *P. tripterus* (Born, 1778), not only in the broad siphonal flange but also in the rather triangular aperture, with denticles on the columellar lip.

Species Group 5: *Pterynotus phyllopterus*

PTERYNOTUS (PTERYNOTUS) BURNSII
(Aldrich)
Plate 2, figure 7

Pterynotus (Pterynotus) burnsii (Aldrich). VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 10, pl. 2, fig. 1 (holotype); MACNEIL and DOCKERY, 1984, Mississippi Bur.

PLATE 3

Figures Page

1-3. *Pterynotus (Pterynotus) praepatiagatus* Vokes, n. sp. (X 2) 13
1. USNM 646949 (holotype); height 34.4 mm, diameter 16.2 mm.
Locality: TU 830, Florida; Chipola Formation.
2. (2c X 10) USNM 462674 (paratype A); height 21.8 mm, diameter 12.2 mm.
Locality: TU 951, Florida; Chipola Formation.
3. Schmelz Coll. (paratype B); height 35.5 mm, diameter 15.8 mm.
Locality: TU 951, Florida; Chipola Formation.
4. *Pterynotus (Pterynotus) patagiatus* (Hedley) (X 2) 14
(4c X 10) USNM 869505; height 26 mm, diameter 13.7 mm.
Locality: Keppel Bay, Australia; Recent.
5. *Pterynotus (Pterynotus) neotripterus* Vokes (X 1 1/2) 14
USNM 323880 (holotype); height 40.2 mm, diameter 18 mm.
Locality: TU 1277, Dominican Republic; Gurabo Formation.
6. *Pterynotus (Pterynotus) pinnatus* (Swainson) (X 10) 13
Vokes Coll.; height 38 mm, diameter 16.3 mm.
Locality: Kii, Japan; Recent.

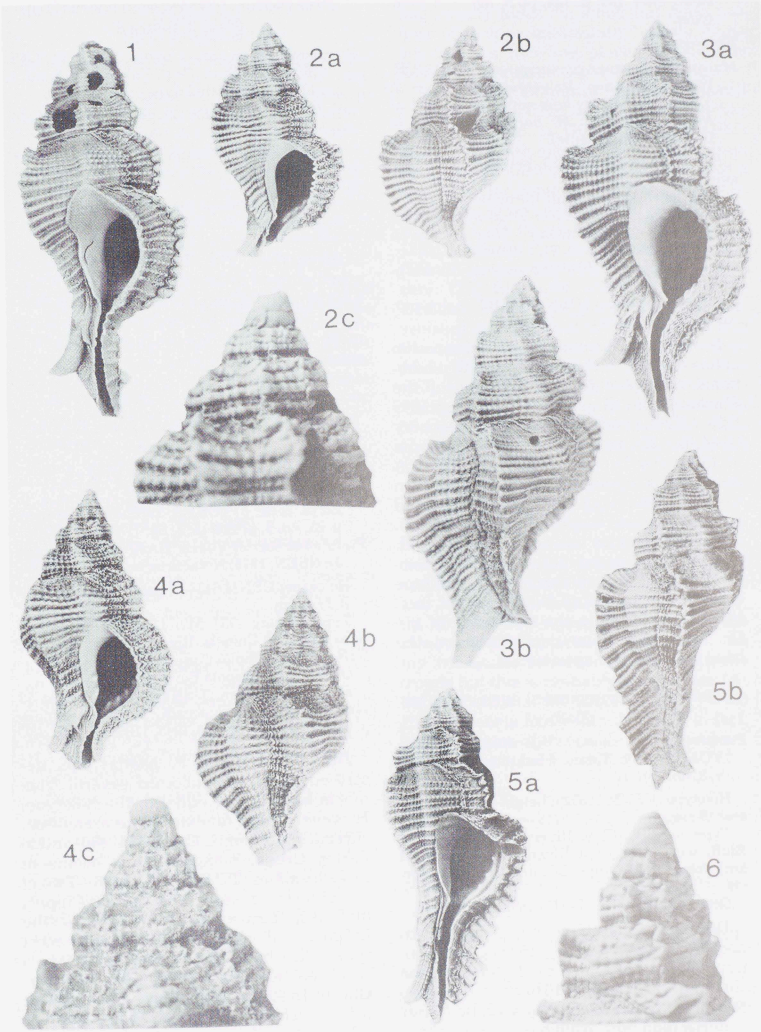

PLATE 3

Geol., Bull. 124, p. 124, pl. 5, figs. 1, 2 (holotype).

Synonym:

Murex (Pteronotus) grandispinosa ALDRICH, 1895, Bulls. Amer. Paleontology, v. 1, no. 2, p. 66. Unnecessary new name for *M. burnsii* Aldrich, 1894, not *M. burnsii* Whitfield *in* Dall, 1890 [nude name].

Holotype: USNM 135155; height 67.5 mm, diameter 33 mm.

Type locality: Red Bluff Formation; Carson's Creek, 1 1/2 to 2 miles [2.5 to 3 km] west [east] of Red Bluff (Chickasawhay River), Wayne County, Mississippi (? = TU 1290).

Occurrence: Red Bluff Formation, Mississippi.

Figured specimen: USNM 135155 (holotype). Additional localities: TU 1288, 1289.

Discussion: Since my original discussion of this species, we have collected two additional examples from the banks of the Chickasawhay River near Red Bluff (TU 1288, 1289), and MacNeil and Dockery (1984, p. 125) also report the species from MGS locality 37 (Red Bluff = TU 1288). A search was made for Aldrich's "Carson Creek" locality but the closest we could find is "Carson Sand Creek" (TU 1290), where this species has not been collected. But it must be noted that whether it is Carson Creek or Carson Sand Creek, the type locality is *east* of Red Bluff and not *west* (which would be on the other side of the Chickasawhay River), as stated on the label with the type specimen.

Pterynotus (Pterynotus) rufirupicolus (Dall)

Pterynotus (Pterynotus) rufirupicolus (Dall). VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 12.

Holotype: USNM 166725; height 42 mm, diameter 19 mm.

Type locality: Flint River Formation; Red Bluff, west bank Flint River, seven miles [11 km] above Bainbridge, Decatur County, Georgia.

Occurrence: Flint River Formation, Georgia.

Discussion: Nothing more is known about this species based upon a single internal mold, but it may be the same as the contemporary *P. postii*. However, the two cannot be put in synonymy with no better material than now available.

Pterynotus (Pterynotus) postii (Dall)
Plate 2, figure 8

Pterynotus (Pterynotus) postii (Dall). VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 12, pl. 2, fig. 2 (holotype).

Holotype: USNM 130349; height 38 mm, diameter 21 mm.

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

Occurrence: Tampa Limestone, Florida.

Figured specimen: USNM 130349 (holotype).

Discussion: The Tampa Limestone is now believed to be latest Oligocene (Chickasawhayan Stage) rather than Early Miocene, as previously considered. Nothing more can be added to the discussion of this species.

Pterynotus (Pterynotus) hoerlei Vokes
Plate 2, figure 9

Pterynotus (Pterynotus) hoerlei VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 12, pl. 2, fig. 3; VOKES, 1972, Earth Science, v. 25, no. 3, p. 124, pl. 2, fig. 7.

Pterynotus hoerlei Vokes. HARASEWYCH and JANSEN, 1979, Nemouria, no. 22, p. 14.

Holotype: USNM 645616; height 59 mm, diameter 29.5 mm.

Type locality: TU 547, Chipola Formation; west bank of Chipola River (SW 1/4 Sec. 29, T1N, R9W), Calhoun County, Florida.

Occurrence: Chipola Formation, Florida.

Figured specimen: USNM 429797; height 33 mm, diameter 15 mm; locality TU 555. Additional localities: TU 825, 830, 1048, 1196.

Discussion: Since *P. hoerlei* was described, we have collected several fragments but nothing equal to the holotype. However, these do extend the area of occurrence to Tenmile Creek (TU 830) and to Farley Creek, along which it occurs at three localities (TU 825, 1048, 1196). Two of these are the shallowest of all Chipola localities, occurring at what was the Chipola shoreline. Nevertheless, most specimens have come from TU 555, a coral-reef locality on the Chipola River. One of these, in the Hoerle Collection at the U.S. National Museum, is figured here (pl. 2, fig. 9).

PTERYNOTUS (PTERYNOTUS) PHYLLOPTERUS
(Lamarck)
Plate 4, figures 1-3

Murex phyllopterus LAMARCK, 1822, Anim. sans Vert., v. 7, p. 164; KIENER, 1842, Coquille Vivantes, v. 7, Genre Rocher, p. 103, pl. 24, fig. 1; CERNOHORSKY, 1971, Veliger, v. 14, no. 2, p. 189, fig. 5 (holotype).

Pterynotus (Pterynotus) phyllopterus (Lamarck). EMERSON and OLD, 1972, Veliger, v. 14, no. 4, p. 350, figs. 1-13 (figs. 7-10 = syntypes, *Murex rubridentatus* Reeve); HARASEWYCH and JENSEN, 1979, Nemouria, no. 22, p. 12, figs. 11, 12 (shell), 13 (distribution), 19 (radula); VOKES, 1989, Bulls. Amer. Paleontology, v. 97, no. 332, p. 52, pl. 5, fig. 1.

Pterynotus phyllopterus (Lamarck). RADWIN and D'ATTILIO, 1976, Murex Shells of the World, p. 100, pl. 7, fig. 8; FAIR, 1976, The Murex Book, p. 67, pl. 13, fig. 157 (holotype); ABBOTT and DANCE, 1982, Compendium of Seashells, p. 140 (color photograph); SUTTY, 1986, Seashell Treasures Caribbean, p. 52, fig. 52 (color photographs).

Synonym:

Murex rubridentatus REEVE, 1846, Conch. Icon., v. 3, *Murex*, pl. 36, fig. 186.

Holotype: MHNG 1099/27; height 83.4 mm (*fide* Cernohorsky, 1971, p. 188).

Type locality: Martinique (designated by Emerson and Old, 1972, p. 552).

Occurrence: Gurabo Formation, Dominican Republic; Tamiami Formation, Florida; Moín Formation, Costa Rica; Recent, Windward Islands.

Figured specimens: Fig. 1, Wright Coll.; height 63.1 mm, diameter 33.4 mm; locality, reef off Club Méditerranée, Martinique. Fig. 2, USNM 462675; height (incomplete) 27 mm, diameter 16 mm; locality TU 1175. Fig. 3, USNM 462676; height (as is) 41.4 mm, diameter (as is) 18.1 mm; locality TU 1489. Additional localities: TU 954, 1231, 1240.

Discussion: In 1970, I observed that *Pterynotus hoerlei* "is closely related to the Recent Indo-Pacific species *P. phyllopterus* (Lamarck)" (Vokes, 1970, p. 13). In 1972 Emerson and Old reported specimens of this strikingly beautiful species from the island of Martinique, in the Lesser Antilles. The form lives in relatively shallow water, about 30 meters in depth, and that specimens of this large species remained undiscovered for such a long time is utterly amazing. Sutty (1986, p. 52) describes finding the first specimens of this "new" species in 1969 and she observes that the animal usually hides "in small but deep hollows of rock or madrepore," rarely straying from its dwelling place. Presumably this is how it eluded capture for so long.

Many living examples have been taken since the original report, and the range has been extended to Guadeloupe, but this seems to be the extent of its range today. However, in earlier geologic times it had a much greater range, occurring (mostly as fragments today) in the Dominican Republic in the Late Miocene/Early Pliocene (TU 1231), southern Florida in the mid-Pliocene (TU 1175), and Costa Rica in the Pleistocene (TU 954, 1240, 1489). All of these localities have coralline material associated with them, and it is apparent that the species has always inhabited coral-reefs. The locality at TU 1175 was originally referred to the Caloosahatchee Formation (Vokes, 1989b, p. 53) but in a study of these southwestern Florida coral-reefs, Meeder (1990) has assigned the beds to the Tamiami Formation.

The *P. phyllopterus* line goes back in the New World to the Early Oligocene *P. burnsii*, almost without change. In addition, in the Miocene of Italy there are two(?) other species described by Bellardi as *Murex perlongus* (1872, p. 75, pl. 5, fig. 8) and *Murex rovasendae* (*ibid.*, p. 75, pl. 5, fig. 9). The latter almost certainly is the same as *P. phyllopterus; M. perlongus* lacks the triangular shoulder extension to the fronds but this is probably due to wear. As the two occur at the same locality (Torino Hills) it seems likely that they are, in fact, two examples of the same species and are both synonyms of *P. phyllopterus*.

PTERYNOTUS (PTERYNOTUS) XENOS
Harasewych
Plate 4, figure 4

Murex tristichus Dall. HUMFREY, 1975, Sea Shells of the West Indies, p. 136, pl. 22, fig. 35 (not of Dall).

Pterynotus (Pterynotus) xenos HARASEWYCH, 1982, Biol. Soc. Washington, Proc., v. 95, no. 4, p. 639, figs. 1-3.

Pterynotus xenos Harasewych. CRNKOVIC, 1992, Texas Conch., v. 28, no. 2, p. 42, text-figs. 1, 2.

Holotype: USNM 703309; height 6.3 mm, diameter 3.7 mm.

Type locality: Discovery Bay, Jamaica, in 60 meters.

Occurrence: Recent only, Jamaica and Cuba to Honduras.

Figured specimen: USNM 703309 (holotype).

Discussion: Based upon five small specimens (the known maximum size of the species is less than 7 mm), all from the type locality, this species originally was figured by Humfrey (1975, pl. 22, fig. 35) as *P. tristichus* (Dall), a form only generically similar. When described, Harasewych (1982, p. 641) suggested that its closest relative "will likely prove to be *P. tripterus* (Born, 1778) from the Indo-Pacific." However, *P. xenos* lacks the scabrous surface ornamentation characteristic of the typical Species Group, to which I would refer *P. tripterus*. The similarity between the two forms is the denticulate aperture, a character that also occurs in the Group of *P. phyllopterus*, and, in spite of the small size, I consider this to be the species closest to *P. xenos*.

In the original description Harasewych noted that the inner lip is smooth, although the holotype has a single large denticle on the columellar lip (see pl. 4, fig. 4). Presumably it is pathologic, for the figured paratype does not show such a structure nor does the specimen in my collection. The latter was collected by Hortensia Sarasua from the sands dredged to form the Havana harbor and was the only example known from anywhere other than the type locality until Crnkovic (1992) reported the species from 14 meters depth off Isla Roatan, Honduras. The scarceness of this relatively shallow-water species probably is due more to its small size than to actual rarity.

Subgenus PTEROCHELUS Jousseaume, 1880

Pterochelus JOUSSEAUME, 1880, Le Naturaliste, Année 2, no. 42, p. 335.

Type species: *Murex acanthopterus* Lamarck, 1816, by original designation.

PLATE 4

Figures — Page

1-3. *Pterynotus (Pterynotus) phyllopterus* (Lamarck) 17
1. (X 1 1/4) Wright Coll.; height 63.1 mm, diameter 33.4 mm.
Locality: Reef off Club Méditerranée, Martinique; Recent.
2. (X 1 1/2) USNM 462675; height (incomplete) 27 mm, diameter 16 mm.
Locality: TU 1175, Florida; Tamiami Formation.
3. (X 1 1/4) USNM 462676; height (as is) 41.4 mm, diameter (as is) 18.1 mm.
Locality: TU 1489, Costa Rica; Moín Formation.

4. *Pterynotus (Pterynotus) xenos* Harasewych (X 10) 17
USNM 703309 (holotype); height 6.3 mm, diameter 3.7 mm.
Locality: Discovery Bay, Jamaica, in 60 meters; Recent.

5. *Pterynotus (Pterochelus) angelus* (Aldrich) (X 2) 20
USNM 644608 (holotype); height 26 mm, diameter 14 mm.
Locality: Red Bluff, Chickasawhay River, Wayne County, Mississippi (= TU 1288); Red Bluff Formation.

6. *Pterynotus (Pterochelus) ariomus* (Clench and Pérez Farfante) (X 2) 20
MCZ 164734 (holotype); height 24 mm, diameter 12.5 mm.
Locality: Off Hollywood, Florida, in 50-60 fathoms [91-109 meters]; Recent.

7, 8. *Pterynotus (Purpurellus) mirificus* Vokes 21
7. (X 2) USNM 323885 (holotype); height 29.6 mm, diameter 17.6 mm.
Locality: TU 1215, Dominican Republic; Gurabo Formation.
8. (X 10) USNM 323884 (paratype B); height (incomplete) 13.5 mm, diameter (incomplete) 11.9 mm.
Locality: TU 1215, Dominican Republic; Gurabo Formation.

9. *Pterynotus (Purpurellus) repetiti* Vokes (X 1 1/4) 21
USNM 646438 (holotype); height (incomplete) 53.5 mm, diameter 28 mm.
Locality: TU 866, North Carolina; "Silverdale Beds" (= Haywood Landing Member, Belgrade Formation).

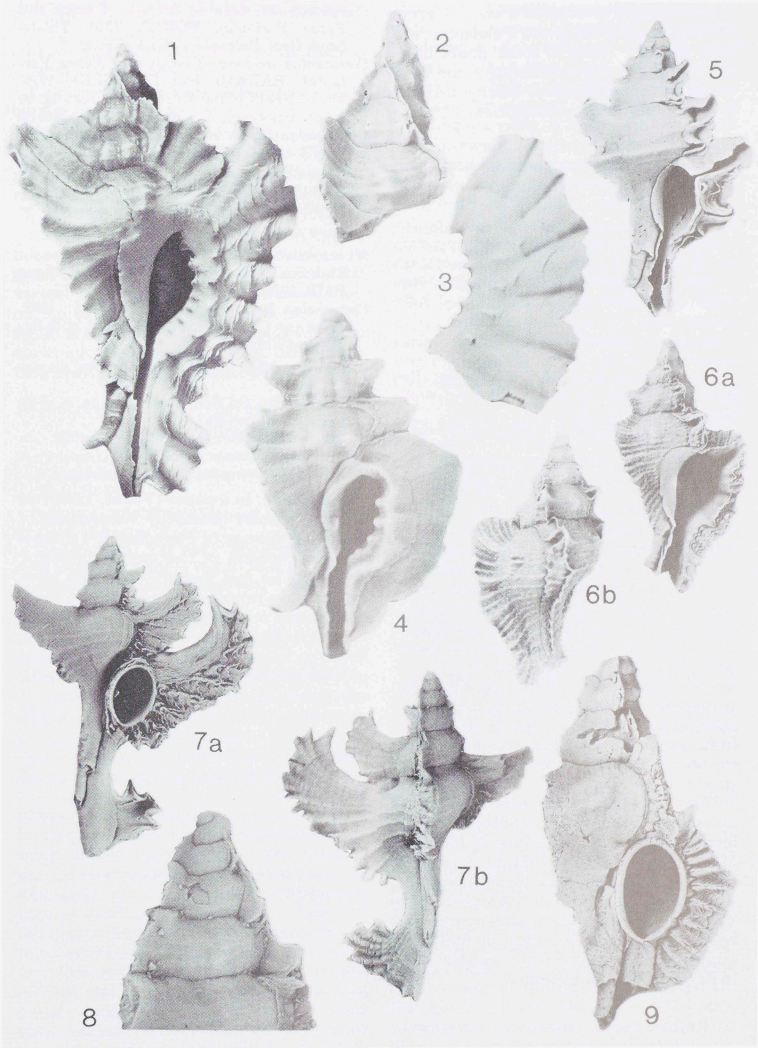

PLATE 4

Discussion: Pterochelus is another group that has existed since the Paleogene with little change. There is some doubt about whether the group is still living in the Western Atlantic, but certainly there is no question about the Oligocene species.

PTERYNOTUS (PTEROCHELUS) ANGELUS
(Aldrich)
Plate 4, figure 5

Pterynotus (Pterochelus) angelus (Aldrich). VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 15, pl. 3, fig. 5 (holotype); MACNEIL and DOCKERY, 1984, Mississippi Bur. Geol., Bull. 124, p. 125, pl. 5, figs. 3 (holotype), 4, 5.

Holotype: USNM 644608; height 26 mm, diameter 14 mm.

Type locality: Red Bluff Formation; Red Bluff, Chickasawhay River, Wayne County, Mississippi (= TU 1288).

Occurrence: Red Bluff Formation, Mississippi.

Figured specimen: USNM 644608 (holotype).

Discussion: MacNeil and Dockery (1984, p. 126-127) discussed this "orphan species" that is most closely related to the European *P.(P.) bispinosus* (J. de C. Sowerby, 1823), and concluded that there is nothing resembling it in the older Eocene beds or the Oligocene beds in the Gulf Coast region. I now have had the opportunity to compare the American species with several examples of the European one and the only difference I can discern is that the European specimens have a higher spire, making the shell appear more elongate. If the two forms occurred together, the differences would be considered within the limits of species variability.

When I discussed this species in 1970, I noted only three poor examples in the collections of the U.S. National Museum; MacNeil and Dockery (1984, pl. 5, figs. 3-5) have figured all three of these specimens. They had little new material and we have none. Thus, my original statement about hesitating to place the American and European species in synonymy without more material remains unchanged.

PTERYNOTUS (PTEROCHELUS) ARIOMUS
(Clench and Pérez Farfante)
Plate 4, figure 6

Pterynotus (Pterochelus) ariomus (Clench and Pérez Farfante). VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 15.

Pterochelus ariomus (Clench and Pérez Farfante). RADWIN and D'ATTILIO, 1976, Murex Shells of the World, p. 96, text-fig. 59 (after holotype); FAIR, 1976, The Murex Book, p. 22, pl. 14, fig. 187 (holotype); ABBOTT and DANCE, 1982, Compendium of Seashells, p. 141 (holotype, color photograph); VOKES, 1989, American Conchologist, v. 17, no. 2, p. 5, fig. 10 (holotype).

?Synonym:

Murex helenae VERRILL, 1953, Mins. Conch. Club So. California, no. 132, p. 10, text-figs.; FAIR, 1976, The Murex Book, p. 47.

Pterochelus helenae (Verrill). VOKES, 1989, American Conchologist, v. 17, no. 2, p. 5, fig. 11 (after Verrill).

Holotype: MCZ 164734; height 24 mm, diameter 12.5 mm.

Type locality: Off Hollywood, Florida, in 50-60 fathoms [91-109 meters].

Occurrence: Recent only, Florida to (?)Montserrat, Lesser Antilles.

Figured specimen: MCZ 164734 (holotype).

Discussion: In a paper (Vokes, 1989a) on the distribution (primarily Australian) of the living species of *Pterochelus*, I discussed the problem of the western Atlantic species. The fact that the holotype of *P. ariomus* has remained unique for 50 years does cause one to doubt its validity. But there are three mitigating factors: (1) the holotype was collected alive, (presumably) off Florida; (2) there is a markedly similar species in the Pliocene of England, *P. elegantula* (Harmer, 1918, p. 340, pl. 35, fig. 20); and (3) two additional specimens, named *Murex helenae* by Verrill, (supposedly) were collected in fish-traps off Montserrat.

Of course, it is possible that the locality for the holotype of *P. ariomus* is wrong and it came from Australia. It seems quite probable that the Verrill specimens are actually battered examples of the Australian species *P. triformis* (Reeve, 1845), as they appear to be. But this does not explain the presence of the species in the Pliocene of England. And, if the genus was still present in the eastern Atlantic as late as Pliocene time, why should it not still be living somewhere in the western Atlantic? Only discovery of additional material will give a final answer.

Subgenus PURPURELLUS Jousseaume, 1880

Purpurellus JOUSSEAUME, 1880, Le Naturaliste, Année 2, no. 42, p. 335.

Type species: *Murex gambiensis* Reeve, 1845, by original designation.

Discussion: It has been suggested that the morphologic differences between *Purpurellus* and *Pterynotus* are such as to warrant their separation into distinct genera. This has some merit, as the presence of a sealed siphonal canal is extremely rare in the subfamily Muricinae and certainly is of great taxonomic significance. To me, the varical formation and the ornamentation on the early teleoconch whorls (see pl. 4, fig. 8) are so similar to *Pterynotus* s.s. as to outweigh the sealed canal for distinction. However, this is a personal opinion.

PTERYNOTUS (PURPURELLUS) REPETITI Vokes
Plate 4, figure 9

Pterynotus (Purpurellus) repetiti VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 16, pl. 3, fig. 4.

Holotype: USNM 646438; height (incomplete) 53.5 mm, diameter 28 mm.

Type locality: TU 866, "Silverdale Beds"; marl pit on north side of Webb Creek and east of unnumbered county highway, Silverdale, Onslow County, North Carolina.

Occurrence: "Silverdale Beds" (= Silverdale Formation, = Haywood Landing Member, Belgrade Formation), North Carolina.

Figured specimen: USNM 646438 (holotype).

Discussion: The beds at Silverdale, from which the original type lot of only three specimens was collected, initially were considered to be part of the Trent Limestone. When certain muricid species were described from the Silverdale beds (Vokes, 1963, p. 161) and when I treated *Chicoreus (Phyllonotus) davisi* (Richards, 1943) (Vokes, 1967, p. 140) the question of the correct name for the formation was raised. In 1978, two different papers appeared on the Tertiary stratigraphy of North Carolina. One of these (Baum *et al.*, 1978) used the names Belgrade Formation and Silverdale Formation for the two "geographically isolated and lithologically dissimilar units." At about the same time, Ward *et al.* (1978, p. F15) proposed the Haywood Landing Member of the Belgrade Formation for the beds exposed at Haywood Landing and Silverdale. Although the name "Silverdale" has priority on the basis of my informal usage, Baum *et al.* have noted that there are no natural outcrops of either the Belgrade or the Silverdale formations, only exposures in working quarries. A legitimate type locality at Hayward Landing supports the adoption of the latter name (especially as it was proposed by members of the U.S. Geological Survey).

Regardless of the name, the beds, formerly considered to be of Early Miocene age, have been placed in the Late Oligocene (Chickasawhayan Stage) by Gibson (1977, p. 202; 1983, p. 38). Otherwise, there is no new information on this earliest known species of *Purpurellus*. Originally it was the sole link in the otherwise disjunct distribution of a group that today occurs only in West Africa (*P. gambiensis*, the type species) and West America (*P. pinniger* and *P. macleani*). But, now a second species has been reported from the Gurabo Formation of the Dominican Republic.

PTERYNOTUS (PURPURELLUS) MIRIFICUS Vokes
Plate 4, figures 7, 8

Pterynotus (Purpurellus) mirificus VOKES, 1989, Bulls. Amer. Paleontology, v. 97, no. 332, p. 54, pl. 5, figs. 10, 12.

Holotype: USNM 323885; height 29.6 mm, diameter 17.6 mm.

Type locality: TU 1215, Gurabo Formation; Río Gurabo, bluffs on both sides from the ford on the Los Quemados-Sabaneta road upstream to approximately 1 km above the ford, Dominican Republic.

Occurrence: Gurabo Formation, Dominican Republic.

Figured specimens: Fig. 7, USNM 323885 (holotype). Fig. 8, USNM 323884 (paratype B); height (incomplete) 13.5 mm, diameter (incomplete) 11.9 mm; locality TU 1215. Additional locality: TU 1227A.

Discussion: This exquisite little species, which resembles a miniature *P. gambiensis*, is common in the Gurabo Formation, there being 85 specimens in the type lot. But almost all are from a single locality, which is a coral-reef. However, none of the living species are known to inhabit coral-reefs today.

McClincy (1991, p. 45) has described the habitat of the Recent Panamic representatives of the genus, *P. pinniger* (Broderip, 1833) and *P. macleani* Emerson and D'Attilio, 1969. He observed that *P. pinniger* is found "in sand between small rocks on a rubble bottom" but *P. macleani* hides in crevices in rock cliffs, both at about the same 18-20 meters depth.

The West African *P. gambiensis* probably occupies the same niche as *P. pinniger*, as it is usually taken in fishermen's nets. Presumably the Gurabo *P. mirificus* inhabited an environment most similar to that of *P. macleani*, except that the cliff was coral and not ordinary rock.

Genus POIRIERIA Jousseaume, 1880
Subgenus POIRIERIA s.s.

Poirieria JOUSSEAUME, 1880, Le Naturaliste, Année 2, no. 42, p. 335.

Type species: *Murex zelandicus* Quoy and Gaimard, 1833, by original designation.

Discussion: When Part V of Cenozoic Muricidae (including the genus *Poirieria*) was published (Vokes, 1970), the earliest known species of the typical subgenus was *P. woodsensis* from the Early Eocene of Alabama. That paper was published in June; in July, I collected a broken but unmistakable specimen of true *Poirieria* in the Paleocene Matthews Landing Marl at Kimbrough, Alabama (see pl. 5, fig. 1). This same species subsequently was figured by Toulmin (1977, pl. 7, fig. 10, as "*Eupleura morula*"). Thus, representatives of three different muricine generic taxa – *Pterynotus* s.s., *Poirieria* s.s., and *Poirier-*

PLATE 5

Figures — Page

1, 2. *Poirieria (Poirieria)* species (X 2) 24
1. USNM 462677; height (as is) 15 mm; diameter (as is) 15 mm.
Locality: TU 735, Alabama; Matthews Landing Marl Member, Porters Creek Formation.
2. GSA 160-2; height 23.3 mm, diameter (including spines) 15.3 mm.
Locality: Matthews Landing, Alabama River, Wilcox County, Alabama; Matthews Landing Marl Member, Porters Creek Formation.

3. *Poirieria (Poirieria) woodsensis* Vokes (X 2) 24
ANSP 7059 (holotype); height 23 mm, diameter (including spines) 16 mm.
Locality: Woods Bluff, Tombigbee River, Clarke County, Alabama; Bashi Marl Member, Hatchetigbee Formation.

4. *Poirieria (Poirieria) actinophora* (Dall) (X 2 1/2) 25
USNM 430478; height 20.6 mm, diameter (including spines) 14.3 mm.
Locality: U.S. Virgin Islands; Recent.

5. *Poirieria (Paziella) cretacea* Garvie (X 3) 26
USNM 455526 (holotype); height 16.5 mm, diameter 10.1 mm.
Locality: Colorado River, bluff on left bank at Webberville, Travis County, Texas; Kemp Clay.

6, 7. *Poirieria (Paziella) harrisi* Vokes (X 3) 28
6. ANSP 14225 (holotype); height 15 mm, diameter (including spines) 11 mm.
Locality: Matthews Landing, Alabama River, Wilcox County, Alabama; Matthews Landing Marl Member, Porters Creek Formation.
7. USNM 462678; height 16.1 mm, diameter (including spines) 11.8 mm.
Locality: Alabama River, at Dixon's Creek, Wilcox County, Alabama; Matthews Landing Marl Member, Porters Creek Formation.

8. (?)*Poirieria (Paziella) progne* White (X 2) 29
MNRJ 2 972-I (holotype); height 26 mm, diameter 18 mm (after White, 1887, pl. 11, fig. 14).
Locality: Rio Maria Farinha, Pernambuco, Brazil; Maria Farinha Formation.

9. *Poirieria (Paziella) septima* Vokes (X 1 1/2) 30
USNM 646429 (holotype); height 33 mm, diameter 17 mm.
Locality: USGS 10631, Tuzendepetl [*i.e.*, Tuzantepetl], Rio Coatzacoalcos, Veracruz, Mexico; Concepcion Inferior Formation.

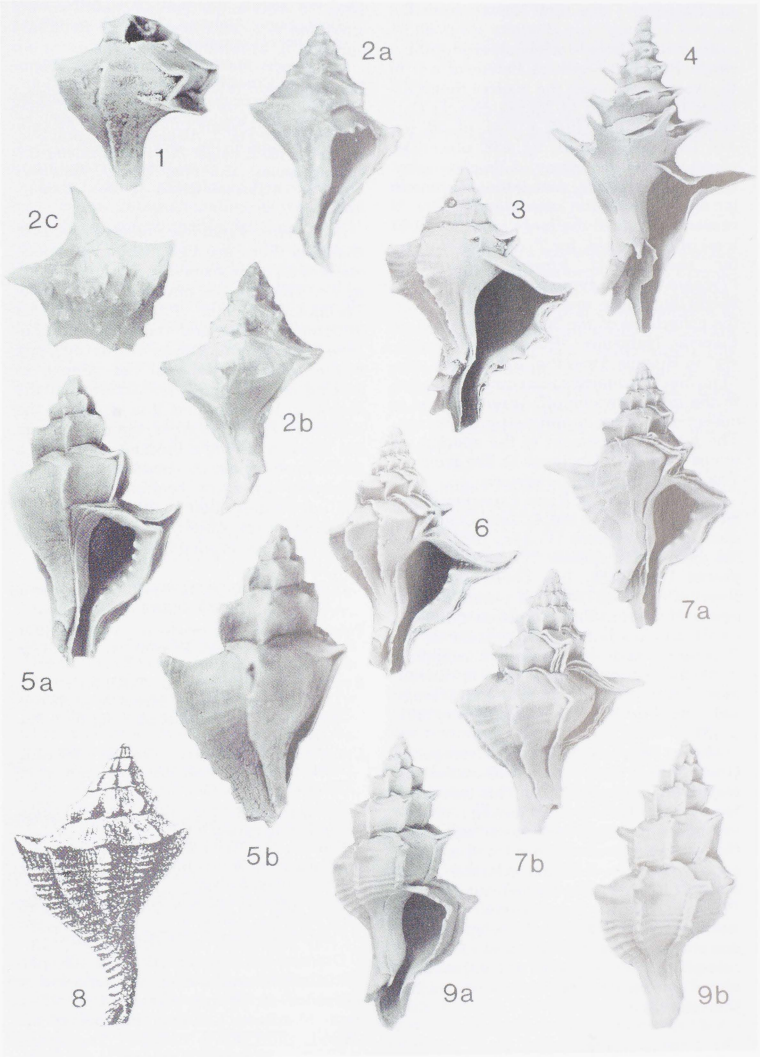

PLATE 5

ia (Paziella) – are now known from the earliest Tertiary.

Formerly, there was considered to be a single Recent species of *Poirieria* s.s. in the western Atlantic, the bizarre South Atlantic form named as *Murex clenchi* Carcelles, 1953. Rios (1975, p. 104, pl. 30, fig. 441; 1985, p. 87, pl. 31, fig. 388) placed *M. clenchi* in the synonymy of *Trophon acanthodes* Watson, 1883, noting that *M. clenchi* is an "anomalous specimen." This is reasonable, given the large size (height 51 mm) of *M. clenchi*, for *T. acanthodes* is by far the largest known species of "*Trophon*." The type is only 37 mm in height but there are many specimens in the collections of the Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" in Buenos Aires that exceed 100 mm. "*Trophon*" *acanthodes* is a common species in the deeper water off Argentina and is collected in large numbers by fishermen. The generic placement of the species remains open but it belongs to the group of *Trophon* s.l., and not to *Poiriera*.

However, another Recent species of *Poirieria* does occur in the Atlantic Ocean. As discussed elsewhere (Vokes, 1988, p. 30) the deep-water species "*Trophon*" *actinophorus* Dall, 1889, has been shown by Bayer (1971, p. 157) to be a member of the genus *Poirieria*. The subgenus *Poirieria* s.s. is another line that is present in the Paleogene and then does not reappear until the Recent fauna due to having moved into a deeper habitat (on average 440 meters for *P. actinophora*, Bayer, 1971, p. 159).

Merle (1989, p. 152) erected a new genus *Crassimurex* (type species *Murex calcitrapoides* Lamarck, 1803). This taxon differs from *Poirieria* s.s. by having more developed spiral sculpture and a "squattier" ("plus trapue") shape due to the lower spire; however, I would consider *Crassimurex* to be no more than a subgenus of *Poirieria*. *Murex calcitrapoides* does indeed have more strongly developed spiral sculpture than the typical smooth *Poirieria zelandica*, but my opinion is that the differences are minor and are specific rather than generic.

POIRIERIA (POIRIERIA) species
Plate 5, figures 1, 2

Eupleura morula (Conrad). TOULMIN, 1977, Geol. Surv. Alabama, Mon. 13, p. 160 (in part, not of Conrad), pl. 7, fig. 10.

Occurrence: Matthews Landing Marl Member, Porters Creek Formation, Alabama.

Figured specimens: Fig. 1, USNM 462677; height (as is) 15 mm; diameter (as is) 15 mm; locality TU 735. Fig. 2, Alabama Geological Survey, GSA 160-2; height 23.3 mm, diameter (including spines) 15.3 mm; locality, Matthews Landing, Alabama River, Wilcox County, Alabama.

Discussion: From the Paleocene beds of Alabama there are two incomplete specimens of an undescribed species of *Poirieria* s.s. This species differs from both the European Eocene *P.(P.) subcristatus* (d'Orbigny, 1850) and the American Eocene *P.(P.) woodsensis*, as well as the living *P.(P.) zelandica* (type of the genus), in lacking secondary spines anterior to the shoulder. In this aspect it is similar to the Recent *P.(P.) actinophora*, but differs from the latter in having a broader shell with a much lower spire. As both of the known examples are badly broken, the species will not be described at this time, but the presence of this oldest known occurrence of *Poirieria* s.s. is documented here.

POIRIERIA (POIRIERIA) WOODSENSIS Vokes
Plate 5, figure 3

Poirieria (Poirieria) woodsensis VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 17, pl. 4, figs. 1, 2.

Eupleura morula (Conrad). TOULMIN, 1977, Geol. Surv. Alabama, Mon. 13, p. 160 (in part, not of Conrad; not pl. 7, fig 10 = *Poirieria* sp.).

Crassimurex woodsensis (Vokes). MERLE, 1989, Bull. Mus. Natl. Hist. Nat. Paris, v. 11, Sect. C, no. 3, p. 152.

Holotype: ANSP 7059; height 23 mm, diameter (including spines) 16 mm.

Type locality: Bashi Marl Member, Hatchetigbee Formation; Woods Bluff, Tombigbee River, Clarke County, Alabama.

Occurrence: Bashi Marl Member, Hatchetigbee Formation, Alabama.

Figured specimen: ANSP 7059 (holotype).

Discussion: Toulmin (1977, p. 160) perpetuated the confusion of the reported occurrence of "*Murex morulus* Conrad" at both Matthews Landing (Paleocene) and Woods Bluff (Early Eocene). The species from Woods Bluff is not the same as the one named *M. morulus* by Conrad (see *P.*

harrisi Vokes, below), which does occur at Matthews Landing; in fact, it is not even the same subgenus. Therefore, it was designated *P. woodsensis*.

As Toulmin (1977, p. 370) noted, Woods Bluff formerly exposed several fossiliferous beds but is now covered by backwater from Coffeeville Dam, yet another victim of improved river navigation.

Merle (1989, p. 152) placed *P. woodsensis* into his new genus *Crassimurex* (type species: *Murex calcitrapoides* Lamarck, 1822; unnecessary new name for *Murex calcitrapa* Lamarck, 1803, not *M. calcitrapa* Lamarck, 1822), a move I find impossible to accept. The only differences between *P. woodsensis* and *P. zelandica* are the lower spire and shorter spines in the older species. There is no more spiral ornamentation in *P. woodsensis* than in *P. zelandica*.

Poirieria (Poirieria) actinophora (Dall)
Plate 5, figure 4

Trophon (Boreotrophon) actinophorus DALL, 1889, Harvard Mus. Comp. Zool., Bull, v. 18, p. 206, pl. 16, fig. 2; DALL, 1889, U.S. Natl. Mus., Bull. 37, p. 20, pl. 15, fig. 2 (entire plate is copy of previous); M. SMITH, 1953, Illus. Cat. Recent Species Rock Shells, p. 19, pl. 9, fig. 2 (after Dall).

Boreotrophon (Actinotrophon) actinophorus (Dall). DALL, 1902, U.S. Natl. Mus., Proc., v. 24, p. 534.

"Unnamed." OLSSON, 1964, Neogene Moll. Northwest. Ecuador, pl. 20, fig. 5 (not in text).

Trophon actinophorus Dall. BULLIS, 1964, Tulane Stud. Zoology, v. 11, p. 107; RIOS, 1975, Brazilian Marine Moll. Icon., p. 88, pl. 25, fig. 361 (after Dall).

Murex (Paziella) actinophorus (Dall). BAYER, 1971, Bull. Marine Sci., v. 21, no. 1, p. 157, text-figs. 30, 35D (radula).

Poirieria (Paziella) actinophorus (Dall). ABBOTT, 1974, American Seashells, ed. 2, p. 186.

Actinotrophon actinophorus (Dall). ABBOTT, 1974, American Seashells, ed. 2, p. 191, fig. 210; RADWIN and D'ATTILIO, 1976, Murex Shells of the World, p. 176, text-fig. 116 (after Dall); D'ATTILIO, 1980, Festivus, v. 12, no. 4, p. 61, fig. 1.

Poirieria (Poirieria) actinophorus (Dall). RIOS, 1985, Seashells of Brazil, p. 83, pl. 29, fig. 361 (after Dall).

Poirieria (Poirieria) actinophora (Dall). VOKES, 1988, Tulane Stud. Geol. Paleont., v. 21, no. 1, p. 29, pl. 4, figs. 3-5.

Holotype: MCZ 7371; height 17.5 mm, diameter (including spines) 14 mm.

Type locality: *Blake* Station 143, off Santa Cruz (St. Croix, V.I.), in 248 fathoms [454 meters].

Occurrence: Esmeraldas beds, Ecuador. Recent, western Atlantic from Bahama Islands to Brazil, Panama, and Colombia (Bayer, 1971, p. 159).

Figured specimen: USNM 430478; height 20.6 mm, diameter (including spines) 14.3 mm; locality, U.S. Virgin Islands. Additional locality: TU 1397.

Discussion: In a work on the fauna of the Pliocene Esmeraldas beds, Onzole Formation, of northwestern Ecuador (Vokes, 1988, p. 30) I noted that *P. actinophora* is one of the few muricine species occurring in both the Atlantic and Pacific faunas. But given the extreme conservatism of the group and its world-wide distribution since the Eocene, its presence in the eastern Pacific is noteworthy but not totally unexpected.

Subgenus PAZIELLA Jousseaume, 1880

Paziella JOUSSEAUME, 1880, Le Naturaliste, Année 2, no 42, p. 335.

Type species: *Murex pazi* Crosse, 1869, by original designation.

Discussion: Paziella is the earliest genus-group of Muricinae, and the only one known older than the Paleocene. Until recently, only a single small specimen (*ca.* 8 mm) represented the Muricinae prior to the Tertiary. This species from the Cenomanian of Saxony, eastern Germany, was named *Murex armatus* Geinitz, 1874. That name is preoccupied by *M. armatus* A. Adams, 1854, and Garvie (1991, p. 88) has renamed it *Poirieria (?Paziella) cenomae*. This species is still the oldest known species of Muricinae but no longer the only pre-Tertiary representative, as Garvie has discovered a second Cretaceous species from the Kemp Clay (Maastrictian) of Texas.

According to Merle (1989, p. 151) the lower spire and the absence of spines on the base of the canal forbids ("empechent") placement of the early species that I would refer to *Paziella* in that group and he would place them in the subgenus *Flexopteron*. There are several species of *Paziella*, both fossil and Recent, which

lack spines on the siphonal canal. For these the subgenus *Bathymurex* Clench and Pérez Farfante, 1945 (type species: *Murex atlantis* Clench and Pérez Farfante; see pl. 5, fig. 11) is available.

However, there are greater differences than just the spire and the spines between *Paziella* and *Flexopteron*. The genus *Flexopteron* (type species: *F. philippinensis* Shuto) is characterized by foliaceus varices, each with a slight shoulder spine formed by the folding over of the varical flange. The aperture is denticulate and patulous. The siphonal canal is short and broad. The only resemblance between *Flexopteron* and those species that Merle would include is the patulous aperture and the folding over of the posterior edge of the apertural flange. In this respect, these species do resemble *Flexopteron* (see *P. collata* below, pl. 6, figs. 5, 6), but the unflanged varices and the narrow extended siphonal canal are much more like *Paziella*. It is probable that the line of *Flexopteron* is derived from these early species of *Paziella*, and similarities should be expected.

The living species *P.(P.) petuchi*, n. sp., *P.(P.) galapagana* (Emerson and D'Attilio, 1970), and presumably *P.(P.) atlantis* (Clench and Pérez Farfante, 1945), differ from the other members of *Paziella* in their relatively heavy intritacalx, or chalky outer layer. Thus, the subgenus *Bathymurex* may be a distinct taxon, including those species similar to *Paziella* but lacking the spines encircling the siphonal canal. Other than the intritacalx, the minimal differences between these species do not warrent the change. However, to keep the most similar species together, they will be divided into Species Groups as above.

Species Group 1: *Poirieria (Paziella) harrisi*

Discussion: There is no evidence that the earliest species of *Paziella* possessed the thick intritacalx seen in the later ones here referred to the group of *P.(P.) atlantis*. This may be an artifact of preservation but, generally at least remnant patchs remain on most specimens, if originally present, and none of the many specimens of *P. harrisi* show such traces.

POIRIERIA (PAZIELLA) CRETACEA Garvie
Plate 5, figure 5

Poirieria (Paziella) cretacea GARVIE, 1991, Tulane Stud. Geol. Paleont., v. 24, no. 4, p. 87, pl. 1, figs. 1, 2.

Holotype: USNM 455526; height 16.5 mm, diameter 10.1 mm.

Type locality: Kemp Clay; Colorado River, bluff on left bank at Webberville, Travis County, Texas.

PLATE 6

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   Locality: TU 1227, Dominican Republic; Gurabo Formation.

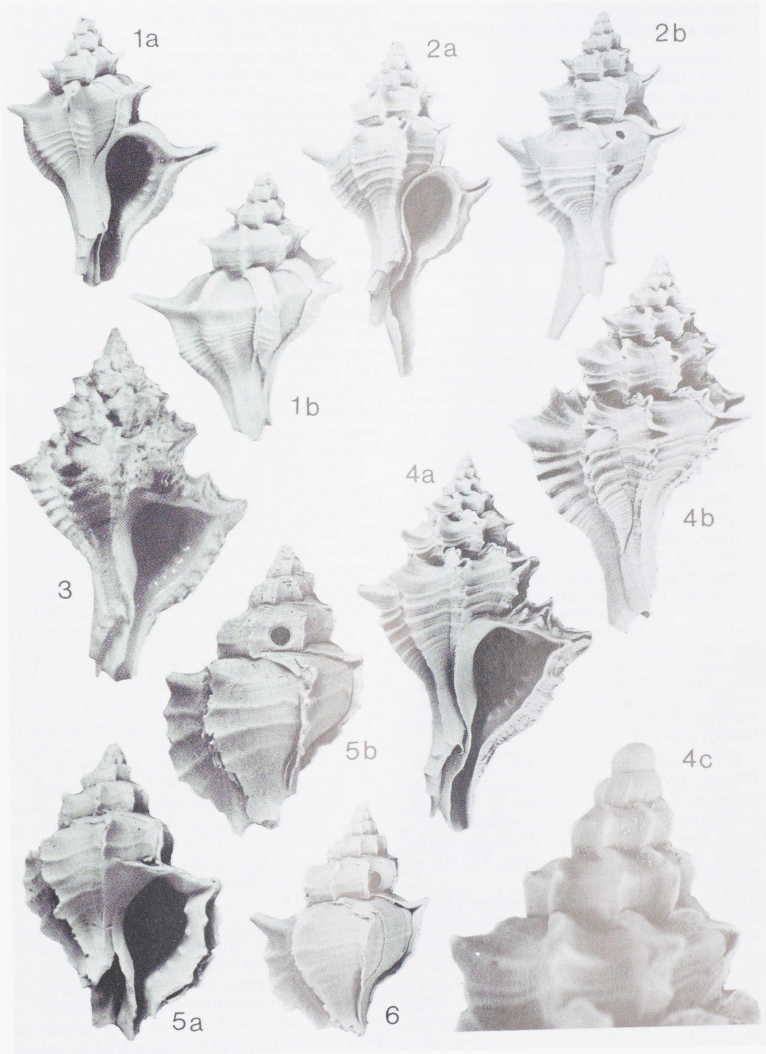


PLATE 6

Occurrence: Kemp Clay, Texas.
Figured specimen: USNM 455526 (holotype).

Discussion: A most exciting find is the recent discovery of a new species referable to the subgenus *Paziella* in the Maastrictian beds of eastern Texas. Not surprisingly, given the conservatism of the group and the close geologic age, there is a great similarity between this latest Cretaceous species and the earliest Tertiary *P. harrisi* Vokes. The only differences are the fewer and less foliated varices, and the smoother surface ornamentation in the older species.

POIRIERIA (PAZIELLA) HARRISI Vokes
Plate 5, figures 6, 7

Poirieria (Paziella) harrisi VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 18, pl. 4, fig. 3 (new name for *Murex morulus* Conrad, 1860, *non* Schroter, 1805).
Eupleura morula (Conrad). TOULMIN, 1977, Geol. Surv. Alabama, Mon. 13, p. 160 (in part, not pl. 7, fig. 10 = *Poirieria* sp.).
Poirieria (Flexopteron) septemcostata harrisi (Vokes). MERLE, 1989, Bull. Mus. Natl. Hist. Nat. Paris, (Ser. 4) v. 11, Sect. C, no. 3, p. 151.

Holotype: ANSP 14225; height 15 mm, diameter (including spines) 11 mm.
Type locality: Matthews Landing Marl Member, Porters Creek Formation; Matthews Landing, Alabama River, Wilcox County, Alabama.
Occurrence: Matthews Landing Marl Member, Porters Creek Formation, Alabama.
Figured specimens: Fig. 6, ANSP 14225 (holotype). Fig. 7, USNM 462678; height 16.1 mm, diameter (including spines) 11.8 mm; locality, Alabama River, at Dixon's Creek, Wilcox County, Alabama.

Discussion: As observed previously (Vokes, 1970, p. 19), this small species is not rare. For example, David T. Dockery III obtained over 75, mostly juvenile, specimens from a site on the Alabama River about one mile below the type locality at Matthews Landing.

From these beautifully preserved juvenile shells it can be seen that the species has a primitive four whorl conical protoconch. Beginning at the terminal varix of the protoconch there are about nine varices on each whorl of the teleoconch, each formed by a simple flange of shelly material. On the later whorls, periodically one varix is thickened and presumably labral denticles are formed; but only those at the aperture are visible. The other varices remain as a thin single layer of shell. There is no pattern to these thickened varices; there may be one or several on a whorl. If two are thickened, one on either side, there is a strong resemblance to the genus *Eupleura*, which caused Palmer and Brann (1966, p. 669) to refer the species to this only distantly related ocenebrine genus.

Also, one can see how the animal might develop consistently three thickened varices per whorl and become a *Pterynotus*. Other than having seven rather than nine varices on the first two teleoconch whorls, the juveniles of the contemporary *Pterynotus matthewsensis* are virtually identical. The protoconchs of the two species are similar, with four conical whorls on each, but that of *Pterynotus matthewsensis* is almost twice as large (0.8 mm *vs.* 0.4 mm in diameter) as that of *P. harrisi*.

In the plate explanation for this species previously (Vokes, 1970, pl. 4), I mistakenly cited the locality for the figured specimen as "Claiborne Bluff, Alabama River, Alabama. Gosport Sand, middle Eocene." Obviously, as the figured specimen is the holotype of *Murex morulus* Conrad, the specimen came from Matthews Landing not Claiborne Bluff! I apologize for this *lapsus*.

Unfortunately, my mistake caused Merle (1989, p. 151) to cite *P. harrisi* as from the Claibornian of Mississippi [*sic*]. This is one of the species that he would place in the subgenus *Flexopteron*. Certainly there are similarities, but I believe that the greater affinity is with *Paziella* and not *Flexopteron*. Likewise, there is a strong generic similarity between *P. septemcostata* (Roualt, 1850) (see Merle, 1989, p. 2, figs. 8, 9) and *P. harrisi*, but not enough to consider the latter a subspecies of the former.

Toulmin (1977, p. 160) reported this species from both Matthews Landing and Woods Bluff, but this is due to confusion with *P. woodsensis* (above). His figured specimen, however, is neither *P. harrisi* nor *P. woodsensis*, but is an undescribed species cited above as *Poirieria (Poirieria)* species.

Species Group 2: *Poirieria (Paziella) atlantis*

(?) POIRIERIA (PAZIELLA) PROGNE (White)
Plate 5, figure 8

Trophon progne WHITE, 1887, Archiv. Mus. Nac. Rio de Janeiro, v. 7, p. 139, pl. 11, fig. 14; PENNA, 1965, Pap. Avul., Dept. Zool., Sao Paulo, v. 17, art. 21, p. 272.

Not *Trophon progone*? White. MAURY, 1912, Acad. Nat. Sci. Philadelphia, Jour., (Ser. 2) v. 15, p. 81, pl. 11, figs. 7, 8.

Holotype: MNRJ 2 972-I; height 26 mm, diameter 18 mm (*fide* White, 1887).

Type locality: Maria Farinha Formation; Rio Maria Farinha, Pernambuco, Brazil.

Occurrence: Maria Farinha Formation, Brazil.

Figured specimen: Holotype, after White, 1887, pl. 11, fig. 14.

Discussion: White described this species from the Paleocene Maria Farinha Formation of Brazil on the basis of a "gutta percha cast of a natural mould, and a natural cast of the interior of the same example" (1887, p. 140). The Museu Nacional de Rio de Janeiro was unable to provide a casting of this species, named as a *Trophon*, but from White's illustration (reproduced here, pl. 5, fig. 8) it is more likely a *Paziella* than a *Trophon*. It is similar to the contemporary *P. harrisi* but has numerous spiral threads on the body whorl. In this it resembles the younger *P. dominicensis* (Gabb) and, for this reason, is placed in this Species Group.

Maury (1912, p. 81, pl. 11, figs. 7, 8) tentatively attributed two fragments from the Paleocene of Soldado Rock, Trinidad, to this species. But her illustrations show neither the varical ridges nor the spiral cords. Other than similar age there is little reason to consider them the same.

POIRIERIA (PAZIELLA) DOMINICENSIS (Gabb)
Plate 6, figure 1

Poirieria (Paziella) dominicensis (Gabb). VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 19, pl. 4, fig. 4 (lectotype); VOKES, 1989, Bulls. Amer. Paleontology, v. 97, no. 332, p. 55, pl. 5, fig. 7.

Synonym:

Murex (Trophon) werneri TOULA, 1911, K.-K. Geol. Reichsanst., Jahrb., v. 61, p. 479, pl. 29, fig. 9.

Lectotype: ANSP 3252 (selected by Pilsbry, 1922, p. 354); height 17.5 mm, diameter (including spines) 11 mm.

Type locality: TU 1227, Gurabo Formation; Arroyo Zalaya, which crosses the road to Jánico from Santiago de los Caballeros, 11 km south of the bridge over the Río Yaque del Norte, at Santiago, Dominican Republic (restricted by Vokes, 1989b, p. 56).

Occurrence: Gurabo Formation, Dominican Republic; Concepcion Inferior Formation, Mexico.

Figured specimen: USNM 323882; height 18.7 mm, diameter (excluding spines) 10.8 mm; locality TU 1227. Additional localities: TU 1251, 1292, 1353, 1448, 1452.

Discussion: Our work in the Dominican Republic showed that *P.(P.) dominicensis* is not rare there, but it is confined to the deepest water portions of the Gurabo Formation in the vicinity of Santiago de los Caballeros. Thus, it was not taken by either the Maury party (Maury, 1917) or the USGS team (Vaughan *et al.*, 1921), who made collections only in the more western, shallower portions of the section.

The specimen I cited from the U. S. National Museum collection (Vokes, 1970, p. 20), is said to be from USGS locality 8516 (= TU 1219) at Potrero [not Portero, as stated], but as discussed in my Dominican report (Vokes, 1989b, p. 56), this probably is incorrect. The specimen came from a collection made by Bland in which the localities are badly confused. Most specimens said to be from Potrero (which is in the Gurabo Formation) appear to be from the Baitoa Formation. But, for *P. dominicensis* the specimen is from neither Potrero nor the Baitoa formation, and its actual source is not known.

The Mexican species *Murex werneri* Toula, 1911, was described from km 70, on the Trans-Isthmian Railroad. In 1970 I said that the beds exposed at this locality probably were the Paraje Solo Formation. Since then we have collected at km 70 (TU 1321) and, although there are no aragonitic shells remaining, the calcareous microfossils indicate an age of N.20 (Akers, 1981, p. 146 [more likely N.19, Kohl, 1985, fig. 7]) and are presumed to be the Concepcion Inferior Formation, the deeper water facies of the sequence of "formations" present in the Isthmus of Tehuantepec, deposited in depths of 180-200 meters (Kohl, 1985, p. 25). The Paraje Solo Formation (to

which I questionably assigned the species) is very shallow, with lignite layers, indicating fresh-water deposition; clearly this deep-water mollusk did not live in that environment.

I also reported a maximum size of 30 mm for the species, based upon Toula's statement (1911, p. 479) that his holotype was 30 mm in height. The largest of the Dominican specimens measures only 21 mm, and reexamination of Toula's work shows that the holotype of *Murex werneri* is only 25 mm in height.

On the basis of the original illustration, another species, *Murex eliseoduartei* Figueiras and Broggi (1976, pl. 1, fig. 3), described from the Late Miocene Camacho Formation of Uruguay, has a marked resemblance to *P. dominicensis*. However, examination of a latex cast made from the original mold (kindly provided to me by Prof. Figueiras) shows that it is a species of the typhine genus *Siphonochelus (Laevityphis)*, similar to the living Caribbean *S.(L.) bullisi* Gertman, 1969. Encircling the shoulder are a series of alternating spines (at the varices) and tubes (between the varices). When the spines break off there is the appearance of eight or nine broken spines per whorl (four varices and four tubes) or, in the case of this mold of the dorsal half of the shell, five "spines."

Poirieria (Paziella) septima Vokes
Plate 5, figure 9

Poirieria (Paziella) septima VOKES, 1970, Tulane Stud. Geol. Paleont, v. 8, no. 1, p. 22, pl. 4, fig. 5.

Holotype: USNM 646429; height 33 mm, diameter 17 mm.

PLATE 7

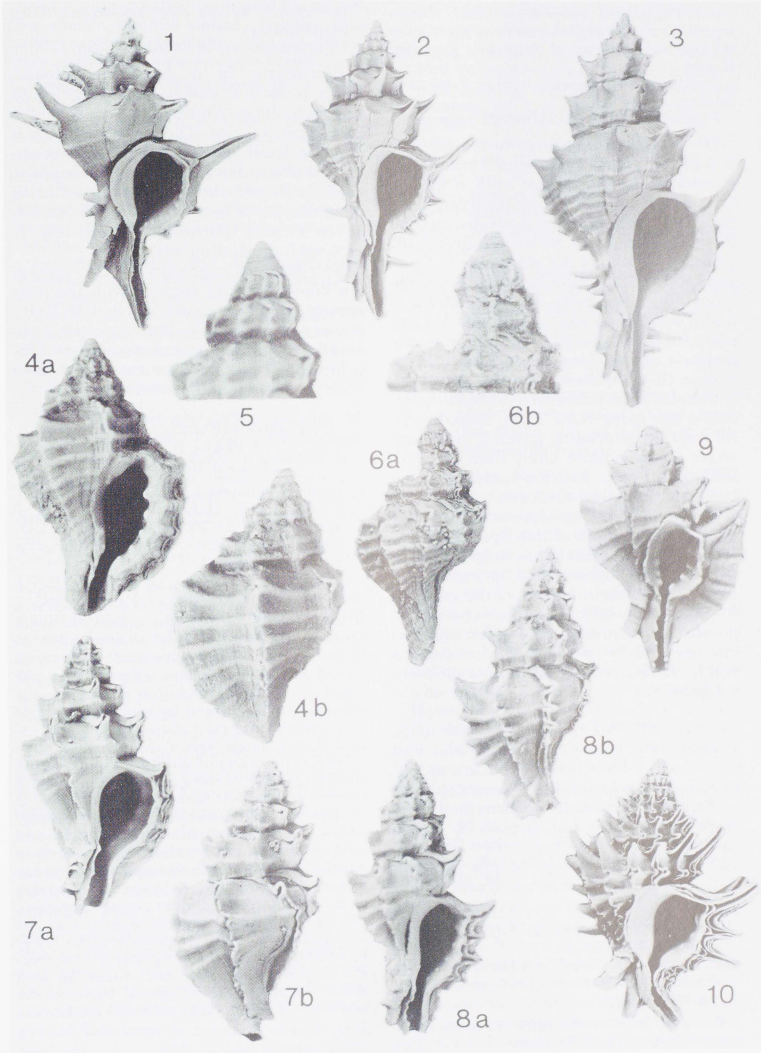


PLATE 7

Type locality: USGS 10631, Concepcion Inferior Formation; Tuzendepetl [*i.e.*, Tuzantepetl], on Río Coatzacoalcos, about seven miles [11 km] east-northeast of Minatitlan, Veracruz, Mexico.

Occurrence: Concepcion Inferior Formation, Mexico.

Figured specimen: USNM 646429 (holotype).

Discussion: Subsequent to the description of *P. septima* we located Tuzantepetl, a small village on the east bank of the Rio Coatzacoalcos, some 4 km upstream from Nanchital, or about 5 km downstream from the new bridge on Mexico Highway 180 (about 9 km above the *old* bridge at Coatzacoalcos). There is a high bluff, but the river has moved away and the material is badly weathered and overgrown. No fossils were found, but the area was originally mapped as the Concepcion Inferior Formation (R.W. Barker, personal communication, 1979), now known to be of Early Pliocene age (zone N.19, Kohl, 1985, fig. 7). As with the preceding species, this deep-water facies is more likely than the shallow-water Paraje Solo Formation to which I originally ascribed the fossil.

Poirieria (Paziella) septima differs from the other members of this Species Group in being larger (maximum height 33 mm) and having a higher spire, giving it a resemblance to the members of the group of *P. pazi*, but it lacks the spines on the siphonal canal. Intermediate species such as this one and ?*P. progone* prevent separation of these Species Groups into different subgenera.

Poirieria (Paziella) atlantis
(Clench and Pérez Farfante)
Plate 6, figure 2

Poirieria (Paziella) atlantis (Clench and Pérez Farfante). VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 23, pl. 5, fig. 2 (holotype); ABBOTT, 1974, American Seashells, ed. 2, p. 186; VOKES, 1989, Bulls. Amer. Paleontology, v. 97, no. 332, p. 56, pl. 5, fig. 6 (holotype).

Paziella pazi (Crosse). RADWIN and D'ATTILIO, 1976, Murex Shells of the World, p. 86 (in part, not of Crosse).

Paziella atlantis (Clench and Pérez Farfante). FAIR, 1976, The Murex Book, p. 22, pl. 15, fig. 196 (holotype).

Holotype: MCZ 164684; height 23.5 mm, diameter (excluding spines) 10.5 mm.

Type locality: *Atlantis* Station 3333, Bahía de Cochinos, Santa Clara Province, Cuba, in 190 to 200 fathoms [348 to 366 meters].

Occurrence: Recent only (known only from the type locality).

Figured specimen: MCZ 164684 (holotype).

Discussion: In a discussion (Vokes, 1989b, p. 56) of *P. dominicensis*, I called attention to the similarity of *P. atlantis* to the Dominican species. The only difference is that the fossil species has the spines extended almost horizontal to the axis of the shell; in *P. atlantis* they are turned more adapically, a difference similar to that between *P. pazi* (horizontal spines) and *P. nuttingi* (upturned spines).

No additional specimens of this species are known, but by analogy with the next species, which is closely related to *P.(P.) atlantis*, it is probable that the shell is covered by a thicker than usual layer of intritacalx. Traces of this intritacalx have been preserved in *P. dominicensis*.

Poirieria (Paziella) petuchi
Vokes, n. sp.
Plate 6, figures 3, 4

Panamurex gatunensis (Brown and Pilsbry). PETUCH, 1981, Malacologia, v. 22, no. 2, p. 322, figures 33, 34; PETUCH, 1987, New Caribbean Moll. Faunas, pl. 15, fig. 8 (not of Brown and Pilsbry).

Description: Biconical shell with protoconch of approximately one and one-half bulbous whorls, line of termination uncertain; teleoconch with six whorls. Axial ornamentation on first teleoconch whorl of nine small laminae, on second and all subsequent whorls, seven per whorl, gradually increasing in size to become varices. Varices formed by multiple layers of shell material, the most abapertural lamina extended as a flange, crenulated by small open spinelets at crossing of spiral cords, that at the shoulder largest, forming an open spine. Spiral ornamentation very faint, one major cord at shoulder on early teleoconch whorls, gradually adding one smaller cord between shoulder and suture and two anterior to the shoulder on spire whorls; body whorl with six major cords and numerous secondary cords between these and also on the siphonal canal. Suture deeply impressed, pits formed between varices. Aperture almost triangular, folding into the shoulder spine. Inner lip smooth, appressed at the posterior end, free-standing at the anterior end. Outer lip with seven elongate nodules, placed between the major spiral cords. Siphonal canal moderately long, slightly recurved at distal end forming weak siphonal fasciole. When fresh entire outer surface of shell covered by a thick chalky-white intritacalx masking the spiral ornamentation;

broken areas revealing tiny spiral tubes beneath the smooth external surface. Aperture pure white in color; operculum muricoid, pale yellow, with a pointed terminus similar to *Paziella pazi*.

Holotype: USNM 784571; height 26 mm, diameter 16.6 mm.

Type locality: Golfo de Triste [northwest of Puerto Cabello], Venezuela, in 35 meters (by shrimpers).

Etymology of name: In honor of Edward J. Petuch, Florida Atlantic University, Boca Raton, Florida, who first brought the little known northern South America fauna to our attention.

Occurrence: Recent only, off northern South America, Venezuela to Barbados (paratype B, off St. James, in 183 meters).

Figured specimens: Fig. 3, USNM 784571 (holotype; photograph courtesy of S.D. Kaicher). Fig. 4, Sunderland Coll. (paratype A), height 26.3 mm, diameter 16.6 mm; locality, Golfo de Venezuela, in 200 meters (by shrimpers).

Discussion: Petuch (1981, p. 322, figs. 33, 34) referred a single living specimen from off the coast of Venezuela to the fossil species *Panamurex gatunensis* (Brown and Pilsbry, 1911); however, it is not *P. gatunensis*. Nor, can it be placed in the subgenus *Panamurex*, as it lacks the columellar rugae, which distinguish *Panamurex* from *Paziella*.

Both figured specimens have been painstakingly "cleaned" and have only traces of intritacalx. Fortunately, another specimen, formerly in the collection of Eugenia Wright and now in my possession (paratype B), shows that the species has a very thick intritacalx, similar to that seen in the members of the genera *Aspella* and *Dermomurex*. This same thick intritacalx is also present in the eastern Pacific species *P.(P.) galapagana* (Emerson and D'Attilio, 1970) (see those authors, p. 272, for discussion of this layer in the paratypes).

Poirieria (Paziella) petuchi is closely related to *P.(P.) atlantis* but differs in having foliaceous varices, with small open spinelets where the spiral cords cross the varices, especially between the suture and the shoulder spine. In contrast, *P. atlantis* has rounded varical ridges, with simple welts where the spiral cords cross. The spiral cords are also heavier in *P. atlantis* than in *P. petuchi*.

Species Group 3: *Poirieria (Paziella) pazi*

POIRIERIA (PAZIELLA) PAZI (Crosse)
Plate 7, figure 1

Poirieria (Paziella) pazi (Crosse). VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 22, pl. 5, fig. 1; ABBOTT, 1974, American Seashells, ed. 2, p. 185, fig. 1939, color pl. 9, fig. 1939.

Paziella pazi (Crosse). RADWIN and D'ATTILIO, 1976, Murex Shells of the World, p. 86 (in part), pl. 26, fig. 3 only; FAIR, 1976, The Murex Book, p. 65, pl. 15, fig. 197.

Poirieria pazi (Crosse). ABBOTT and DANCE, 1982, Compendium of Seashells, p. 143 (color photograph).

Holotype: Collection of Journal de Conchyliologie [Mus. Natl. Hist. Nat. Paris] (Clench and Pérez Farfante, 1945, p. 45); height 35 mm, diameter (including spines) 29.5 mm.

Type locality: "Maris Antillarum."

Occurrence: Recent only, eastern Florida to Honduras, including Gulf of Mexico.

Figured specimen: USNM 678944; height 39 mm, diameter (excluding spines) 19 mm; locality, *Silver Bay* Station 2481, off Hollywood, Florida, in 200 fathoms [366 meters].

Discussion: Radwin and D'Attilio (1976, p. 86) placed into synonymy all four Recent forms of *Paziella* found in the western Atlantic. They may be correct for two species, *P. pazi* and *P. nuttingi*, which sometimes do occur together in the deeper waters around southern and western Florida. For example, Houston Museum of Natural Science collections made from west of Cape San Blas and south of the Dry Tortugas contain both species, although there are many more lots with only one species.

However, the two forms are readily separable, even though detailed examination fails to reveal notable differences in the protoconch, early whorls, apertural denticulations, etc. The immediate obvious difference is the length and angle of the spines: *P. nuttingi* has short spines, those at the shoulder directed adapically; *P. pazi* has long spines, those at the shoulder directed nearly horizontally, those on the siphonal canal recurved adapically.

Due to the deep habitat (200 to 600 meters) little is known of the ecology of these species. However, *P. pazi* appears to be a mud-dweller and *P. nuttingi* a shell-rubble or hard-bottom dweller. Thus, the difference in spines may be a reflection of the soft vs. hard bottom. But, why are there no intermediate forms? All examples easily can be placed into one "form" or the other;

therefore, it is equally reasonable that there are two distinct species with differing ecologic preferences.

POIRIERIA (PAZIELLA) NUTTINGI (Dall)
Plate 7, figure 2

Poirieria (Paziella) nuttingi (Dall). VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 24, pl. 5, fig. 4 (holotype); ABBOTT, 1974, American Seashells, ed. 2, p. 185, fig. 1941 (holotype).

Paziella pazi (Crosse). RADWIN and D'ATTILIO, 1976, p. 86 (in part, not of Crosse), pl. 26, fig. 1 only.

Paziella nuttingi (Dall). FAIR, 1976, The Murex Book, p. 63, pl. 15, fig. 201 (holotype).

Poirieria nuttingi (Dall). ABBOTT and DANCE, 1982, Compendium of Seashells, p. 143 (holotype, color photograph).

Holotype: USNM 107372; height 44.4 mm, diameter (excluding spines) 20.5 mm.

Type locality: Eight miles [13 km] east of Sand Key [near Key West], Florida, in 15 fathoms [27 meters].

Occurrence: Recent only, off southern and western Florida.

Figured specimen: USNM 869506; height 35.3 mm, diameter (excluding spines) 16.6 mm; locality, west of Cape San Blas, Florida, in 200 meters.

Discussion: As noted above, there is a certain resemblance between *P.(P.) pazi* and *P.(P.) nuttingi;* likewise there is a certain resemblance between *P. nuttingi* and *P.(P.) oregonia*. In the latter case, the primary difference is size; *P. oregonia* is approximately twice as large as *P. nuttingi*. The ranges do not overlap, with *P. nuttingi* confined to the Gulf of Mexico and *P. oregonia* confined to the northern coast of South America.

Previously (Vokes, 1970, p. 23), I noted that, although the holotype of *P. nuttingi* does not show denticulations on the inner side of the outer lip, other specimens do. One such shell is shown here (pl. 7, fig. 2). Another similar example was figured by Radwin and D'Attilio (1976, pl. 26, fig. 1) as "*P. pazi*."

POIRIERIA (PAZIELLA) OREGONIA (Bullis)
Plate 7, figure 3

Poirieria (Paziella) oregonia (Bullis). VOKES, 1970, Tulane Stud. Geol. Paleont, v. 8, no. 1, p. 26, pl. 5, fig. 3 (holotype); ABBOTT, 1974, American Seashells, ed. 2, p. 186.

Paziella pazi (Crosse). RADWIN and D'ATTILIO, 1976, Murex Shells of the World, p. 86 (in part, not of Crosse), pl. 26, fig. 2 only (AMNH 111202 – paratype, *P. oregonia);* text-fig. 50 (radula).

Paziella oregonia (Bullis). FAIR, 1976, The Murex Book, p. 64, pl. 15, fig. 200 (holotype).

Holotype: USNM 635149; height 85.2 mm, diameter (excluding spines) 37.8 mm.

Type locality: *Oregon* Station 2023, 95 miles [153 km] north of Pte. Mana, French Guiana, in 135 fathoms [247 meters].

Occurrence: Recent only, from Trinidad south along the coast of Brazil to the Equator (Bullis, 1964, p. 106).

Figured specimen: USNM 635149 (holotype).

Discussion: Also placed in the synonymy of *P. pazi* by Radwin and D'Attilio, this large species more nearly resembles *P. nuttingi*. One could consider this a geographical subspecies of *P. nuttingi*, but there are strong reasons to separate it as a distinct species. In addition to the larger size, there are always two rows of spines on the siphonal canal of *P. oregonia* and only one row on *P. nuttingi*. But the most striking difference is the surface of *P. oregonia*, which is covered by a thin layer of a cream colored material, similar to an intritacalx but harder and not as easily removed as the typical chalky layer of other muricine species.

Clench and Pérez Farfante (1945, p. 45) report *P. pazi* from the Lesser Antilles (after Tryon, 1880, p. 134). This record may refer to *P. oregonia*, for no specimens of true *P. pazi* are known from so far south.

Subgenus FLEXOPTERON Shuto, 1969

Flexopteron SHUTO, 1969, Mem. Fac. Sci., Kyushu Univ., Ser. D., Geol., v. 19, no. 1, p. 111.

Type species: *Flexopteron philippinensis* Shuto, 1969, by original designation.

Discussion: When this subgenus was discussed previously (Vokes, 1970, p. 5), several fossil species were referred to this taxon, ranging from the Caribbean to Europe to the Philippine type of the subgenus, but there were no known living representatives of the line. Since then Houart (1985, p. 166, figs. 3a-d) has described a living species off Madagascar, *P. priminova*, from an average depth of 330

meters. He also figured the radula of this new species, which, although not greatly different from *P. zelandica*, is most similar to those "Trophonine" genera such as *Boreotrophon* and *Nipponotrophon* that I consider more closely related to *Poiriera* than to *Trophon* s.s. Until the systematics of the subfamily Trophoninae are better understood, it is best to leave all these taxa in their accustomed place.

Poiriera (Flexopteron) collata (Guppy)
Plate 6, figures 5, 6

Poiriera (Flexopteron) collata (Guppy). VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 26, pl. 4, fig. 6 (paratype); VOKES, 1989, Bulls. Amer. Paleontology, v. 97, no. 332, p. 57, pl. 5, fig. 5.

Holotype: USNM 115479; height 22 mm, diameter 15 mm.

Type locality: Bowden Formation; Bowden, Parish of St. Thomas, Jamaica (= TU 705).

Occurrence: Gurabo and Mao formations, Dominican Republic; Bowden Formation, Jamaica.

Figured specimens: Fig. 5, USNM 323881; height 20.8 mm, diameter 14.2 mm; locality TU 1227. Fig. 6, USNM 462679; height (incomplete) 17 mm, diameter 12.8 mm; locality TU 1227. Additional localities: TU 1208, 1250, 1357, 1381.

Discussion: This species was described originally from the deep-water beds of the Bowden Formation, Jamaica. We now have several specimens of *P.(F.) collata* from the deepest water facies of the Gurabo Formation of the Dominican Republic in beds estimated to have been deposited in 150 to 350 meters depth. This agrees with the depth preference of the single living representative of the group, *P.(F.) primanova* Houart, 1985, described from an average depth of 330 meters in the Indian Ocean.

Subgenus PAZINOTUS Vokes, 1970

Pazinotus VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 27.

Type species: *Eupleura stimpsonii* Dall, 1889, by original designation.

Discussion: When this subgenus was described it included but one fossil species (*P. bowdenensis*) and one living species (*P. stimpsonii*) in the New World, plus a few European fossil species. Since that time, several new species have been recognized, including *Pazinotus adventus* Poorman, 1980, considered to be the eastern Pacific cognate (see Vokes, 1984, p. 212, pl. 1, figs. 5, 6) of *P. bowdenensis*, which proves to be still living in the western Atlantic, and several living Indo-Pacific forms both newly described and old species newly assigned to the group.

However, one Recent species originally assigned to the group, *"Murex" funafutiensis* Hedley, 1899, is instead a member of a superficially similar group, *Pygmaepterys* (type species: *Murex alfredensis* Bartsch, 1915) (see Vokes and D'Attilio, 1980, p. 52, pl. 2, figs. 4, 5). Species referred to this latter group differ from members of *Pazinotus* in their complex surface ornamentation generated by numerous fine axial growth lines crossing numerous spiral threads. The surface of *Pazinotus*, except for the major spiral cords, is almost smooth, with a linen-like ornamentation at most. But both groups have four or more winged varices, somewhat scalloped by the spiral cords, and a denticulate aperture. Both are also small (under 20 mm) and the two may be easily confused.

In a recent paper (Houart, 1991b, p. 40) has shown that certain species, which have a morphological similarity to those of *Pazinotus*, have a radula more akin to the Muricopsinae, indicating they would be better placed in *Pygmaepterys*. One of the two species for which he has radular information, *P. spectabilis* Houart, 1991, has an overall morphology not unlike *P.(P.) hystricina* (Dall), causing a question as to the correct familial placement of that species. However, the second, *P. sibogae* (Schepman, 1911), although having the same type of spinose webbed varices has a makedly scabrous shell surface, so much so that it was originally assigned to the genus *Latiaxis*. As Houart notes, only when we have radular data for all of the species, especially *P.(P.) stimpsonii* (Dall), type of *Pazinotus*, will we be able to make a final decision.

In addition to the living forms now recognized, one other fossil species, originally treated as *Hexaplex silvaticus* (Palmer), has been recognized as the earliest member of the subgenus.

POIRIERIA (PAZINOTUS) SILVATICA
(Palmer)
Plate 7, figures 4-6

Hexaplex (Hexaplex) silvaticus (Palmer). VOKES, 1968, Tulane Stud. Geol., v. 6, no. 3, p. 96, pl. 1, figs. 2, 5.

? Synonym:

Murex angulatus MEYER, 1886, Alabama Geol. Surv., Bull. 1, pt. 2, p. 74, pl. 2, fig. 18 (not *M. angulatus* Solander *in* Brander, 1766, *etc.*).

Holotype: PRI 3003; height (incomplete) 6 mm, diameter 5 mm.

Type locality: Cook Mountain Formation; Lapiniere Landing, Ouachita River, Ouachita Parish, Louisiana.

Occurrence: Weches Formation and Stone City Beds, Texas; Cook Mountain Formation, Louisiana and Texas; Wautubbee Formation, Mississippi; (?)Moodys Branch Formation, Mississippi.

Figured specimens: Fig. 4, USNM 462680; height 9.6 mm, diameter 6.1 mm; locality TU 85. Fig. 5, USNM 462681; height 5.5 mm, diameter 3.4 mm; locality TU 1258. Fig. 6, USNM 638830 (holotype, *Murex angulatus*); height 9 mm, diameter 5.5 mm; locality, (?)Jackson, Mississippi. Additional localities: TU 61, 1262, 1529.

Discussion: When Palmer (1937, p. 264) originally described this species as *Murex vanuxemi silvaticus*, she stated that the "variety" differed from the typical *M. vanuxemi* in being smooth between the varices. Later (Vokes, 1968, p. 96), I declared that this difference was sufficient to place the two forms in separate species. With the description of the subgenus *Pazinotus*, the smoothness was recognized as a generic character. Another generic character formerly overlooked is the presence of from one to three denticles on the columellar lip.

As is typical of *Pazinotus*, most specimens of *P.(P.) silvatica* are relatively small (under 10 mm) but the species does attain a larger size, one specimen (locality TU 85) is almost 18 mm in height. Well preserved examples show a small flange along the abapertural portion of the varices.

This is not a rare species, it occurs at numerous localities in Mississippi, Louisiana, and Texas. Palmer (1937, pl. 35, fig. 11) cites the paratype (PRI 3004) as from the Gosport Sand, Alabama [which I repeated in 1968] but this must be a mistake. In her text (1937, p. 265) Palmer does not mention the Gosport nor is there any mention in Palmer and Brann (1966, p. 784). We have not taken it at any Gosport localities.

In Palmer and Brann (*ibid.*) the species is said to occur in the Weches Formation, Texas, although there are no localities in the Weches cited. However, we have taken several examples at three different Weches localities.

"*Murex*" *angulatus* Meyer was described from Jackson, Mississippi. Examination of the type species (figured in Vokes, 1968, pl. 1, fig. 5; refigured here pl. 7, fig. 6) shows that it is very like specimens of *P. silvatica*. Dockery has reported nothing like *M. angulatus* from the Late Eocene Moodys Branch Formation in Mississippi (Dockery, 1977, 1980) nor have we found anything like it in that formation. Therefore, one might conclude that the "Jackson" reference is an error, and that the specimen actually was collected in the Newton area, where *P. silvatica* is found at every locality in the early Middle Eocene Wautubbee Formation.

POIRIERIA (PAZINOTUS) BOWDENENSIS Vokes
Plate 7, figures 7, 8

Poirieria (Pazinotus) bowdenensis VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 27, pl. 5, fig. 5; VOKES, 1976, Tulane Stud. Geol. Paleont., v. 12, no. 3, p. 110 (footnote); VOKES, 1984, Shells and Sea Life, v. 16, no. 11, p. 212, pl. 1, fig. 6 (holotype).

Holotype: USNM 369621; height 13.9 mm, diameter 6 mm.

Type locality: Bowden Formation; Bowden, Parish of St. Thomas, Jamaica (= TU 705).

Occurrence: Agueguexquite Formation, Mexico; Bowden Formation, Jamaica; Moín Formation, Costa Rica. Recent, Gulf of Mexico (so far as known).

Figured specimens: Fig. 7, USNM 869507; height 11.5 mm, diameter 6.2 mm; locality, off Cape San Blas, Florida, in 183 meters. Fig. 8, USNM 462682; height 12 mm, diameter 6.2 mm; locality TU 1240. Additional localities: TU 638, 1046, 1239.

Discussion: When *P. bowdenensis* originally was described there was but one fossil specimen known. Once described, the species was recognized living in the Gulf of Mexico, at depths of about 200 meters. Many specimens resulted from the dredgings of James Moore, Bradenton, Florida, who generally dredged in the Gulf off southwestern Florida. Dredging in other localities might reveal that the species is not confined to the Gulf.

In addition to the living examples, we

now have collected several specimens in both the Agueguexquite Formation, Veracruz, Mexico, and the Moín Formation, Costa Rica. Surprisingly, we did not find any in the deep-water facies of the Dominican Republic, especially in the Mao Formation, the same age as the Agueguexquite (where we have taken seven specimens).

On the basis of the single type specimen there was some question as to the maximum size of the species. The largest example now at hand measures under 15 mm, and my statement that the type is probably an adult (Vokes, 1970, p. 28) was correct.

POIRIERIA (PAZINOTUS) STIMPSONII (Dall)
Plate 7, figure 9

Poirieria (Pazinotus) stimpsonii (Dall). VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 28, pl. 5, figs. 6 (lectotype), 7 (paralectotype); ABBOTT, 1974, American Seashells, ed. 2, p. 186, fig. 1947 (after Dall); HOUART, 1991, Nautilus, v. 105, no. 1, p. 31, figs. 6, 7 (protoconch), 32 (shell).

Pazinotus stimpsonii (Dall). RADWIN and D'ATTILIO, 1976, Murex Shells of the World, p. 87, pl. 23, fig. 3; FAIR, 1976, The Murex Book, p. 79, pl. 15, fig. 202 (lectotype); LEAL, 1991, Mar. Prosobranch Gastr. Oceanic Islands Brazil, p. 138.

Lectotype: USNM 87087 (designated by Vokes, 1970, p. 28); height 12 mm, diameter 7 mm.

Type locality: *Blake* Station (unnumbered), off Barbados, in 100 fathoms [183 meters].

Occurrence: Recent only, from Florida to Vitória, Espírito Santo, Brazil (Houart, 1991a, p. 31).

Figured specimen: MCZ 7310 (paralectotype); height 11 mm, diameter 7.4 mm; locality, same as lectotype.

Discussion: Houart (1991a, p. 31) has extended the southern limit of the range of this deep-water species to off Vitória, Espírito Santo, Brazil, in depths from 52 meters to 1,575 meters. The later figure is for a transported dead specimen. This form generally lives at about 200 meters.

POIRIERIA (?PAZINOTUS) HYSTRICINA (Dall)
Plate 7, figure 10; text-figure 1

Murex (Phyllonotus) hystricinus DALL, 1889, Harvard Mus. Comp. Zool., Bull., v. 18, p. 200, pl. 16 [not pl. 15, as stated], fig. 4 (*Murex hystricina* on pl. expl.); M. SMITH, 1953, Illus. Cat. Rock Shells, p. 9, pl. 9, fig. 7 (after Dall), pl. 12, fig. 5 (paratype).

Murex (Poirieria) hystricinus Dall. CLENCH and PÉREZ FARFANTE, 1945, Johnsonia, v. 1, no. 17, p. 45, pl. 24, figs. 4-7 ("holotype").

Latiaxis hystricinus (Dall). VOKES, 1971, Bulls. Amer. Paleontology, v. 61, no. 268, p. 58.

Poirieria (Paziella) hystricina (Dall). ABBOTT, 1974, American Seashells, ed. 2, p. 185, fig. 1940 (lectotype).

Paziella hystricina (Dall). RADWIN and D'ATTILIO, 1976, Murex Shells of the World, p. 85, pl. 25, fig. 12; D'ATTILIO, 1980, Festivus, v. 12, no. 8, p. 96, text-fig. 1.

Poirieria (?Pazinotus) hystricinus (Dall). VOKES, 1984, Shells and Sea Life, v. 16, no. 11, p. 212, 215 (footnote).

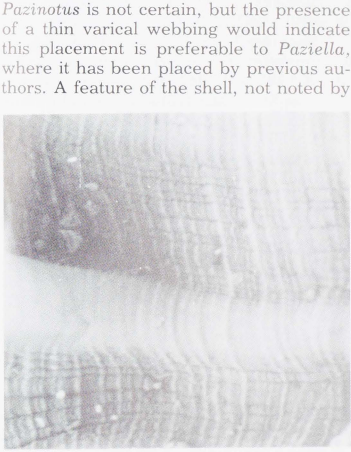
Lectotype: MCZ 7307 (selected by Clench and Pérez Farfante, 1945, p. 46); height 19.5 mm, diameter (including spines) 14.8 mm.

Type locality: *Blake* Station 206, off Martinique, Lesser Antilles, in 170 fathoms [311 meters].

Occurrence: Recent only, from Cuba south to Barbados (D'Attilio, 1980, p. 96).

Figured specimen: MCZ 7307 (lectotype).

Discussion: As the above synonymy shows, the generic placement of this peculiar deep-water species has been a problem for some time. Assignment here to *Pazinotus* is not certain, but the presence of a thin varical webbing would indicate this placement is preferable to *Paziella*, where it has been placed by previous authors. A feature of the shell, not noted by



Text-figure 1. *Poirieria (?Pazinotus) hystricina* (Dall); MCZ 7307 (lectotype); height 19.5 mm, diameter 14.8 mm; locality, *Blake* Station 206, off Martinique, Lesser Antilles. Detail of surface sculpture (X 25).

either Dall or Clench and Pérez Farfante is the beautiful linen-like texture of the shell surface (see text-fig. 1). The only other species with this type of surface ornament is the Philippine *P.(Pazinotus) oliverai* (Kosuge, 1984). (See cover of *Conchologists of America Bulletin*, v. 14, no. 2, June, 1986, for an enlarged photograph showing this pattern.)

Houart (1991b, p. 40) has described a species, *Pazinotus spectabilis*, from New Caledonia, which has a strong similarity to *P.(P.) hystricina*. But, as Houart demonstrates (*ibid.*, text-fig. 39), it has a muricopsine radula, indicating that *Pygmaepterys* may be a better assignment. A second species, also from New Caledonia, *P.(P.) vaubanensis* Houart, 1986, also is morphologically similar to *P. hystricina*, but we have no radular information in this case. Until we have radulae for all of the species involved, including not only *P. hystricina*, but also the type species of both *Pazinotus* and *Pygmaepterys*, assignment to either taxon is only provisional.

Poirieria (Pazinotus) hystricina is rather variable, as discussed by D'Attilio (1980, p. 96), who observed that the number of varices range from seven to nine, the apertural denticles from four to six, and the primary spiral cords (not including that at the shoulder) from three to five.

Compared to other species of *Pazinotus*, this one has a relatively higher spire and shorter canal, giving the shell a more globose appearance. The siphonal canal is strongly deflected, causing the species to resemble certain examples of *Latiaxis spinosus* Hirase, 1908, which is why I erroneously placed it in the genus *Latiaxis* (Vokes, 1971b, p. 58).

Dall (1889, p. 200) did not select a holo-

PLATE 8

Figures Page

1, 2. *Poirieria (Panamurex) laccapoia* (Gardner) 40

1. (X 2) USNM 645618; height 26 mm, diameter 14 mm.
Locality: TU 458, Florida; Chipola Formation.

2. (X 10) USNM 462683; height 15.6 mm, diameter 7 mm.
Locality: TU 830, Florida; Chipola Formation.

3-6. *Poirieria (Panamurex) gatunensis* (Brown and Pilsbry) 40

3. (X 1 1/2) NMB H 17382; height 27.9 mm, diameter 19 mm.
Locality: NMB 17516, Venezuela; Cantaure Formation.

4. (X 1 1/2) USNM 645620; height 40.8 mm, diameter 26 mm.
Locality: TU 958, Panama; Gatun Formation.

5. (X 2) USNM 462684, height 26 mm, diameter 17.2 mm.
Locality: TU 757, Panama; Gatun Formation.

6. (X 2) USNM 462685; height 29.8 mm, diameter 18 mm.
Locality: TU 958, Panama; Gatun Formation.
(Color pattern under ultraviolet light)

7, 8. *Poirieria (Panamurex) alaquaensis* (Mansfield) 42

7. (X 1 1/2) UNAM IGM 2187 (holotype, *P. dubitalis* Vokes); height 36 mm, diameter 27.5 mm.
Locality: "Tuxtepec, Oaxaca, Mexico" (almost certainly near Nuevo Teapa, Veracruz, Mexico); Concepcion Inferior Formation.

8. (X 2) USNM 462686; height 21.3 mm, diameter 13.8 mm.
Locality: TU 1318, Veracruz, Mexico; Concepcion Inferior Formation.

9-12. *Poirieria (Panamurex) clarksvillensis* (Mansfield) (X 2) 44

9. CM 35637 (holotype, *P. susankhanae*); height 19.3 mm, diameter 11.2 mm.
Locality: APAC quarry, Sarasota, Florida (= TU 1000), "Pinecrest Beds" (= Fruitville Formation).

10. Stephens Coll.; height 19.5 mm, diameter 11.3 mm.
Locality: TU 1000, Florida; Fruitville Formation.

11. USNM 462687; height 24 mm, diameter 13.2 mm.
Locality: TU 60, Florida; Jackson Bluff Formation.

12. Stephens Coll.; height 23 mm, diameter 13.5 mm.
Locality: TU 1000, Florida; Fruitville Formation.

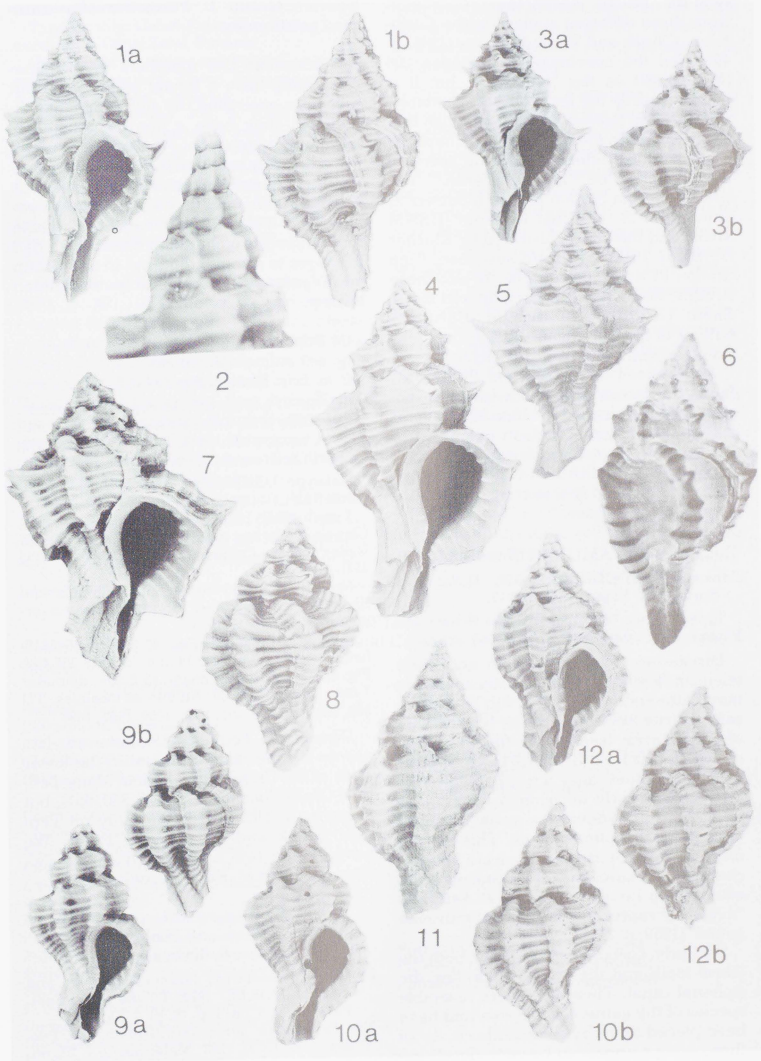


PLATE 8

type for "*Murex*" *hystricinus*, reporting it from three different stations in the Caribbean. Clench and Pérez Farfante (1945, p. 46) cited the specimen from Station 206 (MCZ 7307) as the "holotype," but it is more correctly the lectotype. Presumably, it is the shell figured by Dall, although that one was said to measure 21 mm. There are certain minor differences in the aperture but this may be "artistic license." The specimen from Station 158, off Montserrat, is in the U.S. National Museum (USNM 87083) and has been illustrated by Kaicher (1978, no. 1619). The third specimen, from Station 2134, south of Cuba, is also there (USNM 93959) and has been figured by M. Smith (1953, pl. 12. fig. 5). Certainly, neither of these matches the original illustration as well as the MCZ specimen.

As reported by Clench and Pérez Farfante, this is an extremely deep-water species, living in depths of 148 to 254 fathoms [271 to 465 meters]. Radwin and D'Attilio (1976, p. 86) gave a depth range of 296 to 552 meters, but D'Attilio (1980, p. 96) reports a number of specimens from only 165 meters, off Barbados.

Subgenus PANAMUREX Woodring, 1959

Panamurex WOODRING, 1959, U.S. Geol. Surv., Prof. Paper 306-B, p. 217.

Type species: *Murex gatunensis* Brown and Pilsbry, 1911, by original designation.

Discussion: The protoconch and early teleoconch whorls of *P.(P.) laccapoia* are much attenuated (see pl. 8, fig. 2) and the same is true in *P. gatunensis*, type species of *Panamurex* (see pl. 8, fig. 5). Other members that lack the labral tooth, such as *P.(P.) fusinoides*, have a much lower spire and spinose early teleoconch whorls (see pl. 9, fig. 4), in addition to a row of spines encircling the siphonal canal. This may indicate that there are two separate lines included in *Panamurex*, as Woodring indicated when he observed that *P. heilprini* "evidently represents a different muricine genus" (1959, p. 218).

Similarly, certain members lack both the labral tooth and the spines encircling the siphonal canal. These members resemble species of the genus *Calotrophon* and have been placed there by some authors. As all three groups appear to be very closely related I will retain them in *Panamurex*, but will separate them into Species Groups.

Species Group 1: *Poirieria (Panamurex) gatunensis*

Discussion: The members of this Species Group have a strong labral tooth but no spines encircling the siphonal canal. In addition, they have a heavier intritacalx than most members of *Poirieria* (excluding those possibly referred to *Bathymurex*, see above). In fossil specimens this deciduous covering commonly is lost but enough remains on isolated specimens to indicate that all species included in *Panamurex* had this layer to some extent, but in the Group of *P. gatunensis* it probably was much thicker.

Poirieria (Panamurex) laccapoia (Gardner)
Plate 8, figures 1, 2

Poirieria (Panamurex) laccapoia (Gardner). VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 31, pl. 7, fig. 1; VOKES, 1972, Earth Science, v. 25, no. 3, p. 124, pl. 2, fig. 6.

Holotype: USNM 371880; height 18 mm, diameter 9.8 mm.

Type locality: USGS 2213, Chipola Formation; Chipola River, one mile [0.4 mi = 0.6 km] below Bailey's Ferry, Calhoun County, Florida (= TU 457).

Occurrence: Oak Grove Sand, Chipola and Shoal River formations, Florida; unknown formation, Chiapas, Mexico.

Figured specimens: Fig. 1, USNM 645618; height 26 mm, diameter 14 mm; locality TU 458. Fig. 2, USNM 462683; height 15.6 mm, diameter 7 mm; locality TU 830. Additional localities: TU 549, 820, 823, 949, 951, 1020, 1050, 1097, 1098.

Discussion: Poirieria (Panamurex) laccapoia is especially abundant in the lower beds of the Chipola Formation, along Tenmile Creek (localities TU 546, 830, 951), but it occurs at almost every locality on Tenmile Creek and the Chipola River. We have only a few examples from the calcarenite facies on Farley Creek.

Poirieria (Panamurex) gatunensis (Brown and Pilsbry)
Plate 8, figures 3-6

Poirieria (Panamurex) gatunensis (Brown and Pilsbry). VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 40, pl. 7, fig. 6.

Not *Panamurex gatunensis* (Brown and Pilsbry). PETUCH, 1981, Malacologia, v. 22, no. 2, p. 322, figs. 33, 34; PETUCH, 1987, New Caribbean Moll. Faunas, pl. 15, fig. 8 [= *Poirieria (Paziella) petuchi*, n. sp.].

Holotype: ANSP 1720; height (incomplete) 32 mm, diameter 21 mm.

Type locality: Gatun Formation; Gatun Locks excavation, Canal Zone, Panama.

Occurrence: Cantaure and Punta Gavilán formations, Venezuela; Gatun Formation, Panama; Tubará Group, Colombia.

Figured specimens: Fig. 3, NMB H 17382; height 27.9 mm, diameter 19 mm; locality NMB 17516 (= TU 1269). Fig. 4, USNM 645620; height 40.8 mm, diameter 26 mm; locality TU 958. Fig. 5, USNM 462684, height 26 mm, diameter 17.2 mm; locality TU 757. Fig. 6, USNM 462685; height 29.8 mm, diameter 18 mm; locality TU 958. Additional localities: TU 1429, 1431, 1432, 1433.

Discussion: As noted previously (Vokes, 1970, p. 42), this species is widespread, ranging from Panama to Venezuela; however, the age is no longer "Middle Miocene." In Panama and Colombia the species occurs in Pliocene beds, and in the Gibson Smith Collection, now at the Naturhistorisches Museum, Basel, Switzerland, there are three large examples of *P. gatunensis* from the Pliocene Punta Gavilán Formation of Venezuela.

But the Cantaure Formation, Venezuela, where Jung (1965, p. 523, pl. 69, figs. 11, 12) reported the species as "cf. *gatunensis*," is Early Miocene. Examination of the numerous Cantaure specimens (pl. 8, fig. 3) in the Gibson Smith Collection (40 in all) reveals that they are true *P.(P.) gatunensis* and not the correlative *P.(P.) laccapoia*, as might be anticipated.

The Chipola and Cantaure formations are considered to be of the same late Early Miocene age and yet the muricid faunas are almost totally different. There are a few cognate pairs of species, especially in the subgenus *Panamurex* (see Table 1), but only *Haustellum gilli* (Maury, 1910) and *Murexiella (Subpterynotus) textilis* (Gabb, 1973) occur in both formations. Whether this is a result of ecologic differences or simple geographical separation is not certain but what we see here is the initiation of the two biogeographic provinces Petuch (1982b, p. 280) termed the "Caloosahatchian" and the "Gatunian" Provinces.

Under ultraviolet light the color pattern of *P. gatunensis* is shown as dark lines marking the tops of each of the spiral cords, most intense where the cords cross the varices (pl. 8, fig. 6). This is essentially the same pattern as in *P.(P.) fusinoides* (pl. 9, fig. 3b), and *P.(P.) eugeniae*, n. sp., an indication of the close relationship of these three Species Groups.

TABLE 1

Comparison of Muricinae in the Chipola and Cantaure formations, with possible cognate species.

CHIPOLA FORMATION	CANTAURE FORMATION
Haustellum gilli	*Haustellum gilli*
Chicoreus (Chicoreus) dujardinoides	*Chicoreus (Chicoreus) corrigendum*
Chicoreus (Chicoreus) lepidotus	–
Chicoreus (Chicoreus) elusivus	*Chicoreus (Chicoreus) cornurectus*
Chicoreus (Siratus) chipolanus	*Chicoreus (Siratus) quirosensis*
–	*Chicoreus (Siratus) denegatus*
Chicoreus (Siratus) juliagardnerae	–
Chicoreus (Siratus) sextoni	–
Chicoreus (Phyllonotus) louisae	–
Chicoreus (Phyllonotus) infrequens	–
Chicoreus (Phyllonotus) folidodes	–
Hexaplex veatchi	–
Pterynotus (Pterynotus) praepatagiatus	–
Pterynotus (Pterynotus) hoerlei	–
Poirieria (Panamurex) laccapoia	*Poirieria (Panamurex) gatunensis*
Poirieria (Panamurex) fusinoides	*Poirieria (Panamurex) improcerus*
Poirieria (Panamurex) lychnia	*Poirieria (Panamurex) gibsonsmithi*
Poirieria (Panamurex) mauryae	–
Dermomurex (Dermomurex) matercula	–
Dermomurex (Trialatella) farleyensis	–
Dermomurex (Takia) curviductus	–
Dermomurex (Takia) vaughani	–

Petuch (1981, p. 322, figs. 33, 34) reported a single living specimen (USNM 784571) from off the coast of Venezuela, in 35 meters depth, as *Panamurex gatunensis*. At the time, he stated that E. Vokes had suggested the specimen was a new species. It differs from *P. gatunensis* in having open flanges along the varical ribs and in lacking the labral tooth seen in that species. Even more importantly, it does not have rugae on the columellar wall and, therefore, it should not be referred to *Panamurex*, but is a new species of *Paziella*, described above as *Poirieria (Paziella) petuchi*.

POIRIERIA (PANAMUREX) ALAQUAENSIS
(Mansfield)
Plate 8, figures 7, 8

Poirieria (Panamurex) alaquaensis (Mansfield). VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 43, pl. 7, figs. 3 (holotype), 4.

Synonym:

Poirieria (Panamurex) dubitalis VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 42, pl. 7, fig. 5.

Holotype: USNM 373148; height 15 mm, diameter 9 mm.

Type locality: USGS 12046, Choctawhatchee Group; Vaughan Creek, about three miles [4.8 km] from its junction with Alaqua Creek, about 6 1/2 miles [10.4 km] nearly south of DeFuniak Springs, Walton County, Florida.

Occurrence: Choctawhatchee Group (?Jackson Bluff Formation); Concepcion Inferior and Agueguexquite formations, Veracruz, Mexico.

Figured specimens: Fig. 7, UNAM IGM 2187 (holotype, *P. dubitalis);* height 36 mm, diameter 27.5 mm; locality, "Tuxtepec, Oaxaca, Mexico" (almost certainly near Nuevo Teapa, Veracruz, Mexico). Fig. 8, USNM 462686; height 21.3 mm, diameter 13.8 mm; locality TU 1318. Additional localities: TU 1025, 1514, 1515.

Discussion: We now have numerous specimens of *P.(P.) alaquaensis* from the Concepcion Inferior Formation of Veracruz, Mexico, and it is clear that the species I originally described as *P.(P.) dubitalis*, said to be from "Tuxtepec, Oaxaca," is the same. At that time I expressed doubt about the locality and suggested that because two specimens of the Agueguexquite Formation species *Typhis carmenae* Gertman, 1969, were in the same lot, *P. dubitalis* came from the Agueguexquite Formation, probably near Coatzacoalcos.

PLATE 9

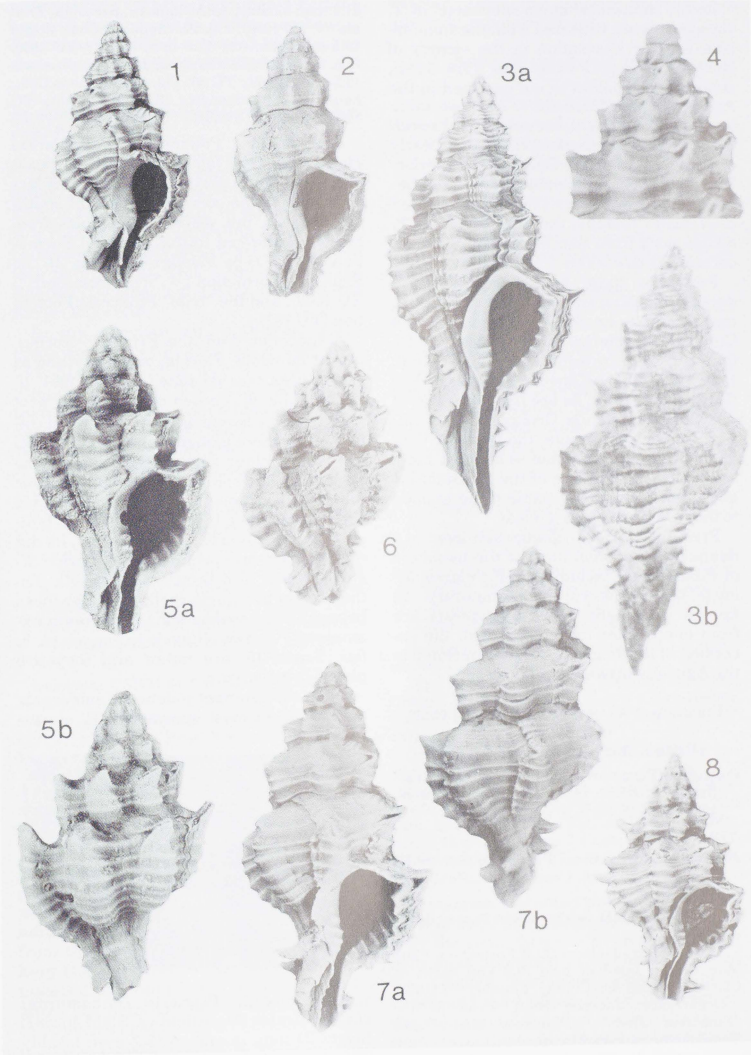


PLATE 9

Later, numerous large specimens of *T. carmenae* were collected from the Concepcion Inferior Formation in the vicinity of Nuevo Teapa (TU 1025, 1318, 1514, 1515), showing the species is not confined to the Agueguexquite Formation. At these same localities we have collected several specimens of *P. alaquaensis* and the two clearly occur together in the Concepcion Inferior. The single rolled specimen from the Agueguexquite Formation (TU 638), as cited previously, remains the only record of *P. alaquaensis* from that formation; it almost certainly is reworked.

Formerly, these beds were all considered Late Miocene in age, but they are now known to be Early Pliocene, with the Concepcion Inferior slightly older (N.19) than the Agueguexquite (N.20) (see Kohl, 1985, fig. 7). The Concepcion Inferior is a deep-water facies, as are the exposures of the Choctawhatchee Group south of De-Funiak Springs. In age, the beds on Vaughan Creek are the same as those at Jackson Bluff, but because of the facies difference, the formational name to be applied to these beds remains unclear.

Presumably *P.(P.) alaquaensis* lived in a deeper habitat than most of the members of *Panamurex*, including *P.(P.) clarksvillensis*, its shallow-water contemporary. All known specimens of *P. alaquaensis* are from deep-water formations, with the exception of the single reworked specimen in the Agueguexquite Formation.

POIRIERIA (PANAMUREX) CLARKSVILLENSIS (Mansfield)

Plate 8, figures 9-12; text-figure 2

Poirieria (Panamurex) clarksvillensis (Mansfield). VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 43, pl. 7, fig. 7.

Synonym:

Panamurex susankhanae PETUCH, 1991, W.H. Dall Paleont. Resh. Center, Spec. Publ. 1, p. 26, pl. 4, fig. 6.

Holotype: USNM 496424; height 30 mm, diameter 17 mm.

Type locality: Jackson Bluff Formation; Four Mile Creek, one-half mile [0.8 km] north of Clarksville, Calhoun County, Florida (= TU 73).

Occurrence: Jackson Bluff, Fruitville (= "Pinecrest Beds"), Pinecrest Beds, and Tamiami formations, Florida.

Figured specimens: Fig. 9, CM 35637 (holotype, *P. susankhanae*); height 19.3 mm, diameter 11.2 mm; locality, APAC quarry, Sarasota, Florida (= TU 1000). Fig. 10, Stephens Coll.; height 19.5 mm, diameter 11.3 mm; locality TU 1000. Fig. 11, USNM 462687; height 24 mm, diameter 13.2 mm; locality TU 60. Fig. 12, Stephens Coll.; height 23 mm, diameter 13.5 mm; locality TU 1000. Additional locality: TU 1177.

Discussion: Poirieria (Panamurex) clarksvillensis is fairly common at Jackson Bluff (TU 60) in northern Florida. It is less abundant in the correlative beds of southern Florida, but we have examples from localities referred to the Tamiami Formation (TU 1177) by Meeder (1990, fig. 3), the Fruitville Formation (= "Pinecrest Beds"; TU 1000), and the "true" Pinecrest Formation (TU 797).

A specimen from the Fruitville Formation at Sarasota, Florida, was described as *Panamurex susankhanae* (Petuch, 1991, p. 26, pl. 4, fig. 6). Petuch compared his new species to *P. alaquaensis*, stating that it differs in the more elongate shell and in lacking the shoulder spines that characterize the latter. The spines are not conspicuous in smaller examples (see pl. 8, fig. 8) but his shell does have a higher spire than is typical of *P. alaquaensis*. Unfortunately, he did not compare his specimen to *P. clarksvillensis*, which also occurs at Sarasota. On the basis of this single shell, the differences between *P. susankhanae* and a young example of *P. clarksvillensis* (compare pl. 8, figs. 9 and 10) are minor and they are placed in synonymy.

From the remnant patches of intritacalx remaining on most specimens, *P. clarks-*

Text-figure 2. *Poirieria (Panamurex) clarksvillensis* (Mansfield); USNM 462687; height 24 mm, diameter 13.2 mm; locality TU 60. Detail of surface, showing remnant patches of intritacalx (X 5).

villensis (see text-fig. 2) probably had the heaviest coating of any of the members of *Panamurex*. In life it may well have looked like a member of the genus *Dermomurex*.

Species Group 2: *Poirieria (Panamurex) fusinoides*

Discussion: The members of this group differ from the typical *P. gatunensis* in lacking the labral tooth. In addition, there is a row of spines encircling the siphonal canal and the early whorls are also spinose (see pl. 9, fig. 4). This is the oldest of the Species Groups, extending back to the Early Oligocene.

In my previous study (Vokes, 1970), there was but one living species referred to this Species Group – *P.(P.) carnicolor* (Clench and Pérez Farfante, 1945). Since then a new species from off Somalia, *P.(P.) hemmenorum* Houart and Muhlhauser, 1990, which is very like the Chipola species *P. fusinoides*, has been described.

POIRIERIA (PANAMUREX) MACNEILI Vokes
Plate 9, figure 1

Poirieria (Panamurex) macneili VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 30, pl. 6, figs. 1, 2 (new name for *Murex simplex* Aldrich, 1886, *non* Philippi, 1841); MACNEIL and DOCKERY, 1984, Mississippi Bur. Geol., Bull. 124, p. 126, pl. 31, figs. 15, 16.

Holotype: USNM 644618; height 15.5 mm, diameter 9 mm.

Type locality: Byram Formation; "Bryan's Ferry" [= Byram], Pearl River, Hinds County, Mississippi (= TU 66).

Occurrence: Byram Formation, Mississippi.

Figured specimen: USNM 646432; height 23.5 mm, diameter 12.3 mm; locality same as holotype. Additional locality: TU 1203.

Discussion: Only one additional specimen has been collected of this earliest American member of the subgenus *Panamurex*. It is from Redwood, Mississippi, north of Vicksburg, the first example not from the type locality. MacNeil and Dockery (1984, p. 124) did not have additional material and ours is too incomplete to figure. The number cited for the holotype of this species in MacNeil and Dockery (1984, p. 126 – USNM 481661) is incorrect. According to Warren Blow, of the U.S. National Museum (personal communication, October, 1991), this number pertains to a totally different specimen.

POIRIERIA (PANAMUREX) HEILPRINI (Cossmann)
Plate 9, figure 2

Poirieria (Panamurex) heilprini (Cossmann). VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 30, pl. 6, figs. 3, 4.

Holotype: WFIS 870; height "slightly exceeding one inch;" diameter "half-inch" (Heilprin, 1886, p. 108).

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

Occurrence: Tampa Limestone, Florida.

Figured specimen: USNM 165089; height 23.5 mm, diameter 13 mm; locality same as holotype.

Discussion: Other than that the Tampa Limestone is now considered to be of Late Oligocene (Chickasawhayan) age, there is no new information on *P.(P.) heilprini* (Cossmann, 1903; new name for *Murex spinulosa* Heilprin, 1886, *non* Deshayes, 1835).

POIRIERIA (PANAMUREX) FUSINOIDES (Gardner)
Plate 9, figures 3, 4

Poirieria (Panamurex) fusinoides (Gardner). VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 34, pl. 6, fig. 9; VOKES, 1972, Earth Science, v. 25, no. 3, p. 124, pl. 2, fig. 3.

Holotype: USNM 371854; height 36.7 mm, diameter 16.5 mm.

Type locality: USGS 2564, Chipola Formation; Chipola River, one mile [0.4 mi = 0.6 km] below Bailey's Ferry, Calhoun County, Florida (= TU 457).

Occurrence: Chipola and (?) Shoal River formations, Florida.

Figured specimens: Fig. 3, USNM 462688; height 50.5 mm, diameter (excluding spines) 21.9 mm; locality TU 458. Fig. 4, USNM 462689; height 12 mm, diameter 7.1 mm; locality TU 655. Additional localities: TU 69(?), 826, 1021, 1050, 1098.

Discussion: As noted previously (Vokes, 1970, p. 35), *P.(P.) fusinoides* occurs in exactly the same facies as *P. laccapoia*, with both most abundant in the lower beds of the Chipola Formation along Tenmile Creek and the Chipola River, and rare in the calcarenite facies of Farley Creek. A single incomplete specimen has been recovered from the younger Shoal River Formation.

Previously the largest specimen noted was 45 mm in height, but an even larger specimen has been collected (pl. 9, fig. 3) of this, the largest of the Chipola species of *Panamurex*. The color pattern, as revealed by ultraviolet light (pl. 9, fig. 3b), shows a pattern of dark lines topping the spiral cords, much the same as in *P. gatunensis*.

POIRIERIA (PANAMUREX) IMPROCERUS
Vokes, n. sp.
Plate 9, figures 5, 6

Description: Shell small for the group, maximum height under 18 mm; probably seven teleoconch whorls in an adult, no specimens with apical whorls preserved. Axial ornamentation of seven heavy, rounded varices on each whorl from the earliest to last formed; these ornamented only by crossing of spiral cords. On approximately fourth teleoconch whorl, sharp somewhat adapically-directed spines developed at crossing of shoulder cord. Spiral ornamentation on earliest whorls of three cords, intercalary cords gradually added; body whorl with seven to nine major cords, varying with the strength of intercalary cords; one spinose cord on the siphonal canal. Shell surface smooth except for spiral cords. Suture sinuated by alternate placement of varices on each succeeding whorl. Aperture oval; inner lip smooth, appressed, with four elongate rugae on anterior half. Inner side of outer lip with about seven strong lirae, located between the position of the external spiral cords. Siphonal canal short, broad, recurved at distal end, forming a small siphonal fasciole.

Holotype: NMB H 17383; height 17.5 mm, diameter 11.6 mm.

Type locality: NMB 17529, Caujarao Formation; San Raphael, Edo. de Falcón, Venezuela.

Etymology of name: Latin *improcerus* – short or undersized.

Occurrence: Caujarao and Cantaure formations, Venezuela.

Figured specimens: Fig. 5, NMB H 17383 (holotype). Fig. 6, NMB H 17384 (paratype); height 15.1 mm, diameter 9.5 mm; locality NMB 17519, Paraguaná Peninsula, Venezuela (= TU 1269).

Discussion: In the Gibson Smith Collection at the Naturhistorisches Museum, Basel, Switzerland, there are several specimens of a new species that is similar in many respects to *P.(P.) fusinoides* but differs in being shorter and smaller. Most of these are from the Mataruca Member of the Caujarao Formation exposed at Carrizal, Edo. de Falcón, Venezuela (NMB loc. 17530), but the two best preserved examples (the holotype and paratype) are from San Raphael, Falcón, and the Paraguaná Peninsula, respectively.

Only the latter specimen is not from the Late Miocene Caujauro Formation, it is from the earlier Cantaure Formation. Whether it is a function of age or of preser-

PLATE 10

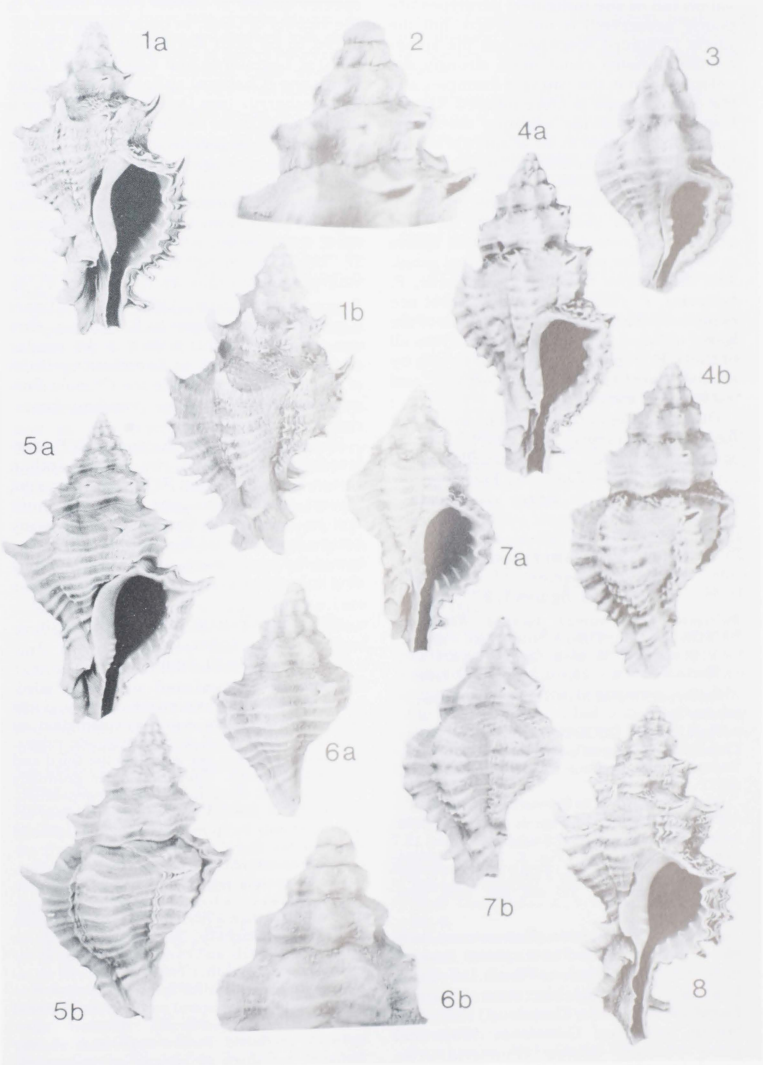


PLATE 10

vation (all of the unfigured paratypes are poorly preserved) is not certain, but the single Cantaure specimen has the spines on the siphonal canal more strongly developed than in the younger examples and the overall shape is more inflated. On the basis of this unique example the differences do not seem to be of specific importance; perhaps additional material will change that viewpoint.

All of the members of this Species Group are similar in general aspect, all have about seven rounded varices, with spines at the shoulder and on the siphonal canal. The differences between *P. macneili*, *P. heilprini*, *P. fusinoides*, and *P. gabbi* are minimal and are related to the height of the spire, inflation of the whorls, etc. From all of these *P. improcerus* differs in having by far the lowest spire, the smallest size, and the heaviest varices.

Other members of the group, such as *P. lychnia*, *P. mauryae* and *P. turbinelloides* are more scabrous; *P. gibsonsmithi*, which also occurs in the Cantaure Formation, is distinguished by its larger size, weaker varices, and more biconic outline.

Poirieria (Panamurex) lychnia
(Gardner)
Plate 10, figures 1, 2

Poirieria (Panamurex) lychnia (Gardner). VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 35, pl. 6, fig. 5; VOKES, 1972, Earth Science, v. 25, no. 3, p. 122, pl. 1, fig. 6.

Holotype: USNM 371853; height 25.5 mm, diameter 15 mm.

Type locality: USGS 2213, Chipola Formation; Chipola River, one mile [0.4 mi = 0.6 km] below Bailey's Ferry, Calhoun County, Florida (= TU 457).

Occurrence: Chipola Formation, Florida.

Figured specimens: Fig. 1, USNM 462690; height 27.6 mm, diameter (including spines) 15.7 mm; locality TU 950. Fig. 2, USNM 462691; height 11.7 mm, diameter 8 mm; locality TU 547. Additional localities: TU 459, 830, 1020, 1050, 1196.

Discussion: Poirieria (Panamurex) lychnia is closely related to a species that occurs in the Oligocene beds of Gaas, France. The latter has several names: *Fusus turbinelloides* Grateloup, 1833; *Turbinella muricina* Grateloup, 1847; and more recently *Murex (Poirieria) corniculatus* Vergneau, 1963. The French species occurs at almost every locality in the vicinity of Gaas, in beds that are considered to be both Early Oligocene (Stampian) at Lagouarde and Espibos, and Late Oligocene (Chattian) at Saint-Paul-les-Dax and Lesbarritz (see Dolin *et al.*, 1985, for a discussion of these localities).

The Early Oligocene occurrence makes this the oldest known species of *Panamurex*, slightly preceding the Middle Oligocene Byram Formation *P.(P.) macneili*. As may be seen from the examples figured here, this species, when worn (pl. 10, fig. 3), bears a great resemblance to *P. mauryae*. When unworn (pl. 10, fig. 4), as figured by Vergneau (1963, fig. 5), it bears a greater resemblance to *P. lychnia*. One can assume that this is due to the similar environment, which as described by Dolin *et al.* (1985, p. 9) was, like the Chipola Formation, a warm shallow coralline facies, rich in mollusks.

Presumably it is the European *P.(P.) turbinelloides* that gave rise to the Indian Ocean Recent species *P.(P.) hemmenorum* Houart and Muhlhauser, 1990, but there are no species of *Panamurex* presently known from the Old World in the strata between the two. Clearly there are some missing links that have yet to be discovered.

Poirieria (Panamurex) gibsonsmithi
Vokes, n. sp.
Plate 10, figures 5, 6

Description: Biconic shell with seven teleoconch whorls and a protoconch of one and one half rounded whorls. Axial ornamentation on first teleoconch whorl of nine angulate ridges, decreasing to seven per whorl on the third and succeeding whorls. Shoulder angles gradually developing into open spines, almost perpendicular to axis of shell. Varices low, rounded, ornamented only by spiral cords and one spine at the shoulder. Spiral ornamentation on early teleoconch whorls of three cords: one at shoulder, one immediately adjacent to suture and one midway between; a fourth soon added on shoulder ramp and then a fifth between the two main cords at the periphery. Body whorl with six or seven major cords and two or three smaller intercalary ones. Another two strong cords on siphonal canal. Except for spiral cords shell surface smooth. On the spiral cords on the siphonal canal small adaperturally directed open spinelets produced. Suture appressed, slightly sinuated by offset of varices on succeeding whorls. Aperture oval, inner lip wide, appres-

sed, smooth but with four or five elongate rugae on anterior half. Inner side of outer lip opening into the shoulder spine and marked with about nine lirae, corresponding to spaces between external spiral cords. Siphonal canal short, recurved at distal end, forming a small fasciole.

Holotype: NMB H 17385; height 26.6 mm, diameter 18.6 mm.

Type locality: NMB 17516, Cantaure Formation; Paraguaná Peninsula, Venezuela (= TU 1269).

Etymology of name: In honor of Mr. Jack Gibson Smith, formerly of Caracas, Venezuela, now of Surrey, England, who's extraordinary collection of Venezuelan fossil mollusks has been deposited in the Naturhistorisches Museum, Basel, Switzerland.

Occurrence: Cantaure Formation, Venezuela.

Figured specimens: Fig. 5, NMB H 17385 (holotype). Fig. 6, NMB H 17386 (paratype); height 9.6 mm, diameter 5.6 mm; locality same as holotype.

Discussion: In the Gibson Smith Collection at the Naturhistorisches Museum, Basel, Switzerland, there are eight specimens from the long known locality at "Casa Cantaure," Paraguaná Peninsula, Venezuela (see Jung, 1965), of a new species that is similar in general morphology to *P.(P.) lychnia* but differs in lacking the scabrous surface ornamentation of the latter species.

The combination of an appressed suture and shoulder spines directed perpendicularly to the axis gives the shell a marked biconic outline that readily distinguishes it from all other members of the Species Group. The spines on the siphonal canal are the least well developed in the Group, with the possible expection of the younger Caujarao Formation examples of *P. improcerus*, n. sp. (however, as noted above, this may be a function of poor preservation in the latter).

Poirieria (Panamurex) mauryae Vokes
Plate 10, figure 7

Poirieria (Panamurex) mauryae VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 36, pl. 6, fig. 8; VOKES, 1972, Earth Science, v. 25, no. 3, p. 122, pl. 1, fig. 7.

Holotype: USNM 646431; height 16.6 mm, diameter 9 mm.

Type locality: TU 458, Chipola Formation; east bank of Chipola River, just above mouth of Farley Creek (SW 1/4 Sec. 20, T1N, R9W), Calhoun County, Florida.

Occurrence: Chipola Formation, Florida.

Figured specimen: USNM 462693; height 15.8 mm, diameter 9.6 mm; locality TU 555. Additional localities: TU 459, 819, 998, 999, 1048, 1098, 1196.

Discussion: Poirieria (Panamurex) mauryae is found at almost every Chipola locality, occurring almost equally in all facies. Most examples are more or less abraded but well preserved specimens do show small spines at the shoulder and, more importantly, encircling the siphonal canal (pl. 10, fig. 7b).

Poirieria (Panamurex) gabbi Vokes
Plate 9, figures 7, 8

Poirieria (Panamurex) gabbi VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 39, pl. 7, fig. 2; VOKES, 1989, Bulls. Amer. Paleontology, v. 97, no. 332, p. 57, pl. 5, fig. 8.

Holotype: USNM 646084; height 24.7 mm, diameter 14.3 mm.

Type locality: USGS 8544, Gurabo Formation; right bank of Río Gurabo, about 150 meters above middle ford at Gurabo Adentro, Monte Cristi, Dominican Republic (= TU 1210).

Occurrence: Gurabo Formation, Dominican Republic.

Figured specimens: Fig. 7, USNM 375461; height 41.9 mm, diameter 22.4 mm; locality TU 1412. Fig. 8, PRI 33042; height 27.9 mm, diameter 17.9 mm; locality TU 1210. Additional locality: TU 1211.

Discussion: Poirieria (Panamurex) gabbi was based upon a single specimen collected by Vaughan *et al.* (1921) in their reconnaisance of the Dominican Republic. Our work there yielded only another five specimens, all but one (pl. 9, fig. 7) from the vicinity of the type locality.

Poirieria (Panamurex) carnicolor (Clench and Pérez Farfante)
Plate 10, figure 8

Poirieria (Panamurex) carnicolor (Clench and Pérez Farfante). VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 46, pl. 6, fig. 6.

Panamurex carnicolor (Clench and Pérez Farfante). FAIR, 1976, The Murex Book, p. 30, not pl. 15, fig. 195 (= *Acanthotrophon* sp.).

Holotype: MCZ 7305; height 20 mm, diameter 10 mm (*fide* Clench and Pérez Farfante, 1945, p. 48; specimen not found).

Type locality: *Blake* Station 273, off Barbados, Lesser Antilles, in 103 fathoms [184 meters].

Occurrence: Recent only, Lesser Antilles.

Figured specimen: USNM 679266; height 28 mm, diameter 16 mm; locality *Oregon* Station 5070, off Nevis, Leeward Islands, in 50 to 60 fathoms [91-110 meters].

Discussion: Radwin and D'Attilio (1976, p. 31) considered *P. carnicolor* a "name of dubious identity," their reason being: "We have examined the supposed holotype of *P. carnicolor* on loan from the Museum of Comparative Zoology, and have concluded that it does not represent the specimen figured with the original description; indeed, it may not even represent the same species. The specimen figured by Vokes [1970] as this species is not from the type lot, although it does resemble the original figure."

Examination of the "holotype" in the MCZ collections shows that they are absolutely correct. The specimen is not *P. carnicolor;* it is neither the shell figured nor described. It is the specimen figured by Fair (1976, pl. 15, fig. 195) and is, as Radwin and D'Attilio indicated, not only a different species but a different genus. It is a species of the muricopsine genus *Acanthotrophon* and will be treated in a future part of this series.

A search of the MCZ collections did not turn up the true holotype. It was hoped that a second specimen, stated by Clench and Pérez Farfante (1945, p. 49) to be in the U.S. National Museum collections (USNM 87082, from Station 156, off Montserrat), might prove to be the holotype. Unfortunately, that shell (figured by M. Smith, 1953, pl. 12, fig. 4) is a much less ornamented specimen, although there is no question it is the same species as the figured holotype. So, for the present, the holotype is "lost." But this does not prevent identification of the species, as Radwin and D'Attilio implied.

The type of "*Murex*" *interserratus* Sowerby, 1879, the species with which *P. carnicolor* was originally confused, has been located in the Muséum National d'Histoire Naturelle, Paris. It is figured by Houart (1982, text-fig. c) and D'Attilio and Myers (1985, text-fig. 1), who all assign it to the genus *Murexsul.* It is similar to *P. carnicolor* in the numerous spinose varices and the somewhat scabrous surface; otherwise there is no more than a familial relationship. The type locality, which was unknown, is Japan. *Murex interserratus* has two other invalid synonyms: *Murex ednae* M. Smith, 1940, and *Murexsul zonatus* Hayashi and Habe, 1965.

Leal, in his study of the gastropods from the Brazilian oceanic islands (1991, p. 137), included a form as "*Panamurex* sp. 1, which he stated had been tentatively identified by Houart (in press) as *Panamurex carnicolor* but which he believed to be a different species. In Houart's published paper the species was treated as *Murexsul*

PLATE 11

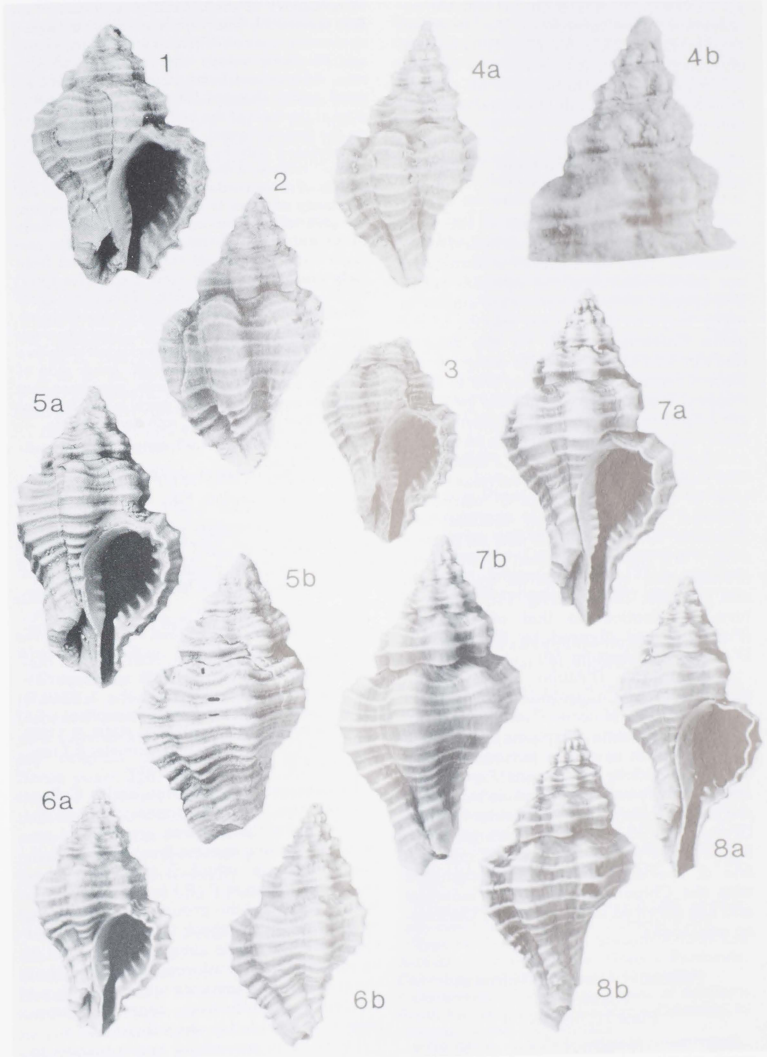


PLATE 11

sp. (1991a, p. 31, figs. 8, 30, 31) with the observation: The largest of the Brazilian specimens is 5.2 mm long . . . Examination of adult specimens is necessary for positive identification." On the basis of his illustrations the assignment to *Murexsul* is preferable to *Panamurex*.

Species Group 3: *Poirieria (Panamurex) velero*

Discussion: The members of this Species Group are the least ornamented of the subgenus. They have neither a labral tooth nor spines encircling the siphonal canal. The species included herein are similar in many ways to the Recent species of the genus *Calotrophon* and, for this reason, Radwin and D'Attilio (1976) assigned the Recent representative of this line to *Calotrophon*. I do not doubt that the two lines are closely related; the earliest members of *Calotrophon* still carry the rugae on the columellar lip that characterize *Panamurex*. The radulae of *Calotrophon turritus* (Dall), type of the genus, and of *C. ostrearum* (Conrad) (both figured by McLean and Emerson, 1970, text-figs. 8 and 15, respectively) are identical to that of *Poirieria (Panamurex) velero* (figured by Radwin and D'Attilio, 1976, text-fig. 14), which, in turn, is identical to that of *Poirieria (Paziella) pazi* (figured by Radwin and D'Attilio, 1976, text-fig. 50).

Radwin and D'Attilio (1976, p. 32) suggested that *Calotrophon* was a direct descendant of a Miocene *Panamurex* form, which, as they state: "explains the absence of *Calotrophon* in earlier periods and the apparent paucity of Recent *Panamurex* species." If *P. velero* stood alone in time as the only member of this particular Species Group, I would accept it as a strange member of *Calotrophon*, but it is just one of a line of species that probably originated with the Chipola species *P.(P.) mauryae* and has survived in the southern Caribbean until today.

POIRIERIA (PANAMUREX) RUTSCHI
Vokes, n. sp.
Plate 11, figures 1-4

Description: Massive shell with seven teleoconch whorls and protoconch of one and one half rounded whorls, the first whorl at an angle to remainder of shell. Axial ornamentation on first teleoconch whorl of nine rounded ridges, decreasing to six on third and succeeding whorls and becoming heavy, rounded, indistinct varices. Adapertural faces of varices marked by small spines directed forward from the spiral cord at the base of the body whorl and that one on the siphonal canal. No other spines; varices ornamented only by crossing of spiral cords. Spiral ornamentation on early teleoconch whorls of three cords: one at shoulder, one immediately adjacent to suture and one between; a fourth added later on shoulder ramp. Body whorl with six or seven major cords, plus one major cord on siphonal canal, separated from body whorl by a smaller cord. Except for spiral cords, shell surface smooth. Suture on early whorls appressed but becoming increasingly impressed and sinuated by varices. Aperture oval; inner lip wide, appressed, smooth but with five elongate rugae on anterior half. Inner side of outer lip with about seven lirae, corresponding to spaces between external spiral cords. Siphonal canal short, very broad, with deep fasciole.

Holotype: NMB H 17387; height 21.8 mm, diameter 15.2 mm.

Type locality: NMB 17531, Punta Gavilán Formation; Punta Gavilán, Edo. de Falcón, Venezuela.

Etymology of name: In honor of Rolf F. Rutsch, author of many papers on Caribbean fossil mollusks, in particular those of the Punta Gavilán Formation, type locality of this new species.

Occurrence: Punta Gavilán Formation, Venezuela.

Figured specimens: Fig. 1, NMB H 17387 (holotype). Fig. 2, NMB H 17388 (paratype A); height 23.4 mm, diameter 14 mm. Fig. 3, NMB H 17389 (paratype B); height (incomplete) 17.4 mm, diameter 12.1 mm. Fig. 4, NMB H 17890 (paratype C); height 15.5 mm, diameter 8.7 mm. Locality of all same as the holotype.

Discussion: In the Gibson Smith Collection at the Naturhistorisches Museum, Basel, Switzerland, there are several examples of a new species from Punta Gavilán, Venezuela, which is transitional between the group of *P.(P.) laccapoia*, with a labral tooth, and the group of *P.(P.) velero*, which lacks the labral tooth. The labral tooth in *P. rutschi* is almost vestigial but is important for it reinforces my belief that the species of *Panamurex* with and without the tooth are sufficiently near in relationship to be included in one subgenus.

There is a superficial resemblance to another Venezuelan species, *P.(P.) recticanalis*, but the new species differs in the

more attenuated spire, in addition to the presence of the labral tooth, which is not developed in the latter.

Unfortunately the material at Punta Gavilán is silicified and not very well preserved. Thus it was necessary to use several specimens to view all of the morphological features. For this reason there are three figured paratypes, in addition to the holotype.

POIRIERIA (PANAMUREX) RECTICANALIS (Weisbord)
Plate 11, figure 5

Latirus (Polygona) recticanalis WEISBORD, 1962, Bulls. Amer. Paleontology, v. 42, no. 193, p. 356, pl. 30, figs. 17, 18.

Not *Panamurex recticanalis* (Weisbord). PETUCH, 1987, New Caribbean Moll. Faunas, p. 89, pl. 20, figs. 4, 5 [= *Poirieria (Panamurex) eugeniae*, n. sp.].

Panamurex recticanalis (Weisbord). LYONS, 1991, Bull. Florida Mus. Nat. Hist., Biol. Sci., v. 35, no. 3, p. 198.

Holotype: PRI 26254; height 15 mm, diameter 8.7 mm.

Type locality: Playa Grande Formation (Maiquetia Member); Quebrada Las Bruscas, about 125 meters upstream from junction with Quebrada Las Pailas, Dto. Federal, Venezuela.

Occurrence: Playa Grande and Mare formations, Venezuela.

Figured specimen: NMB H 17391; height 17 mm, diameter 10 mm; locality, Quebrada Mare Abajo, Dto. Federal, Venezuela.

Discussion: Poirieria (Panamurex) recticanalis, which is closely related to the Recent *P. velero*, was originally described as a *Latirus* and, thus, was overlooked in my original discussion of *Panamurex*. Some years ago, Mr. Jack Gibson Smith, then of Caracas, Venezuela, advised me that the species should be referred to *Panamurex* and loaned me several specimens collected at the type locality of Weisbord's Mare Formation (locality W-14 of Weisbord, 1962, p. 11), one of which is figured here (pl. 11, fig. 5).

Since that time Petuch, who received the same information from Mr. Gibson Smith (see Petuch, 1981, p. 308), figured a Recent specimen from the "Gatunian Relict Pocket" of northern Venezuela, which he referred to *P. recticanalis*. It is not the same species and is described below as *P. eugeniae*.

The Recent *P. velero* is morphologically similar to *P. recticanalis* and there is some reason to place the two in synonymy. However, there are consistent differences. The older *P. recticanalis* is larger for the same number of whorls; the two figured specimens are approximately the same size, but the specimen of *P. velero* (pl. 11, fig. 6) has one more whorl at the same size. In addition, *P. recticanalis* always has a secondary cord between each of the major spiral cords but *P. velero* does not (*P. eugeniae* also has these secondary cords). Therefore, though the two forms are closely related, they are not placed in synonymy.

Most early workers considered the beds of the Cabo Blanco Group to be of Quaternary age (see Weisbord's discussion, 1962, pp. 29-33) but, on the basis of percentage of living species, Weisbord concluded that the beds ranged from Late Miocene at the bottom (Catia Member, Playa Grande Formation) to Pleistocene (Abisinia Formation). Later work utilizing planktic foraminifers has determined that the Playa Grande is Pleistocene also. Unfortunately, the exposures of the Cabo Blanco Group have been destroyed in the expansion of the Maiquetia (Caracas) International Airport (see Gibson Smith, 1971), another classic fossil collecting locality lost to "progress."

POIRIERIA (PANAMUREX) VELERO (Vokes)
Plate 11, figure 6

Poirieria (Panamurex) velero VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 47, text-fig. 1.

Calotrophon velero (Vokes). RADWIN and D'ATTILIO, 1976, Murex Shells of the World, p. 31, pl. 23, fig. 5; DE JONG and COOMANS, 1988, Stud. Fauna Curaçao and Caribbean Isl., no. 214, p. 73, pl. 36, fig. 396.

Panamurex velero (Vokes). FAIR, 1976, The Murex Book, p. 85, pl. 15, fig. 199 (holotype); PETUCH, 1987, New Caribbean Moll. Faunas, p. 189, pl. 19, figs. 10, 11.

Holotype: LACM-AHF 1407 (not 1406, as originally cited); height 14.2 mm, diameter 8 mm.

Type locality: *Velero* III Stations A-13-39 and A-14-39, Cabo de la Vela, Guajira Peninsula, Colombia, in 10-22 fathoms [18-40 meters].

Occurrence: Recent only, coast of northern South America, from Santa Marta, Colombia, to Curaçao, Netherland Antilles.

Figured specimen: LACM-AHF 1407 (holotype).

Discussion: Radwin and D'Attilio (1976, p. 31) assigned *P. velero* to the genus *Calotrophon*, on the basis of their observation that "an examination of several dozen specimens of *C. ostrearum* from Boca Ciega, Florida, has resulted in the discovery that fully one-third of the specimens had more or less well-marked denticles at the anterior of the columella," and they believed that this character is, therefore, of questionable value in assigning species to one or the other of these genera.

I have not examined any specimens from Boca Ciega, but in the hundreds of fossil and Recent examples of *C. ostrearum* from other localities, except for the oldest fossil examples (those from the earliest "Pinecrest Beds"), I have seen no more than a single small denticle at the very neck of the siphonal canal (well shown in Vokes, 1976b, pl. 5, fig. 8a; refigured here pl. 19, fig. 8); this cannot be considered equivalent to the several strong rugae marking the columellar wall seen in the species of *Panamurex*.

But, columellar rugae are just one of a set of characteristics inherited from a line of ancestors going far back in geologic time. That *Calotrophon* branched off the *Panamurex* line is not questioned, with the earliest species *C. phagon* being a contemporary of *P.(P.) mauryae*, and the two lines have continued on parallel courses since the Early Miocene. To place both lineages in the same genus masks (and ignores) the geologic history of the two groups.

From the evidence at hand, *P. velero* is relatively abundant only in a limited area near the Guajira Peninsula, Colombia. De Jong and Coomans (1988, p. 73) report about 100 specimens from Aruba, as well as some from Curaçao and Santa Marta, Colombia. The apparent limited distribution may be the result of the small size of the species (specimens rarely exceed 15 mm) and they may be overlooked easily by collectors.

POIRIERIA (PANAMUREX) EUGENIAE
Vokes, n. sp.
Plate 11, figures 7, 8

Panamurex recticanalis (Weisbord). PETUCH, 1987, New Caribbean Moll. Faunas, p. 89, pl. 20, figs. 4, 5 (not of Weisbord).

Description: Shell with protoconch of one and one-half bulbous whorls, ended by onset of or-

PLATE 12

Figures Page

1-3. *Aspella castor* Radwin and D'Attilio 57
1. (X 5) USNM 663525 (holotype); height 13 mm, diameter 5.9 mm.
Locality: Puerto Rico; Recent.
(Photograph courtesy of G.E. Radwin and A. D'Attilio)
2. (X 6) USNM 323895; height 9.1 mm, diameter 4.3 mm.
Locality: TU 1227A, Dominican Republic; Gurabo Formation.
3. (X 8) MORG 23.763; height 5.8 mm, diameter 2.7 mm.
Locality: Abrolhos Archipelago, Brazil; Recent.

4, 5. *Aspella senex* Dall (X 4) 58
4. USNM 739566; height 14 mm, diameter 8 mm.
Locality: "Hourglass" Station L, about 85 miles [137 km] off Ft. Myers, Florida, in 27 fathoms [49 meters]; Recent.
5. USNM 647439; height 14.6 mm, diameter 6.4 mm.
Locality: TU 759, Florida; Bermont Formation.

6, 7. *Aspella cryptica* Radwin and D'Attilio 58
6. (X 8) SDSNH 62608 (holotype); height 6.2 mm, diameter 2.8 mm.
Locality: Itapoan [Itapuã], Bahia, Brazil; Recent.
7. (X 6) MORG 21.024; height 9 mm, diameter 4 mm.
Locality: Guaratiba Alcobaça, Bahia, Brazil (*ex* pisce); Recent.

8, 9. *Aspella morchi* Radwin and D'Attilio (X 8) 59
8. SDSNH 62609 (holotype); height 6.6 mm, diameter 3.3 mm.
Locality: Natal Bay, Rio Grande do Norte, Brazil; Recent.
9. MORG 22.616; height 6.5 mm, diameter 3.3 mm.
Locality: Ilha do Farol, Atol das Rocas [off Rio Grande do Norte], Brazil; Recent.

PLATE 12

namentation, no marked terminal varix; five teleoconch whorls in adult. Axial ornamentation on early whorls of teleoconch of first nine, then eight swollen ridges, having small open spines on each at the shoulder; gradually deceasing to six per whorl and losing the spines. On later whorls the axial ridges showing little varicial break, best seen at anterior end of siphonal canal. Surface of shell almost smooth except for growth lamellae anterior to suture. Spiral ornamentation on all whorls except last consisting of three strong cords, one at shoulder, one at suture, and one between; better developed across axial ridges. On about third teleoconch whorl a secondary cord appearing on shoulder ramp and by fifth teleoconch whorl secondary cords developed between each of the four posteriormost major spiral cords. On body whorl five major cords, plus the secondaries on shoulder and between posterior major cords; an additional four smaller cords on siphonal canal. Suture sigmoidal, undulated by axial ridges. Aperture oval, inner side of outer lip with about nine strong lirae, corresponding to spaces between major spiral cords. Columellar lip appressed at posterior end, free-standing at anterior end, with five rugae distributed over anterior half. Siphonal canal moderately long, recurved at distal end, forming small siphonal fasciole. Color cream, with darker lines topping the major spiral cords; a light frosting of intritacalx, evidently easily removed, none of type lot possessing more than traces.

Holotype: USNM 860292; height 19.2 mm, diameter 10.5 mm.

Type locality: Off Santa Marta, Colombia, in 50 meters.

Etymology of name: In honor of Eugenia I. Wright, Phoenix, Arizona, who provided the type specimen and who, over the years, has been extremely generous with specimens for illustration or comparison.

Occurrence: Recent only, northern South America, from Santa Marta, Colombia, to Golfo de Venezuela (*fide* Petuch, 1987).

Figured specimens: Fig. 7, USNM 860292 (holotype). Fig. 8, USNM 860293 (paratype); height 17.3 mm, diameter 9 mm; locality, off Cabo de la Vela, Colombia, in 20 meters.

Discssion: Although *P.(P.) eugeniae* occurs in the same area and depth as the congeneric *P. velero*, the two are easily separated. The new species is larger; at the same number of whorls it is about one-third larger than *P. velero* (pl. 11, figs. 6 and 7 both have five teleoconch whorls) and is more elongate, with a higher spire and longer siphonal canal. The spiral ornamentation in the new species is like that of the older *P. recticanalis*, with a secondary cord between each pair of major spiral cords, unlike *P. velero*, which has only the major cords. The holotype and one paratype have five columellar rugae in contrast to the four that seem to be constant in *P. velero* and *P. recticanalis*.

All three species are similar, and *P. recticanalis* presumably is ancestral to both living forms. Thus, *P. velero* is like its ancestor in the shorter outline and the four rugae; *P. eugeniae* is like its ancestor in retaining the intermediate spiral cords. Of the three, *P. recticanalis* is of median size; *P. velero* is smaller, *P. eugeniae* is larger.

The type lot consists of four specimens: the holotype, paratype, and one specimen in my collection; plus the specimen figured by Petuch (1987, pl. 20, figs. 4, 5). The latter shows well the darker color lines topping the spiral cords, the same pattern seen in the fossil species *P. gatunensis* and *P. fusinoides*.

Genus ASPELLA Mörch, 1877

Aspella MÖRCH, 1877, Malak. Blatter, v. 24, p. 24.

Type species: *Ranella anceps* Lamarck, 1822, by monotypy.

Discussion: The exact identity of *Ranella anceps* Lamarck, 1822, type of the genus *Aspella*, has been a problem since first described. In earlier times most species of *Aspella* were referred to "*anceps*." Radwin and D'Attilio (1976, p. 21) discussed the problem, noting that the major distinguishing feature of these similar shells is the intritacalx, the thick deciduous layer so characteristic of the group as a whole. In their opinion, when beachworn (as is the type specimen of *Ranella anceps*), these shiny smooth specimens are virtually unidentifiable. There are, however, differences in the overall outline of the shell.

In attempting to sort out the various nominal species of *Aspella*, Radwin and D'Attilio discovered seven new species, which they named in an appendix to their book (1976, pp. 219-228), stating "it is likely that whatever Lamarck's *A. anceps* actually was has been treated herein under the name of one of the 11 species we have included, and the name is probably best considered a *nomen dubium*" (1976, p. 21).

Based on Kiener's illustration (1842, pl. 4, fig. 2) of Lamarck's species, I originally

(Vokes, 1975, p. 125) considered the South African *A. acuticostata* Turton, 1932, as the same species. Subsequently, Winston Ponder, of the Australian Museum, located Lamarck's type specimen in the Geneva Museum and it is not quite as narrow a shell as *A. acuticostata*. After Radwin and D'Attilio's treatment, I attempted (Vokes, 1985a, p. 431) to determine which of the possible contenders was the "real" *Aspella anceps* and concluded that it was *A. platylaevis* Radwin and D'Attilio, which has the requisite slender shape, the relatively large (14 mm) size, and the widest distribution (known from Western Australia to French Polynesia and the Philippine Islands). But it also could be *A. ponderi* Radwin and D'Attilio, moderately common in Western Australia, from whence a number of other Lamarck species come (e.g., *Murex acanthopterus*, *M. secundus*, and *M. fimbriatus* [= *planiliratus* Reeve]). Nevertheless, as Radwin and D'Attilio noted (1976, p. 21), whichever species is *A. anceps*, the generic concept remains unchanged, so similar are all the species.

When all forms of *Aspella* were lumped into "*anceps*" the group was very small. In 1975 there was a total of five described Recent species worldwide; but, I noted then that there were several species (seven, it turned out) soon to be described by Radwin and D'Attilio. Later another three Indo-Pacific species were described by Houart, and one additional eastern Pacific species by me. Thus, in less than 20 years the described species in the genus has increased from five to 16, plus another known but undescribed one.

The geologic history of the genus *Aspella* begins in the Oligocene of France. In the New World no species of *Aspella* are known before the Early Pliocene, but there are eight living species (four in the western Atlantic, four in the eastern Pacific). In addition, there are eight Indo-Pacific species, and one in the Mediterranean. Barash and Danin (1972, p. 312, fig. 8) cited *Aspella anceps* as an Indo-Pacific species that has migrated through the Suez Canal. According to their records, "*A. anceps*" has been known in the Mediterranean since 1905 but their figured specimen does not match any known Indo-Pacific species and, instead of being a migrant, almost certainly is endemic to the Mediterranean area.

ASPELLA CASTOR Radwin and D'Attilio
Plate 12, figures 1-3

Aspella castor RADWIN and D'ATTILIO, 1976, Murex Shells of the World, p. 219, pl. 28, fig. 1, text-figs. 158 (shell), 159 (intritacalx), 160 (radula); VOKES, 1984, Shells and Sea Life, v. 16, no. 11, p. 212, pl. 1, fig. 8 (holotype); VOKES, 1989, Bulls. Amer. Paleontology, v. 97, no. 332, p. 58, pl. 7, fig. 12.

Aspella senex Dall. RIOS, 1985, Seashells of Brazil, p. 87, pl. 31, fig. 382; HOUART, 1991, Nautilus, v. 105, no. 1, p. 27; LEAL, 1991, Mar. Prosobranch Gast. Oceanic Islands Brazil, p. 143 (not of Dall).

Holotype: USNM 663525; height 13 mm, diameter 5.9 mm.

Type locality: Puerto Rico.

Occurrence: Gurabo Formation, Dominican Republic. Recent, Florida, Puerto Rico, Virgin Islands, and Abrolhos Archipelago, Brazil.

Figured specimens: Fig. 1, USNM 663525 (holotype; photograph courtesy of G.E. Radwin and A. D'Attilio). Fig. 2, USNM 323895; height 9.1 mm, diameter 4.3 mm; locality TU 1227A. Fig. 3, MORG 23.763; height 5.8 mm, diameter 2.7 mm; locality, Abrolhos Archipelago, Brazil.

Discussion: Radwin and D'Attilio (1976, p. 219) separated *Aspella castor* from *A. senex* on the basis that the new species is more elongate. This holds true for Recent examples of the two species (compare pl. 12, figs. 1 and 4), but with fossil specimens of *Aspella*, the varical extensions formed by the intritacalx cause problems for they are invariably lost in the fossil state. Thus, a fossil *A. senex* is much narrower than a living one (compare pl. 12, figs. 4 and 5) and conversely, a fossil specimen of *A. castor* is much wider than a fossil *A. senex*.

In the Gurabo Formation, Dominican Republic, we have collected four examples of *A. castor*, all from one unusual locality where shallow-water reefal material has been washed downslope by gravity flow into deep-water Gurabo clays. These clays have been dated with planktic foraminifera as Zone N.18, or basal Pliocene. Thus, these specimens are the oldest known species of *Aspella* in the New World.

Aspella castor was described originally from Puerto Rico and the Virgin Islands. In the collections of the Academy of Natural Sciences, Philadelphia, a juvenile specimen (ANSP 36335) from Tampa Bay,

Florida, can be referred to this species. If the locality is correct, this extends the range into the Gulf of Mexico.

Houart (1991a, p. 27) and Leal (1991, p. 143) recorded *Aspella senex* from Vitória Bank, Espírito Santo, Brazil; however, neither figured the specimen. As Houart noted, Rios (1985, p. 87) had previously reported this species from the Abrolhos Islands. The specimens from the Abrolhos (MORG 23.763 and 26.855, seven in all; see pl. 12, fig. 3) are all tiny (under 6 mm) but otherwise seem referable to *A. castor*. They are certainly close to it but, given the small size, they may prove to be a different species.

ASPELLA SENEX Dall
Plate 12, figures 4, 5

Aspella senex Dall. VOKES, 1975, Tulane Stud. Geol. Paleont., v. 11, no. 3, p. 132, pl. 1, figs. 1-4, 7; RADWIN and D'ATTILIO, 1976, Murex Shells of the World, p. 25, pl. 1, figs. 1, 2; FAIR, 1976, The Murex Book, p. 76, pl. 16, fig. 209.

Not *Aspella senex* Dall. RIOS, 1985, Seashells of Brazil, p. 87, pl. 31, fig. 382; HOUART, 1991, Nautilus, v. 105, no. 1, p. 27; LEAL, 1991, Mar. Prosobranch Gast. Oceanic Islands Brazil, p. 143 (= *A. castor*).

Holotype: USNM 163959; height 9.5 mm, diameter 4 mm.

Type locality: Caloosahatchee or Bermont Formation; Shell Creek, Cleveland County, Florida (= TU 539A/B).

Occurrence: Fruitville (= "Pinecrest Beds"), Caloosahatchee, and Bermont formations, Florida; Waccamaw Formation, South Carolina. Recent, from North Carolina to Veracruz, Mexico.

Figured specimens: Fig. 4, USNM 739566; height 14 mm, diameter 8 mm; locality "Hourglass" Station L, about 85 miles [137 km] off Ft. Myers, Florida, in 27 fathoms [49 meters]. Fig. 5, USNM 647439; height 14.6 mm, diameter 6.4 mm; locality TU 759. Additional localities: TU 79, 558.

Discussion: Aspella senex remains as rare today as it was in 1975. The beds at the APAC quarry in Sarasota, Florida (TU 1000), as well as those along the Kissimmee River (TU localities 728, 729, 730), are now referred to the Fruitville Formation rather than the Pinecrest Beds (Waldrop and Wilson, 1990), but we have no new material from either area. In the collections of Richard E. Petit, North Myrtle Beach, South Carolina, there are a few examples of *A. senex* from the Waccamaw Formation (TU 558), although we have not collected any personally.

Houart (1991a, p. 27), Leal (1991, p. 143) and Rios (1985, p. 87) have reported *Aspella senex* from the Abrolhos Islands, Brazil. Examination of material in the collections of the Museu Oceanográfico, Rio Grande do Sul, reveals that the specimens are better assigned to *A. castor*. The single dead specimen reported from the Vitória Seamount by Houart and Leal (*ibid.*) is assumed to be the same.

ASPELLA CRYPTICA
Radwin and D'Attilio
Plate 12, figures 6, 7; text-figure 3

Aspella anceps (Lamarck). RIOS, 1970, Coastal Brazilian Seashells, p. 83 (in part); RIOS, 1975, Brazilian Mar. Moll. Icon., p. 87 (in part), not pl. 25, fig. 357 (= *A. morchi*); RIOS, 1985, Seashells of Brazil, p. 87 (in part), not pl. 31, fig. 379 (= *A. morchi*) (not of Lamarck).

Aspella cryptica RADWIN and D'ATTILIO, 1976, Murex Shells of the World, p. 220, pl. 1, fig. 10, text-figs. 161 (shell), 162 (intritacalx); VOKES, 1984, Shells and Sea Life, v. 16, no. 11, p. 212, pl. 1, fig. 10 (holotype); RIOS, 1985, Seashells of Brazil, p. 87, pl. 31, fig. 380 (holotype).

Holotype: SDSNH 62608; height 6.2 mm, diameter 2.8 mm.

Type locality: Itapoan [Itapuã], Bahia, Brazil.

Text-figure 3. *Aspella cryptica* Radwin and D'Attilio; MORG 20.989; height 6.2 mm, diameter 2.3 mm; locality, Itapuã, Bahia, Brazil. Detail of intritacalx (X 70).

Occurrence: Recent only, northern Brazil.

Figured specimens: Fig. 6, SDSNH 62608 (holotype; photograph courtesy of G.E. Radwin and A. D'Attilio). Fig. 7, MORG 21.024; height 9 mm, diameter 4 mm; locality, Guaratiba Alcobaça, Bahia, Brazil (*ex* pisce).

Discussion: Rios (1970, p. 83; 1975, p. 87, pl. 25, fig. 357) reported "*Aspella anceps*" from several stations in northern Brazil. Subsequently (1985, p. 87) he noted that *A. anceps* is an Indo-Pacific species and does not occur in Brazil, but he did not identify the shell he figured under this name. I examined the specimens he assigned to *A. anceps* and most are *A. morchi*, but one (Station 29, Paripueira, Alagoas) is *A. cryptica*. His figured specimen (Station 6, off Pará River) appears to be *A. morchi*.

Kaicher (1978, no. 1566) has figured an example from the Abrolhos Archipelago, Brazil, which is considerably larger than the holotype (estimated height 14 mm, if complete). Most specimens in the Museu Oceanográfico, Rio Grande do Sul, are about 7 mm; the specimen figured here (pl. 12, fig. 7) is the largest.

ASPELLA MORCHI
Radwin and D'Attilio
Plate 12, figures 8, 9; text-figure 4

Aspella anceps (Lamarck). RIOS, 1970, Coastal Brazilian Seashells, p. 83 (in part); RIOS, 1975, Brazilian Mar. Moll. Icon., p. 87 (in part), pl. 25, fig. 357; RIOS, 1985, Seashells of Brazil, p. 87 (in part), pl. 31, fig. 379 (not of Lamarck).

Aspella morchi RADWIN and D'ATTILIO, 1976, Murex Shells of the World, p. 223, pl. 1, fig. 9, text-figs. 166 (shell), 167 (intritacalx); VOKES, 1984, Shells and Sea Life, v. 16, no. 11, p. 212, pl. 1, fig. 12 (holotype); RIOS, 1985, Seashells of Brazil, p. 87, pl. 31, fig. 381 (holotype); HOUART, 1991, Nautilus, v. 105, no. 1, p. 27, text-figs. 9, 10 (protoconch), 29 (shell); LEAL, 1991, Mar. Prosobranch Gast. Oceanic Islands Brazil, p. 143, pl. 1, fig. L (shell); pl. 18, figs. J (juvenile shell), K (protoconch), L (intritacalx).

Holotype: SDSNH 62609; height 6.6 mm, diameter 3.3 mm.

Type locality: Natal Bay, Rio Grande do Norte, Brazil (Leal, 1991, p. 143, has observed that "there is no such thing as a bay in Natal"; presumably the locality is simply Natal).

Occurrence: Recent only, northern Brazil.

Figured specimens: Fig. 8, SDSNH 62609 (holotype). Fig. 9, MORG 22.616; height 6.5 mm, diameter 3.3 mm; locality, Ilha do Farol, Atol das Rocas [off Rio Grande do Norte], Brazil.

Text-figure 4. *Aspella morchi* Radwin and D'Attilio; MORG 22.616; height 6.5 mm, diameter 3.3 mm; locality, Ilha do Farol, Atol das Rocas, Brazil. Detail of intritacalx (X 60).

Discussion: As noted above, most specimens cited by Rios (1970, p. 83; 1975, p. 87) as *Aspella anceps* are *A. morchi*. Apparently, *A. morchi* has a more extensive range, extending from Pará to Bahia; but *A. cryptica* is reported only from Bahia and the adjoining states of Alagoas and Espírito Santo.

The two Brazilian species are both relatively small, but may be distinguished by the smooth shell of *A. cryptica* in contrast to the somewhat angulate, nodulose shell of *A. morchi*. The intritacalx in both species is very characteristic, with that of *A. morchi* having much larger punctae (compare text-figs. 3 and 4). Houart (1991a, text-figs. 9, 10, 29) and Leal (1991, pl. 18, fig. K) have both figured specimens of *A. morchi*, demonstrating that the protoconch has one and one-half bulbous whorls, as do the majority of species of *Aspella*.

Genus DERMOMUREX Monterosato, 1890

Dermomurex MONTEROSATO, 1890, Natural. Sicil., v. 9, p. 181 (new name for *Poweria* Monterosato, 1884, *non* Bonaparte, 1840).

Type species: *Murex scalarinus* Bivona-Bernardi, 1832 (= *M. scalaroides* Blainville, 1829), by original designation (for *Poweria*).

Discussion: The number of species placed in the genus *Dermomurex* has increased from 32 Recent and fossil species in 1975 to 58, as of this work, in which four additional species are named. Many of these are from the Indo-Pacific area where, in 1975, only four fossil species and two Recent ones were recognized (one had no known name in 1975 but it proved to have been named *Phyllocoma neglecta* Habe and Kosuge, 1971, and now is referred to *Trialatella*). Table 2 shows the numbers of species in the different subgenera of *Dermomurex* and their geographic distribution. These numbers include fossil and living species without distinction, as several species occur both in the Recent fauna and in the fossil record.

Subgenus DERMOMUREX s.s.

Discussion: Previously I noted (Vokes, 1975, p. 129) that, for the most part, Recent species of *Dermomurex* s.s. are confined to the New World. This observation has been modified somewhat by the recognition of two previously described Australian species (*D. angustus* and *D. goldsteini*, see Vokes, 1985b) and the description of a third, also from Western Australia (*D. raywalkeri* Houart, 1986). At this writing there are 12 New World (including three described herein) and four Old World species in the living fauna (three Australian, one Mediterranean).

As in "*Aspella anceps*," many specimens of *Dermomurex* are misidentified. In looking through collections, first in Australia and then in the U.S., I discovered several new species, variously identified by the name of any previously described species. Obviously the group is still poorly known and additional undescribed species doubtlessly hide incognito in other collections.

One Australian fossil species, "*Murex*" *crassiliratus* Tate, 1888, previously attributed to *Dermomurex* s.s. (Vokes, 1971b, p. 37) is referable to *Pygmaepterys*. However, another Australian fossil species, *D. garrardi* Vokes, 1985 [previously misidentified in collections as *Litozamia didymus* (Tate, 1888), or *Pterynotus bifrons* (Tate, 1888)], occurs in beds of Balcombian (middle Miocene) age. This form may well be most closely related to the Indo-Pacific species, *Dermomurex (Trialatella) neglecta* (Habe and Kosuge). It certainly bears little resemblance to the typical group of species such as *D.(D.) matercula* and its descendants.

DERMOMUREX (DERMOMUREX) MATERCULA Vokes

Plate 13, figure 1

Dermomurex (Dermomurex) matercula VOKES, 1975, Tulane Stud. Geol. Paleont., v. 11, no. 3, p. 133, pl. 2, fig. 3.

Holotype: USNM 647442; height 16.2 mm, diameter 8.5 mm.

Type locality: TU 830, Chipola Formation; Tenmile Creek, at power-line crossing about one mile [1.6 km] west of Chipola River (SE 1/4 Sec. 12, T1N, R10W), Calhoun County, Florida.

Occurrence: Chipola Formation, Florida.

Figured specimen: USNM 647442 (holotype). Additional locality: TU 546.

Discussion: This, the oldest known species of *Dermomurex* s.s., remains as rare as when described. We have collected a few additional specimens but they add little information.

TABLE 2

Distribution of species (fossil and Recent) in the subgenera of *Dermomurex* by geographic region.

Subgenus	Western Atlantic	Eastern Pacific	Europe	Indo-Pacific	Total
Dermomurex s.s.	13	3	4	6	26
Gracilimurex	1	1	–	–	2
Trialatella	6	1	2	2	11
Takia	5	1	2	8	16
Viator	–	–	–	3	3
Total	25	6	8	19	58

DERMOMUREX (DERMOMUREX) GRANULATUS
Vokes
Plate 13, figure 2

Dermomurex (Dermomurex) granulatus VOKES, 1989, Bulls. Amer. Paleontology, v. 97, no. 332, p. 60, pl. 7, figs. 4-6.

Holotype: USNM 323889; height 15.4 mm, diameter 7.4 mm.

Type locality: TU 1296, Gurabo Formation; Río Gurabo, both sides, from 1 km above the horse-trail to the base of the formation approximately 2 km above the trail, or about 3 to 4 km (airline) above the ford on Los Quemados-Sabaneta road, Dominican Republic.

Occurrence: Gurabo Formation, Dominican Republic.

Figured specimen: USNM 323889 (holotype). Additional localities: TU 1212, 1215, 1227A, 1250, 1354.

Discussion: When *Dermomurex (Dermomurex) granulatus* was described, I considered it as the intermediate stage between *D. matercula* and *D. pauperculus*. However, in overall morphology it has a greater resemblance to *D. pacei* (which was named while my paper was in press), but differs in having a less elevated spire and a smaller aperture. The line of *D. granulatus*/*D. pacei* almost certainly is descended from the French Middle Miocene *D. tenellus* Mayer, 1869 (see Vokes, 1975, p. 128, pl. 2, fig. 1), and all three species are characterized by the presence of nodules on the spiral cords.

DERMOMUREX (DERMOMUREX) PACEI
Petuch
Plate 13, figures 6, 7

Dermomurex pacei PETUCH, 1988, Neogene Hist. Trop. Amer. Moll., p. 152, pl. 29, figs. 10, 11.

Holotype: USNM 859939; height 16 mm, diameter 8 mm.

Type locality: Pickles Reef, Plantation Key, Monroe County, Florida.

Occurrence: Moín Formation, Costa Rica. Recent, Bahama Islands and Florida to Cuba.

Figured specimens: Fig. 6, USNM 869508, height 19.1 mm, diameter 9.2 mm; locality, Marianao, La Habana, Cuba (dredged fill). Fig. 7, USNM 462694; height 16.8 mm, diameter 7.7 mm; locality TU 1240. Additional locality: TU 1307.

Discussion: This recently described species is closely related to another recently described eastern Pacific species, *D.(D.) gunteri* Vokes, 1985. When the latter was described (Vokes, 1985a, p. 436, figs. 15, 16), it was observed that "there is no living species with which it may be compared." Astonishingly, only three years later, the Atlantic cognate was discovered.

This species first came to my attention when Hortensia Sarasua of La Habana, Cuba, sent me a collection of muricids from the dredged fill at Marianao. In it were six examples of *D. pacei*, as well as several examples of *D.(D.) sarasuae*, named below.

In the Worsfold Collection at the Academy of Natural Sciences, Philadelphia, there are three specimens (ANSP 374059) of *D. pacei* from Grand Bahama Island. In addition, we have five fossil specimens from the Moín Formation at Puerto Limón, Costa Rica. Further collecting almost certainly will reveal the species living in the southern Caribbean.

DERMOMUREX (DERMOMUREX) CRACENTIS
Vokes
Plate 13, figure 3

Dermomurex (Dermomurex) cracentis VOKES, 1989, Bulls. Amer. Paleontology, v. 97, no. 332, p. 61, pl. 7, figs. 7, 8.

Holotype: USNM 323891; height 14.9 mm, diameter 6.9 mm.

Type locality: TU 1219, Gurabo Formation; Río Amina, bluff on east side of river, just above the ford, which is 2 km west of Potrero, and about 3 km downstream from "La Represa," Dominican Republic.

Occurrence: Gurabo Formation, Dominican Republic.

Figured specimen: USNM 323891 (holotype). Additional localities: TU 1227A, 1449.

Discussion: In contrast to the other two species of *Dermomurex* s.s. described from the Dominican Republic, *D.(D.) cracentis* is totally unlike any known New World species. Its nearest relative is the Australian *D. garrardi* Vokes, which is also a slender and relatively smooth species. A modern analog may someday be discovered but at this time we have only this "misplaced" species with no known ancestors or descendants in the New World.

DERMOMUREX (DERMOMUREX) OLSSONI
Vokes
Plate 15, figures 5-7

Aspella scalarioides [sic] (Blainville). MAURY, 1917, Bulls. Amer. Paleontology, v. 5, no. 29, p. 104(268), pl. 17(43), fig. 11 (not of Blainville).

Dermomurex (Dermomurex) engonatus (Dall). VOKES, 1975, Tulane Stud. Geol. Paleont., v. 11, no. 3, p. 136 (in part, Dominican Republic reference only; not of Dall).

Dermomurex (Dermomurex) olssoni VOKES, 1989, Bulls. Amer. Paleontology, v. 98, no. 332, p. 59, pl. 7, figs. 1-3.

Holotype: USNM 323886; height 22.7 mm, diameter 10.2 mm.

Type locality: TU 1215, Gurabo Formation; Río Gurabo, bluffs on both sides, from the ford on the Los Quemados-Sabaneta road upstream to approximately 1 km above the ford, Dominican Republic.

Occurrence: Gurabo Formation, Dominican Republic. Recent, Bahama Islands to Bay Islands, Honduras.

Figured specimens: Fig. 5, USNM 323886 (holotype). Fig. 6, USNM 869511; height 19 mm, diameter 8.1 mm; locality, Alder's Cay, Berry's Island, Bahama Islands. Fig. 7, USNM 323887 (paratype B); height 14.4 mm, diameter 7 mm; locality TU 1215. Additional locality: TU 1354.

Discussion: Previously (Vokes, 1975, p. 136) I included the Dominican Republic specimen that Maury (1917, pl. 17, fig. 11) referred to the Mediterranean *D. scalaroides* (Blainville) in synonymy with *D.(D.) engonatus* (Dall, 1892). With additional Dominican material, it became clear that the Maury specimen was not *D. engonatus* (now synonymized with *D. alabastrum*, see below) but was instead a new species, which I named *D. olssoni*. The latter is shorter, more inflated, and lacks the shoulder spines of *D. alabastrum*.

A question remained, to which living species might the Dominican species be most closely related? It bears only a subgeneric resemblance to the widespread *D. pauperculus*, but no other was closer. Surprisely, a living example of *D. olssoni* was taken recently by Pat Bingham, under a rock at one meter depth, in the Bahama Islands (pl. 15, fig. 6). In the collection of Harry G. Lee, Jacksonville, Florida, there is another large example (height 23.3 mm) taken under rubble at one meter depth, Utila, Bay Islands. These records are shallower than the presumed 20 to 50 meters depth occurrence of the fossil specimens (see Vokes, 1989b, p. 21); perhaps water temperatures are somewhat cooler at these depths today than in the Pliocene and the species has migrated vertically.

PLATE 13

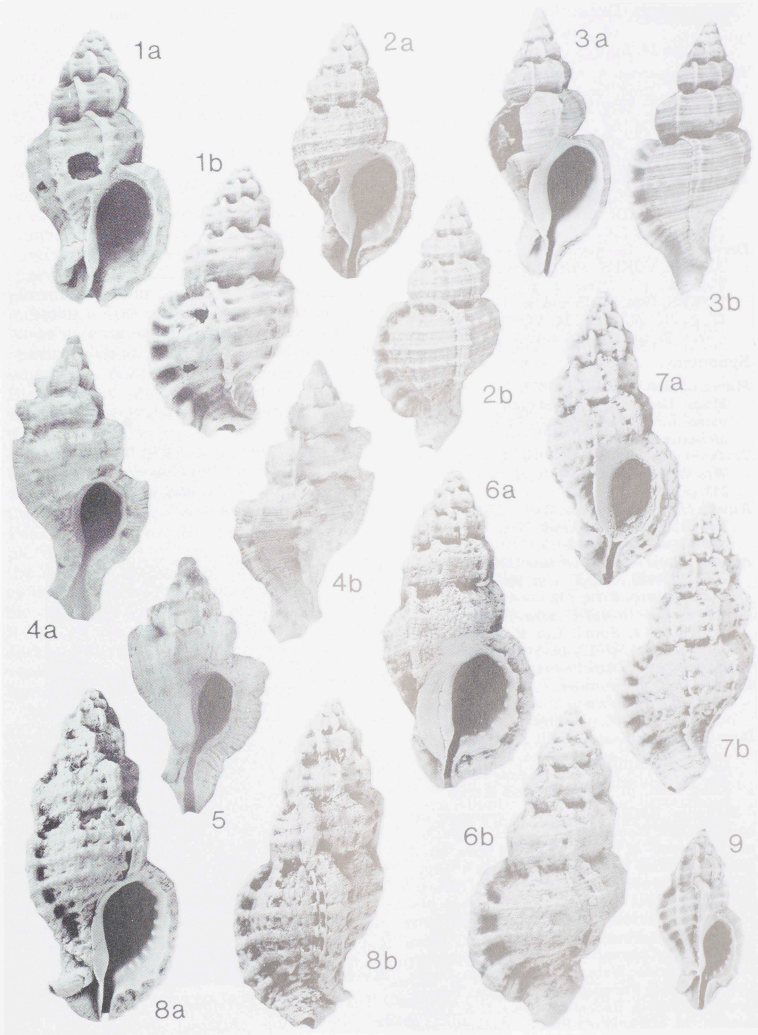


PLATE 13

DERMOMUREX (DERMOMUREX) ALABASTRUM
(A. Adams)
Plate 14, figures 1-5; text-figure 5

Murex alabastrum A. ADAMS, 1864, Zool. Soc. London, Proc. for 1863, p. 508; G.B. SOWERBY, JR., 1879, Thes. Conch., v. 4, *Murex*, p. 20, pl. 21, fig. 191; RADWIN and D'ATTILIO, 1976, Murex Shells of the World, p. 217 ("species of uncertain identity").

Dermomurex alabastrum (A. Adams). VOKES, 1975, Tulane Stud. Geol. Paleont., v. 11, no. 3, p. 138; FAIR, 1976, The Murex Book, p. 19, pl. 16, fig. 216.

Dermomurex (Dermomurex) alabastrum (A. Adams). VOKES, 1976, Tulane Stud. Geol. Paleont., v. 12, no. 1, p. 45, text-fig. 1; VOKES, 1984, Shells and Sea Life, v. 16, no. 11, p. 212, pl. 1, fig. 14; VOKES, 1985, Veliger, v. 27, no. 4, p. 436, text-fig. 21.

Synonyms:

Murex adamsii KOBELT, 1877, Jahr. Deutsch. Malac. Gesell., v. 4, p. 154 (unnecessary new name for *M. alabastrum* Adams non *M. alabaster* Reeve).

Trophon (Aspella) engonatus DALL, 1892, Wagner Free Inst. Sci., Trans., v. 3, pt. 2, p. 243, pl. 13, fig. 6a.

Aspella (Aspella) engonata (Dall). OLSSON and HARBISON, 1953, Acad. Nat. Sci. Phila., Mon. 8, p. 251, pl. 39, fig. 5.

Aspella pauperculum varians NOWELL-USTICKE, 1969, Suppl. List New Shells St. Croix, p. 15, pl. 3, fig. 692.

Aspella varians Nowell-Usticke. NOWELL-USTICKE, 1971, Suppl. List New Shells (revised edition), p. 12, pl. 6 (no number) (in synonymy with *Aspella cantrainei* Recluz).

Dermomurex (Dermomurex) engonatus (Dall). VOKES, 1975, Tulane Stud. Geol. Paleont., v. 11, no. 3, p. 136, pl. 3, figs. 5, 6.

Dermomurex engonatus (Dall). PETUCH, 1986, Jour. Coastal Resh., v. 2, no. 4, p. 397, pl. 4, fig. 10; PETUCH, 1988, Neogene Hist. Trop. Amer. Moll., pl. 17, figs. 4, 5 (not in text).

Syntypes: BMNH 1974127 [two syntypes: (A) height 25 mm, diameter 11.6 mm; (B) height 20.9 mm, diameter 10.1 mm]; "long. 14 lines, lat. 3 lines" [obviously an error for 6 lines] (= height 29.5 mm, diameter 12.7 mm; Adams, 1864, p. 508).

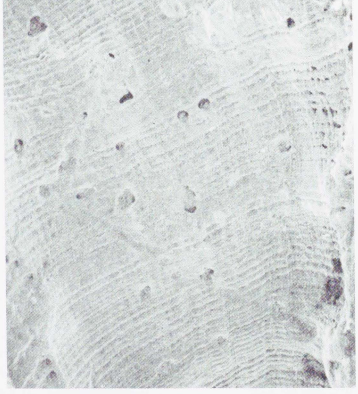
Type locality: Martinique, Lesser Antilles.

Occurrence: Pinecrest, Fruitville (= "Pinecrest Beds"), Caloosahatchee, and Bermont formations, Florida; Waccamaw Formation, South Carolina; Moín Formation, Costa Rica; Tubará Group, Colombia. Recent, St. Croix, U.S. Virgin Islands, to Martinique, Belize, Panama, and Venezuela.

Figured specimens: Fig. 1, USNM 462695; height 25.3 mm, diameter 11.3 mm; locality TU 1512. Fig. 2, USNM 462696; height 15.6 mm, diameter 8.5 mm; locality TU 1512. Fig. 3, AMNH 186115 (paratype, *Aspella varians* Nowell-Usticke); height 29 mm, diameter 13 mm; locality, St. Croix, U.S. Virgin Islands. Fig. 4, Vink Coll.; height 14 mm, diameter 7 mm; locality, Taganga, near Santa Marta, Colombia. Fig. 5, UCMP 39835; height (incomplete) 20.3 mm, diameter 13.6 mm; locality, UCMP S-22, Punta Pua, Dept. of Bolivar, Colombia. Additional localities: TU 558, 1307, 1491.

Discussion: In spite of the fact that "*Murex*" *alabastrum* was described from Martinique and well-figured by Sowerby (1879, pl. 21, fig. 191), as late as 1975 no one had recognized the species in the western Atlantic. Thus, in February, 1975, I stated (Vokes, 1975, p. 138) that it was another example of the mistaken locality data common among species named by A. Adams, and placed it in synonymy with the eastern Pacific *Dermomurex indentatus* (Carpenter, 1857).

In June of that year, I had the pleasure to visit the late Gordon Nowell-Usticke, at his home in St. Croix, and to study his extensive collection of West Indian



Text-figure 5. *Dermomurex (Dermomurex) alabastrum* (Adams). Vokes Coll., height 14.5 mm, diameter 7.3 mm, locality, Portobelo, Panama, in 30 meters. Detail of intritacalx (X 30).

Muricidae. Imagine my surprise to find that the species he had originally named *Aspella pauperculum varians* (1969) but subsequently (1971) placed into synonymy with *Dermomurex cantainei* (Recluz) was the heretofore unrecognized *Dermomurex alabastrum*.

This information was published (Vokes, 1976a) as an addendum to the *Dermomurex* portion of Cenozoic Muricidae and there I compared the Recent *D. alabastrum* with the Floridian fossil species *D. engonatus*, concluding that the two are probably conspecific. But, at that time I hesitated to place the two in synonymy without more material, particularly of the Recent form. Now, I have examined many additional specimens of *D. alabastrum*, including two syntypes at the British Museum (Natural History), as well as exceptionally well preserved examples of *D. engonatus*, and there are no differences.

In addition to new southern Florida localities, there are examples from the Waccamaw Formation (TU 558) of South Carolina in the collection of Richard E. Petit, North Myrtle Beach, South Carolina. We collected one beautiful specimen in the Moín Formation, Costa Rica (TU 1307), as well as several Recent examples from the dredgings for the harbor at Moín (TU R-369). In the collection of Harry G. Lee, Jacksonville, Florida, there is a single juvenile taken at 6 meters depth, off Alligator Cay, Belize.

As noted previously (Vokes, 1975, p. 137), in the collections of the Museum of Paleontology, Berkeley, there is an incomplete specimen from the Tubará Group at Punta Pua, near Cartegena, Dept. of Bolivar, Colombia, which is figured here (pl. 14, fig. 5). James Ernest has also dredged numerous specimens off Portobelo, Panama, at about 30 meters. These show an intritacalx (text-fig. 5) with a pattern resembling a coarsely woven cloth, similar to that in *D. pauperculus**.

*Collectors should learn not to attempt to clean the "limy coating" off of specimens of *Aspella* and *Dermomurex*. When examined under a microscope, the pattern of the intritacalx in each species is dramatically different and each is quite beautiful.

DERMOMUREX (DERMOMUREX) PAUPERCULUS
(C.B. Adams)
Plate 13, figures 8, 9

Dermomurex (Dermomurex) pauperculus (C.B. Adams). VOKES, 1975, Tulane Stud. Geol. Paleont., v. 11, no. 3, p. 138, pl. 2, figs. 4-7; VOKES, 1984, Shells and Sea Life, v. 16, no. 11, p. 212, pl. 1, fig. 16; VOKES, 1985, Veliger, v. 27, no. 4, p. 436, text-fig. 19.

Aspella paupercula (C.B. Adams). RIOS, 1975, Brazilian Mar. Moll. Icon., p. 87, pl. 25, fig. 358.

Dermomurex pauperculus (C.B. Adams). RADWIN and D'ATTILIO, 1976, Murex Shells of the World, p. 47, pl. 1, figs. 25, 26; FAIR, 1976, The Murex Book, p. 65, pl. 16, figs. 215, 215a; RIOS, 1985, Seashells of Brazil, p. 87, pl. 31, fig. 384; DE JONG and COOMANS, 1988, Stud. Fauna Curaçao and Caribbean Isl., no. 214, p. 73, pl. 37, fig. 395.

Synonym:

Triton cantrainei RECLUZ, 1853, Jour. de Conchyl., v. 4, p. 246, pl. 8, fig. 10.

Lectotype: MCZ 156124; height 15.9 mm, diameter 7.8 mm (designated by Clench and Turner, 1950, p. 382).

Type locality: Jamaica.

Occurrence: Fruitville Formation (= "Pinecrest Beds"), Florida; unnamed Pleistocene formation, Panama; Moín Formation, Costa Rica. Recent, from Florida to Ceará, Brazil (Rios, 1985, p. 87), east coast of Central America from Mexico to Panama and northern South America.

Figured specimens: Fig. 8, MCZ 125072, height 30 mm, diameter 14.8 mm; locality, Causeway, Biscayne Bay, Miami, Dade County, Florida. Fig. 9, Stephens Coll., height 15.4 mm, diameter 7.3 mm; locality TU 1000.

Discussion: Dermomurex (Dermomurex) pauperculus is the most abundant and widespread species of *Dermomurex* in the western Atlantic. It is common throughout the Florida Keys. We also have specimens from the Bay Islands, Honduras (TU R-503), Costa Rica (TU R-366), Panama (TU R-181; Portobelo, James Ernest) and Venezuela (Los Roques, Work, 1969; Punta Tarma, Dto. Fed., Pierre Hoeblich; Playa Grande, Dto. Fed., J. Gibson Smith). Radwin and D'Attilio (1976, p. 47) have reported it from Trinidad, de Jong and Coomans (1988, p. 73) from Curaçao, and Rios (1975, p. 87; 1985, p. 87) from Ceará, northern Brazil. It occurs in depths ranging from intertidal to as much as 30 meters, usually under stones or dead coral.

Because of the shallow habitat, this species is rare in the fossil record. One specimen (pl. 13, fig. 9) has been collected in the Fruitville Formation at Sarasota, Florida. We have a single juvenile specimen from the Moín Formation, Costa Rica (TU 954), and there is one incomplete example from the Pleistocene at Mt. Hope, Panama (ANSP 184739). These three specimens complete the known occurrence in the fossil record.

In his report on mollusks occurring in the Los Roques Archipelago, Venezuela, Work listed "*Aspella*" *paupercula*, and figured the egg capsules of individuals raised in captivity (1969, p. 669, text-fig. 4). The capsules are unusual in that they bear little resemblance to typical vase-shaped muricine capsules but are virtually identical to those of the Magellanic *Trophon geversianus* (Pallas, 1774), type of the genus *Trophon*. This almost certainly represents convergence in these only distantly related forms.

Muricid egg capsules, in general, are more reflective of the level of "primitiveness" *vs.* "advancement" than phylogenetic relationships. Presumably, *D. paupercula* is relatively primitive for a member of the Muricinae and Trophon s.s. (which is the only group of the Trophoninae to have such capsules) is the most advanced of the Trophoninae. Unfortunately we have no information on other species of *Dermomurex*, so one cannot say if this is characteristic of the group as a whole, but in most muricids all of the species of a single subgenus have more or less similar (but by no means identical) egg capsules.

Dermomurex (Dermomurex) binghamae Vokes, n. sp.
Plate 14, figure 8

Description: Shell stout, protoconch and early whorls unknown. At least five teleoconch whorls in adult. Axial ornamentation on early whorls of six broad, low ridges; on about fourth teleoconch whorl alternate ridges strengthening into varices, the other ridges remaining as intervarical swellings, best seen at intersection with spiral cords. Varices low, rounded, each abutting corresponding varix on preceding whorl, but placed somewhat abaperturally, forming a spiral line up the spire. Spiral ornamentation of three low indistinct cords on spire whorls, seven cords on body whorl, most obvious adjacent to varices, where deep pits are formed on both ad- and abapertural sides between the cords. Suture impressed, midway between each pair of varices a flattened buttress formed by intervarical ridges, leaving deep pits on either side. Aperture rounded, inner lip smooth, appressed; outer lip with five or six nodules on inner side, corresponding to spaces between spiral cords.

PLATE 14

Figures — Page

1-5. *Dermomurex (Dermomurex) alabastrum* (A. Adams) 64
1. (X 2) USNM 462695; height 25.3 mm, diameter 11.3 mm.
Locality: TU 1512, Florida; Caloosahatchee Formation.
2. (X 3) USNM 462696; height 15.6 mm, diameter 8.5 mm.
Locality: TU 1512, Florida; Caloosahatchee Formation.
3. (X 2) AMNH 186115 (paratype, *Aspella varians* Nowell-Usticke); height 29 mm, diameter 13 mm.
Locality: St. Croix, U.S. Virgin Islands; Recent.
4. (X 3) Vink Coll.; height 14 mm, diameter 7 mm.
Locality: Taganga, near Santa Marta, Colombia; Recent.
5. (X 2) UCMP 39835; height (incomplete) 20.3 mm, diameter 13.6 mm.
Locality: UCMP S-22, Punta Pua, Dept. of Bolivar, Colombia; Tubará Group.
6. *Dermomurex (Dermomurex) sarkini* Vokes, n. sp. (X 4) 69
USNM 377396 (holotype); height 12.7 mm, diameter 6.5 mm.
Locality: TU 1240, Costa Rica; Moín Formation.
7. *Dermomurex (Dermomurex) obeliscus* (A. Adams) (X 2 1/2) 68
USNM 838038; height 23.5 mm, diameter 11 mm.
Locality: Islote Island, Nayarit, Mexico; Recent.
8. *Dermomurex (Dermomurex) binghamae* Vokes, n. sp. (X 2 1/2) 66
USNM 860294 (holotype); height 20 mm, diameter 10.8 mm.
Locality: Norman Cay, Bahama Islands; Recent.

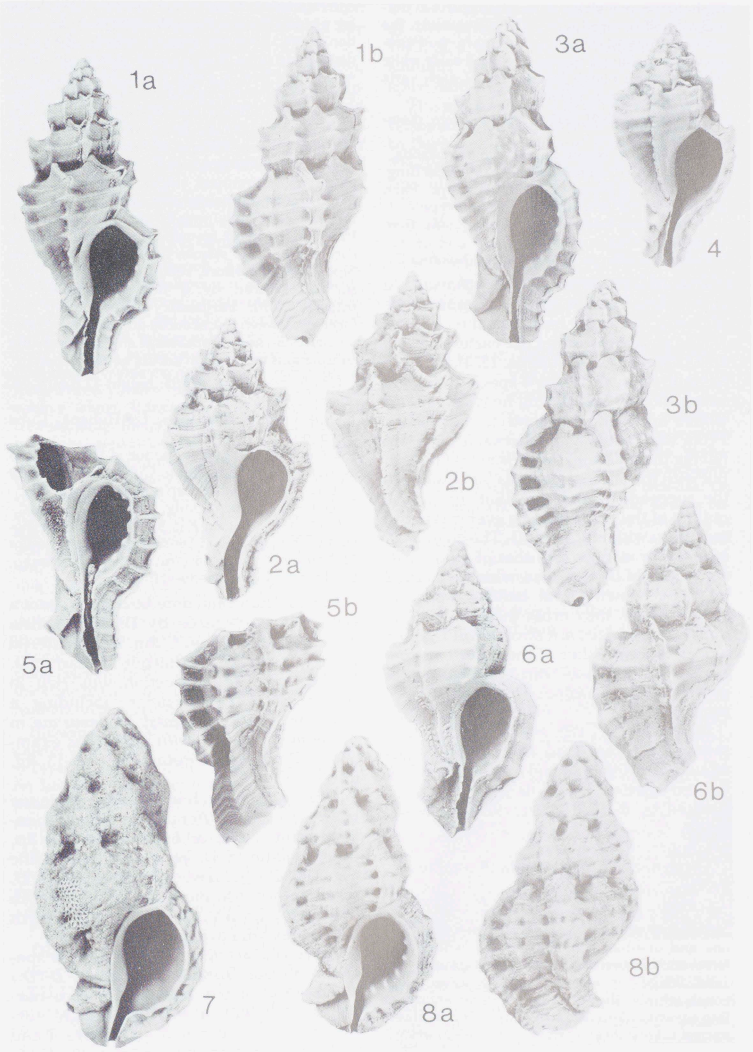


PLATE 14

Siphonal canal short, strongly recurved dorsally. Shell covered with a thick intritacalx, the exact nature of which is unknown (not preserved in holotype specimen). Shell color white with a brown blotch in advance of each varix and strongest at shoulder area.

Holotype: USNM 860294; height 20 mm, diameter 10.8 mm.

Type locality: Norman Cay, Bahama Islands.

Etymology of name: In honor of Patricia Bingham (Mrs. Richard Bingham), West Palm Beach, Florida, who collected the holotype.

Occurrence: Recent only (known only from the type locality).

Figured specimen: USNM 860294 (holotype).

Discussion: Dermomurex binghamae is a short, stout species, with the appearance of being a cross between the Atlantic *D.(D.) pauperculus* and the eastern Pacific *D.(D.) obeliscus* (A. Adams, 1853). From its Atlantic relative, the new species differs in being shorter and having heavier varices, which are better aligned up the spire. From the Pacific *D. obeliscus*, it differs in having the individual whorls more inflated, but with the suture not set as far down onto the succeeding whorl, so that the overall outline of the spire is more evenly tapered (compare with pl. 14, fig. 7). The color of *D. binghamae* is more like that of *D. pauperculus* than of *D. obeliscus*, which is marked by dark brown spiral bands, especially strong where they cross the varices. The intervarical ridges are stronger in *D. binghamae* than in either of the other two species, and combined with the spiral cords give a nodulose appearance to the shell surface.

Unfortunately, the sole example of this new species has had the intritacalx removed but it is assumed to be like that of related species, which is very thick and marked by a linen-like texture (see text-fig. 5).

DERMOMUREX (DERMOMUREX) SARASUAE
Vokes, n. sp.
Plate 15, figures 8, 9

Description: Shell elongated; protoconch of one and one-half smooth, bulbous whorls; six teleoconch whorls in adult. Axial sculpture of six small flanges on each of the first three teleoconch whorls, then every other one enlarging into a varix, alternate ones remaining as intervarical ridges; three varices and three intervarical ridges per whorl. Varices flattened, with a slight angulation at shoulder, each connected to corresponding varix on preceding whorl, forming a spiral line up the spire. Spiral ornamentation weak, none on earliest whorls, gradually developing into three major cords on spire whorls and five on body whorl. Numerous fine threads both on top of and between spiral cords over entire shell surface. Spiral cords crossing over varices, forming large welts. At intersection of intervarical ridges and spiral cords a line of sharp nodules produced. Suture impressed, except at intervarical ridges, where buttress-like structures attach to preceding whorl. Aperture elongate-oval; inner lip smooth, appressed. Inner side of outer lip with five heavy denticles, corresponding to spaces between spiral cords. Siphonal canal short, recurved dorsally. Shell surface covered by a heavy linen-like intritacalx. With intritacalx present deep pits formed between spiral cords adjacent to varices on both ad- and abapertural sides. These not conspicuous without intritacalx being present.

Holotype: USNM 860295; height 17.5 mm, diameter 7.8 mm

Type locality: Marianao, La Habana, Cuba (dredged fill).

Etymology of name: In honor of Dra. Hortensia Sarasua, of La Habana, Cuba, for her many contributions to Caribbean malacology.

Occurrence: Recent only, Cuba to Honduras.

Figured specimens: Fig. 8, USNM 860295 (holotype). Fig. 9, USNM 860296 (paratype); height 12.3 mm, diameter 5.5 mm; locality, Marianao, La Habana, Cuba (dredged fill).

Discussion: Some time back I was sent a collection of muricids by Dra. Hortensia Sarasua, La Habana, Cuba, from material dredged to make the harbor at Marianao, La Habana. The collection was rich in specimens of *Dermomurex*, including a new species, here named *D. sarasuae* in her honor, together with numerous examples of *D.(D.) pacei* Petuch (see pl. 13. fig. 6).

This new species has some resemblance to *D. pacei* but differs in lacking the enlarged inductura, or expanded inner lip, characteristic of *D. pacei* and its Pacific cognate, *D. gunteri*. The varices of *D. sarasuae* are also more persistent than in the latter species, where in late growth stages they tend to disappear.

There is a stronger similarity to the species from the Gurabo Formation, *D.(D.) olssoni* Vokes, but *D. sarasuae* is a narrower shell with a correspondingly narrower aperture (compare pl. 15, figs. 7 and 9). There are also more numerous denticles on the inner side of the outer lip in *D.*

olssoni, which has about eight, often paired denticles; *D. sarasuae* has only five very heavy denticles.

In addition to these Cuban examples, specimens have also been collected by Kevan Sunderland, diving at night, about 18 meters depth, off Utila, Bay Islands, Honduras, and by Emilio Garcia, under rocks at Roatan, Bay Islands.

DERMOMUREX (DERMOMUREX) SARKINI
Vokes, n. sp.
Plate 14, figure 6

Description: Protoconch of one and one-half bulbous whorls, six teleoconch whorls in the immature holotype. Axial ornamentation on early teleoconch of six flange-like varices on each whorl, on sixth teleoconch whorl every other varix reduced to become an intervarical swelling, barely visible except where crossing the suture. Three varices (presumably) on each successive whorl. Varices rounded, with a small free-standing flange along abapertural edge, best developed at base of body whorl. Spiral ornamentation beginning with a single cord at periphery, gradually intercalating a smaller cord on either side; on body whorl five spiral cords, three visible on previous whorls. Faint spiral threads between major cords, barely seen and masked by intritacalx in life. Suture impressed, on adult body whorl interrupted by crossing of intervarical swellings. Aperture rounded; inner lip smooth, appressed; outer lip with probably seven nodules on inner side, those on anterior portion better developed. Siphonal canal moderately long, recurved, with a small fasciole. In life shell surface covered by a thick intritacalx, but only remnant patches remaining on the fossil holotype.

Holotype: USNM 377396; height 12.7 mm, diameter 6.5 mm.

Type locality: TU 1240, Moín Formation; Barrio Los Corales, top of hill at end of road that passes Standard Fruit Co. box factory, 1.8 km north of main highway at Pueblo Nuevo, which is 2 km west of Puerto Limón, Costa Rica.

Etymology of name: In honor of the late Edward Sarkin, of Orlando, Florida, longtime student of the Muricidae.

Occurrence: Moín Formation, Costa Rica.

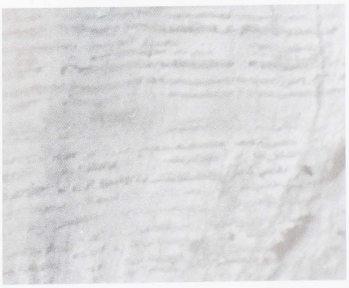
Figured specimen: USNM 377396 (holotype).

Discussion: From the middle Pleistocene beds of the upper Moín Formation (TU 1240, topographically the highest point on the Limón Peninsula; dated as planktic zone N.22 by Dr. W.H. Akers, personal communication), we have a single specimen that is closely related to the European *D.(D.) scalaroides* (Blainville, 1829), type of the genus *Dermomurex* (see Vokes, 1975, pl. 5, fig. 8), but which differs in being smaller, with sharper varices, a lower spire, and a longer siphonal canal.

The morphology of this new species is intermediate between those forms assigned to *Dermomurex* s.s. and those assigned to *Trialatella*, confirming the gradational nature of these two taxa. Radwin and D'Attilio (1976) resolved this difficulty by placing all species in *Dermomurex* s.s., but there is a valid distinction to be made between most of the species. Due to its similarity to the type of the genus, this species is better placed in *Dermomurex* s.s.

DERMOMUREX (DERMOMUREX) WORSFOLDI
Vokes, n. sp.
Plate 13, figures 4, 5; text-figure 6

Description: Shell elongate, protoconch of one and one-half rounded whorls. Teleoconch of five whorls in largest specimen seen, probably six in fully adult shell. Axial ornamentation on earliest teleoconch whorls of six lamellae. On third teleoconch whorl every other lamella enlarged into a varix, alternate ones remaining as angulate intervarical ridges, three varices and three ridges per whorl. Varices thin, sharp-edged, with an angulation at the shoulder. Spiral ornamentation essentially lacking; adult body whorl with four faint flattened cords, best seen crossing and immediately adjacent to var-



Text-figure 6. *Dermomurex (Dermomurex) worsfoldi* Vokes, n. sp. ANSP 369631 (holotype); height 12.8 mm, diameter 6 mm; locality, Grand Bahama Island, Bahama Islands. Detail of intritacalx (X 25).

ices. Suture simple, between each pair of varices a flattened buttress extending across suture to preceding whorl. Aperture ovate, inner lip smooth, appressed entire length. Outer lip smooth, edge crenulated by spiral cords (margin recessed into each almost invisible cord). Siphonal canal moderately long, wide, recurved at distal end. Surface covered by a heavy white intritacalx, when fresh almost smooth; when slightly worn marked by numerous fine spiral tunnels crossing over entire surface.

Holotype: ANSP 369631; height 12.8 mm, diameter 6 mm.

Type locality: Gold Rock, Grand Bahama Island, Bahama Islands, in 24 meters.

Etymology of name: In honor of Mr. Jack Worsfold, who's collection of Bahamian mollusks is now deposited at the Academy of Natural Sciences, Philadelphia.

Occurrence: Recent only, Bahama Islands (known only from vicinity of type locality).

Figured specimens: Fig. 4, ANSP 369631 (holotype). Fig. 5, ANSP 391950 (paratype A); height 9.1 mm, diameter 5.1 mm; locality, Tamarind, Grand Bahama Island, Bahamas.

Discussion: In the Worsfold collection, now at the Academy of Natural Sciences, Philadelphia, there are three specimens originally identified as *Dermomurex abyssicola*, which are, however, a new species. The species is similar to *D. (Trialatella) abyssicola* and, for this reason, there is a question whether it should be assigned to *Trialatella* or to *Dermomurex* s.s. The lack of strong spiral ornamentation and the flattened wing-like varices are characters nearest to *Trialatella*. But there is no varical extension along the siphonal canal and the general appearance of the shell is most similar to *D. sarasuae*, n. sp., differing in having more alate varices, and a more triangular shape due to the extensions of the varices at the shoulder. As discussed further under the subgenus *Trialatella* (below) the assignment of certain species to either *Dermomurex* s.s. or *Trialatella* is totally subjective. The three species, *D. worsfoldi*, *D. kaicherae*, and *D. glicksteini*, are intermediate in the spectrum of characters that define these two subgenera.

From *D.(T.) abyssicola*, this new species is distinguished by its narrower form (compare pl. 13, fig. 4 and pl. 17, fig. 4) and by the presence of varical expansions at the shoulder rather than along the siphonal canal, as is typical of *Trialatella*.

The holotype is the largest specimen known, and it is clearly immature. Given the extreme variability of *Dermomurex* species through the range of growth stages, it is not certain exactly what the adult shell would look like. In addition to

PLATE 15

Figures Page

1, 2. *Dermomurex (Dermomurex) kaicherae* Petuch (X 3) 72
1. USNM 859837 (holotype); height 15.7 mm, diameter 7.9 mm.
Locality: Cabo de la Vela, Guajira Peninsula, Colombia; Recent.
2. USNM 869509; height 15.4 mm, diameter 8.5 mm.
Locality: Tortola, British Virgin Islands; Recent.

3, 4. *Dermomurex (Dermomurex) glicksteini* Petuch 72
3. (X 3) USNM 859836 (holotype); height 16.2 mm, diameter 7.5 mm.
Locality: Palm Beach Island, Palm Beach County, Florida, in 150 meters; Recent.
4. (X 3 1/2) USNM 869510; height 12.8 mm, diameter 5.6 mm.
Locality: Bailey's Bay, Bermuda; Recent.

5-7. *Dermomurex (Dermomurex) olssoni* Vokes 61
5. (X 2 1/2) USNM 323886 (holotype); height 22.7 mm, diameter 10.2 mm.
Locality: TU 1215, Dominican Republic; Gurabo Formation.
6. (X 3) USNM 869511; height 19 mm, diameter 8.1 mm.
Locality: Alder's Cay, Berry's Island, Bahama Islands; Recent.
7. (X 3) USNM 323887 (paratype B); height 14.4 mm, diameter 7 mm.
Locality: TU 1215, Dominican Republic; Gurabo Formation.

8, 9. *Dermomurex (Dermomurex) sarasuae* Vokes, n. sp. (X 3) 68
8. USNM 860295 (holotype); height 17.5 mm, diameter 7.8 mm.
Locality: Marianao, La Habana, Cuba (dredged fill); Recent.
9. USNM 860296 (paratype); height 12.3 mm, diameter 5.5 mm.
Locality: Marianao, La Habana, Cuba (dredged fill); Recent.

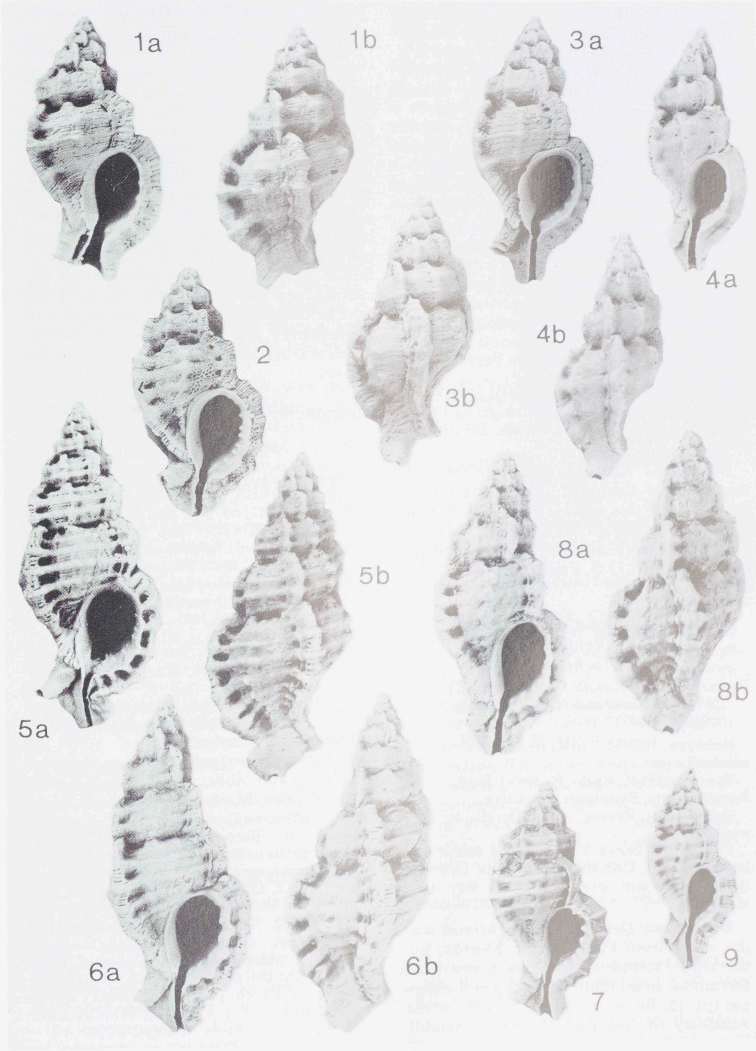


PLATE 15

the holotype, there is a juvenile specimen (height 6.9 mm) from from the type locality (ANSP 391949, paratype B) and there is a third specimen (ANSP 391950, paratype A; pl. 13, fig. 5), from Tamarind, Grand Bahama Island.

DERMOMUREX (DERMOMUREX) KAICHERAE
Petuch
Plate 15, figures 1, 2

Dermomurex (Trialatella) kaicherae PETUCH, 1987, New Caribbean Moll. Faunas, p. 96, pl. 24, figs. 17, 18.

Holotype: USNM 859837; height 15.7 mm, diameter 7.9 mm.

Type locality: Cabo de la Vela, Guajira Peninsula, Colombia.

Occurrence: Recent only, from Virgin Islands to Colombia.

Figured specimens: Fig. 1, USNM 859837 (holotype). Fig. 2, USNM 869509; height 15.4 mm, diameter 8.5 mm, locality, Tortola, British Virgin Islands.

Discussion: Although described from off the coast of Colombia, most examples I have seen of this species have been taken in shallow water in the British Virgin Islands. We have also collected examples from St. Croix, U.S. Virgin Islands (TU R-314).

DERMOMUREX (DERMOMUREX) GLICKSTEINI
Petuch
Plate 15, figures 3, 4

Dermomurex (Trialatella) glicksteini PETUCH, 1987, New Caribbean Moll. Faunas, p. 25, pl. 3, figs. 15, 16.

Holotype: USNM 859836; height 16.2 mm, diameter 7.5 mm.

Type locality: Palm Beach Island, Palm Beach County, Florida, in 150 meters.

Occurrence: Recent only, Florida to Bermuda.

Figured specimens: Fig. 3, USNM 859836 (holotype). Fig. 4, USNM 869510; height 12.8 mm, diameter 5.6 mm; locality, Bailey's Bay, Bermuda.

Discussion: Dermomurex glicksteini was described from Palm Beach, Florida, but the only examples I have seen are from Bermuda. In addition to the figured example (pl. 15, fig. 4), in the collections of the Academy of Natural Sciences, Philadelphia, there are several beachworn shells from Gibbett's Beach, Bermuda (ANSP 314820).

Subgenus GRACILIMUREX Thiele, 1929

Gracilimurex THIELE, 1929, Handbuch Syst. Weichtierkunde, v. 1, p. 289.

Type species: *Murex bicolor* Thiele, 1929 (*non M. bicolor* Risso, 1826, *etc.*, = *Aspella bakeri* Hertlein and Strong, 1951), by original designation.

Discussion: Adult shells of the two species of *Gracilimurex* (the eastern Pacific *D. bakeri* and the western Atlantic *D. elizabethae*) superficially resemble members of the genus *Aspella*, as discussed previously (Vokes, 1975, p. 129); however, this is the result of convergence, as the radulae are markedly dissimilar and the shell ornamentation is more closely akin to *Dermomurex* s.s. For these reasons the taxon is considered a subgenus of *Dermomurex*.

DERMOMUREX (GRACILIMUREX) ELIZABETHAE
(McGinty)
Plate 16, figures 1-5

Dermomurex (Gracilimurex) elizabethae (McGinty). VOKES, 1975, Tulane Stud. Geol. Paleont., v. 11, no. 3, p. 141, pl. 3, figs. 1 (holotype), 2; VOKES, 1984, Shells and Sea Life, v. 16, no. 11, p. 212, pl. 1, fig. 18 (holotype); VOKES, 1985, Veliger, v. 27, no. 4, p. 437, text-fig. 10 (holotype).

Dermomurex (Gracilimurex) cf. *elizabethae* (McGinty). VOKES, 1975, Tulane Stud. Geol. Paleont., v. 11, no. 3, p. 141, pl. 3, figs. 3, 4.

Dermomurex elizabethae (McGinty). RADWIN and D'ATTILIO, 1976, Murex Shells of the World, p. 45, pl. 1, figs. 15, 16 (holotype); FAIR, 1976, The Murex Book, p. 39, pl. 16, fig. 210 (holotype), 213 (as cf. *elizabethae*, *ex* Vokes, 1975, pl. 3, fig. 4).

Holotype: ANSP 176449; height 12.5 mm, diameter 5.8 mm.

Type locality: Middle Sambo Shoals, near Key West, Monroe County, Florida.

Occurrence: Bermont Formation. Florida. Recent, Florida to Bahamas and Virgin Islands.

Figured specimens: Fig. 1, ANSP 176449 (holotype). Fig. 2, USNM 869512; height 13.4 mm, diameter 6.5 mm; locality TU R-42. Fig. 3, USNM 739572; height 16.4 mm, diameter 7.8 mm; locality, Pompano Beach, Broward County, Florida (dredged fill). Fig. 4, USNM 869513, height 19.6 mm, diameter 8.7 mm; locality, Pompano Beach, Broward County, Florida, in 3 to 4 meters. Fig. 5, USNM 647443; height 18.5 mm, diameter 8 mm; locality TU 759.

Discussion: When *Dermomurex (Gracilimurex) elizabethae* was previously treated (Vokes, 1975, p. 141) there was a question

of whether the fossil specimens, which occurred only along the Caloosahatchee River (TU 759 and TU 803), were the same species or a form that was intermediate between *D. engonatus* and *D. elizabethae*. Since that time, I have seen many more examples of Recent *D. elizabethae* and the two forms are the same. The holotype of *D. elizabethae* is a relatively small shell, but a growth series from Pompano Beach indicates that this species attains a height of over 20 mm. These larger specimens more closely resemble the fossil examples (compare pl. 16, figs. 4 and 5). In the collection of Harry G. Lee, Jacksonville, Florida, there are two examples taken together at Virgin Gorda, British Virgin Islands, in 3 meters depth, which match the two forms exactly.

In the same discussion, it was questioned whether the fossil specimens were from the "Glades" fauna, now the Bermont Formation, or the underlying Caloosahatchee Formation. At that time there was but a single specimen attributable to *D. engonatus* known from the post-Caloosahatchee beds of Florida, and I speculated about whether *D. elizabethae* had replaced the older species. As stated above, "*D. engonatus*" is alive and well in the area to the south of Florida living under the name of *D. alabastrum*, and the species has simply shifted geographically to warmer waters due to climatic cooling after the Caloosahatchee Formation.

The presence of the closely related species *D.(G.) bakeri* (Hertlein and Strong) (pl. 16, fig. 6) in the eastern Pacific leads to the suggestion that the two cognate forms have a common ancestor, not yet discovered, somewhere in the Miocene and the resemblance to *D. engonatus/alabastrum* is only generic.

Subgenus TRIALATELLA Berry, 1964

Trialatella BERRY, 1964, Leaflets in Malac., v. 1, no. 24, p. 149.

Type species: *Trialatella cunninghamae* Berry, 1964, by original designation.

Discussion: In the last few years a number of new species have been referred to the subgenus *Trialatella*. Some are typical members of the group with alate varices (*D. oxum, D. cuna [= D. antecessor], D. leali*) but some are not greatly different from *Dermomurex (Dermomurex) alabastrum (D. kaicherae, D. glicksteini)*.

The actual differences between *Trialatella* and *Dermomurex* s.s. are difficult to list but, in general, in *Trialatella* the spire is shorter and the siphonal canal is more elongated. There is an extension of the varices along the base of the body whorl and siphonal canal, which may be even further expanded by the intritacalx. The early whorls tend to retain the juvenile six varices per whorl longer in the growth cycle than do members of *Dermomurex* s.s.

This is a relatively consistent morphotype that may be recognized as "typical" *Trialatella*. Although *D. glicksteini* and *D. kaicherae* have somewhat more elongated siphonal canals than the typical *Dermomurex* s.s. form, they are more closely related to it than to *Trialatella* and are, therefore, treated as members of the group.

Dermomurex (Trialatella) farleyensis Vokes

Plate 16, figure 7

Dermomurex (Trialatella) farleyensis VOKES, 1975, Tulane Stud. Geol. Paleont., v. 11, no. 3, p. 144, pl. 4, fig. 1.

Holotype: USNM 647448; height 14.5 mm, diameter 7.5 mm.

Type locality: TU 999, Chipola Formation; Farley Creek, about 300 yards (275 meters) downstream from bridge of Florida Highway 275 (SW 1/4 Sec. 21, T1N, R9W), Calhoun County, Florida.

Occurrence: Chipola Formation, Florida.

Figured specimen: USNM 647448 (holotype). Additional locality: TU 1196.

Discussion: The oldest known species of *Trialatella* is *D.(T.) farleyensis*, known almost exclusively from the exposures of the Chipola Formation along Farley Creek, Calhoun County, Florida. No additional information can be added.

Dermomurex (Trialatella) pterynoides Vokes

Plate 16, figure 8

Dermomurex (Trialatella) pterynoides VOKES, 1989, Bulls. Amer. Paleontology, v. 97, no. 332, p. 61, pl. 7, figs. 9-11.

Holotype: PRI 30013; height 20 mm, diameter 9.6 mm.

Type locality: Zone I (? = TU 1282), Cercado Formation; Río Cana, "Orchid Gorge," above

the bridge at Caimito, Dominican Republic.

Occurrence: Cercado and Gurabo formations, Dominican Republic.

Figured specimen: PRI 30013 (holotype). Additional localities: TU 1227A, 1250.

Discussion: In the material at the Paleontological Research Institution, Ithaca, New York, collected by the Maury 1916 Expedition to the Dominican Republic, there is a beautiful specimen of *Trialatella*, which Maury did not include in her study of the fauna (Maury, 1917). In our collections made in the Dominican Republic there are several additional specimens but none as well preserved as Maury's, which is the holotype of the species.

The Mio/Pliocene Dominican *D.(T.) pterynoides* is similar to the Pleistocene *D.(T.) antecessor* but differs in that the varices are perfectly aligned up the spire, causing it to have a superficial resemblance to members of the genus *Pterynotus;* hence the name.

DERMOMUREX (TRIALATELLA) ANTECESSOR
Vokes
Plate 17, figures 1, 2

Dermomurex (Trialatella) antecessor VOKES, 1975, Tulane Stud. Geol. Paleont., v. 11, no. 3, p. 145, pl. 4, figs. 5, 6.

Synonym:

Dermomurex (Trialatella) cuna PETUCH, 1990, Nautilus, v. 104, no. 2, p. 60, text-figs. 9, 10.

Holotype: USNM 647446; height 17 mm, diameter 8.2 mm.

Type locality: TU 954, Moín Formation; hillcut immediately behind Standard Fruit Company box factory, just west of cemetery at Pueblo Nuevo, about 2 km west of Puerto Limón, Costa Rica.

Occurrence: Moín Formation, Costa Rica; Bermont Formation, Florida. Recent, Panama.

Figured specimens: Fig. 1, USNM 647446 (holotype). Fig. 2, USNM 860527 (holotype, *Dermomurex cuna*); height 14.3 mm, diameter 7.1 mm; locality, Portobelo, Panama, in 65 meters. Additional localities: TU 1239, 1240.

Discussion: Petuch recently (1990, p. 60, text-figs. 9, 10) described a new species of *Trialatella* from off Portobelo, Panama. In comparing it to the "possible Pleistocene ancestor" *D.(T.) antecessor*, he noted that the latter differed in "being a more elongated species with less developed varices and coarser corded body whorl sculpture" (*ibid.*, p. 62). He neglected to take into account the very different appearance of *Trialatella* species when the intritacalx is present and when it is removed. If the holotype of *D. cuna* were "cleaned" it would look just like *D. antecessor*.

In the description of *D.(T.) cuna*, Petuch considered the small specimen from off Panama that I originally figured as *D.(T.)*

PLATE 16

Figures Page

1-5. *Dermomurex (Gracilimurex) elizabethae* (McGinty) 72
1. (X 4) ANSP 176449 (holotype); height 12.5 mm, diameter 5.8 mm.
Locality: Middle Sambo Shoals, near Key West, Monroe County, Florida; Recent.
2. (X 4) USNM 869512; height 13.4 mm, diameter 6.5 mm.
Locality: TU R-42, Florida; Recent.
3. (X 3) USNM 739572; height 16.4 mm, diameter 7.8 mm.
Locality: Pompano Beach, Broward County, Florida (dredged fill); Recent.
4. (X 3) USNM 869513, height 19.6 mm, diameter 8.7 mm.
Locality: Pompano Beach, Broward County, Florida, in 3 to 4 meters; Recent.
5. (X 3) USNM 647443; height 18.5 mm, diameter 8 mm.
Locality: TU 759, Florida; Bermont Formation.
6. *Dermomurex (Gracilimurex) bakeri* (Hertlein and Strong) (X 3) 73
USNM 869514; height 17.5 mm, diameter 8.5 mm.
Locality: Manzanillo, Colima, Mexico; Recent.
7. *Dermomurex (Trialatella) farleyensis* Vokes (X 3) 73
USNM 647448 (holotype); height 14.5 mm, diameter 7.5 mm.
Locality: TU 999, Florida; Chipola Formation.
8. *Dermomurex (Trialatella) pterynoides* Vokes (X 3) 73
PRI 30013 (holotype); height 20 mm, diameter 9.6 mm.
Locality: Zone I (? = TU 1282), Dominican Republic; Cercado Formation.

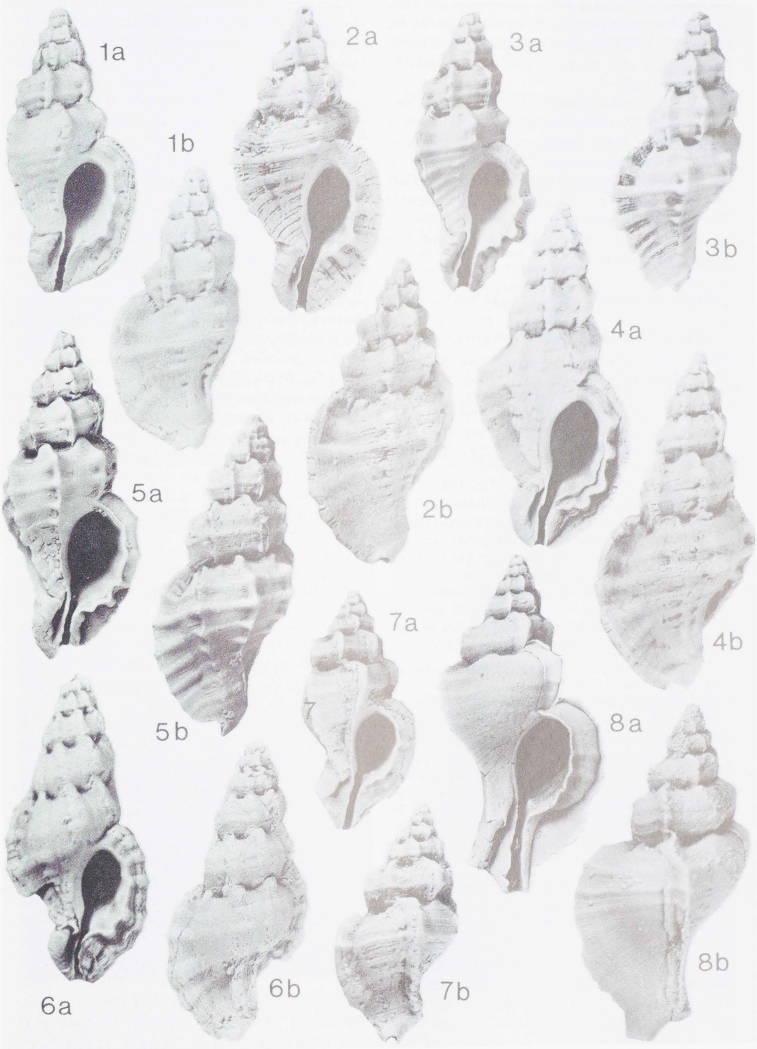


PLATE 16

abyssicola (Vokes, 1975, pl. 4, fig. 3 – subsequently changed to *D. oxum*) also to be referable to *D. cuna*. Geography not withstanding, I still place it with *D. oxum*, as discussed below.

The "unnamed post-Caloosahatchee formation" of Florida, in which this species is represented by a single specimen from locality TU 201 (paratype, Vokes, 1975, pl. 4, fig. 5), is now known as the Bermont Formation. However, I know of no additional Florida specimens, although we have collected several more examples from the Moín Formation.

DERMOMUREX (TRIALATELLA) ABYSSICOLA (Crosse)

Plate 17, figures 3-5; text-figures 7, 8

Dermomurex (Trialatella) abyssicola (Crosse). VOKES, 1975, Tulane Stud. Geol. Paleont., v. 11, no. 3, p. 148 (in part), pl. 4, fig. 2; not pl. 4, fig. 3 (= *D. oxum*); VOKES, 1984, Shells and Sea Life, v. 16, no. 11, p. 212, pl. 1, fig. 20; VOKES, 1985, Veliger, v. 27, no. 4, p. 437, text-fig. 14.

Dermomurex abyssicola (Crosse). RADWIN and D'ATTILIO, 1976, Murex Shells of the World, p. 44, text-fig. 22 (after Crosse, 1865, pl. 1, fig. 4); LEAL, 1991, Mar. Prosobranch Gast. Oceanic Islands Brazil, p. 141 (in part, not references to *D. oxum*).

Trialatella abyssicola (Crosse). FAIR, 1976, The Murex Book, p. 17, unnumbered text-fig. (after Crosse, 1865, pl. 1, fig. 4); not pl. 16, figs. 214, 214a (= *D. oxum*).

Holotype: Not found; height 11 mm, diameter 6 mm (*fide* Crosse, 1865, p. 30).

Type locality: Guadeloupe, Lesser Antilles.

Occurrence: Recent only, from Bahama Islands and Gulf of Mexico to Lesser Antilles.

Figured specimens: Fig. 3, Holotype (after Crosse, 1865, pl. 1, fig. 4). Fig. 4, ANSP 368988; height 14 mm, diameter 7.2 mm; locality, Tamarind, Grand Bahama Island, Bahamas, in 46 to 54 meters. Fig. 5, MNHN; height 7.7 mm, diameter 4.2 mm; locality, Guadeloupe, Lesser Antilles, in 4 meters.

Discussion: Although described over 100 years ago, this species has eluded workers with great success. In the Worsfold collection at the Academy of Natural Sciences, Philadelphia, there is one unquestionable example of this rare form. The holotype was described from 250 fathoms (456 meters) but it is unlikely that the species lives this deep. The Worsfold specimen is from about 50 meters, which is a more probable depth.

By comparing the illustrations of the holotype and the Bahamian example (pl. 17, figs. 3, 4) one can see that the two are identical, including the strange "stripe" encircling the base of the body whorl, which is an area where the intritacalx decorticates. The intritacalx on this species is very distinctive. When unworn, it is marked by a latticework of axial and spiral lines with small punctae developed at the intersections. This is in marked contrast to the intritacalx of *D.(T.) oxum*, which when unworn has a "gritty" appearance, as though small sand grains were embedded in it (compare text-figs. 7 and 9). When worn, both species develop the ornamentation seen in the illustration of the holotype of *D. abyssicola*, with a combination of strong spiral grooves and short axial lines (see text-fig. 8; pl. 17, fig. 8).

I figured a small specimen from off Cape San Blas, Panama (Vokes, 1975, pl. 4, fig. 3) as *D.(T.) abyssicola*, but later changed it to *D.(T.) oxum* Petuch (Vokes, 1985a, p. 437, text-fig. 13). In the description of another western Atlantic species of *Trialatella*, Petuch (1990, p. 60) stated his belief that "this now well known specimen" is, in fact, an example of his *D. cuna*. Comparison of the shell with the holotypes of both *D. cuna* [i.e., *D. antecessor*] and *D.*

Text-figure 7. *Dermomurex (Trialatella) abyssicola* (Crosse); MNHN; height 6.4 mm, diameter 3.3 mm; locality, Guadeloupe, Lesser Antilles, in 4 meters. Detail of intritacalx (X 60).

Text-figure 8. *Dermomurex (Trialatella) abyssicola* (Crosse); ANSP 368988; height 14 mm, diameter 7.2 mm; locality, Tamarind, Grand Bahama Island, Bahamas. Detail of intritacalx (X 25).

oxum (pl. 17, figs. 2, 6, 7) shows that the small Panama shell has the lower spire and heavier spiral cords of *D. oxum*.

At the Muséum National d'Histoire Naturelle, Paris, there are numerous specimens collected by J.P. Pointier from the island of Guadeloupe, the type locality of *D.(T.) abyssicola*. One of the juvenile Guadeloupe specimens, also with an intact intritacalx, is figured here (pl. 17, fig. 5) for comparison with the juvenile *D. oxum*. In addition to the differences in the intritacalx, the decrease in number of varices is delayed so that the shell retains six varices until about the fifth teleoconch whorl in *D. abyssicola* (compare pl. 17, figs. 5 and 7). *Dermomurex abyssicola* apparently lacks the wide varical expansions of *D. oxum*. This also is apparent in the larger specimens (pl. 17, figs. 4, 6). Evidently, *D. abyssicola* does not develop the "typical" *Trialatella* flange along the siphonal canal. Nevertheless, with its resemblance to *D. oxum*, it should be included in this subgenus.

In addition to these figured examples, in my collection there is one specimen said to be dredged off Cedar Key, Florida, at 45 meters depth, by Jim Moore of Bradenton, Florida. If this locality is correct, the range of this species is almost as widespread as *D.(D.) pauperculus*. Its deeper habitat explains why it is less well represented in collections.

DERMOMUREX (TRIALATELLA) OXUM Petuch

Plate 17, figures 6-8; text-figure 9

Dermomurex (Trialatella) abyssicola (Crosse). VOKES, 1975, Tulane Stud. Geol. Paleont., v. 11, no. 3, p. 148 (in part), pl. 4, fig. 3 only (not of Crosse).

Trialatella abyssicola (Crosse). FAIR, 1976, The Murex Book, p. 17 (in part), pl. 16, figs. 214, 214a only (after Vokes pl. 4, fig. 3).

Dermomurex (Trialatella) oxum PETUCH, 1979, Biol. Soc. Washington, Proc., v. 92, no. 3, p. 517, text-figs. 1E, 1F; VOKES, 1985, Veliger, v. 27, no. 4, p. 432, text-figs. 12 (holotype), 13; PETUCH, 1987, New Caribbean Moll. Faunas, pl. 27, figs. 10, 11 (holotype); PETUCH, 1988, Neogene Hist. Trop. Amer. Moll., p. 163, pl. 39, figs. 18, 19 (holotype); HOUART, 1991, Nautilus, v. 105, no. 1, p. 27, text-figs. 1 (intritacalx), 26 (shell).

Dermomurex abyssicola (Crosse). LEAL, 1991, Mar. Prosobranch Gast. Oceanic Islands Brazil, p. 141 (in part).

Holotype: USNM 780648; height 12.5 mm, diameter 6.6 mm.

Type locality: Santa Barbara Island, Abrolhos Archipelago, Bahia, Brazil, in 25 meters.

Occurrence: Recent only, Panama to Brazil.

Figured specimens: Fig. 6, USNM 780648 (holotype). Fig. 7, USNM 739671; height 9 mm, diameter 4 mm; locality TU R-98. Fig. 8, MNHN; height 15.5 mm, diameter 8 mm; locality, Vitória

Text-figure 9. *Dermomurex (Trialatella) oxum* Petuch. USNM 739671; height 9 mm, diameter 4 mm; locality TU R-98. Detail of intritacalx (X 25).

Bank, Espírito Santo, Brazil, in 52 meters (photograph courtesy of R. Houart).

Discussion: Originally, Petuch did not compare *D. oxum* to *D. abyssicola*, stating only that it was the only Atlantic species of Dermomurex resembling the new species. Although the two forms are extremely similar there are certain differences in the overall shape and, especially, in the nature of the intritacalx, as discussed above. Furthermore, according to J.P. Pointier, of the Muséum National d'Histoire Naturelle, Paris, who has collected numerous examples of *D. abyssicola* in Guadeloupe, the latter is never associated with coral-reefs (as is *D. oxum*) but is found on the under side of rocky ledges in about 5 meters depth (personal communication).

Leal (1991, p. 142) considers *D. oxum* and *D. abyssicola* to be the same species, adding that neither Petuch (1979) nor Vokes (1985a) had actually compared *D. oxum* with material from Guadeloupe. The fact that in 1985, I figured both *D. oxum* (1985a, figs. 12, 13) and a specimen from Guadeloupe, which I identified as *D. abyssicola* (1985a, fig. 14), should indicate that I had compared them and considered them to be distinct species, although I did not discuss the comparison.

DERMOMUREX (TRIALATELLA) LEALI Houart
Plate 17, figure 9

Dermomurex sp. 1, LEAL, 1991, Mar. Prosobranch Gast. Oceanic Islands Brazil, p. 142.

Dermomurex (Trialatella) leali HOUART, 1991, Nautilus, v. 105, no. 1, p. 27, text-figs. 2 (intritacalx), 5 (protoconch), 27, 28 (both holotype).

Holotype: MORG 26.457; height 9.5 mm, diameter 5.6 mm.

Type locality: *Marion-Dufresne* Station DC 22, Vitória Bank, Espírito Santo, Brazil, in 52 meters.

Occurrence: Recent only (known only from type locality).

Figured specimen: MORG 26.457 (holotype; photograph courtesy of R. Houart).

PLATE 17

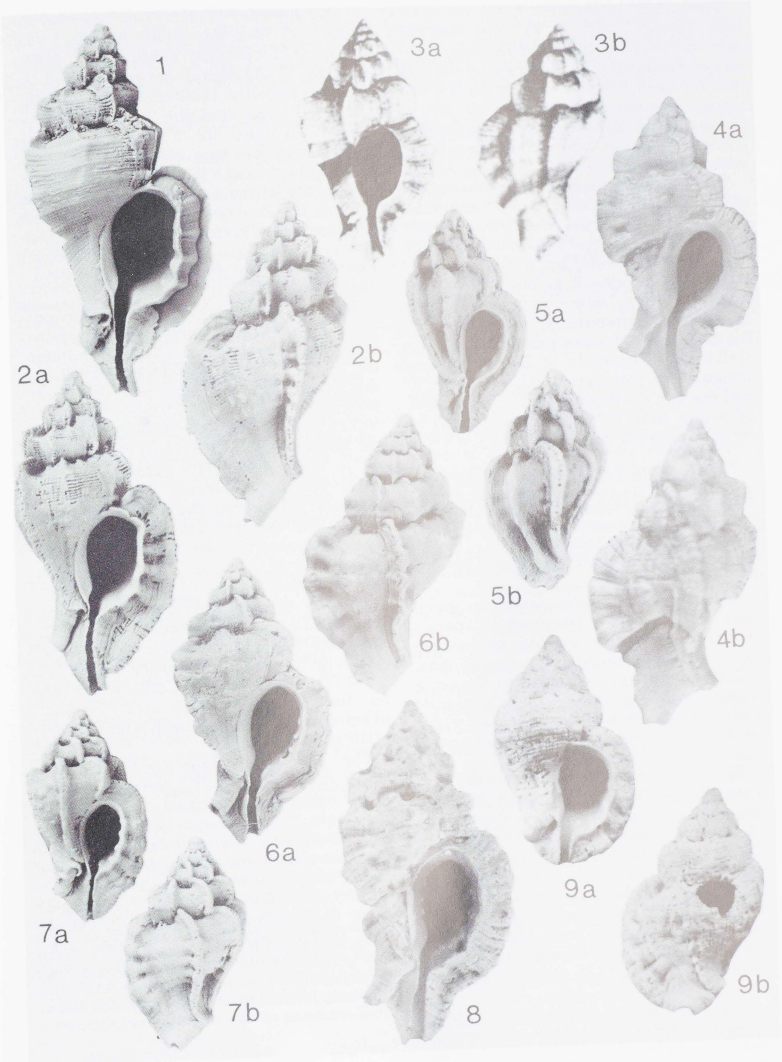


PLATE 17

Discussion: In his description of *D.(T.) leali*, Houart (1991a, p. 31) separated his new species from the other Brazilian species of *Trialatella*, *D.(T.) oxum* by the fact that his shell has five varices on the last whorl, in contrast to three in *D. oxum*. However, it is obvious that his specimen is a juvenile, and an adult would have three varices.

The distinguishing characteristics include the intritacalx, which is much coarser in *D. leali*, the more inflated body whorl, and the shorter siphonal canal. This is a valid new species but it would be misleading to describe it as having five varices; the adult, when found, will have three varices. Houart's type specimen is at the same stage of development as the "now well-known" example of *D. oxum* mentioned above (compare pl. 17, figs. 7 and 9) and one can see that it is just at the point of changing from six varices per whorl to three varices per whorl.

Subgenus TAKIA Kuroda, 1953

Takia KURODA, 1953, Venus, v. 17, p. 190.

Type species: *Murex inermis* Sowerby, 1841 (*non M. inermis* Philippi, 1836, *etc.* = *Dermomurex infrons* Vokes, 1974), by original designation.

Discussion: When the American members of the group of *Dermomurex* species that retain six varices throughout their development were originally studied (Vokes, 1975), several were assigned to *Viator*, a subgenus distinguished by a long *straight* siphonal canal, in contrast to species with a long *recurved* siphonal canal, which are assigned to the subgenus *Takia*.

This decision was based upon the premise that these Oligocene-Early Miocene species were somehow ancestral to the line of the Australian Recent *Dermomurex (Viator) antonius* Vokes, 1974, type of that subgenus. At the time, it was noted that the "Australian Middle Miocene (Balcombian) *D.(V.) asteriscus* (Tate) clearly shows the transition from the relatively short-canaled *D. sexangulus* to the very long-canaled Recent *D. antonius*" (Vokes, 1975, p. 153).

This was changed by the discovery of an Australian species that is not only contemporary with, but remarkably similar in appearance to, the American Late Oligocene *D. sexangulus* (Dall). This Australian "copy" of the American species was named *D.(T.) imitator* Vokes (1985b, p. 53, pl. 2, fig. 7). As both *D. sexangulus* and *D. imitator* have the relatively short, slightly recurved canal and the large inductura (expanded inner lip) of typical *Takia*, in contrast to the long straight canal and small inductura of *Viator*, it was decided to place both of these Oligocene species, as well as the American descendants of the line back into *Takia*, and let the Australian line evolve in place, though a series of species discussed at the same time (Vokes, 1985b, pp. 52-57).

Thus, as presently construed, the evolution of *Viator* would begin with the Late Oligocene *Dermomurex (Takia) imitator* (pl. 18, fig. 7), which would then give rise to the *Viator* line, beginning with the Early Miocene *Dermomurex (Viator) darraghi* Vokes, 1985, continuing through the Middle Miocene *D.(T.) asteriscus* (Tate, 1888), on to the living *D.(T.) antonius* Vokes, 1974. No unexplainable long distance transport is required; the only puzzling aspect is the extreme similarity of the two Late Oligocene species, which must have been derived from an as-yet unknown common ancestor.

Another species described at the same time, *D.(T.) cretaceus* Vokes (1985b, p. 52, pl. 2, figs. 4-6) from the Early Oligocene of Australia, is probably ancestral to the living *D.(T.) bobyini* Kosuge, 1984, which differs from the type species, *D.(T.) infrons*, in being more angulate, with a strong fold at the shoulder.

The other two Indo-Pacific species *D.(T.) infrons* and *D.(T.) wareni* Houart, 1991, recently described from New Caledonia, are believed to be descendants of the European Oligocene *D.(T.) cotteavi* (Meunier, 1880), and the single living eastern Pacific form, *D.(T.) myrakeenae* (Emerson and D'Attilio, 1970), is presumed to be derived from the American Oligocene *D.(T.) cookei* Vokes. At this time there are no known species of *Takia* living in the Atlantic Ocean – but given the rate of discovery of new species of *Dermomurex* in the Caribbean of late, one may yet appear.

DERMOMUREX (TAKIA) COOKEI Vokes
Plate 18, figures 1, 2

Dermomurex (Takia) cookei MacNeil MS *in*

VOKES, 1975, Tulane Stud. Geol. Paleont., v. 11, no. 3, p. 149, pl. 5, figs. 2-4; MACNEIL and DOCKERY, 1984, Mississippi Bur. Geol., Bull. 124, p. 127, pl. 4, figs. 15, 18, 19 (holotype), 20 (paratype A), pl. 18, figs. 8, 14, 20 (paratype B).

Holotype: USNM 647449; height 20.5 mm, diameter 11 mm.

Type locality: USGS 15085, Red Bluff Formation; Chickasawhay River, about one mile [1.6 km] southwest of Hiwannee, Wayne County, Mississippi (= TU 226).

Occurrence: Red Bluff and Mint Springs formations, Mississippi.

Figured specimens: Fig. 1, USNM 647449 (holotype). Fig. 2, USNM 462697; height 14.4 mm, diameter 7.6 mm; locality MGS 37, Red Bluff, Chickasawhay River, Wayne County, Mississippi (= TU 1289). Additional locality: TU 1289.

Discussion: In the collections of the Mississippi Geological Survey there are several additional examples of *D.(T.) cookei*, all from the general type area on the Chickasawhay River. One of these is a juvenile in which the intritacalx is unusually well preserved (pl. 18, fig. 2), showing that when unbroken it is nearly smooth and when broken relatively large spiral tubes are exposed.

DERMOMUREX (TAKIA) PORTELLI
Vokes, n. sp.
Plate 18, figures 3, 4

Dermomurex (Viator) aff. *D.(V.) sexangulus* (Dall). ROSSBACH and CARTER, 1991, Jour. Paleontology, v. 65, no. 1, p. 98, text-figs. 9.8, 9.9.

Description: Shell large for the genus, body whorl greatly inflated. Protoconch and early whorls not known; at least six teleoconch whorls in the adult. Axial ornamentation on all early whorls of seven rounded varices, increasing to nine on adult body whorl (gerontic?). Each varix abutted against corresponding varix of preceding whorl but slightly abapertural to it, forming a spiral line up the spire whorls. Spiral ornamentation of two ill-defined cords on spire whorls, six major cords on body whorl, plus several smaller cords on sub-sutural ramp and siphonal canal, all crossing both varices and intervarical spaces with equal strength. Superimposed upon the larger cords tertiary threads covering the entire shell surface. Suture impressed between varices creating deep pits. Aperture rounded, inner lip smooth, appressed at posterior end, with a wide, flaring inductura developed on anterior portion. Inner side of outer lip with seven strong lirae, corresponding to the spaces between the spiral cords. Siphonal canal long, slightly recurved at distal end, almost sealed over but open by a narrow slit. In life, shell covered by a thick intritacalx, but only remnant patches remaining in fossil state.

Holotype: UF 32456; height 28.1 mm, diameter 17.2 mm.

Type locality: Suwannee Limestone; Terramar (SW 1/4 Sec. 10, T26S, R22E), Polk County, Florida.

Etymology of name: In honor of Roger W. Portell, Florida Museum of Natural History, Gainesville, Florida, who collected the type specimen.

Occurrence: Suwannee Limestone, Florida; River Bend Formation, North Carolina.

Figured specimens: Fig. 3, UF 32456 (holotype). Fig. 4, UNC 14037-339 (paratype); height (incomplete) 22.3 mm, diameter (incomplete) 15.7 mm; locality Martin Marietta Quarry, about 1.6 km northwest of New Bern, Craven County, North Carolina.

Discussion: Rossbach and Carter (1991), in a study of the mollusks of the River Bend Formation (= part of the Trent Formation of older literature), determined that the fauna was of Vicksburgian or at least pre-Chickasawhayan age for exposures at New Bern, Craven County, North Carolina. They figured two examples of a muricid gastropod, which they assigned to *Dermomurex (Viator)* aff. *D.(V.) sexangulus*, noting that the latter "has a more step-like appearance to its spire and more robust spiral cords with larger interspaces" (*ibid.*, p. 98).

One of their two figured specimens is the same species as a specimen collected from the Suwannee Limestone of Florida, here described as *D.(T.) portelli*, confirming Rossbach and Carter's age determination for the New Bern beds. The second specimen (UNC 14037-139) is not as well preserved (see pl. 18, fig. 5) and does not show the deep pits along the suture characteristic of this new species. However, on the basis of size, number of varices, number of spiral whorls, etc., I can find no basis to separate the two examples. It is probable that the second specimen is simply atypical but, for this reason, I decided not to make it a paratype.

From the slightly younger *D.(T.) sexangulus*, this new species differs in being less massive, having more numerous spiral cords, a longer siphonal canal, and a more expanded inductura. This latter feature and the elongate lirae on the inner side of

the outer lip are similar to the same structures in the younger *D.(T.) vaughani*, from the Chipola Formation. In general aspect, *D. portelli* resembles the latter species, but has a higher spire and a shorter, more recurved siphonal canal.

DERMOMUREX (TAKIA) SEXANGULUS (Dall)
Plate 18, figure 6

Dermomurex (Viator) sexangulus (Dall). VOKES, 1975, Tulane Stud. Geol. Paleont., v. 11, no. 3, p. 152, pl. 6, figs. 1 (holotype), 2 (holotype, *Murex gilletteorum*).

Dermomurex (Takia) sexangulus (Dall). VOKES, 1985, Malac. Soc. Australia, Jour., v. 7, nos. 1-2, p. 53, pl. 2, fig. 2 (holotype, *Murex gilletteorum*).

Synonym:

Murex (Panamurex) gilletteorum VOKES, 1963, Tulane Stud. Geol., v. 1, no. 3, p. 160, pl. 2, fig. 1.

Holotype: USNM 165086; height 21.4 mm, diameter 14 mm.

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

Occurrence: Tampa Limestone, Florida; "Silverdale Beds" (= Silverdale Formation = Haywood Landing Member, Belgrade Formation), North Carolina.

Figured specimen: USNM 644377 (holotype, *Murex gilletteorum*); height 43.5 mm, diameter 26 mm; locality TU 562.

Discussion: As is discussed further under the species *Pterynotus (Purpurellus)*

PLATE 18

Figures Page

1, 2. *Dermomurex (Takia) cookei* MacNeil MS *in* Vokes 80
1. (X 3) USNM 647449 (holotype); height 20.5 mm, diameter 11 mm.
Locality: USGS 15085, Chickasawhay River, Wayne County, Mississippi (= TU 226); Red Bluff Formation.
2. (X 4) USNM 462697; height 14.4 mm, diameter 7.6 mm.
Locality: MGS 37, Red Bluff, Chickasawhay River, Wayne County, Mississippi (= TU 1289); Red Bluff Formation.

3, 4. *Dermomurex (Takia) portelli* Vokes, n. sp. (X 2) 81
3. UF 32456 (holotype); height 28.1 mm, diameter 17.2 mm.
Locality: Terramar, Polk County, Florida; Suwannee Limestone.
4. UNC 14037-339 (paratype); height (incomplete) 22.3 mm, diameter (incomplete) 15.7 mm.
Locality: Martin Marietta Quarry, New Bern, Craven County, North Carolina; River Bend Formation.

5. (?) *Dermomurex (Takia) portelli* Vokes, n. sp. (X 2) 81
UNC 14037-139; height (incomplete) 22.8 mm, diameter (incomplete) 16.2 mm.
Locality: Martin Marietta Quarry, New Bern, Craven County, North Carolina; River Bend Formation.

6. *Dermomurex (Takia) sexangulus* (Dall) (X 1 1/4) 82
USNM 644377 (holotype, *Murex gilletteorum* Vokes); height 43.5 mm, diameter 26 mm.
Locality : TU 562, North Carolina; "Silverdale Beds" (= Haywood Landing Member, Belgrade Formation).

7. *Dermomurex (Takia) imitator* Vokes (X 2) 80
NMV P 74074 (holotype); height 28.4 mm, diameter 19.6 mm.
Locality: Bird Rock Cliffs, Torquay, Victoria, Australia; Jan Juc Formation.

8. *Dermomurex (Takia) curviductus* Vokes (X 1 1/4) 84
USNM 647452; height 51.8 mm, diameter 34.5 mm.
Locality: TU 830, Florida; Chipola Formation.

9. *Dermomurex (Takia) vaughani* (Maury) (X 1 1/2) 84
USNM 647450; height 35.5 mm, diameter 22.7 mm.
Locality: TU 825, Florida; Chipola Formation.

10. *Dermomurex (Takia) infrons* Vokes (X 2) 84
ANSP 241534; height 29.8 mm, diameter 14.6 mm.
Locality: Tosa, Japan; Recent.

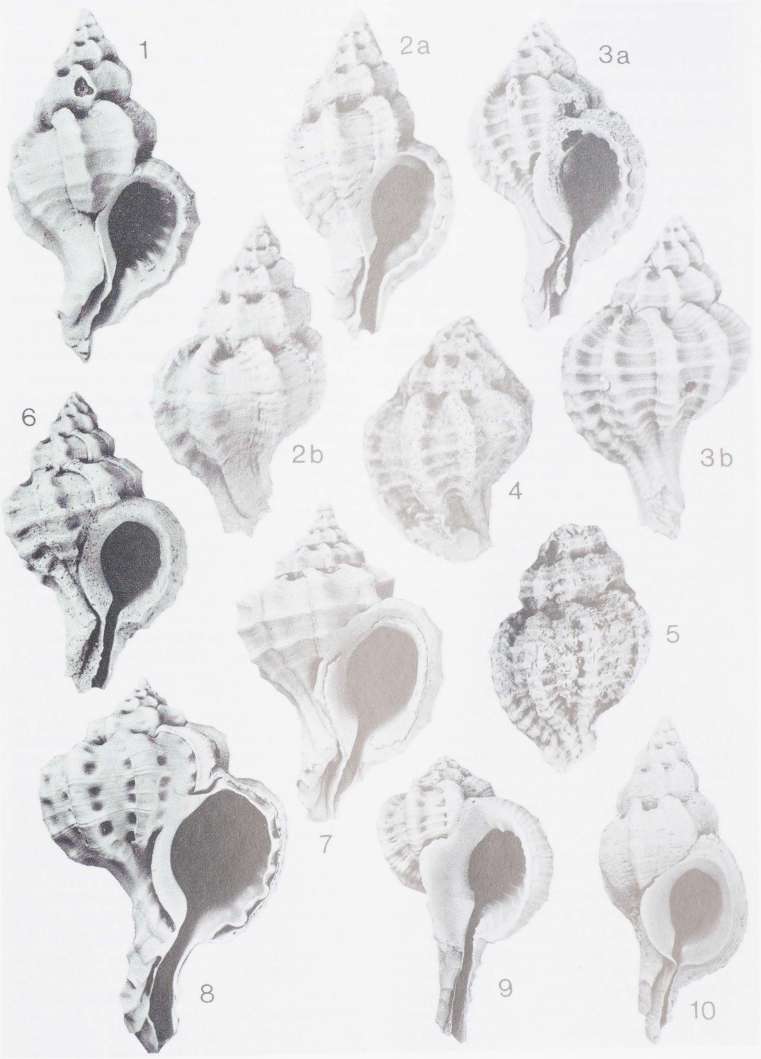


PLATE 18

repetiti Vokes (above), the beds at Silverdale, North Carolina, are now referred either to the Silverdale Formation (Baum *et al.*, 1978) or to the Haywood Landing Member of the Belgrade Formation (Ward *et al.*, 1978), but in either case are of Late Oligocene (Chickasawhayan) age. Otherwise, there is no new information on this species; no additional material has been collected.

Previously, I have vacillated between placing this species in *Takia* (Vokes, 1971b, p. 97) and *Viator* (Vokes, 1974, p. 7; 1975, p. 152). As stated in the discussion of the subgenus *Takia* (above), work on the Australian species of these two groups (Vokes, 1985b) has convinced me that all of the American species are better referred to *Takia*, with the name *Viator* restricted to the Australian members of the group.

As noted above, the specimens referred to *Dermomurex (V.)* aff. *D.(V.) sexangulus* from the River Bend Formation, New Bern, North Carolina, by Rossbach and Carter (1991, p. 98) are referred to *D.(T.) portelli*, n. sp.

DERMOMUREX (TAKIA) CURVIDUCTUS Vokes
Plate 18, figure 8

Dermomurex (?Viator) curviductus VOKES, 1975, Tulane Stud. Geol. Paleont., v. 11, no. 3, p. 156, pl. 7, figs. 2, 3.

Dermomurex (Takia) curviductus Vokes. VOKES, 1985, Malac. Soc. Australia, Jour., v. 7, nos. 1-2, p. 53.

Holotype: USNM 647452; height 51.8 mm, diameter 34.5 mm.

Type locality: TU 830, Chipola Formation; Tenmile Creek, at power line crossing about one mile [1.6 km] west of Chipola River (SE 1/4 Sec. 12, T1N, R10W), Calhoun County, Florida.

Occurrence: Chipola Formation, Florida.

Figured specimen: USNM 647452 (holotype).

Discussion: Referring the American species of this group to the subgenus *Takia* solves some problems with the placement of this unusual species that clearly resembles *D.(T.) vaughani* but has a recurved canal rather than the straight canal of the latter. If *D. vaughani* is considered aberrant, reflecting a convergent resemblance to the Australian species of *Viator*, then *D. curviductus* more easily can be placed with the other species of *Takia*, which are characterized by recurved siphonal canals.

The low spire of these two Chipola species is markedly different from most species of *Takia*, which typically are rather high spired (see pl. 18, fig. 10, *D. infrons*, type of *Takia*). The two exceptions to this are the Australian *D.(T.) imitator* (see pl. 18, fig. 7) and the Italian species *D. taurinensis* (Michelotti, 1841), which as noted previously (Vokes, 1975, p. 156, pl. 7, fig. 5) is extremely close to *D. curviductus*. These four species possibly could be separated as a different subgenus but I prefer to consider all four simply as unusual examples of *Takia*.

There have been no additional specimens taken since this species was named and no new information is available.

DERMOMUREX (TAKIA) VAUGHANI (Maury)
Plate 18, figure 9

Dermomurex (Viator) vaughani (Maury). VOKES, 1975, Tulane Stud. Geol. Paleont., v. 11, no. 3, p. 153, pl. 7, figs. 1, 4.

Dermomurex (Takia) vaughani (Maury). VOKES, 1985, Malac. Soc. Australia, Jour., v. 7, nos. 1-2, p. 53.

Holotype: PRI 3561; height 22.5 mm, diameter 14 mm.

Type locality: Chipola Formation; "Bailey's Ferry," = TU 554, east bank of Chipola River, at power line crossing (SW 1/4 Sec. 17, T1N, R9W), Calhoun County, Florida (designated by Vokes, 1975, p. 153).

Occurrence: Chipola Formation, Florida.

Figured specimen: USNM 647450; height 35.5 mm, diameter 22.7 mm; locality TU 825. Additional localities: TU 998, 1048.

Discussion: It is *D.(T.) vaughani*, with its long straight canal that causes the greatest problem in subgeneric assignment. In this character it closely resembles *D. antonius* Vokes, 1974, type of *Viator* Vokes, 1974, but the large expanded inductura differs strikingly from that species, which has a small oval aperture with an appressed inner lip. As discussed above, I have concluded that the resemblance to *Viator* is due to convergence between the American and Australian lines descending from the two similar Oligocene species *D. sexangulus* and *D. imitator*.

In *D.(T.) vaughani* the inductura is even more expanded than in *D.(T.) infrons*, type of *Takia* (see pl. 18, fig. 10). The aperture also differs in the presence of lirations on the inner side of the outer lip, rather

than the denticles developed in *Takia*, and the spire is much lower in *D. vaughani* than in *D. infrons*. It is obvious that the two forms are only distantly related, with the New World and Old World branches of the line having been separated since the Early Tertiary. Nevertheless, as indicated above, it is better to consider this species as an aberrant member of the group rather than to erect yet another subgenus.

Genus CALOTROPHON Hertlein and Strong, 1951

Calotrophon HERTLEIN and STRONG, 1951, Mollusks West Coast of Mexico and Central Amer., pt. 10, *in* Zoologica, v. 36, p. 87.

Type species: *Calotrophon bristolae* Hertlein and Strong, 1951 (= *Tritonalia turrita* Dall, 1919), by original designation.

Discussion: The relationship of *Calotrophon* to members of the genus *Panamurex* has been discussed above. There seems little question that *Calotrophon* is derived from a *Panamurex* ancestor, the Early and Middle Miocene species *C. phagon* could be placed equally well in either genus (as in my previous treatment of the two groups). Based upon phylogeny it would be better to place the genus *Calotrophon* immediately after *Poirieria (Panamurex)*. However, I prefer to follow the same sequence presented in the earlier papers, thus *Calotrophon* and *Attiliosa* will continue to be placed at the end of the subfamily.

The genus *Calotrophon* is a small group, with previously only four taxa in the western Atlantic, plus the eastern Pacific type of the genus, *C. turritus* (Dall). To this, we now add two Miocene species previously placed in *Poirieria (Panamurex)* and one other Pleistocene species from the southern Caribbean. However, with additional material from the Pleistocene Moín Formation of Costa Rica, I now refer *C. ascensus* Vokes (1976b, p. 110, pl. 6, figs. 1, 2) to the muricopsine genus *Acanthotrophon*. Thus, the count is six species, ranging in age from Early Miocene to Recent.

CALOTROPHON PHAGON (Gardner) Plate 19, figure 1

Poirieria (Panamurex) phagon (Gardner). VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 38, pl. 6, fig. 7; VOKES, 1976, Tulane Stud. Geol. Paleont., v. 12, no. 3, p. 103, pl. 1, fig. 5.

Holotype: USNM 371856; height 16.5 mm, diameter 9.2 mm.

Type locality: USGS 2646, Oak Grove Sand; Oak Grove, Yellow River, Okaloosa County, Florida (= TU 91).

Occurrence: Oak Grove Sand and Shoal River Formation, Florida.

Figured specimen: USNM 646430; height 20 mm, diameter 11.5 mm; locality TU 91. Additional locality: TU 69A.

Discussion: Calotrophon phagon was described from the Oak Grove Sand, considered to be a shallow-water facies of the Chipola Formation, and we have two examples from the Shoal River Formation (TU 69A), also a near-shore sand. Although the Oak Grove and the Chipola are the same age we have not collected any specimens of *C. phagon* in the Chipola Formation.

Previously (Vokes, 1970, p. 39), I assigned this species to *Poirieria (Panamurex)* and suggested that it might be a shallow equivalent of *P. mauryae*, but as all of the specimens are consistent in lacking any trace of spines on the siphonal canal and, with the discovery of the transitional species *C. venezuelanus* (below), it is more likely that *C. phagon* represents the earliest species of the *Calotrophon* group.

CALOTROPHON HUTCHISONI Jung Plate 19, figures 2, 3

Poirieria (Panamurex) hutchisoni (Jung). VOKES, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 44; VOKES, 1976, Tulane Stud. Geol. Paleont., v. 12, no. 3, p. 103, pl. 1, figs. 3 (paratype), 4 (holotype).

Holotype: USNM 645494; height 16.6 mm, diameter 9.4 mm.

Type locality: USGS 271178, Melajo Clay; Melajo River, west of Matura Bay, Trinidad.

Occurrence: Melajo Clay, Trinidad.

Figured specimens: Fig. 2, USNM 645495 (paratype); height 15.6 mm, diameter 9 mm; locality USGS 18399, Melajo River, Trinidad. Fig. 3, USNM 645494 (holotype).

Discussion: When described by Jung (1969, p. 494, pl. 50, figs. 7-9) this species was assigned provisionally to the genus *Calotrophon*. Subsequently (Vokes, 1970, p. 44; 1976b, p. 103), I placed it in *Poirieria (Panamurex)*; however, with the discovery of *C. venezuelanus* (below) I now believe that Jung was correct. Although *P. hutchisoni* has spinose early whorls of the teleoconch (pl. 19, fig. 3) and rugae on the inner

lip, the overall morphology is more similar to the later species of *Calotrophon*. It is known only from the type lot taken from the Late Miocene Melajo Clay, Trinidad.

CALOTROPHON OSTREARUM (Conrad)
Plate 19, figures 4-9

Calotrophon ostrearum (Conrad). VOKES, 1976, Tulane Stud. Geol. Paleont, v. 12, no. 3, p. 105, pl. 1, figs. 6-9; pl. 2, figs. 1-6; pl. 3, figs. 4-9 only (figs. 1-3 = *C. ostrearum conradi*); pl. 4, figs. 1-11; pl. 5, figs. 1-11; RADWIN and D'ATTILIO, 1976, Murex Shells of the World, p. 30, pl. 3, fig. 4; VOKES, 1984, Shells and Sea Life, v. 16, no. 1, p. 212, pl. 1, fig. 24.

Synonyms:

Fusus mexicanus REEVE, 1848, Conchologia Iconica, v. 4, *Fusus*, pl. 19, fig. 77; BULLOCK, 1976, Tulane Stud. Geol. Paleont., v. 12, no. 3, p. 133, pl. 1, figs. 1-5 (as *Calotrophon ostrearum* on plate explanation).

Urosalpinx floridana CONRAD, 1869, Amer. Jour. Conch., v. 5, p. 106, pl. 12, fig. 4.

Muricidea floridana var. *attenuata* DALL, 1890, Wagner Free Inst. Sci., Trans., v. 3, pt. 1, p. 149.

Cantharus (Pseudosalpinx) perplexus OLSSON and HARBISON, 1953, Acad. Nat. Sci. Phila., Mon. 8, p. 255, pl. 37, figs. 1, 1a.

Calotrophon emilyae PETUCH, 1988, Neogene Hist. Trop. Amer. Moll., p. 55, pl. 18, figs. 7, 8.

Calotrophon libertiensis (Mansfield). PETUCH, 1988, Neogene Hist. Trop. Amer. Moll., pl. 18, figs. 9, 10 (not of Mansfield).

Lectotype (*Urosalpinx floridana* Conrad): ANSP 36551 (designated by McLean and Emerson, 1970, p. 60); height 29.2 mm (*fide* Olsson and Harbison, 1953, expl. pl. 37).

PLATE 19

Figures — Page

1. *Calotrophon phagon* (Gardner) (X 2 1/2) 85
   USNM 646430; height 20 mm, diameter 11.5 mm.
   Locality: TU 91, Florida; Oak Grove Sand.
2, 3. *Calotrophon hutchisoni* Jung 85
   2. (X 3) USNM 645495 (paratype); height 15.6 mm, diameter 9 mm.
   Locality: USGS 18399, Melajo River, Trinidad; Melajo Clay.
   3. (X 10) USNM 645494 (holotype); height 16.6 mm, diameter 9.4 mm.
   Locality: USGS 271178, Melajo River, Trinidad; Melajo Clay.
4-9. *Calotrophon ostrearum* (Conrad) (X 2) 86
   4. USNM 240644; height 27.9 mm, diameter 14.4 mm.
   Locality: TU 932, Florida; Fruitville Formation.
   5. USNM 240659; height 27.4 mm, diameter 13.2 mm.
   Locality: TU 519, Florida; Caloosahatchee Formation.
   6. USNM 462698; height 22.3 mm, diameter 12.3 mm.
   Locality: TU 1000, Florida; Fruitville Formation.
   7. FSBC I 11240; height 23.2 mm, diameter 14 mm.
   Locality: "Hourglass" Station K, off Ft. Myers, Florida, in 20 fathoms [37 meters]; Recent.
   8. USNM 711108; height 22.4 mm, diameter 11.6 mm.
   Locality: TU R-9, Florida; Recent.
   9. USNM 240660; height 24.6 mm, diameter 12 mm.
   Locality: TU 519, Florida; Caloosahatchee Formation.
10, 11. *Calotrophon ostrearum conradi* (Mansfield) (X 2) 88
   10. USNM 240652; height 23.4 mm, diameter 11.8 mm.
   Locality: TU 60, Florida; Jackson Bluff Formation.
   11. USNM 240655; height 24.4 mm, diameter 12.8 mm.
   Locality: TU 1000, Florida; Fruitville Formation.
12. *Calotrophon venezuelanus* Vokes, n. sp. (X 3) 89
   NMB H 17392 (holotype); height 14.3 mm, diameter 7.7 mm.
   Locality: NMB 17512, Venezuela; Mare Formation.
13. *Calotrophon andrewsi* Vokes (X 2 1/2) 89
   USNM 711111 (holotype); height 20 mm, diameter 11.4 mm.
   Locality: TU R-44, Quintana Roo, Mexico; Recent.

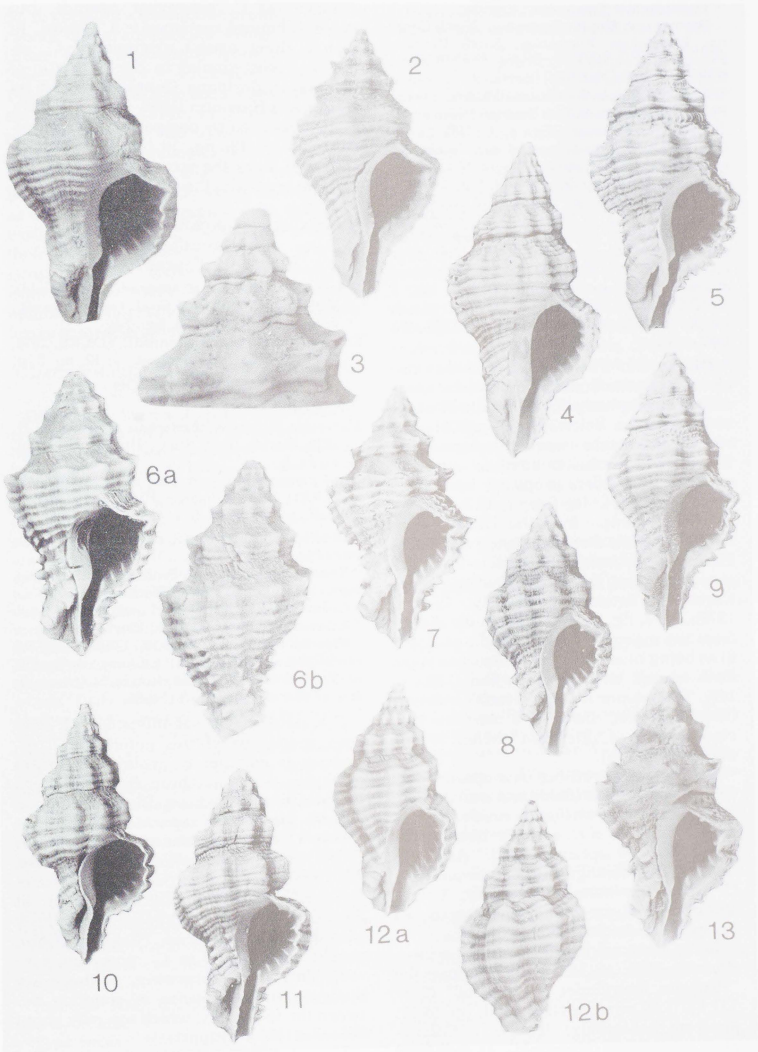


PLATE 19

Type locality: Tampa Bay, Florida.

Occurrence: Duplin Formation, North Carolina; Waccamaw Formation, South Carolina; Pinecrest, Tamiami, Fruitville (= "Pinecrest Beds"), Caloosahatchee, Bermont, Anastasia, and Ft. Thompson formations, Florida. Recent, Florida and northwestern Yucatan Peninsula.

Figured specimens: Fig. 4, USNM 240644; height 27.9 mm, diameter 14.4 mm; locality TU 932. Fig. 5, USNM 240659; height 27.4 mm, diameter 13.2 mm; locality TU 519. Fig. 6, USNM 462698; height 22.3 mm, diameter 12.3 mm; locality TU 1000. Fig. 7, FSBC I 11240; height 23.2 mm, diameter 14 mm; locality "Hourglass" Station K, off Ft. Myers, Florida, in 20 fathoms [37 meters]. Fig. 8, USNM 711108; height 22.4 mm, diameter 11.6 mm; locality TU R-9. Fig. 9, USNM 240660; height 24.6 mm, diameter 12 mm; locality TU 519. Additional localities: TU 1491, 1492, 1493.

Discussion: The variability of this species was documented by numerous specimens ranging in age from Middle Pliocene to Recent (see Vokes, 1976b, p. 105). As a result, there are numerous synonyms. Since that discussion another name, *C. emilyae*, has been proposed by Petuch (1988, p. 55, pl. 18, figs. 7, 8) for an attenuated example from the Tamiami Formation at Mule Pen Quarry (= TU 1177). His type specimen is identical to the specimen from the Duplin Formation, North Carolina, figured previously (Vokes, 1976b, pl. 3, fig. 9), and differs only slightly from the example figured (*ibid.*, pl. 3, fig. 8) as being nearest to the dimensions of the form named "*attenuata*" by Dall (1890, p. 149). The proportions of Petuch's holotype (height 19 mm, diameter 9 mm) are very close to those of "*attenuata*" (height 29 mm, diameter 13 mm).

Petuch compared his new species only to *C. conradi* (Mansfield) and stated: "The body whorl of *C. emilyae* is much more tapered than that of *C. conradi*, blending directly into the siphonal canal." As this is the trait that distinguishes *C. conradi* from *C. ostrearum* (noted previously; Vokes, 1976b, p. 109), he should have compared his specimen with *C. ostrearum*.

In the same work, he figured a specimen (Petuch, 1988, pl. 18, figs. 9, 10) from the "Pliocene Everglades Pseudoatoll" (? = TU 1177; all other species cited, pp. 55-57, are from that locality) identified as *Calotrophon libertiensis* (Mansfield). As discussed earlier (Vokes, 1976b, p. 109), the latter is a synonym of *C. ostrearum conradi*, but Petuch's figured specimen is a "typical" (if such a thing exists) example of *C. ostrearum*, most similar to the paratype of *Urosalpinx floridana* Conrad, figured by Olsson and Harbison (1953, pl. 37, fig. 2a). As may be seen by comparing his illustration with pl. 19, fig. 10 herein, Petuch's specimen lacks the strong basal constriction that separates the subspecies.

CALOTROPHON OSTREARUM CONRADI
(Mansfield)
Plate 19, figures 10, 11

Calotrophon ostrearum conradi (Mansfield). VOKES, 1976, Tulane Stud. Geol. Paleont., v. 12, no. 3, p. 109, pl. 2, figs. 7-9.

Calotrophon ostrearum (Conrad). VOKES, 1976, Tulane Stud. Geol. Paleont., v. 12, no. 3, p. 105 (in part), pl. 3, figs. 1-3 only.

Synonym:

Muricidea floridana libertiensis MANSFIELD, 1930, Florida Geol. Surv., Bull. 3, p. 86, pl. 11, fig. 8.

Not *Calotrophon libertiensis* (Mansfield). PETUCH, 1988, Neogene Hist. Trop. Amer. Moll., pl. 18, figs. 8, 9 (= *C. ostrearum*).

Holotype: USNM 370203; height 30 mm, diameter 16 mm.

Type locality: Jackson Bluff Formation; Harvey's Creek, Leon County, Florida.

Occurrence: Jackson Bluff and Fruitville (= "Pinecrest Beds") formations, Florida.

Figured specimens: Fig 10, USNM 240652; height 23.4 mm, diameter 11.8 mm; locality TU 60. Fig. 11, USNM 240655; height 24.4 mm, diameter 12.8 mm; locality TU 1000.

Discussion: The identification of Pliocene specimens of this genus as *C. ostrearum* is completely arbitrary. Certain examples, such as those from northern Florida in the Jackson Bluff Formation (TU 60), have been separated as the subspecies *C. ostrearum conradi*, on the basis of the constricted siphonal canal. Using this criterion, some of the contemporaneous examples from farther south at Sarasota (TU 1000), although previously placed in *C. ostrearum* (Vokes, 1976b), should be assigned to *C. ostrearum conradi*. This is not surprising, as there are numerous other species in common between the two areas, which are only about 260 miles [420 km] apart.

However, at this locality there are also examples of *C. ostrearum* s.s. (see pl. 19,

fig. 6) creating a taxonomic problem, as we cannot have subspecies living together. Other early specimens from the lower Pinecrest Beds (= Fruitville Formation; TU locs. 730, 932) also are somewhat atypical (see Vokes, 1976b, pl. 2, figs. 1-6) and presumably gave rise to both subspecies, as they are morphologically intermediate. There may be a stratigraphic separation between the two subspecies at Sarasota, as the "*conradi*" examples were collected earlier when the pits were to the south of their present location (the old Warren Bros. pit). The "*ostrearum*" examples are from the newer APAC pits. Until we have additional information, I will treat the two forms as stratigraphic subspecies.

CALOTROPHON VENEZUELANUS Vokes, n. sp.
Plate 19, figure 12

Description: Shell with six teleoconch whorls, protoconch unknown. Axial ornamentation initially of nine angulate ridges, gradually decreasing in number to seven heavy, rounded varices on body whorl. Varices unornamented except for welts raised by crossing of spiral cords, last few varices delineated by a raised line on the adapertural side representing position of former aperture. Shell surface covered by numerous axial growth lines, best seen just anterior to suture. Spiral ornamentation not developed until about third teleoconch whorl, initially of two cords: one at shoulder and one between shoulder and suture. Gradually two secondary cords added on shoulder ramp and one additional cord added between two major cords on spire whorls. Body whorl with six major cords and another two on siphonal canal, plus two weaker cords on shoulder and one weaker one intermediate between two major cords at shoulder and periphery. Suture markedly appressed, sinuated by varices of preceding whorl; just anterior to suture a depressed groove on shoulder ramp, paralleling suture and forming almost a double suture line. Aperture oval; inner lip smooth, appressed the entire length, with two extremely weak nodules at anterior end. Outer lip crenulated by spiral cords, especially that at shoulder; inner side with about nine lirae, corresponding to spaces between external spiral cords. Siphonal canal short, broad, slightly recurved at distal end, forming a small siphonal fasciole.

Holotype: NMB H 17392; height 14.3 mm, diameter 7.7 mm.

Type locality: NMB 17512, Mare Formation (type locality); Cabo Blanco, Dto. Federal, Venezuela.

Etymology of name: For the country from which it comes.

Occurrence: Mare Formation, Venezuela.

Figured specimen: NMB H 17392 (holotype).

Discussion: In the Gibson Smith Collection at the Naturhistorisches Museum, Basel, Switzerland, there is a single example of *Calotrophon* that is similar to *C. ostrearum* but has a shorter siphonal canal. Like the two Miocene species now assigned to *Calotrophon*, this new species has very faint rugae at the base of the inner lip. It is the combination of these relict rugae in a shell otherwise unmistakably *Calotrophon* that caused me to reevaluate my former placement of the Miocene species.

The beds at Cabo Blanco were considered by Weisbord (1962) to be of Early Pliocene age. But, as discussed above under the species *Poirieria (Panamurex) recticanalis*, planktic foraminifera indicate that the Playa Grande Formation (which underlies the Mare Formation) is Pleistocene in age. Also, as noted above, this famous locality has been destroyed by the Caracas Airport expansion, and it is unlikely that we will ever find any more examples of this new species.

CALOTROPHON ANDREWSI Vokes
Plate 19, figure 13

Calotrophon andrewsi VOKES, 1976, Tulane Stud. Geol. Paleont., v. 12, no. 3, p. 110, pl. 6, figs. 3-6.

Holotype: USNM 711111; height 20 mm, diameter 11.4 mm.

Type locality: TU R-44, Isla Mujares, Quintana Roo, Mexico.

Occurrence: Recent only, southwestern Florida to northeastern Yucatan.

Figured specimen: USNM 711111 (holotype).

Discussion: We have no new information on this species, which is rare in collections perhaps due to continued confusion with *C. ostrearum*.

Genus ACANTHOLABIA
Olsson and Harbison, 1953

Acantholabia OLSSON and HARBISON, 1953, Acad. Nat. Sci. Phila., Mon. 1, p. 251.

Type species: *Acantholabia floridana* Olsson and Harbison, 1953, by original designation.

Discussion: In my sequence of papers on the Cenozoic Muricinae the genus *Acantholabia* was not included, for I placed it with the group of *Urosalpinx*, *Eupleura*, etc., in the Ocenebrinae, as originally suggested by Olsson and Harbison (1953, p. 252).

However, additional material has indicated that it is closer to *Calotrophon*.

This genus, which initially contained but one fossil species represented by only a few specimens, and with no living counterpart, is very distinctive with its strong labral tooth (see pl. 20, figs. 3b, 4b). But except for that feature the overall morphology of the shell is not much different from *Calotrophon*. Therefore, it is placed here, provisionally; a placement that could be changed by the discovery of living animals.

ACANTHOLABIA FLORIDANA
Olsson and Harbison
Plate 20, figures 1-3

Acantholabia floridana OLSSON and HARBISON, 1953, Acad. Nat. Sci. Phila., Mon. 1, p. 252, pl. 33, fig 10.

Not *Acantholabia floridana* Olsson and Harbison. PETUCH, 1988, Neogene Hist. Trop. Amer. Moll., p. 51, pl. 12, figs. 13, 14; PETUCH, 1991, W.H. Dall Paleont. Resh. Center, Spec. Publ. 1, p. 28, pl. 4, fig. 12 [same specimen as 1988 = *A. sarasotaensis* Petuch].

Holotype: ANSP 19307; height 25.7 mm, diameter 14.5 mm.

Type locality: Caloosahatchee Formation; North St. Petersburg, 70th Ave. at 9th St. N., Pinellas County, Florida (= TU 68).

Occurrence: Tamiami and Caloosahatchee formations, Florida.

Figured specimens: Fig. 1, ANSP 19307 (holotype). Fig. 2, ANSP 19307A (paratype); height 22.6 mm, diameter 12.6 mm; locality same as holotype. Fig. 3, USNM 462699; height 21.6 mm, diameter 12.3 mm; locality TU 1177.

Discussion: This unusual species is rare. The three figured specimens are the only ones known to me. Apparently there are no examples in the Hoerle Collection at the U.S. National Museum. The single specimen from the Tamiami Formation (TU 1177) is so different from the type specimens that it may be a new species, or the genus may be quite variable, which can be

PLATE 20

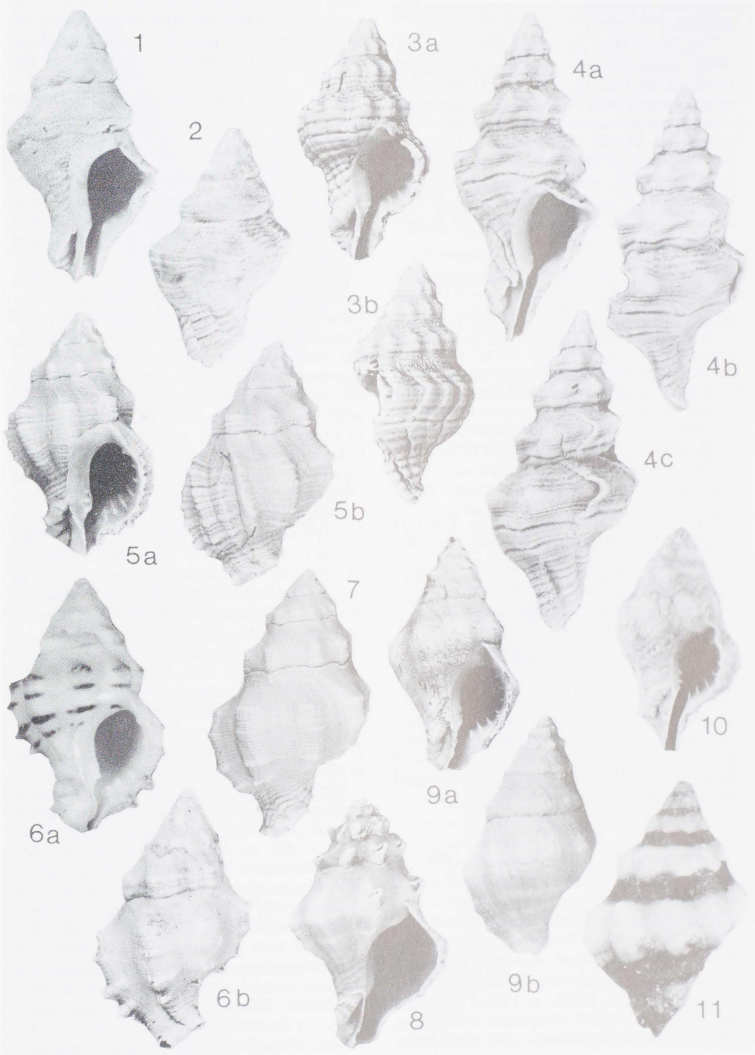


PLATE 20

expected if phylogenetically close to *Calotrophon*.

The form that oocurs at Sarasota (TU 1000) originally was figured by Petuch (1988, pl. 12, figs. 13, 14) as *A. floridana* but subsequently was described as a new species, *A. sarasotaensis* (Petuch, 1991, p. 27, pl. 4, figs. 10, 11). At that time, the specimen figured in 1988 as 18 mm in height, from Sarasota, was refigured as 24 mm in height, and from the Caloosahatchee Formation. It is *A. sarasotaensis* and is presumably from Sarasota.

ACANTHOLABIA SARASOTAENSIS Petuch
Plate 20, figure 4

Acantholabia floridana Olsson and Harbison. PETUCH, 1988, Neogene Hist. Trop. Amer. Moll., p. 51, pl. 12, figs. 13, 14; PETUCH, 1991, W.H. Dall Paleont. Resh. Center, Spec. Publ. 1, p. 28, pl. 4, fig. 12 (not of Olsson and Harbison).

Acantholabia sarasotaensis PETUCH, 1991, W.H. Dall Paleont. Resh. Center, Spec. Publ. 1, p. 27, pl. 4, figs. 10, 11.

Holotype: CM 35638; height 30.9 mm, diameter 15 mm.

Type locality: "Pinecrest Beds" (= Fruitville Formation); APAC quarry, Sarasota, Sarasota County, Florida (= TU 1000).

Occurrence: Fruitville Formation (= "Pinecrest Beds), Florida.

Figured specimen: CM 35638 (holotype).

Discussion: The members of the genus *Acantholabia* from the APAC quarry at Sarasota (TU 1000; seven specimens in our collection) are consistently different from the type material, in the higher spire and the more angulate shoulder. This morphotype is constant and, though the genus may be variable, this represents a second valid species in the group.

Genus ATTILIOSA Emerson, 1968

Attiliosa EMERSON, 1968, Veliger, v. 10, no. 4, p. 380.

Type species: *Coralliophila incompta* Berry, 1960 (= *Peristernia nodulosa* A. Adams, 1855), by original designation.

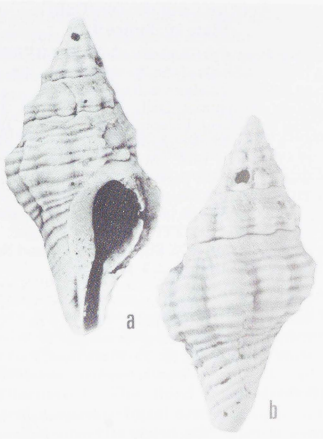
Discussion: In my original treatment of *Attiliosa* (Vokes, 1976b, p. 111), I included the Dominican Republic species "*Muricidea*" *striata* Gabb, 1873, as the earliest known species of the group. Subsequently, *M. striata* was transferred to the muricopsine genus *Acanthotrophon* (see Vokes, 1980) and the material I included in the species split into two taxa: *A. striata* and *A. striatoides* Vokes, 1980 (both will be covered in the next part of the series).

The oldest American representative of the genus, however, is still from the Dominican Republic, in the Cercado and the Gurabo formations, which are Late Miocene and Early Pliocene in age, respectively. Thus, the age of the earliest representative (Vokes, 1976b, p. 102) remains correct, only the name of the species has changed.

The American species is not the oldest member of the genus as there is an unnamed form in the Stampian beds of France (figured in Vokes, 1989b, pl. 6, fig. 11), which is so similar that if it were found together with *Attiliosa aldridgei* it probably would be considered conspecific. In addition, there are other Miocene species in France and Italy, which are presumed to be ancestral to the Indo-Pacific forms assigned to the genus by Vokes and D'Attilio (1982).

The genus *Attiliosa* is comprised of but a few species, each of which has an extraordinarily complicated taxonomic history. Collectively the Recent species assigned to the group have been referred to *Murex*, *Muricidea*, *Muricopsis*, *Peristernia*, *Coralliophila*, *Vasum*, and *Latiaxis*. Vokes and D'Attilio (1982) reviewed the genus and recognized three Indo-Pacific species. In the New World there are three species (one not yet named) in the western Atlantic, plus the eastern Pacific type of the genus. Only *A. aldridgei* occurs in the fossil record of the western Atlantic.

Another fossil species from the Pliocene of Florida (= locality TU 1493) has been named *Attiliosa viaavensis* by Petuch (1986, p. 402, pl. 4, figs. 14, 15). There is little resemblance between the unique holotype (figured here, text figure 10) and the other species of *Attiliosa*. Indeed, if anything, it might be a *Calotrophon*. But the complete lack of varicial break, even on the siphonal canal, indicates to me that the species should not be referred to the Muricidae. The specimen is worn, especially on the early whorls, but William G. Lyons, of the Florida Dept. of Natural Resources, suggests (written comm., November, 1991) that the shell may be a species of *Latirus*.



Text-figure 10. *"Attiliosa" viaavensis* Petuch; MCZ 29222 (holotype); height 15.4 mm, diameter 7.5 mm; locality, Bird Road, Miami, Dade County, Florida.

ATTILIOSA ALDRIDGEI (Nowell-Usticke)
Plate 20, figures 5-8

Muricopsis philippiana (Dall). HUMFREY, Sea Shells of the West Indies, p. 138, pl. 16, fig. 3 (not of Dall).

Muricopsis pudicus (Reeve). HUMFREY, Sea Shells of the West Indies, p. 138, pl. 16, fig. 7 (not of Reeve).

Attiliosa aldridgei (Nowell-Usticke). VOKES, 1976, Tulane Stud. Geol. Paleont., v. 12, no. 3, p. 124, pl. 8, figs. 9 (paratype)-11; RADWIN and D'ATTILIO, 1976, Murex Shells of the World, p. 25, pl. 28, fig. 5 (paratype); RADWIN and D'ATTILIO, 1978, Tulane Stud. Geol. Paleont., v. 14, no. 3, p. 132, text-fig. 4 (radula); VOKES and D'ATTILIO, 1982, Veliger, v. 25, no. 1, p. 69, figs. 6-9; VOKES, 1989, Bulls. Amer. Paleontology, v. 97, no. 332, p. 62, pl. 6, figs. 9, 10.

Synonym:

Muricopsis poeyi SARASUA and ESPINOSA, 1979, Poeyana, no. 193, p. 2, text-fig. 1; VOKES and D'ATTILIO, 1982, Veliger, v. 25, no. 1, p. 67, fig. 10 (holotype).

Holotype: AMNH 189620; height 29.4 mm, diameter 20 mm.

Type locality: Rat Island, Antigua, British West Indies.

Occurrence: Cercado and Gurabo formations, Dominican Republic; Caloosahatchee and Bermont formations, Florida; Moín Formation, Costa Rica. Recent, from Jamaica to Lesser Antilles, Bahama Islands, Yucatan to Panama.

Figured specimens: Fig. 5, USNM 869515; height 19.1 mm, diameter 12.8 mm; locality TU R-369. Fig. 6, Sunderland Coll.; height 29.7 mm, diameter 18.3 mm; locality, Bimini, B.W.I., in 6-9 meters. Fig. 7, USNM 462692; height 31.5 mm, diameter 20.1 mm; locality TU 1215. Fig. 8, USNM 323924; height 10.8 mm, diameter 6.9 mm; locality TU 1240. Additional occurrences: TU 283, 727, 1422, R-99, R-109, R-303.

Discussion: When I originally treated this misunderstood species (Vokes, 1976b, p. 124) it was known only from the Recent fauna, although widely distributed in the western Atlantic from the Bahamas to Panama. Since that time, we have has discovered numerous examples in the fossil record of the Dominican Republic [a total of 13 specimens from two coral-reef localities in the the Cercado (TU 1422) and Gurabo (TU 1215) formations, respectively]. In addition, juvenile examples were recognized in the Caloosahatchee (TU 283) and Bermont (TU 727) formations of southern Florida.

Because living specimens are invariably covered with a thick coating of calcareous algae, the fossil specimens commonly give a better idea of the appearance of the shell than do "cleaned" examples of Recent material. This has caused problems with identification. For example, in Jamaica, Humfrey (1975, p. 138, pl. 16, figs. 3, 7) figured an adult and a juvenile as two different species, neither identified as *A. aldridgei*. In the collection of Kevan and Linda Sunderland, Sunrise, Florida, there are numerous examples of the spinose juvenile shells from 12 to 25 meters depth on the reefs in the Bay Islands, which show the small hooked spines similar to those in the fossil specimen figured here (pl. 20, fig. 8). In the same collection is one very large example from Bimini (pl. 20, fig. 6), similar to Humfrey's adult specimen of *"Muricopsis philippiana"*; comparison with a comparably-sized example from the Gurabo Formation (pl. 20, fig. 7) shows them to be conspecific.

The two examples figured by Humfrey were referred respectively to *Muricopsis philippiana* (Dall) and *Muricopsis pudicus* (Reeve). The first of these taxa is another species of *Attiliosa* treated below and may

be distinguished from *A. aldridgei* by its more slender, non-spinose shell. The second is a species that was mistakenly described as being from the "Island of St. Domingo," perhaps the cause of Humfrey's confusion, for there is certainly little more than a familial similarity between the two. The type of *Murex pudicus* Reeve, 1845, has been figured by Kaicher (1980, no. 2504) and it is a West African species of *Hexaplex*.

Because of the relative obscurity of the original publication (Nowell-Usticke, 1969), where the species was named *Vasum aldridgei*, and the revised edition of the same (Nowell-Usticke, 1971), where the genus was changed to *Attiliosa*, the same species was also named *Muricopsis poeyi* by Sarasua and Espinosa in 1979. Comparison of a photograph of the holotype specimen provided by Dra. Sarasua and republished in Vokes and D'Attilio (1982, fig. 10) shows it to be identical to the Gurabo example figured at the same time (*ibid.*, fig. 7).

The use of the genus *Muricopsis* by Humfrey and by Sarasua and Espinosa is a reflection of the several small denticles at the base of the columellar lip, characteristic of the genus *Attiliosa*, as well as *Acanthotrophon*, a muricopsine genus with species that have been confused with those of *Attiliosa*, for the same reason. In the work that first sorted out the differences between *Attiliosa* and *Acanthotrophon*, Radwin and D'Attilio (1978) figured the radulae of both groups, showing that they are muricine and muricopsine, respectively.

The radula of *Attiliosa* is similar to that of *Poirieria* (cf. Radwin and D'Attilio, 1976, text-fig. 57, *P. zelandica*). As noted earlier (Vokes, 1976b, p. 104), this radular type is markedly different from that of *Calotrophon*, which is more like that of *Paziella* (Radwin and D'Attilio, 1976, text-fig. 50, "*P. pazi*," actually *P. oregonia*). This corroborates the geological evidence that *Poirieria* and *Paziella* have had separate lines of descent since the beginning of the Tertiary and that, although *Calotrophon* and *Attiliosa* are both members of the "*Paziella* clan" (*sensu* Vokes, 1971a), they are not as closely related as once thought (see Vokes, 1971b, p. 7).

ATTILIOSA PHILIPPIANA (Dall)
Plate 20, figure 9

Not *Muricopsis philippiana* (Dall). HUMFREY, 1975, Sea Shells of the West Indies, p. 138, pl. 16, fig. 3 [= *Attiliosa aldridgei*].

Attiliosa philippiana (Dall). VOKES, 1976, Tulane Stud. Geol. Paleont., v. 12, no. 3, p. 120, pl. 8, figs. 12 (lectotype)-14; RADWIN and D'ATTILIO, 1976, Murex Shells of the World, p. 26 (in part); RADWIN and D'ATTILIO, 1978, Tulane Stud. Geol. Paleont., v. 14, no. 3, p. 132, text-figs 6, 6a (radula); VOKES and D'ATTILIO, 1982, Veliger, v. 25, no. 1, p. 69; VOKES, 1984, Shells and Sea Life, v. 16, no. 11, p. 212, pl. 1, fig. 22.

Not *Attiliosa philippiana* (Dall). RADWIN and D'ATTILIO, 1976, Murex Shells of the World, p. 26 (in part), pl. 3, fig. 10; KAICHER, 1980, Card Catalogue of World Wide Shells, Pack no. 25, Muricidae, Part V, fig. 2574 [= *Acanthotrophon striatoides* Vokes].

Lectotype: USNM 93337 (designated by Vokes, 1976b, p. 122); height 14.9 mm, diameter 8.8 mm.

Type locality: U.S. Fish Commission Station 2362, off Cabo Catoche, Quintana Roo, Mexico, in 25 fathoms [46 meters].

Occurrence: Recent only, southern Florida and northern Yucatan.

Figured specimen: FSBC I 11242; height 14.4 mm, diameter 8 mm; locality about 35 miles [57 km] north of Cabo Catoche, Mexico, in 20 fathoms [37 meters].

Discussion: The confusion of this species with the superficially similar *Acanthotrophon striatoides*, Vokes, 1980, began with Dall, who included two specimens in the type lot of the species he named *Muricidea philippiana*. One of these (USNM 93337), figured by Dall (1902, pl. 29, fig. 5) and subsequently selected as the lectotype (Vokes, 1976b, p. 122), is referable to the genus *Attiliosa*. But the second (USNM 34642; figured by M. Smith, 1953, pl. 20, fig. 20, as *Coralliophila philippiana*) is a specimen of *Acanthotrophon striatoides*. It is the latter that was figured as the lectotype of *philippiana* by Radwin and D'Attilio (1976, pl. 3, fig. 10) although the USNM number and locality (*ibid.*, p. 255), as well as the dimensions cited ("ca. 15 mm in length", p. 26), are all for USNM 93337, the real lectotype.

My reason for choosing USNM 93337 as lectotype is that it was the illustrated specimen and the locality given by Dall (1889, p.

213 – Station 2362) was for that specimen. However, the original description is clearly a composite of the two forms, and the dimensions cited are those of the *A. striatoides* specimen. Either one might have been selected with equal validity. Radwin and D'Attilio's slightly later designation (December, 1976 *vs.* September, 1976) of the specimen numbered USNM 93337 agrees with my action, in spite of their figuring the wrong shell.

ATTILIOSA species
Plate 20, figures 10, 11

Figured specimens: Fig. 10, USNM 860299; height 13.9 mm, diameter 8 mm. Fig. 11, USNM 860298; height 14.3 mm, diameter 9.2 mm; locality of both, Samana, Dominican Republic, in 3 meters.

Discussion: The third species of *Attiliosa* recognized in the western Atlantic, this distinctive form is readily distinguishable by the brown and white striped color pattern (pl. 20, fig. 11); although this is normally hidden beneath a thick calcareous covering (pl. 20, fig. 10), as is typical of the genus. The description of this new species is being published by Petuch and is included here only to complete the survey of the genus in the western Atlantic. At present it is known only from the type locality in the Dominican Republic.

POSTSCRIPT

In the previous portion of this Addendum (Vokes, 1990, p. 6) I once again raised the question as to the correct locality for the seemingly Indo-Pacific species described as *Murex surinamensis* Okutani, 1982. I felt certain the species did not come from the western Atlantic but had no better suggestion to offer. Since that time work by two different sets of authors (Emerson and Sage, 1991; Bouchet and Bail, 1991) has shown that apparently the locality is the Saya de Malha Bank, to the east of Madagascar. This location is arrived at by switching not only West for East longitude, but also North for South Latitude (a complication I had not even contemplated).

These two papers resulted in a note by Okutani himself (1991) explaining how the mix-up occurred and a correction for the type locality of several species, including *Murex surinamensis*, which correctly reads: 10°46′ South, 61°32′ East, in 94 meters.

This correction leaves us with the very suspect *Murex maculatus* Verrill, 1950, as the only possible species of *Murex* s.s. in the western Atlantic. The holotype of *M. maculatus* still has not been located, but I believe that we may safely state that there are *no* species of *Murex* s.s. in the western Atlantic.

V. LOCALITY DATA

The following are Tulane University fossil locality numbers:

60. Jackson Bluff Fm., borrow pits at Jackson Bluff, Ochlockonee River (NW 1/4 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.
66. Byram Marl, type locality, west bank of Pearl River, at Byram, Hinds Co., Mississippi.
68. Caloosahatchee Fm., North St. Petersburg, 70th Ave. at 9th St. N., Pinellas Co., Florida.
69. Shoal River Fm., type locality, Shell Bluff, Shoal River (NW 1/4 Sec. 4, T3N, R21W), about 3 1/2 miles north of Mossyhead, Walton Co., Florida.
69A. Shoal River Fm., first ravine upstream from Shell Bluff, Shoal River (NW 1/4 Sec. 4, T3N, R21W), about 3 1/2 miles north of Mossyhead, Walton Co., Florida.
73. Jackson Bluff Fm., "Dripping Springs," Four Mile Creek, about 1000 feet upstream from bridge of Florida Highway 73 (NE 1/4 Sec. 36, T1N, R10W), Calhoun Co., Florida.
79. Caloosahatchee and Bermont fms. mixed, spoil banks north and south side of Caloosahatchee River, at Ortona Lock (Sec. 27, T42S, R30E), Glades Co., Florida.
85. Wautubbee Fm., roadcuts on county road, 4 miles northeast of Rose Hill, Jasper Co., Mississippi.
91. Oak Grove Sand, type locality, west bank of Yellow River, about 100 yards below bridge at Oak Grove (NE 1/4 Sec. 20, T5N, R23W), Okaloosa Co., Florida.
99. Moodys Branch Fm., Montgomery Landing (also known as Creola Bluff), west bank of Red River (Sec. 20, T8N, R5W), Grant Parish, Louisiana.
201. Bermont Fm., spoil banks at pit just south of Belle Glade (at Belle Glade Camp), Palm Beach Co., Florida.

226. Red Bluff Fm., west bank Chickasawhay River, approximately 1 mile southwest of Hiwannee (SW 1/4 Sec. 28, T10N, R7W), Wayne Co., Mississippi.
283. Caloosahatchee and Bermont fms. mixed, spoil banks on cross-canal 1.3 miles southwest of Port Charlotte Railroad Station (formerly Murdock), on south side of Florida Highway 771 and Seaboard Air Line R. R. line (Sec. 12, T40S, R21E), Charlotte Co., Florida.
457. Chipola Fm., west bank of Chipola River, about 1/2 mile below Tenmile Creek (SW 1/4 Sec. 17, T1N, R9W), Calhoun Co., Florida (= USGS 2213, 2564, and 3419, "one mile below Bailey's Ferry").
458. Chipola Fm., east bank of Chipola River, above Farley Creek (SW 1/4 Sec. 20, T1N, R9W), Calhoun Co., Florida.
459. Chipola Fm., east bank of Chipola River, steep bank about 1500 feet above the mouth of Taylor Lake Branch (NW 1/4 Sec. 29, T1N, R9W), Calhoun Co., Florida.
519. Caloosahatchee Fm., Harney Pond Canal spoil banks, at Florida Highway 78, northwest side of Lake Okeechobee (NW 1/4 Sec. 18, T40S, R33E), Glades Co., Florida.
539A. Bermont Fm., Shell Creek (upper beds), about eight miles east of Cleveland (Sec. 30, T40S, R25E), Charlotte Co., Florida.
539B. Caloosahatchee Fm., Shell Creek (lower beds), about eight miles east of Cleveland (Sec. 30, T40S, R52E), Charlotte Co., Florida.
546. Chipola Fm., Tenmile Creek, about 1 3/4 miles west of Chipola River (NE 1/4 Sec. 12, T1N, R10W), Calhoun Co., Florida (= USGS 2212, "one mile west of Bailey's Ferry").
547. Chipola Fm., west bank of Chipola River, about 2000 feet above Fourmile Creek (SW 1/4 Sec. 29, T1N, R9W), Calhoun Co., Florida.
549. Chipola Fm., east bank of Chipola River, about 1/4 mile below Fourmile Creek (NE 1/4 Sec. 32, T1N, R9W), Calhoun Co., Florida.
554. Chipola Fm., east bank of Chipola River at power line crossing (SW 1/4 Sec. 17, T1N, R9W), Calhoun Co., Florida.
555. Chipola Fm., east bank of Chipola River, about 1000 feet above Fourmile Creek (SW 1/4 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.
562. Silverdale Beds (Belgrade Fm.), Onslow County marl pit on south side of Webb Creek, near Silverdale, Onslow Co., North Carolina.
638. Agueguexquite Fm., roadcut, pipeline cut, and quarry on [old] Mexico Highway 180, 22.5 km east of junction with side road into Coatzacoalcos, Veracruz, Mexico.
655. Chipola Fm., Tenmile Creek, about 0.1 mile downstream from bridge of Florida Highway 73 (NW 1/4 Sec. 12, T1N, R10W), Calhoun Co., Florida.
705. Bowden Fm., type locality, Bowden, east of Port Morant, Parish of St. Thomas, Jamaica.
727. Bermont Fm., borrow pits 2.2 miles east of U.S. Highway 27, 15 miles south of South Bay, Palm Beach Co., Florida.
728. Pinecrest Beds (Fruitville Fm.), 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 (Fruitville Fm.), spoil banks on west side of Kissimmee Canal and east side of Kissimmee River, approximately 1/2 mile south of U.S. Corps of Engineers Structure 65-D (S 1/2 Sec. 33, T36S, R33E), Okeechobee Co., Florida.
730. Pinecrest Beds (Fruitville Fm.), embankment of Seaboard Airline Railroad, just west of Kissimmee River (NW 1/4 Sec. 20, T36S, R33E), Highlands Co., Florida.
735. Matthews Landing Marl, roadcut on Wilcox Co. Highway 162 (formerly Alabama Highway 10), 10 miles northeast of railroad station at Kimbrough, Wilcox Co., Alabama.
757. Gatun Fm., roadcut on south side of Boyd-Roosevelt Highway at junction of road to "Refinería Panamá, S.A.," just east of Cativá, Prov. of Colón, Panama.
759. Bermont Fm., spoil banks north side of Caloosahatchee River, two miles west of Ortona Lock (NE 1/4 Sec. 29, T42S, R30E), Glades 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. Bermont Fm., spoil banks south side of Caloosahatchee River, two miles west of Ortona Lock (NE 1/4 Sec. 29, T42S, R 30E), Glades Co., Florida.
819. Chipola Fm., Farley Creek, 0.2 mile west of bridge of Florida Highway 275 (SW 1/4 Sec. 21, T1N, R9W), Calhoun Co., Florida.
820. Chipola Fm., Farley Creek, at bridge of Florida Highway 275 (SW 1/4 Sec. 21, T1N, R9W), Calhoun Co., Florida.
823. Chipola Fm., Farley Creek, south bank about 2000 feet east of bridge of Florida Highway 275 (SE 1/4 Sec. 21, T1N, R9W), Calhoun Co., Florida.

825. Chipola Fm., Farley Creek at abandoned mill about 1/4 mile west of bridge of Florida Highway 275 (SW 1/4 Sec. 21, T1N, R9W), Calhoun Co., Florida.
826. Chipola Fm., Farley Creek, about 0.1 mile west of abandoned mill, which is 1/4 mile west of bridge of Florida Highway 275 (on section line between Sec. 20 & 21, T1N, R9W), Calhoun Co., Florida.
830. Chipola Fm., Tenmile Creek, at power line crossing about one mile west of Chipola River (SE 1/4 Sec. 12, T1N, R10W), Calhoun Co., Florida.
866. Silverdale Beds (Belgrade Fm.), marl pit on north side of Webb creek and east side of unnumbered county highway, Silverdale, Onslow Co., North Carolina.
932. Pinecrest Beds (Fruitville Fm.), east side of Kissimmee Canal and 1/2 mile south of Seaboard Airline Railroad, south of Fort Basinger (SE 1/4 Sec. 20, R36S, R33E), Okeechobee Co., Florida.
949. Chipola Fm., Chipola River, west bank about 0.1 mile below power line crossing (SW 1/4 Sec. 17, T1N, R9W), Calhoun Co., Florida.
950. Chipola Fm., Chipola River, west bank about 2000 feet above Farley Creek (SW 1/4 Sec. 20, T1N, R9W), Calhoun Co., Florida.
951. Chipola Fm., Tenmile Creek, about 1 1/4 miles west of Chipola River (SE 1/4 Sec. 12, T1N, R10W), Calhoun Co., Florida.
954. Moín Fm., hill cut immediately behind Standard Fruit Co. box factory, just west of cemetery at Pueblo Nuevo, about 2 km west of Puerto Limón, Costa Rica.
958. Gatun Fm., hillslope on east side of road from Boyd-Roosevelt Highway to "Refinería Panamá, S. A.," about 1/2 km north of junction, just east of Cativá, Prov. of Colón, Panama.
993. Weches Fm., roadcut and glade on north side of Texas Highway 21, 3 1/2 miles west of junction with Texas FM 95 at Chireno, Nacogdoches Co., Texas.
998. Chipola Fm., Tenmile Creek, about 1 1/4 miles west of Chipola River (SE 1/4 Sec. 12, T1N, R10W), Calhoun Co., Florida.
999. Chipola Fm., Farley Creek, about 300 yards downstream from bridge of Florida Highway 275 (SW 1/4 Sec. 21, T1N, R9W), Calhoun Co., Florida.
1000. Pinecrest Beds (Fruitville Fm.), borrow pit at east end of 17th street (T36S, R19E), about 8 miles east of U.S. Highway 301 at Sarasota, Sarasota Co., Florida.
1020. Chipola Fm., small tributary (not shown on USGS topographic map) on east bank of Chipola River about 1/2 mile below power line crossing (NE 1/4 Sec. 20, T1N, R9W), Calhoun Co., Florida.
1021. Chipola Fm., Tenmile Creek, north bank, about 2200 feet east of bridge on Florida Highway 73 (NW 1/4 Sec. 12, T1N R9W), Calhoun Co., Florida.
1025. Concepcion Inferior Fm., first road cut on east side of old road from Nueva Teapa to Ixhuatlan, 0.8 km south of junction with highway to Coatzacoalcos (old Mexico Highway 180), Veracruz, Mexico [new highway 180 parallels this road slightly to the east].
1046. Agueguexquite Fm., roadcuts on both sides of [old] Mexico Highway 180, 12 km east of junction with side road into Coatzacoalcos, Veracruz, Mexico.
1048. Chipola Fm., Farley Creek, south bank, about 0.8 miles east of bridge of Florida Highway 275 (NE 1/4 Sec. 21, T1N, R9W), Calhoun Co., Florida.
1050. Chipola Fm., west bank of Chipola River immediately below power line crossing, and directly across river from loc. TU 554 (SW 1/4 Sec. 17, T1N, R9W), Calhoun Co., Florida.
1097. Chipola Fm., Tenmile Creek, south bank of 1972 cut-off meander, 500 yards east of Florida Highway 73 (NW 1/4 Sec. 12, T1N, R10W), Calhoun Co., Florida.
1098. Chipola Fm., Tenmile Creek, south bank just below power line crossing (SE 1/4 Sec. 12, T1N, R10W), Calhoun Co., Florida.
1175. Tamiami Fm., spoil banks along canals south of Florida Highway 858, 2 miles east of junction with Florida Highway 846 (SE 1/4 Sec. 24, T48S, R27E), east of Naples and south of Immokalee, Collier Co., Florida.
1177. Tamiami Fm., Mule Pen Quarry, north side of Florida Highway 846, 9.1 miles east of U.S. 41 at Naples Park (SE 1/4 Sec. 24, T48S, R26E), Collier Co., Florida.
1196. Chipola Fm., Farley Creek, north bank about 0.8 mile east of bridge on Florida Highway 275 (NE 1/4 Sec. 21, T1N, R9W), Calhoun Co., Florida.
1203. Byram Fm., quarry of Mississippi Valley Portland Cement Co., on east side of Mississippi Highway 3, 2.8 miles north of junction with U.S. Highway 61 at Redwood, Warren Co., Mississippi.
1208. Mao Adentro Limestone, roadcut, both sides of highway from Mao to Los Quemados, at ridge 4 km east of Los Quemados, Dominican Republic.
1210. Gurabo Fm., Río Gurabo, east bank, first bluff downstream from ford on Los Quemados-Sabaneta road, Dominican Republic.
1211. Gurabo Fm., Río Gurabo, west bank, second bluff below the ford on Los

Quemados-Sabaneta road, Dominican Republic.

1212. Gurabo Fm., Río Gurabo, east bank, third bluff below the ford on Los Quemados-Sabaneta road, Dominican Republic.

1215. Gurabo Fm., Río Gurabo, bluffs on both sides, from the ford on Los Quemados-Sabaneta road upstream to approximately 1 km above the ford, Dominican Republic.

1219. Gurabo Fm., Río Amina, bluffs on east side of river immediately upstream from ford that is 2 km west of Potrero and about 3 km downstream from "La Represa," Dominican Republic.

1225. Gurabo Fm., banks of Arroyo La Sabrima, west side of Río Mao, upstream from Mao Adentro and downstream from Cercado de Mao, about 11 km by (winding) road or 8 km airline, south of Mao, Dominican Republic.

1227. Gurabo Fm., Arroyo Zalaya, which crosses road to Jánico from Santiago de los Caballeros, 11 km south of bridge over Río Yaque del Norte at Santiago, Dominican Republic.

1227A. Gurabo Fm., Arroyo Zalaya, turbidity flow lens (ca. 30" long, 6" thick) about two feet above base of outcrop at point approximately 75 feet downstream from highway bridge, Dominican Republic.

1231. Gurabo Fm., Río Gurabo, float found in river gravel above and below ford on Los Quemados-Sabaneta road, Dominican Republic.

1239. Moín Fm., hill cut above Standard Fruit Co. box factory at Pueblo Nuevo (same as TU 954 but stratigraphically about 15 meters higher – above coral horizon), Puerto Limón, Costa Rica.

1240. Moín Fm., Barrio Los Corales, top of hill at end of road that passes Standard Fruit Co. box factory (see TU 954), 1.8 km north of main highway at Pueblo Nuevo, which is 2 km west of Puerto Limón, Costa Rica.

1250. Gurabo Fm., Río Verde, south bank, just above the ford at the crossing of a side road that connects Duarte Highway and La Vega-Moca Highway, about 10 km north of La Vega, Dominican Republic.

1251. Gurabo Fm., Río Verde, north bank, high bluff about 0.5 km down from the ford at the crossing of a side road that connects Duarte Highway and La Vega-Moca Highway, about 10 km north of La Vega, Dominican Republic.

1258. Weches Fm., west side of spillway and dam of Lake Nacagdoches, on north side of Texas Highway FM 225, 10 miles west of Bypass 224, west of Nacogdoches, Nacogdoches Co., Texas.

1262. Weches Fm., roadcut on south side of Texas Highway 21, 3.8 miles west of junction with FM 95, at Chireno, Nacogdoches, Texas.

1269. Cantaure Fm., series of arroyos about 500 meters south of "Casa Cantaure" [which is literally one house and which is about 400 meters south of older, now abandoned, house that was the "Casa Cantaure" of Jung, 1965, and others], 14 km (by road) west of Pueblo Nuevo, Paraguaná Peninsula, Venezuela.

1277. Gurabo Fm., Río Gurabo, both sides, upstream from the horsetrail to 0.5 km above the trail, or approximately 2 km (airline) to 2.5 km above the bridge on Los Quemados-Sabaneta road, Dominican Republic.

1282. Cercado Fm., tributary of the Río Cana to the east, about 1 km above the bridge at Caimito on Los Quemados-Sabaneta road, Dominican Republic.

1288. Red Bluff Fm., type locality, east bank Chickasawhay River, about 1 1/2 miles south of Shubuta (NE 1/4 Sec. 16, T10N, R7W), Wayne Co., Mississippi.

1289. Red Bluff Fm., east bank Chickasawhay River, about 3/4 mile south of Hiwannee (SW 1/4 Sec. 28, T10N, R7W), Wayne Co., Mississippi.

1290. Red Bluff Fm., "Carson Sand Creek," at crossing of county road 1 1/2 miles east of Hiwannee (SE 1/4 Sec. 26, T10N, R7W) [possibly Aldrich's Carson Creek loc.], Wayne Co., Mississippi.

1292. Gurabo Fm., Río Mao, west bank, bluffs about 1.5 to 2 km upstream from Mao Adentro, or about 9 km (by road) south of Mao, Dominican Republic.

1296. Gurabo Fm., Río Gurabo, both sides, from about 0.5 km above the horsetrail to approximately 1 km above the trail, or about 2.5 to 3 km (airline) above the ford on Los Quemados-Sabaneta road, Dominican Republic.

1307. Moín Fm., hill top approximately halfway between Puerto Limon and Barrio Los Corales and about 0.5 km north of highway at Pueblo Nuevo, Costa Rica.

1318. Concepcion Inferior Fm., hillcut on pipeline just to northeast of Campo El Chapo, on old road to Ixhuatlan, 4 km south of old road to Coatzacoalos at Nueva Teapa, Veracruz [new highway 180 parallels this road slightly to the east].

1321. Concepcion Inferior Fm., "Kilometer 70" (of Toula, 1911), which is K 70 on Trans-Isthmus railroad south of Coatzacoalcos, 5 km north of Almagres, Veracruz, Mexico.

1353. Gurabo Fm., Arroyo Puñal, outcrops on

south side, above the crossing of the trail from Guayubal to Yabanal, which intersects the paved highway 1.5 km south of Guayubal (*ca.* 12 km airline southeast of Santiago de los Caballeros), Dominican Republic.

1354. Gurabo Fm., Cañada de Zamba, a tributary on the west side of the Río Cana, approximatley 2.5 km east of the village of Zamba, which is 7 km north of Cruz de Santiago (Santiago Rodrigez), on road to Guayubin; or 4.5 km (airline) below the ford at Caimito, Dominican Republic.

1357. Gurabo Fm., Río Yaque del Norte, bluff on west side, just above new (1980) water plant at south edge of Bella Vista, 3 km (by road) south of bridge at Santiago de los Caballeros, Dominican Republic.

1381. Gurabo Fm., Arroyo Babosico, bluffs just up from confluence with Río Yaque del Norte at La Barranca, approximately 8 km upstream from Santiago de los Caballeros, Dominican Republic.

1397. Esmeraldas Beds, Quebrada Camarones, cut-bank on east side of canyon, which is at east edge of village of Camarones, 20 km (by road) east of bridge over Río Esmeraldas, at Esmeraldas, or approximatley 10 km east of mouth of Río Esmeraldas, Prov. of Esmeraldas, Ecuador.

1412. Gurabo Fm., Río Guanajuma, which is a tributary of Río Amina from the west, bluff on south side just upstream from trail at Higuerito Penuelas, which goes to the river approximately 2.5 km upstream from the confluence with Río Amina; or about 1 km above the ford on the road to Potrero, Dominican Republic.

1422. Cercado Fm., Arroyo Bellaco (or Beyaco on topographic maps), which is a tributary of Río Cana from the east, coral reef that is exposed for approximately 1 km below the ford at Las Caobas Adentro, 1 km southwest of Las Caobas, Dominican Republic.

1429. Gatun Fm., construction site, one km southeast of Boyd-Roosevelt Highway, just south of Coco Solo Hospital, Prov. of Colón, Panama.

1431. Gatun Fm., hilltop construction site, 0.5 km northwest of intersection of Boyd-Roosevelt Highway and road to Puerto Pilon, at Sabanita, Prov. of Colón, Panama.

1432. Gatun Fm., north side Boyd-Roosevelt Highway, clearing behind Residential Martin Luther King (formerly Palo Quemado) approximately 1.5 km east of junction of road to Refinería Panamá, S.A., at Cativá, Prov. of Colón, Panama.

1433. Gatun Fm., north side Boyd-Roosevelt Highway, clearing behind Urbanization San Martin, approximately 0.5 km east of junction of road to Refinería Panamá, S.A., at Cativá, Prov. of Colón, Panama.

1448. Gurabo Fm., Río Yaque del Norte, west side, bluffs extending for approximately 1 km upstream from the village of La Barranca, Dominican Republic.

1449. Gurabo Fm., Río Yaque del Norte, west bank, large gravity flows exposed along road that leads down to river at village of La Barranca, Dominican Republic.

1452. Gurabo Fm., Arroyo Zalaya, bluffs on both sides, from crossing of the trail at village of Zalaya upstream for approximately 1 km, Dominican Republic.

1489. Moín Fm., Barrio Los Corales no. 3, *ca.* 0.4 km north of TU 1240, Puerto Limón, Costa Rica.

1491. "Pinecrest Beds," North Ft. Meyers, pits open during construction of Cape Coral, northwest of intersection of U.S. Highway 41 and Florida Highway 78, Lee Co., Florida.

1492. Caloosahatchee Fm., approximately 4 miles southeast of Clewiston (1 mile east and 3 miles south on road to U. S. Sugar Co. Mill), Palm Beach Co., Florida.

1493. "Pinecrest Beds," Arvita Pit, on Bird Road (= W. 40th St.), approximately 5 miles west of Florida Turnpike, on west side of Coral Gables, Dade Co., Florida.

1512. Caloosahatchee and Bermont fms. mixed, DeSoto Mining Company, pits 2 miles east of Florida Highway 31, about 12 miles south of Arcadia (T39S, R25E), DeSoto Co., Florida.

1514. Concepcion Inferior Fm., roadcuts 1.5 km south of intersection of old Mexico Highway 180 (now side road into Coatzacoalcos) on new bypass, which is 15 km east of old bridge at Coatzacoalcos, Veracruz, Mexico.

1515. Concepcion Inferior Fm., roadcuts 0.5 km south of intersection of old Mexico Highway 180 (now side road into Coatzacoalcos) on new bypass, which is 15 km east of old bridge at Coatzacoalcos, Veracruz, Mexico.

1527. Weches Fm., roadcut on west side of U.S. Highway 259, 3.2 miles north of overpass over U.S. Highway 59, north of Nacogdoches, Nacogdoches Co., Texas.

1529. Weches Fm., "Old Donahue Place", beds just below waterfall, south of house; 2 miles west of Texas Highway FM 3, at gate which is 7.1 miles north of Normangee, Leon Co., Texas.

The following are Tulane University Recent locality numbers:

R-9. Dredged in 5 to 9 meters off Longboat Key, Sarasoto, Sarasota Co., Florida.
R-42. Anna Maria Key, off Sarasota, Florida; dredged in approximately 46 meters, by James Moore, Bradenton, Florida.
R-44. Isla Mujares, open ocean side, Quintana Roo, Mexico.
R-98. *Anton Bruun* Cruise 10, dredged in 40 meters northwest of Holandes Cay, and east-northeast of Cape San Blas (9°37′N, 78°50.3′W), Panama.
R-99. *Anton Bruun* Cruise 10, dredged in 31 meters, off northeastern Yucatan Peninsula (21°41′N, 86°34′W), Mexico.
R-109. Bahia de las Minas, Isla Payardi, Prov. of Colón, Panama (7000 YBP).
R-181. Piña, beach on Caribbean coast due west of Gatun, Panama.
R-303. Punta Mosquito, about 8 km east of the village of Holbox, Isla Holbox, Quintana Roo, Mexico.
R-314. Ham's Bay, rocky intertidal area, northest corner of St. Croix, U.S. Virgin Islands.
R-366. Punta Cahuita, 42 km southeast of Puerto Limón, Costa Rica.
R-369. Moín Bay, north side of Limon Peninsula; material dredged from bay for fill to make oil terminal (1976), Moín, Costa Rica.
R-503. Roatan Island, south side of Oak Ridge, Islas de la Bahia (Bay Islands), Honduras.

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VII. APPENDIX I: ALPHABETICAL LIST OF SPECIES INCLUDED IN THIS PART

The following list includes all species treated systematically, as well as certain synonyms not repeated from previous parts. Thus, this is a complete list of names for all western Atlantic species, fossil and Recent, valid or invalid, referred to the genera *Pterynotus*, *Poirieria*, *Aspella*, *Dermomurex*, *Calotrophon*, *Acantholabia*, and *Attiliosa*.

All species were originally named as "*Murex*" unless otherwise noted in brackets following the name. Those species names in ALL CAPS are new taxa described herein. The generic assignment that follows the name of the author is that one to which the species is referred in this paper. Those names without a generic assignment are considered synonyms of the species cited.

abyssicola Crosse, 1865. DERMOMUREX (TRIALATELLA)
actinophorus Dall, 1889. POIRIERIA s.s.
adamsii Kobelt, 1877. = *alabastrum*
alabastrum A. Adams, 1864. DERMOMUREX s.s.
alaquaensis [Muricidea] Mansfield, 1935. POIRIERIA (PANAMUREX)
aldridgei [Vasum] Nowell-Usticke, 1969. ATTILIOSA
aliculus [Pterynotus] Vokes, 1989. PTERYNOTUS s.s.
andrewsi [Calotrophon] Vokes, 1976. CALOTROPHON
angulatus Meyer, 1886. ? = *silvaticus*
angelus Aldrich, 1886. PTERYNOTUS (PTEROCHELUS)
antecessor [Dermomurex] Vokes, 1975. DERMOMUREX (TRIALATELLA)
ariomus Clench and Pérez Farfante, 1945. PTERYNOTUS (PTEROCHELUS)
ascensus [Calotrophon] Vokes, 1976. ACANTHOTROPHON
atlantis Clench and Pérez Farfante, 1945. POIRIERIA (PAZIELLA)
attenuta [Muricidea] Dall, 1890. = *ostrearum*
aurorae [Pterynotus] Garvie, 1991. PTERYNOTUS s.s.
BINGHAMAE [*Dermomurex*] Vokes. DERMOMUREX s.s.
bowdenensis [Poirieria] Vokes, 1970. POIRIERIA (PAZINOTUS)
burnsii Aldrich, 1894. PTERYNOTUS s.s.
bushae [Pterynotus] Vokes, 1970. = *phaneus*
cantrainei [Triton] Recluz, 1853. = *pauperculus*
castor [Aspella] Radwin and D'Attilio, 1976. ASPELLA
carnicolor Clench and Pérez Farfante, 1945. POIRIERIA (PANAMUREX)
clarksvillensis [Muricidea] Mansfield, 1937. POIRIERIA (PANAMUREX)
collatus Guppy, 1873. POIRIERIA (FLEXOPTERON)
conradi [Muricidea] Mansfield, 1930. CALOTROPHON
cookei [Dermomurex] Vokes, 1975. DERMOMUREX (TAKIA)
cracentis [Dermomurex] Vokes, 1989. DERMOMUREX s.s.
cretacea [Poirieria] Garvie, 1991. POIRIERIA (PAZIELLA)
cryptica [Aspella] Radwin and D'Attilio, 1976. ASPELLA
cuna [Dermomurex] Petuch, 1990. = *antecessor*
curviductus [Dermomurex] Vokes, 1975. DERMOMUREX (TAKIA)
dominicensis [Trophon] Gabb, 1873. POIRIERIA (PAZIELLA)
dubitalis [Poirieria] Vokes, 1970. = *alaquaensis*
elizabethae [Aspella] McGinty, 1940. DERMOMUREX (GRACILIMUREX)
emilyae [Calotrophon] Petuch, 1988. = *ostrearum*
engonatus [Trophon] Dall, 1892. = *alabastrum*
EUGENIAE [*Poirieria*] Vokes. POIRIERIA (PANAMUREX)
farleyensis [Dermomurex] Vokes, 1975. DERMOMUREX (TRIALATELLA)
floridana [Acantholabia] Olsson and Harbison, 1953. ACANTHOLABIA
floridana [Urosalpinx] Conrad, 1869. = *ostrearum*
fusinoides [Paziella] Gardner, 1947. POIRIERIA (PANAMUREX)
gabbi [Poirieria] Vokes, 1970. POIRIERIA (PANAMUREX)
gatunensis Brown and Pilsbry, 1911. POIRIERIA (PANAMUREX)
GIBSONSMITHI [*Poirieria*] Vokes. POIRIERIA (PANAMUREX)
gilletteorum Vokes, 1963. = *sexangulus*
glicksteini [Dermomurex] Petuch, 1987. DERMOMUREX s.s.
grandispinosa Aldrich, 1895. = *burnsii*
granulatus [Dermomurex] Vokes, 1989. DERMOMUREX s.s.
guesti [Pterynotus] Harasewych and Jensen, 1979. PTERYNOTUS s.s.
harrisi [Poirieria] Vokes, 1970. POIRIERIA (PAZIELLA)
havanensis [Pterynotus] Vokes, 1970. PTERYNOTUS s.s.
heilprini [Muricopsis] Cossmann, 1903. POIRIERIA (PANAMUREX)

helenae Verrill, 1953. ? = *ariomus*, ? = *triformis*
hoerlei [Pterynotus] Vokes, 1970. PTERYNOTUS s.s.
hutchisoni [Calotrophon?] Jung, 1969. CALOTROPHON
hystricinus Dall, 1889. POIRIERIA (?PAZINOTUS)
IMPROCERUS [*Poirieria*] Vokes. POIRIERIA (PANAMUREX)
kaicherae [Dermomurex] Petuch, 1987. DERMOMUREX s.s.
laccapoia [Muricopsis] Gardner, 1947. POIRIERIA (PANAMUREX)
leali [Dermomurex] Houart, 1991. DERMOMUREX (TRIALATELLA)
libertiensis [Muricidea] Mansfield, 1930. = *conradi*
lightbourni [Pterynotus] Harasewych and Jensen, 1979. PTERYNOTUS s.s.
lychnia [Paziella] Gardner, 1947. POIRIERIA (PANAMUREX)
macneili [Poirieria] Vokes, 1970. POIRIERIA (PANAMUREX)
matercula [Dermomurex] Vokes, 1975. DERMOMUREX s.s.
matthewsensis Aldrich, 1886. PTERYNOTUS s.s.
mauryae [Poirieria] Vokes, 1970. POIRIERIA (PANAMUREX)
mexicanus [Fusus] Reeve, 1848. = *ostrearum*
mirificus [Pterynotus] Vokes, 1989. PTERYNOTUS (PURPURELLUS)
morchi [Aspella] Radwin and D'Attilio, 1976. ASPELLA
morulus Conrad, 1860. = *harrisi*
neotripterus [Pterynotus] Vokes, 1989. PTERYNOTUS s.s.
nuttingi Dall, 1896. POIRIERIA (PAZIELLA)
olssoni [Dermomurex] Vokes, 1989. DERMOMUREX s.s.
oregonia Bullis, 1964. POIRIERIA (PAZIELLA)
ostrearum Conrad, 1846. CALOTROPHON
oxum [Dermomurex] Petuch, 1979. DERMOMUREX (TRIALATELLA)
pacei [Dermomurex] Petuch, 1988. DERMOMUREX s.s.
pauperculus C.B. Adams, 1850. DERMOMUREX s.s.
pazi Crosse, 1869. POIRIERIA (PAZIELLA)
perplexus [Cantharus] Olsson and Harbison, 1953. = *ostrearum*
PETUCHI [*Poirieria*] Vokes. POIRIERIA (PAZIELLA)
phagon [Urosalpinx] Gardner, 1947. CALOTROPHON
phaneus Dall, 1889. PTERYNOTUS s.s.
philippiana [Muricidea] Dall, 1889. ATTILIOSA
phyllopterus Lamarck, 1822. PTERYNOTUS s.s.
poeyi [Muricopsis] Sarasua and Espinosa, 1979. = *aldridgei*
PORTELLI [*Dermomurex*] Vokes. DERMOMUREX (TAKIA)
postii [Pteropurpura] Dall, 1896. PTERYNOTUS s.s.
PRAEPATAGIATUS [*Pterynotus*] Vokes. PTERYNOTUS s.s.
progne [Trophon] White, 1887. ? POIRIERIA (PAZIELLA)
propeposti [Purpura] Mansfield, 1937. PTERYNOTUS s.s.
pterynoides [Dermomurex] Vokes, 1989. DERMOMUREX (TRIALATELLA)
pygmaeus Bush, 1893. = *bushae*, = *phaneus*
radwini [Pterynotus] Harasewych and Jensen, 1979. PTERYNOTUS s.s.
recticanalis [Latirus] Weisbord, 1962. POIRIERIA (PANAMUREX)
repetiti [Pterynotus] Vokes, 1970. PTERYNOTUS (PURPURELLUS)
rubridentatus Reeve, 1846. = *phyllopterus*
rufirupicolus Dall, 1916. PTERYNOTUS s.s.
RUTSCHI [*Poirieria*] Vokes. POIRIERIA (PANAMUREX)
sabinola Palmer, 1960. PTERYNOTUS s.s.
sarasotaensis [Acantholabia] Petuch, 1991. ACANTHOLABIA
SARASUAE [*Dermomurex*] Vokes. DERMOMUREX s.s.
SARKINI [*Dermomurex*] Vokes. DERMOMUREX s.s.
senex [Aspella] Dall, 1903. ASPELLA
septima [Poirieria] Vokes, 1970. POIRIERIA (PAZIELLA)
sexangula Dall, 1915. DERMOMUREX (TAKIA)
silvaticus Palmer, 1937. POIRIERIA (PAZINOTUS)
simplex Aldrich, 1886. = *macneili*
spinulosa Heilprin, 1886. = *heilprini*
stenzeli [Pterynotus] Vokes, 1970. PTERYNOTUS s.s.
stimpsonii [Eupleura] Dall, 1889. POIRIERIA (PAZINOTUS)
susankhanae [Panamurex] Petuch, 1991. = *clarksvillensis*
tristichus Dall, 1889. = *havanensis*
varians [Aspella] Nowell-Usticke, 1969. = *alabastrum*
vaughani Maury, 1910. DERMOMUREX (TAKIA)
veatchi Palmer, 1937. = *sabinola*
velero [Poirieria] Vokes, 1970. POIRIERIA (PANAMUREX)
VENEZUELANUS [*Calotrophon*] Vokes. CALOTROPHON
viaavensis [Attiliosa] Petuch, 1986. = ? FASCIOLARIIDAE
weisbordi Palmer, 1947. PTERYNOTUS s.s.
werneri Toula, 1911. = *dominicensis*
woodsensis [Poirieria] Vokes, 1970. POIRIERIA s.s.
WORSFOLDI [*Dermomurex*] Vokes. DERMOMUREX s.s.
xenos [Pterynotus] Harasewych, 1982. PTERYNOTUS s.s.

VIII. APPENDIX II: STRATIGRAPHICAL LIST OF SPECIES INCLUDED IN THIS PART

The following list is arranged in approximately ascending stratigraphical order, with all of the species recognized as occurring in each formation.

LATE CRETACEOUS
Kemp Clay, Texas
Poirieria (Paziella) cretacea

PALEOCENE
Matthews Landing Marl Member, Porters Creek Formation, Alabama
Pterynotus (Pterynotus) matthewsensis
Poirieria (Poirieria) species
Poirieria (Paziella) harrisi
Bells Landing Marl Member, Tuscahoma Formation, Alabama
Pterynotus (Pterynotus) aurorae
Maria Farhina Formation, Pernambuco, Brazil
(?)*Poirieria (Paziella) progne*

EARLY EOCENE
Bashi Marl Member, Hatchetigbee Formation, Alabama
Poirieria (Poirieria) woodsensis

MIDDLE EOCENE
Weches Formation, Texas
Pterynotus (Pterynotus) stenzeli
Poirieria (Pazinotus) silvatica
Stone City Beds, Texas
Pterynotus (Pterynotus) sabinola
Poirieria (Pazinotus) silvatica
Cook Mountain Formation, Louisiana, Texas (= Crockett Formation), and Mississippi (= Wautubbee Formation)
Pterynotus (Pterynotus) sabinola
Poirieria (Pazinotus) silvatica

LATE EOCENE
Moodys Branch Formation, Louisiana and Mississippi
Pterynotus (Pterynotus) weisbordi
(?)*Poirieria (Pazinotus) silvatica*

EARLY AND MIDDLE OLIGOCENE
Red Bluff Formation, Mississippi
Pterynotus (Pterynotus) burnsii
Pterynotus (Pterochelus) angelus
Dermomurex (Takia) cookei
Mint Springs Formation, Mississippi
Dermomurex (Takia) cookei
Byram Formation, Mississippi
Poirieria (Panamurex) macneili
Suwannee Limestone, Florida
Pterynotus (Pterynotus) propeposti
Dermomurex (Takia) portelli, n. sp.
River Bend Formation, North Carolina
Dermomurex (Takia) portelli, n. sp.

LATE OLIGOCENE/EARLY MIOCENE
Tampa Limestone, Florida
Pterynotus (Pterynotus) postii
Poirieria (Panamurex) heilprini
Dermomurex (Takia) sexangulus
Flint River Formation, Georgia
Pterynotus (Pterynotus) rufirupicolus
"Silverdale Beds" (= Silverdale Formation = Belgrade Formation), North Carolina
Pterynotus (Purpurellus) repetiti
Dermomurex (Takia) sexangulus

LATE EARLY MIOCENE
Cantaure Formation, Venezuela
Poirieria (Panamurex) gatunensis
Poirieria (Panamurex) improcerus, n. sp.
Poirieria (Panamurex) gibsonsmithi, n. sp.
Chipola Formation, Oak Grove Sand, Florida
Pterynotus (Pterynotus) praepatagiatus, n. sp.
Pterynotus (Pterynotus) hoerlei
Poirieria (Panamurex) laccapoia
Poirieria (Panamurex) fusinoides
Poirieria (Panamurex) lychnia
Poirieria (Panamurex) mauryae
Dermomurex (Dermomurex) matercula
Dermomurex (Trialatella) farleyensis
Dermomurex (Takia) curviductus
Dermomurex (Takia) vaughani
Calotrophon phagon
Unnamed formation, Chiapas, Mexico
Poirieria (Panamurex) laccapoia

MIDDLE MIOCENE
Shoal River Formation, Florida
Poirieria (Panamurex) laccapoia
(?)*Poirieria (Panamurex) fusinoides*
Calotrophon phagon

LATE MIOCENE
Cercado Formation, Dominican Republic
Dermomurex (Trialatella) pterynoides
Attiliosa aldridgei
Caujarao Formation, Venezuela
Poirieria (Panamurex) improcerus, n. sp.

PLIOCENE
Melajo Clay, Trinidad
Calotrophon hutchisoni
Gatun Formation, Panama
Poirieria (Panamurex) gatunensis
Punta Gavilán Formation, Venezuela
Poirieria (Panamurex) gatunensis
Poirieria (Panamurex) rutschi, n. sp.
Esmeraldas Beds, Ecuador (East Pacific)
Poirieria (Poirieria) actinophora
Gurabo Formation, Dominican Republic
Pterynotus (Pterynotus) aliculus
Pterynotus (Pterynotus) neotripterus

Pterynotus (Pterynotus) phyllopterus
Pterynotus (Purpurellus) mirificus
Poirieria (Paziella) dominicensis
Poirieria (Flexopteron) collata
Poirieria (Panamurex) gabbi
Aspella castor
Dermomurex (Dermomurex) granulatus
Dermomurex (Dermomurex) cracentis
Dermomurex (Dermomurex) olssoni
Dermomurex (Trialatella) pterynoides
Attiliosa aldridgei

Concepcion Inferior Formation, Mexico
Poirieria (Paziella) dominicensis
Poirieria (Paziella) septima
Poirieria (Panamurex) alaquaensis

Mao Formation, Dominican Republic
Poirieria (Flexopteron) collata

Agueguexquite Formation, Mexico
Poirieria (Pazinotus) bowdenensis
Poirieria (Panamurex) alaquaensis

Duplin Formation, North Carolina
Calotrophon ostrearum

Fruitville Formation (= "Pinecrest Beds"), Florida
Poirieria (Panamurex) clarksvillensis
Aspella senex
Dermomurex (Dermomurex) alabastrum (as *D. engonatus*)
Calotrophon conradi
Calotrophon ostrearum
Acantholabia sarasotaensis

Pinecrest Beds, Florida
Poirieria (Panamurex) clarksvillensis
Dermomurex (Dermomurex) alabastrum (as *D. engonatus*)
Calotrophon ostrearum

Tamiami Formation, Florida
Pterynotus (Pterynotus) phyllopterus
Poirieria (Panamurex) clarksvillensis
Calotrophon ostrearum
Acantholabia floridana

Jackson Bluff Formation, Florida
(?)*Poirieria (Panamurex) alaquaensis*
Poirieria (Panamurex) clarksvillensis
Calotrophon conradi

PLIO-PLEISTOCENE

Caloosahatchee Formation, Florida
Aspella senex
Dermomurex (Dermomurex) alabastrum (as *D. engonatus*)
Calotrophon ostrearum
Acantholabia floridana
Attiliosa aldridgei

Tuberá Group, Colombia
Poirieria (Panamurex) gatunensis
Dermomurex (Dermomurex) alabastrum

Mare Formation, Venezuela
Poirieria (Panamurex) recticanalis
Calotrophon venezuelanus

Playa Grande Formation, Venezuela
Poirieria (Panamurex) recticanalis

Bowden Formation, Jamaica
Poirieria (Flexopteron) collata
Poirieria (Pazinotus) bowdenensis

PLEISTOCENE

Bermont Formation, Florida
Aspella senex
Dermomurex (Dermomurex) alabastrum (as *D. engonatus*)
Dermomurex (Gracilimurex) elizabethae
Dermomurex (Trialatella) antecessor
Calotrophon ostrearum
Attiliosa aldridgei

Anastasia and Ft. Thompson formations, Florida
Calotrophon ostrearum

Waccamaw Formation, South Carolina
Aspella senex
Dermomurex (Dermomurex) alabastrum
Calotrophon ostrearum

Moín Formation, Costa Rica
Pterynotus (Pterynotus) havanensis
Pterynotus (Pterynotus) phyllopterus
Poirieria (Pazinotus) bowdenensis
Dermomurex (Dermomurex) pacei
Dermomurex (Dermomurex) pauperculus
Dermomurex (Dermomurex) alabastrum
Dermomurex (Dermomurex) sarkini, n. sp.
Dermomurex (Trialatella) antecessor
Attiliosa aldridgei

Unnamed formation, Panama
Dermomurex (Dermomurex) pauperculus

RECENT

Pterynotus (Pterynotus) guesti, phaneus, havanensis, lightbourni, radwini, phyllopterus, xenos
Pterynotus (Pterochelus) ariomus
Poirieria (Poirieria) actinophora
Poirieria (Paziella) atlantis, petuchi, n. sp., *pazi, nuttingi, oregonia*
Poirieria (Pazinotus) bowdenensis, stimpsonii, (?) hystricina
Poirieria (Panamurex) carnicolor, velero, eugeniae, n. sp.
Aspella castor, senex, cryptica, morchi
Dermomurex (Dermomurex) olssoni, pacei, pauperculus, alabastrum, sarasuae, n. sp., *binghamae*, n. sp., *kaicherae, glicksteini, worsfoldi*, n. sp.
Dermomurex (Gracilimurex) elizabethae
Dermomurex (Trialatella) antecessor (as *D. cuna*), *abyssicola, oxum, leali*
Calotrophon ostrearum, andrewsi
Attiliosa aldridgei, philippiana, species