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CENOZOIC MURICIDAE OF THE WESTERN ATLANTIC REGION

PART I—MUREX *sensu stricto*

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## PART I—MUREX *sensu stricto*

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### I. ABSTRACT

A study of the marine gastropods of the subgenus *Murex sensu stricto* (type *M. tribulus* Linné) shows that in the fossil record of the western Atlantic region there are 19 species-groups referable to this subgenus. From the same area 15 Recent species are known, only four of which occur in the paleontological record. The oldest species definitely referable to this group appear in the lower Miocene with ten species of this age reported from localities extending from Florida to Brazil. Two subgroups may be recognized, one here termed the "Western Atlantic" subgroup, the other the "Indo-Pacific" subgroup. Both subgroups are present in the western Atlantic today, with the "Indo-Pacific" group generally inhabiting water less than 50 fathoms in depth, and the "Western Atlantic" group in the cooler water of somewhat greater depths.

### II. INTRODUCTION

The genus *Murex* was established in 1758 by Linnaeus (p. 746) and originally comprised all of the gastropods with:

"Testa univalvis, spiralis, exasperata suturis membranaceis. Apertura desines in canalem integrum rectum s. subadscendentum." [Shell univalve, spiral, rough with membranaceous ridges. Aperture ending in a straight, or slightly ascending canal (translation from Dillwyn, 1817, p. 680).]

Linnaeus included a wide variety of shells which subsequently have been divided and redivided into nearly as many genera as the original 59 Linnaean species. Linnaeus himself divided the genus into six subgroups, of which only two are today included even in *Murex sensu lato*. The first of these, "a", was characterized as "Spinosi cauda exserta," and includes *M. tribulus*, selected by Montfort in 1810 (p. 619) as the type species of the genus.

*Murex sensu stricto* therefore consists of those species with an elongated siphonal canal and three varices, more or less spinose. This subgenus, however, may be further sub-

divided into two groups. The first might be termed the "Indo-Pacific" form, with a straight siphonal canal, showing little or no trace of former canals. Many species of this group, including *M. tribulus*, bear a series of varical spines down the length of the canal. The second, or "Western Atlantic" group, differs in that the siphonal canal is deflected to the left, and as the successive canals form, these ends remain as a series of divarications. This form is restricted to the western Atlantic today and many of the early fossil species were of this type. The "Indo-Pacific" form seems to have flourished farther south originally, but both groups now live over all of the area.

According to data collected by the "Challenger" and "Siboga" expeditions (Watson, 1885; Schepman, 1911), the approximately thirty known species of *Murex* s.s. in the Indo-Pacific region today live in water depths of less than 50 fathoms. Those members of the "Indo-Pacific" group which inhabit the western Atlantic are also shallow water forms (see Table I), while the members of the "Western Atlantic" group generally occur in deeper water. The "Indo-Pacific" species appear to be more successful; however this may be only a reflection of the fact that deeper water species are less easily collected. Deep-water dredgings made by the U. S. Fish and Wildlife M/V *Oregon* show that many of the species considered rare are not so, but occur in great numbers in the comparative obscurity of the depths (H. R. Bullis, Jr., personal communication). Originally the "Western Atlantic" group inhabited shallower water, the occurrence with such genera as *Conus*, *Arca*, *Strombus*, *Turritella*, *Macrocallista* and others indicates a water depth of less than 50 fathoms, but presumably rising temperatures in Recent times have caused the group to move into slightly deeper water.

Although the geologic history of the genus *Murex* begins in the Paleocene, *Murex* s.s. does not appear until somewhat later, possibly in the Oligocene. There are species in the upper Eocene of Australia which could be ancestral to the group, and the form prob-



ably developed in the Indo-Pacific area. In the western Atlantic region the first true *Murex* s.s. appear in the lower Miocene, though there are species of other subgenera back to the Paleocene. *Murex quirosensis* Hodson was described from the upper Oligocene of Venezuela, and if this age is correct it is the oldest *Murex* s.s. in this area. However, the age assignment is subject to some doubt (see remarks under that species), and it too is probably lower Miocene in age. *M. quirosensis* is closely related to forms in the Chipola Formation of northern Florida (uppermost lower Miocene), and is either ancestral to (if the age is correct), or contemporaneous with them. In the Chipola Formation there is suddenly an "explosion" of true *Murex* s.s., both in species and in number of individuals, but this may be only a facies phenomenon as the Chipola is a fine sand such as that preferred by living *Murex* s.s.

Coincident with the appearance of the "Western Atlantic" form to the north is that of the "Indo-Pacific" form to the south. Species in the Pirabas Limestone of Brazil, which has been correlated with the Chipola (Maury, 1925, p. 32), as well as *M. messorius* Sowerby of the Caribbean, are of this latter stock. *M. messorius* was a vigorous species which rapidly spread over most of the Caribbean area and still survives, virtually unchanged, today. *M. recurvirostris* Broderip, believed by some to be synonymous with *M. messorius*, is found today on the western coast of Central America from Ecuador to the Gulf of California. This species is closely related to *M. messorius* and doubtless shares a common ancestry. Another West Coast species, *M. elenensis* Dall, is similar to *M. recurvirostris*, though larger and with rows of varical spines down the canal, but is even more closely related to *M. cabritii* Bernardi from the Gulf of Mexico, a species unique among Atlantic Murices in having a spinose canal. Although the two undoubtedly have a common history, no American fossil exhibits this otherwise Indo-Pacific trait, and the ancestry of these two unusual species is unknown.

This study has revealed 19 species-groups referable to *Murex* s.s. in the fossil record of the western Atlantic region (see Table II). Ten of these species have been reported from the lower Miocene, five in the Chipola Formation of Florida and five in the equiva-

lent Pirabas Limestone. Six species occur in middle Miocene beds, four in the upper Miocene, and six in the Pliocene and Pleistocene. In addition there are 15 species known only from the Recent.

An attempt has been made to include all pertinent references for the fossil species, but synonymies for those species which are extant do not, for the most part, include references to the Recent representatives, the latter having been covered by Clench and Pérez Farfante (1945 *et seq.*). All type and figured specimens originally from the Tulane Geological Collections have been deposited in the United States National Museum.

TABLE I  
RECENT SPECIES OF *MUREX* S.S. IN  
THE WESTERN ATLANTIC, WITH  
DEPTH RANGES

"Indo-Pacific" form	
<i>M. cabritii</i> Bernardi:	18-76 fathoms
<i>M. chrysostomus</i> Sowerby:	no data
<i>M. maculatus</i> Verrill:	40-50 fms.*
<i>M. messorius</i> Sowerby:	40 fms.*
<i>M. recurvirostris sallasi</i> Rehder & Abbott:	18-50 fms.
<i>M. rubidus</i> Baker:	6-85 fms.
<i>M. tryoni</i> Hidalgo:	25-115 fms.
"Western Atlantic" form	
<i>M. aguayoi</i> Clench & Pérez Farfante:	185-285 fms.
<i>M. cailleti</i> Petit:	54-200 fms.
<i>M. cailleti kugleri</i> Clench & Pérez Farfante:	25-180 fms.
<i>M. ciboney</i> Clench & Pérez Farfante:	60-248 fms.
<i>M. finlayi</i> Clench:	100 fms.*
<i>M. antillarum</i> Hinds:	40-100 fms.
<i>M. motacillus</i> Gmelin:	95 fms.*
<i>M. pulcher</i> A. Adams:	40-60 fms.

These figures are not definitive but are based on the scanty data available. The data are taken from Clench and Pérez Farfante (1945), Springer and Bullis (1956), unpublished dredging records, and original authors.

\* Representing only one record.

### III. ACKNOWLEDGMENTS

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P. Woodring of the United States Geological Survey, and Dr. G. Arthur Cooper, Curator of Geology, United States National Museum, all loaned specimens essential to the study. In particular she desires to thank Mr. Druid Wilson of the United States Geological Survey for his advice and continued assistance throughout the writing of the work. She would also like to express special appreci-

TABLE II  
GEOLOGIC AND GEOGRAPHIC DISTRIBUTION OF FOSSIL SPECIES  
OF *MUREX* S.S.

	U. Oligocene	L. Miocene	M. Miocene	U. Miocene	Pliocene	Pleistocene	Recent	
<i>M. quirosensis</i> F. Hodson	?							?Agua Clara Fm., Zulia, Venezuela
<i>M. chipolanus</i> Dall		x						Chipola Fm., Florida
<i>M. gardnerae</i> E. H. Vokes, n. sp.		x						Chipola Fm., Florida
<i>M. gilli</i> (Maury)		x						Chipola Fm., Oak Grove Sand, Florida
<i>M. gilli polynematicus</i> Brown & Pilsbry			x					Gatun Fm., Panama
<i>M. vaughani</i> Maury		x						Chipola Fm., Florida
<i>M. pennai</i> Maury		x						Pirabas Limestone, Pará, Brazil
<i>M. toreia</i> Maury		x						Pirabas Limestone, Pará, Brazil
<i>M. williamsi</i> Maury		x						Pirabas Limestone, Pará, Brazil
<i>M. subtilis</i> White		x						Pirabas Limestone, Pará, Brazil
<i>M. messorius</i> Sowerby		x	x	x	x	x	x	Pirabas Limestone, Brazil; Quebradillas Limestone, Porto Rico; Gurabo and Cercado Fms., Santo Domingo; Agueguexquite Fm., Mexico; M. Miocene, Oriente, Cuba; Gatun Fm., Panama and Costa Rica; Bowden Fm., Jamaica; Punta Gavilan and Mare Fms., Venezuela; Recent, Caribbean
<i>M. nicholsi</i> Gardner		x	x					Chipola Fm., Shoal River Fm., Florida
<i>M. domingensis</i> Sowerby			x	x				Gurabo Fm., Santo Domingo; Punta Gavilan Fm., Venezuela
<i>M. yaquensis</i> Maury			x					Gurabo Fm., Santo Domingo
<i>M. antillarum</i> Hinds			x	x	x	x	x	Bowden Fm., Jamaica; Recent, western Atlantic
<i>M. rubidus</i> Baker				x	x	x	x	Unnamed upper Miocene formation, Caloosahatchee Fm., and unnamed post-Caloosahatchee formation, Florida; Recent, Florida and Bahamas
<i>M. chrysostomus</i> Sowerby					x	x	x	Mare Fm., Venezuela; Recent, western Atlantic
<i>M. anniae</i> M. Smith					x			Caloosahatchee Fm., Florida
<i>M. anniae bellegladeensis</i> E. H. Vokes, n. subsp.						x		Unnamed post-Caloosahatchee formation, Florida



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#### IV. SYSTEMATIC DESCRIPTIONS

Phylum MOLLUSCA

Class GASTROPODA

Subclass PROSOBRANCHIA

Order NEOGASTROPODA (or STENOGLOSSA)

Suborder RACHIGLOSSA

Superfamily MURICACEA

Family MURICIDAE

Subfamily MURICINAE

Genus MUREX Linnaeus, 1758

Subgenus MUREX s.s.

MUREX (MUREX) QUIROSENSIS F. Hodson  
Plate 1, figures 4a, b

*Murex recurvirostris quirosensis* F. Hodson, 1931, Bull. Amer. Paleontology, v. 16, no. 59, p. 37, pl. 20, figs. 1, 2, 5 (not 3 as cited).

*Diagnosis*: "This subspecies differs from *M. recurvirostris* Broderip in being more slender, in having a more attenuate spire, in being more spinous especially in the younger stages, in having more delicate spiral sculpture, and in having 2 strong intervarical tubercles (sometimes a weak third one is present) instead of 3 or 4 commonly found in the recent specimens.

"Our Oligocene specimens have a thin, inconspicuous parietal callus which does not stand out from the parietal wall. In the lower Miocene, intergrading forms are found between this Oligocene form and those occurring in the Upper Tertiary, and usually show a strong parietal callus which stands out from the parietal wall.

"Age. Upper Oligocene.

"Holotype locality. Loc. 6, Quirós, District of Miranda, Zulia [Venezuela]; intergrading forms are found in the States of Zulia and Falcón. (*Sensu stricto*, also from the District of Buchivacoa, Falcón.)" (Hodson, 1931)

Shell small; spire elevated, suture deeply impressed. Protoconch smooth, conic, probably of three whorls (incomplete in holotype). Six post-nuclear whorls in adult. Spiral sculpture of alternating primary and secondary threads, with occasional tertiary

threadlets intercalated; about 18 primaries on the body whorl and pillar. Axial sculpture of three stout varices bearing a single recurved spine at the shoulder of each, and two series of open spines on their anterior prolongation. Two intervarical ridges between each pair of varices. Aperture triangular in outline; labium appressed, indistinct except at anterior portion where four transverse rugae are developed. Outer lip bearing 12 denticles within the aperture, corresponding roughly to the primary spiral threads. Anterior canal long, straight, antecedent canals slightly divergent.

Dimensions of holotype: height 32 mm, greatest diameter, including terminal varix (excluding spines), 16 mm.

Holotype: PRI 24104.

*Figured Specimen*: PRI 24104 (holotype).

*Discussion*: Oil company "security regulations" prevented stratigraphic assignment for this locality which was given as "oil seep at El Mene de Saladillo, 1.5 km SW of Quirós" (corrected to Quiroz by Brann and Kent, 1960, p. 17). If the age is correct this would place the species in the Agua Clara Formation but the Oligocene in this area is now known to be much thinner than was previously believed and the assignment is therefore uncertain. No map differentiating the Oligocene from the Miocene is available, so for the time we accept Hodson's determination.

Regardless of age, this *Murex* is certainly a distinct species, and is allied more closely with *M. gardnerae* Vokes n. sp., from the Chipola Formation (lower Miocene) than with *M. recurvirostris*. If Oligocene, it is the earliest known Caribbean fossil definitely referable to *Murex* s.s.

MUREX (MUREX) CHIPOLANUS Dall

Plate 1, figures 3a, b

*Murex chrysostris* Gray, var. *chipolana* DALL, 1890, Wagner Free Inst. Sci., Trans., v. 3, pt. 1, p. 139.

not *Murex (Murex) chipolanus* Dall. GARDNER, 1947, U.S.G.S. Prof. Paper 142-H, p. 517, pl. 53, figs. 1, 2. (= *M. gardnerae*, n. sp.)

*Diagnosis*: "The specimens from the Chipola River differ from the recent *M. chrysostris* in being smaller than the average adult recent specimens, with a slightly shorter canal, from which the antecedent canal tends to divaricate, while in the typical *chrysostris* it is usually continuous.

"The anterior margin of the varices in the fossil also tends to be more spinose or to have the projecting points more produced



than in the recent shell, though similarly situated and similar in number." (Dall, 1890)

Shell of moderate size; protoconch smooth, conic,  $3\frac{1}{2}$  whorls. Post-nuclear whorls, six or seven; body whorl inflated. Spiral sculpture of irregularly alternating primary and secondary threads, with some tertiary threadlets; 12 to 14 primary threads on body whorl and pillar. Axial sculpture of three strong varices, with one or two pronounced intervarical nodes. Where certain of the primary spirals cross these varices spines are produced, one strong at the shoulder, another almost as strong at the periphery, and two or three smaller on the anterior portion of the varix; in addition, one or two spines on the pillar. Aperture oval; labium with a heavy callus, standing free from the body wall at the margin; three or four rugae on the anterior half. Outer lip crenulated, and bearing within about eight denticles. Anterior canal long, recurved, with antecedent canals remaining as distinct divarications.

Dimensions of lectotype: height 38 mm, greatest diameter, including terminal varix (exclusive of spines), 20 mm.

Lectotype: USNM 112156.

Type locality: USGS 2212, Ten Mile Creek, one mile west of Chipola River, Calhoun County, Florida.

*Figured specimen:* USNM 112156 (lectotype). Other occurrences: TU locality nos. 70, 196, 430?, 456, 546; USGS 2213.

*Discussion:* Dall described this species from the Chipola Formation (uppermost lower Miocene) without a figure. In 1947, Gardner figured a specimen which she termed the "lectotype." However, collections from the Chipola River area have disclosed that two superficially similar species occur there; one is that figured by Gardner as "*M. chipolanus*", the other agrees more closely with Dall's description. Presumably the two were considered the same by Gardner. Gardner's selection of a "lectotype" was unnecessary as a type had been selected by Schuchert and Dall (1905, p. 420) with the USNM number 112156 and the type locality of "Ten Mile Creek, Chipola River" (USGS 2212). A specimen bearing these type and locality numbers is present in the National Museum collections. The specimen figured by Gardner, clearly of the other species, is indicated as being from locality 2213, which is on the Chipola River, "one mile below Bailey's Ferry".

The United States National Museum record of these specimens reveals that USNM

112156 was catalogued as one specimen, with Ten Mile Creek, Chipola River given as the locality. Another single specimen, USNM 112157, was catalogued as one specimen from Chipola River at Bailey's Ferry. These two specimens were catalogued on the same day and are the only two that can be found labelled in Dall's handwriting. All other specimens dating from Dall's time (lot nos. 114250, 114251) were catalogued later and without identification in the catalogue; they now carry the old labels, but with identification in Gardner's handwriting. Both lots (114250, 114251) labelled in Gardner's handwriting now contain more specimens than when originally catalogued so there is no hope of discovering whether USNM 371885 (her "lectotype") may have been removed from either of them. Thus there seems to be sufficient reason for questioning whether Gardner's figured "lectotype" was actually one of the specimens originally identified by Dall. Therefore, *M. chipolanus* is redescribed and figured here for the first time, and Gardner's "lectotype" is referred to a new species, *M. gardnerae*, described below.

MUREX (MUREX) GARDNERAE E. H. Vokes,  
n. sp.

Plate 1, figures 1a, b

*Murex (Murex) chipolanus* Dall. GARDNER, 1947, U.S.G.S. Prof. Paper 142-H, p. 517, pl. 53, figs. 1, 2. (not of Dall)

*Diagnosis:* Shell rather small for the group. Spire elevated; body inflated, rounded abruptly at the base into the slender pillar. Whorls of adult conch six or seven, moderately convex. Protoconch small, smooth, elevated, including four volutions. Axial sculpture of three varices, spinose at the periphery of the later whorls and the body, the spines slender, sickle-shaped, laminar, one of the primary spiral threads forming the midrib; spines not developed behind the periphery; commonly secondary spines in front of the periphery at the intersection with the primary spiral threads, especially on the base of the body and the pillar; primary varices on the medial whorls standing up like heavy, well-rounded cords; two or three more or less irregular secondary axial ribs usually developed between each pair of primary ribs on the spire, on the body commonly reduced to peripheral tubercles; on the early whorls usually eight to ten equisized and equispaced, well-rounded axial ribs crossed by three or four rather prominent spiral cords. Spiral threads subequal and equispaced; posterior



primary spiral forming the axis of the prominent varical spines; three or four lirae intercalated between the posterior peripheral primary thread and the posterior suture with or without additional secondary threadlets; two to four threadlets also intercalated between the two peripheral spirals; ten primary threads in front of the periphery of the body, subequal and regularly spaced, the wider interspaces with one or two fine lirae; sculpture on the pillar less regular, about six primary threads with intercalated secondaries. Aperture broadly oval, feebly notched posteriorly. Outer lip angulated at the periphery, the margin finely crenate. Inner wall of aperture excavated at the base of the body; labium reflected, forming a heavy callus, with its thin, sharp margin discrete from the body wall; corrugations within the margin rather heavy on the posterior half. Anterior canal long and slightly flexed toward its extremity, the former canals slightly divergent. Final canal roofed over and almost closed by a thin laminar plate of the callus. (After Gardner, 1947)

Dimensions of holotype: height 37.8 mm, greatest diameter, including terminal varix (excluding spines), 16.6 mm.

Holotype: USNM 643750.

Type locality: TU 456, Ten Mile Creek, about ½ mile downstream from bridge of Florida Highway 73, (NW¼ Sec. 12, T1N, R10W), Calhoun County, Florida.

*Figured specimen:* USNM 643750 (holotype). Other occurrences: TU locality nos. 70, 196, 458, 546; USGS 2212, 2213?.

*Discussion:* This species may be distinguished from *M. chipolanus*, with which it occurs, by the presence of one strong spine at the shoulder only, and secondary open spinelets on the anterior portion of the varices, rather than the two strong spines with several smaller spines, typical of *M. chipolanus*. It may also be distinguished by the longer, straighter canal, and by the two or three weak axial ribs, in contrast to the much stronger intervarical nodes of *M. chipolanus*.

The specimen figured by Gardner as "*M. chipolanus*", which has been discussed above, is an extraordinarily large individual. Although one specimen of similar dimensions has been collected by the writer (TU locality 546), most are considerably smaller, usually less than 25 mm in height. *M. chipolanus*, which tends to be 30 mm or more in the adult, is generally the larger species. Gardner's specimen was cited as being from USGS locality 2213 (TU locality 457). However, the writer has found no trace of

this species in large collections made at that locality, and only three specimens have been collected anywhere along the Chipola River (at TU locality 458), but *M. gardnerae* is fairly common along Ten Mile Creek, west of the Chipola River, in a slightly more silty facies. Because of these factors it was deemed advisable to select as the holotype of this new species a specimen other than Gardner's, of a more typical size and from an established locality.

#### MUREX (MUREX) GILLI (Maury)

Plate 2, figures 1-4

*Murex mississippiensis* Conrad. DALL, 1890, Wagner Free Inst. Sci., Trans., v. 3, pt. 1, p. 139 (in part); DALL, 1915, U. S. Natl. Mus., Bull. 90, p. 73 (in part).

*Fusus gilli* MAURY, 1910, Bull. Amer. Paleontology, v. 4, no. 21, p. 137, pl. 22, fig. 3.

*Murex (Murex) gilli* (Maury). GARDNER, 1947, U.S.G.S. Prof. Paper 142-H, p. 518.

*Murex (Murex) dasus* GARDNER, 1947, U.S.G.S. Prof. Paper 142-H, p. 518, pl. 53, fig. 4.

*Diagnosis:* "Shell with six convex whorls of which the first three are smooth and the remainder sculptured. Spiral sculpture of well-defined threads alternating in size. Longitudinal sculpture of rounded riblets (ten on the last whorl). Suture waved; pillar nearly straight; aperture and canal keyhole shaped. Length of shell 9; greatest diameter 4 mm.

"Named in honor of Professor Gill of Cornell University.

"Oak Grove, Florida." (Maury, 1910)

Shell rather small for the group, moderately heavy, stout fusiform. Whorls of conch six to seven, broadly convex, rapidly increasing in diameter. Body whorl inflated, abruptly constricted into the moderately long and slender pillar. Protoconch small, smooth, conic, coiled 3½ times. Axial sculpture on the earliest whorls of about eight sharply rounded, well-elevated costae, separated by narrower intercostals; reduced on the final whorls to three varices, with one to three irregular riblets or nodes in the intervarical spaces; later varices usually produced into short, sharp spines at the shoulder, a primary spiral thread forming the midrib of the spines; one or two series of varical spines also developed on the pillar. Spiral sculpture close, sharp, and regular; primary spiral threads on the early whorls usually four, increasing to about seven on the final whorl of the spire, and 20 on the body and the pillar; interprimary areas crowded with secondary and tertiary threadlets. Aperture rather large, oblique, broadly rounded behind, smoothly contracting into the linear anterior canal; posterior canal obscure. Labrum broad,



arcuate; the margin elevated and heavily denticulated, the denticles approximately 15, corresponding roughly to the spaces between the primary spiral threads. Labium smoothly excavated, heavily glazed, the wash thinning on the base of the body so that the spiral sculpture shows through. Pillar straight, reinforced, the margin of the wash standing apart from the wall of the pillar, corrugated within the margin by four to six rugose denticles. Anterior canal moderately long and straight with parallel proximate margins. (After Gardner, 1947)

Holotype: USNM 639075.

Type locality: Oak Grove (TU locality 91), Florida.

*Figured specimens:* Fig. 1, USNM 643754 (topotype—*M. gilli*); height 35 mm, greatest diameter, including terminal varix (excluding spines), 23.5 mm; locality TU 91. Fig. 2, USNM 643752; height 32 mm, diameter 17 mm, locality TU 70. Fig. 3, USNM 639075 (holotype—*M. gilli*); height 9 mm, diameter 4 mm. Fig. 4, USNM 643753; height 8 mm, diameter 4 mm; locality TU 70. Other occurrences: TU locality nos. 196, 456, 458, 546, 549.

*Discussion:* Examination of the holotype of *Fusus gilli* reveals that it is a juvenile specimen of the species later named *M. dasus* by Gardner. (Compare Plate 2, figures 3 and 4.) As the original description was of an immature specimen, Gardner's description of the adult form (*M. dasus*) is also given. Gardner did not report *M. dasus* from the Oak Grove Sand; however, at the type locality of that formation (TU locality 91) it is one of the more common gastropods in a predominantly pelecypod fauna. The Oak Grove is now thought perhaps to be only a facies of the Chipola Formation where *M. gilli* is also common.

MUREX (MUREX) GILLI POLYNEMATICUS  
Brown and Pilsbry  
Plate 2, figure 5

*Murex polynematicus* BROWN and PILSBRY, 1911, Acad. Nat. Sci. Phila., Proc., v. 63, p. 353, pl. 26, fig. 1.

*Murex (Murex?) polynematicus* Brown and Pilsbry. WOODRING, 1959, U.S.G.S. Prof. Paper 306-B, p. 215, pl. 36, figs. 2, 3; pl. 37, figs. 6, 9.

*Diagnosis:* "This form differs from the recent *M. recurvirostris* and the Oligocene subspecies *domingensis* Gabb [*sic*] by having more numerous spiral threads in the interval of the major spirals—three or four

in each interval. There are six varices on the last one and a half whorls, none on the earlier whorls. The varices are not very large, and not excavated behind. A shoulder spine is present on the last two varices only, and is short and conic. The three intervarical spaces on the last whorl bear three, two and one folds, respectively. These folds are shorter and higher than in *recurvirostris*. Diameter 38 mm; length unknown, the anterior canal being broken." (Brown and Pilsbry, 1911)

"Moderately large, strongly shouldered, moderately spinose. Protoconch consisting of three acutely tapering whorls. Early post-protoconch whorls not shouldered, sculptured with axial ribs and three spiral threads. First varix appearing on third or fourth sculptured whorl or delayed until about sixth. Varices moderately pinched, well ahead of corresponding varix on preceding whorl. At first two or three strong axial ribs, extending from suture to suture, between varices; later two and finally on body whorl generally one, swollen and extended on shoulder but not reaching suture. Spiral sculpture of late whorls consisting of closely spaced threads of different rank. All except earliest post-protoconch whorls also sculptured with faint irregular axial swellings and microscopic irregularly spaced axial threads. Varices bearing a short erect spine at shoulder and on body whorl a blunt projection or low spine below the shoulder. One or two slender spines present or absent on pillar on the two varices preceding terminal varix. Edge of outer lip scalloped; interior bearing elongate denticles well within aperture. Siphonal canal moderately long, narrow, slightly bent backward, tip broken. Basal part of inner lip bearing elongate denticles.

"Height (incomplete) 54.5 mm, diameter (including terminal varix and its broken shoulder spine) 33.7 mm." (Woodring, 1959)

Holotype: Acad. Nat. Sci. Phila. 1719.

Type locality: Gatun Locks excavation, Canal Zone.

*Figured specimen:* USNM 643759; height 40 mm, greatest diameter, including terminal varix, 21 mm; locality USGS 16909.

*Discussion:* *M. polynematicus*, from the Gatun Formation (middle Miocene) of Panama, was described originally from an imperfect specimen; therefore, the expanded description of Woodring (1959) is cited also. This species is much too similar to *M. gilli* to be distinguished as a separate species. Woodring (1959, p. 216) says, "*M. dasus* [= *gilli*] is almost indistinguishable from small specimens of *M. polynematicus*, except that *M. dasus* has stronger secondary



axial sculpture." This characteristic is quite variable in *M. gilli* and probably is not a valid distinction, but until the writer has seen more specimens of *M. polynematicus* the subspecific designation will be applied. The principal difference, which may be ecological, seems to be size; the average *M. polynematicus* is about 50 mm in height, and the average *M. gilli* is 35 mm or less. However, one incomplete specimen collected from the Chipola beds (TU locality 458) approaches *M. polynematicus* in size.

MUREX (MUREX ?) VAUGHANI Maury

Plate 1, figures 2a, b

*Murex vaughani* MAURY, 1910, Bull. Amer. Paleontology, v. 4, no. 21, p. 143, pl. 23, fig. 6.

*Murex (Murex) vaughani* MAURY, GARDNER, 1947, U.S.G.S. Prof. Paper 142-H, p. 519.

*Diagnosis*: "Shell small, pyriform, compact, resembling in shape young specimens of *M. messorius* Sowerby of the Pliocene and recent faunas. Whorls about six, the nuclear nearly smooth, the three later whorls bearing each seven varices. On the body whorl the varices are prominent, rounded, somewhat broader than the interspaces. The varices of the shell form nearly continuous, sinuous lines from near the apex to the base of the canal. Spiral sculpture of raised lines of which groups of two or three are much stronger and stand out prominently from among alternating feebler spirals. Outer lip with about ten strong internal lirae; aperture oval; canal not quite half the length of the shell. Length of the shell 22.5; greatest width 14 mm.

"Chipola marls, Bailey's Ferry, Florida.

"Named in honor of Mr. T. W. Vaughan of the United States Geological Survey." (Maury, 1910)

*Figured specimen*: PRI 3461 (holotype). Other occurrences: TU locality 548.

*Discussion*: This rare species from the Chipola Formation is somewhat dubiously assigned to this subgenus. It has seven varices, while appearing otherwise to be a *Murex* s.s., and seems closer to the Recent *M. tumulosus* Sowerby (in a miniature version), than to any American species, fossil or Recent. Gardner (1947, p. 519) said of this shell, "nothing quite like it has been found in the collections available for study." One incomplete specimen has been collected by the writer (TU locality 548) and this apparently is only the second known example.

MUREX (MUREX) PENNAI Maury

*emend.* E. H. Vokes

Plate 4, figure 5

*Murex pennae* MAURY, 1925, Ser. Geol. Min. Brasil, Mon. 4, p. 141, pl. 6, fig. 4.

*Diagnosis*: "Shell with somewhat the form of *Murex messorius* but with a much higher spire, and varices without spines. Whorls eight, including the nuclear [whorls]. The spire is very high and the convex whorls are separated by a deeply impressed suture. The imprint of one side of the shell in the limestone shows two varices extending continuously up the spire from whorl to whorl, almost vertically. The third varix is not shown. The varices are low, rounded, with no trace of any spines. On each whorl there are between the varices four, narrow, low, longitudinal ribs. The spiral sculpture consists of very sharply defined spiral threads, almost uniform though finer threads are sometimes interpolated. Anterior canal very long, perfectly straight, and the varices extend almost its entire length as sharp ridges. Aperture not preserved. Length of shell 50 mm, greatest diameter 20 mm.

"This beautiful *Murex* is dedicated to Sr. Ferreira Penna, who in 1876, discovered this fossiliferous outcrop.

"Locality—Rio Pirabas. [State of Pará, Brazil]" (Maury, 1925)

*Discussion*: It is regrettable that the preservation of the fossils in the Pirabas Limestone (lower Miocene) is in the form of molds, for the original illustration is so poor that any positive statement concerning relationships is impossible. However, this species bears a strong resemblance to some specimens of *M. domingensis* Sowerby from the Caribbean (see Plate 2, fig. 7) and it is probable that the two are synonymous.

The name of this species has been emended to *M. pennai*, as it was named for a man. (Art. 31, Int. Code Zool. Nomen., 1961, p. 33)

MUREX (MUREX) TOREIA Maury

Plate 4, figure 6

*Murex toreia* MAURY, 1925, Serv. Geol. Min. Brasil, Mon. 4, p. 145, pl. 6, fig. 11.

*Diagnosis*: "Shell small, fusiform, with a high spire comprising about seven whorls. Three varices are shown in the mold. The entire surface is reticulated by the intersection of very delicate, closely-set, longitudinal ribs and nearly uniform, spiral threads. Length of shell 24 mm, greatest width 11 mm.

"This species is recognized by its high



spire, convexly rounded whorls, reticulate surface, and graceful, delicate form.

"Locality—Rio Pirabas. [State of Pará, Brazil]" (Maury, 1925)

*Discussion:* This *Murex* from the Pirabas Limestone of the uppermost lower Miocene of Brazil is notable for the lack of constriction of the lower part of the body whorl. On the basis of Maury's figure it seems closer to the Recent *M. pulcher* A. Adams\* (cf. Clench and Pérez Farfante, 1945, pl. 12) than to any fossil and may be ancestral to that atypical species which lives off Brazil today.

#### MUREX (MUREX?) WILLIAMSI Maury

Plate 4, figure 7

*Murex williamsi* MAURY, 1925, Serv. Geol. Min. Brasil, Mon. 4, p. 141, pl. 6, fig. 8.

*Diagnosis:* "Shell ovately pyriform, with five volutions which bear low, rounded, inconspicuous varices, presumably three to a volution, but the imprint shows only a portion of the shell. The earlier whorls are sculptured with narrow, delicate, longitudinal ribs, numbering about sixteen on the penultimate whorl. On the last whorl the ribbing is feebler, and about four weak ribs lie between a pair of varices. The entire shell is spirally sculptured with threads of unequal thickness, and on the convex part of the last whorl narrow, flat bands alternate with the spirals. The transverse growth lines are most apparent in the intervals between the spirals. Anterior canal somewhat bent, characters of aperture not preserved. Length of shell 34 mm, greatest width 16 mm.

"This interesting *Murex* is dedicated to Dr. Horace Williams of the Geological Survey of Brazil.

"Locality—Rio Pirabas. [State of Pará, Brazil]" (Maury, 1925)

*Discussion:* This species was described from a fragmentary mold in the Pirabas Limestone (lower Miocene). From Maury's illustration it is impossible to determine the distinguishing features, and its relationships are wholly unknown.

#### MUREX (MUREX) SUTILIS White

Plate 4, figure 8

*Murex subtilis* WHITE, 1887, Mus. Nac. Rio de Janeiro, Arch., v. 7, p. 137, pl. 11, fig. 11.

*Diagnosis:* "Shell rather small; body subglobose; spire about equal in height to the breadth of the body portion of the last volu-

tion, exclusive of the beak; principal varices three in number to each volution, strong, prominent, laterally reflexed, crenulated, and bearing a few slender spines upon their edges, which are arranged in three continuous rows from the apex to the base of the beak. The spaces between the rows of principal varices are each traversed by three or four distinct but slightly raised, secondary varices, and also by numerous revolving raised lines, which are continuous with the crenulations of the varices; beak long and slender, its length equal to more than two-thirds the full length of the shell from the apex to the point of the beak; aperture suboval, a little longer than wide.

"Length from the apex to the point of the beak, 38 millimeters; greatest transverse diameter, including two of the varices, 17 millimeters.

"This species is represented in the collections only by some fragments, and a natural mould of the greater part of a shell. These specimens, however, show the generic and specific characteristics in a somewhat satisfactory manner. Notwithstanding the great geologic age of this species, it is plainly a typical *Murex*." (White, 1887)

*Discussion:* This *Murex*, described from the Pirabas Limestone of Brazil, was thought by White to be of Cretaceous age, hence the reference to "the great geologic age." Maury (1925, p. 139) correlated this formation with the Chipola Formation, and placed *M. subtilis* in synonymy with *M. messorius*, stating that "a very careful comparison of the fragments and of the figure of the more perfect specimen described by Dr. White as *Murex subtilis* with shells of *Murex messorius* indicates that the Pirabas specimens are small shells of the latter species." This may well be the case. However, the figure published by White is sufficiently different to cause the writer to withhold judgment until personal comparison with White's material is possible.

#### MUREX (MUREX) MESSORIUS Sowerby

Plate 3, figures 6-8

*Murex messorius* SOWERBY, 1841, Conchological Illustrations, pl. 194, fig. 93; SOWERBY, 1841, Zool. Soc. London, Proc., pt. 8, p. 137; SOWERBY, 1879, Thesaurus Conchyliorum, IV, *Murex*, p. 5, pl. 381, fig. 20.

*Murex recurvirostris* Broderip. GABB, 1873, Amer. Phil. Soc., Trans., (N.S.) v. 15, pt. 1, p. 201. (not of Broderip)

*Murex messorius* Sowerby. BROWN and PILSBRY, 1911, Acad. Nat. Sci. Phila., Proc., v. 63, p. 353.

*Murex messorius* Sowerby. MAURY, 1917, Bull. Amer. Paleontology, v. 5, no. 29, p.

\* See page 111.



- 265, pl. 42, figs. 1, 2; MAURY, 1920, New York Acad. Sci., Sci. Surv. Porto Rico and Virgin Islands, v. 3, pt. 1, p. 63; MAURY, 1925, Serv. Geol. Min. Brasil, Mon. 4, p. 137, pl. 6, fig. 5.
- Murex messorius* Sowerby. OLSSON, 1922, Bull. Amer. Paleontology, v. 9, no. 39, p. 303.
- Murex (Haustellum) messorius* Sowerby. TRECHMANN, 1933, Geol. Mag., v. 70, no. 823, p. 38, pl. 4, fig. 14.
- Murex recurvirostris* Broderip. RUTSCH, 1934, Schweizer. Palaeont. Gesell., Abh., v. 54, no. 3, p. 64, pl. 4, fig. 1; v. 55, no. 1, p. 136. (not of Broderip).
- Murex (Murex) woodringi* CLENCH and PÉREZ FARFANTE, 1945, Johnsonia, v. 1, no. 17, p. 9, pl. 4, figs. 1-3.
- Murex woodringi* Clench and Pérez Farfante. AGUAYO, 1948, Soc. Malac. "Carlos de la Torre", Rev., v. 6, no. 2, p. 63.
- Murex (Murex) recurvirostris recurvirostris* Broderip. WOODRING, 1959, U.S.G.S. Prof. Paper 306-B, p. 214, pl. 35, figs. 5, 8; pl. 36, figs. 11, 12. (not of Broderip)
- Murex (Murex) recurvirostris* Broderip. PERRILLIAT MONTOYA, 1960, Paleontología Mexicana, no. 8, p. 21, pl. 3, figs. 10, 11. (not of Broderip)
- Murex (Murex) recurvirostris recurvirostris* Broderip. WEISBORD, 1962, Bull. Amer. Paleontology, v. 42, no. 193, p. 278, pl. 26, figs. 3, 4. (not of Broderip)

*Diagnosis:* "Mur. testa clavata, subventricosa, fulvo-rubescens, griseo, rubro, fuscoque maculata; spira brevis; cauda elongata, recta, angusta, minime recurva; varicibus tribus, crassis, costatis, ante crenulatis, pone foveolatis, ad angulum posticum spina brevis recta, ad caudam spina falcata, subelongata, deinde una brevior, recta; interstitiis duobus ad tribus costis noduliferis; apertura ovali, postice subcanalifera; labio interno postice tumido, intus crenulato; labio externo denticulato, antice paululum extante; canali fere clauso. Long. 2.40; lat. ex. var. .90 poll. [height 61 mm, width, 23 mm] Hab. ---? Mus. Cuming, Stainforth.

"Distinguishable by the thickened varices, and the spine at the base of the caudal canal, shaped like a reaper's hook." (Sowerby, 1841)

"Shell medium in size, from 50 to 72 mm (2 to 2¾ inches) in length, rather solid and moderately spinose. Whorls eight or nine, strongly convex. Ground color cream to dark gray with a wide band of a darker shade at the shoulder of the whorls; sometimes there is another immediately below the middle and a third one at the base of the whorls. These are best viewed from within the aperture. Spire acute and extended. Suture irregular and deeply indented. Aperture oval to subcircular, polished and colored from oyster white to dark

gray and occasionally stained with brown. Parietal lip reflected, adhering to the body whorl above and free below the midpoint. Below the margin and on the inner wall of this lip there are from three to nine flattened denticles and a single rounded denticle at the upper extremity. Outer lip erect and possessing a series of very strong and long denticles with their forward ends producing a prominent crenulated edge on the lip. Siphonal canal narrow and extended, its length being a little less than the total height of the whorls. It is straight except for the distal end which is moderately turned upwards. Axial sculpture consists of three varices which are moderately spinose. At the shoulder of the whorls on each varix there is generally a large open spine and at the base of the varix at the beginning of the siphonal canal there is a rather large recurved, spur-like spine. Remaining spines on the varices are open in front and scale-like. Intervarical ridges are two in number on the early whorls and increase to four or five on the later whorls, though they may be reduced on the last whorl to only two. Spiral sculpture consists of alternating large and fine ridges, the larger culminating in a spine on each varix. Nuclear whorls one and one-half to two, rounded, glass-like and pale brown in color. The next two whorls possess very prominent axial ridges and somewhat finer spiral threads. Operculum subcircular, unguiculate and possessing very fine concentric lines." (Clench and Pérez Farfante, 1945)

*Figured specimens:* Fig. 6, USNM 643761; height 45.5 mm, greatest diameter, including terminal varix, 30 mm; locality USGS 8516. Fig. 7, USNM 639037; height 55 mm, diameter 26 mm; locality, Recent, Colon, Panama. Fig. 8 (nucleus only figured), USNM 643766; height 14 mm, diameter 8 mm; locality USGS 16926. Other occurrences: see discussion.

*Discussion:* *Murex messorius* is placed by some authors in synonymy with the West Coast shell, *M. recurvirostris* Broderip. Although they are similar, the two forms are distinguishable and, because of the geographic separation, it is more useful to keep them apart than to unite them. *M. recurvirostris* may be distinguished from *M. messorius* by its much shorter spire and its varices which are deeply excavated behind. A Pacific shell, *M. recurvirostris lividus* Carpenter, from the vicinity of Mazatlán, Mexico, shows strong affiliation with *M. messorius* and could represent an intermediate form. *M. recurvirostris sallasi* Rehder and Abbott found in the Caribbean should be



allied with the Atlantic species as it is closer to *M. messorius* than to *M. recurvirostris*.

Recently, Axel A. Olsson established (personal communication) by comparison with Sowerby's type in the British Museum (Nat. Hist.), that *M. woodringi* Clench and Pérez Farfante is a synonym of *M. messorius*. It is of interest that Clench and Pérez Farfante in their description of *M. woodringi* (cited above) make reference to the "large spur-like spine" at the base of the siphonal canal, the spine which Sowerby likened to "a reaper's hook". It is surprising that the similarity was not noted by these authors; however, it is probable that they, like others, were led astray by the confusion of *M. messorius* with *M. recurvirostris*.

*M. messorius* has been reported from beds as old as the uppermost lower Miocene in Brazil (Maury, 1925) and Porto Rico (Maury, 1920), from the middle Miocene of Santo Domingo (Gabb, 1873, as *recurvirostris*; Maury, 1917), Cuba (Aguayo, 1948), Costa Rica (Olsson, 1922), Panama (Brown & Pilsbry, 1911; Woodring, 1959, as *recurvirostris*), Mexico (Perrilliat Montoya, 1960, as *recurvirostris*), and other areas in the Caribbean. In Venezuela it has been reported from the upper Miocene (Rutsch, 1934, as *recurvirostris*) and the Pliocene (Weisbord, 1962, as *recurvirostris*). Clench and Pérez Farfante (1945, p. 10) suggested that the "*M. recurvirostris*" of Woodring from the Bowden Formation of Jamaica (Woodring, 1928, p. 288) is also this species. Woodring's figured specimen (*ibid.*, pl. 17, figs. 7, 8) is referable to *M. antillarum* Hinds (see discussion of that species), but the Tulane collections reveal that both *M. messorius* and *M. antillarum* occur in the Bowden.

The Recent distribution of *M. messorius* is much the same as the fossil. It ranges over all of the Caribbean and the Gulf of Mexico, exclusive of Florida. Although the species has been reported from Pliocene and Recent localities in Florida, it does not occur there and the species reported usually is *M. rubidus*. *M. messorius* and *M. rubidus* are mutually exclusive, perhaps the result of differing temperature requirements.

MUREX (MUREX) NICHOLSI Gardner  
Plate 3, figures 3-5

*Murex (Murex) nicholsi* GARDNER, 1947,  
U.S.G.S. Prof. Paper 142-H, p. 519, pl. 53,  
fig. 3.

*Diagnosis:* Shell rather small, though probably reaching dimensions greater than those of the type. Whorls six or seven in the adult, broadly convex, increasing rapidly in diameter. Body well rounded medially, abruptly constricted into the pillar. Whorls closely appressed, the sutures inconspicuous and sinuated by the axial ribs. Protoconch smooth, polished. Axial ribs on the earliest turns narrowly rounded, sharply elevated, equal and equispaced; three narrow, rounded varices developed on the medial portion of the shell; spinose only at the intersection with the primary spiral thread which outlines the periphery. Spiral sculpture rather sharp; three narrow, angular, primary threads on the early whorls, the posterior outlining the shoulder; a fourth introduced on the later whorls; two or three secondary lirations may be developed, one of them approximating the primaries; spiral sculpture on the body regular; six subequal and subequispaced primary threads on the medial portion and the base, a secondary threadlet intercalated midway between each pair; three less fine secondaries developed between the posterior primary and the suture line, the medial a little coarser than those on either side; pillar with six or seven secondaries, more widely spaced anteriorly. Aperture obliquely lobate, broadly rounded behind, obscurely sulcate posteriorly. Outer lip broadly arcuate; margin crenulated; inner surface of terminal varix dentate. Inner wall of aperture more strongly convex than the outer, heavily glazed, rugose along the pillar; inner margin of pillar sharply rounded. Anterior canal long and straight. (After Gardner, 1947)

Dimensions of holotype: height 25 mm, diameter including varices, 14.5 mm.

Holotype: USNM 371851.

Type locality: Five to six miles west-northwest of Mossyhead, Walton County, Florida.

*Figured specimens:* Fig. 3, LSU 3419; height 34 mm, greatest diameter, including terminal varix, 21.5 mm; locality LSU 962. Fig. 4, USNM 643751; height 28 mm, diameter 11.5 mm; locality TU 70. Fig. 5, (nucleus only figured) USNM 643767; height 20 mm, diameter 9 mm; locality TU 70. Other occurrences: TU locality nos. 69A, 458, 554; LSU 853.

*Discussion:* The original description of *M. nicholsi* was based on imperfect material. Better specimens available to the writer permit certain observations to be made. The species attains a larger size; Plate 3, figure 3, shows a specimen 34 mm in height, with an incomplete apex and canal. If complete it would approach 45 mm, comparable to



the larger species from the Miocene. It is also more spinose, especially in the younger stages (fig. 4), with a tendency toward open spines on the anterior portion of the varices, and on the pillar. *M. nicholsi* is extremely close to *M. domingensis* from the Gurabo Formation of Santo Domingo. Gardner (1947, p. 519) stated that *M. nicholsi* differs from that species in being "less slender, with a shorter, broader canal, more elevated axials and less prominent primary spirals." In view of the variability of *M. domingensis* these factors probably would not be sufficient to separate the two species. However, the protoconchs are very different with *M. nicholsi* having  $3\frac{1}{2}$  conic whorls and *M. domingensis* having  $1\frac{1}{2}$  bulbous whorls whose axis is eccentric to the rest of the shell.

Although *M. nicholsi* was described from the Shoal River Formation (middle Miocene) the writer has collected four specimens from the lower Miocene Chipola Formation, thus extending the range.

MUREX (MUREX) DOMINGENSIS Sowerby  
Plate 2, figures 6-9

- Murex domingensis* SOWERBY, 1850, Geol. Soc. London, Quart. Jour., v. 6, p. 49, pl. 10, fig. 5.  
*Murex domingensis* Sowerby. GABB, 1873, Amer. Phil. Soc., Trans., (N.S.) v. 15, pt. 1, p. 201.  
*Murex domingensis* Sowerby. GUPPY, 1876, Geol. Soc. London, Quart. Jour. v. 32, p. 521.  
*Murex domingensis* Sowerby. MAURY, 1917, Bull. Amer. Palaentology, v. 5, no. 29, p. 265, pl. 42, figs. 3-6.  
*Murex domingensis* Sowerby. RUTSCH, 1934, Schweizer. Paleont. Gesell., Abh., v. 54, no. 3, p. 65, pl. 4, fig. 2; v. 55, no. 1, p. 136.  
*Murex domingensis* Sowerby. RAMIREZ, 1949, Univ. Santo Domingo, Inst. Geog. Geol., Pub. 70, p. 29, pl. 6, fig. 4.  
*Murex (Murex) domingensis* Sowerby. PFLUG, 1961, Acta Humboldtiana, Ser. Geol. Palaeont., no. 1, p. 44, pl. 10, figs. 7-13.

*Diagnosis*: "Testa subovata, utrinque subacuminata, trifariam varicosa, anfractibus senis, longitudinaliter costellatis, spiraliter valde striatis; varicibus prominentibus, rotundatis, marginibus paucispinosus, spinis brevissimus; labio columellari antice rugulosa; canali breviuscula." (Sowerby, 1850)

Shell size average for the group. Spire elevated; inflation of whorls variable with resultant change in overall shape. Eight

whorls in the adult; protoconch polished, bulbous, consisting of  $1\frac{1}{2}$  whorls, axis eccentric. Three narrow varices developed on the earliest post-nuclear whorls, a single spine produced at the shoulder; occasionally small open spinelets on the anterior portion of the varices at the intersection with the primary spiral threads. Between the varices three to five narrow sharp axial ridges. Radial sculpture of primary and secondary threads with some tertiary threadlets; about 16 primary threads on the body whorl and pillar. Aperture variable from almost circular to oval; outer lip crenulated by about ten denticles; labium appressed at posterior portion, standing free at anterior portion, bearing eight to ten rugae. Anterior canal long and almost straight.

Dimensions of lectotype: height 45 mm, diameter 27 mm.

Lectotype: British Museum (Nat. Hist.) 83948 (selected by Pflug, 1961).

Type Locality: Dominican Republic.

*Figured specimens*: Fig. 6, USNM 643764; height 37 mm, greatest diameter, including terminal varix, 19 mm; locality USGS 8516. Fig. 7, USNM 643765; height 42.7 mm, diameter 20 mm; locality USGS 8516. Fig. 8, USNM 643762; height 31.7 mm, diameter 19 mm; locality USGS 8528. Fig. 9 (nucleus only figured), USNM 643763; height incomplete, diameter 7 mm; locality USGS 8528. Other occurrences: see discussion.

*Discussion*: *M. domingensis* is a common shell in the middle Miocene Gurabo Formation of Santo Domingo (Dominican Republic). It is exceedingly variable and for this reason three different specimens have been figured to show the range of variation. It may be distinguished from *M. messorius* Sowerby, with which it occurs, by its finer ornamentation, by the presence of varices on the earliest post-nuclear whorls, and by its unusual protoconch. *M. domingensis* is closely related to *M. antillarum* Hinds and is undoubtedly ancestral to that species which has the same type of protoconch. It differs from *M. antillarum* in its lack of spines other than at the shoulder and in the relatively uniform spiral ribbing which is finer and less swollen at the intersection with the axial ribs. Some specimens do have small open spinelets on the anterior portion of the varices, in the manner of *M. antillarum*.

Although Woodring (1928, p. 289) stated that *M. domingensis* is found only in the Gurabo Formation, Rutsch (1934) figured a shell from the Punta Gavilan Formation



(upper Miocene) of Venezuela, which is certainly conspecific with a specimen figured by Maury (1917, pl. 42, fig. 6) from Santo Domingo. Maury identified her shell as "an extraordinarily large specimen, 74 x 42 mm, apparently referable to *M. domingensis*." Adult specimens of *M. nicholsi* Gardner from northwestern Florida are remarkably similar to adults of *M. domingensis*, but are easily distinguished by the very different nuclei and early postnuclear whorls, indicating that the resemblance is one of convergence rather than close relationship.

Guppy has reported "*M. domingensis*" from Springvale, Trinidad (1911, p. 4), from Jamaica (1866a, p. 288) and from Cumana, Venezuela (1866b, p. 576). However, the Jamaican form is most certainly *M. antillarum* (see remarks under that species), and the others may be *M. messorius*, which Guppy considered only a Recent species. Referring to *M. domingensis*, he stated, "to my eyes its nearest kindred is *M. messorius*, a West-Indian recent species" (1876, p. 521).

#### MUREX (MUREX) YAQUENSIS Maury

*Murex antillarum* GABB, 1873, Amer. Phil. Soc., Trans., (N.S.), v. 15, pt. 1, p. 202, non *M. antillarum* Hinds, 1844.

*Murex yaquensis* MAURY, 1917, Bull. Amer. Paleontology, v. 5, no. 29, p. 266, pl. 42, fig. 7, *nom. nov.* for *M. antillarum* Gabb non Hinds.

*Murex yaquensis* Maury. PILSBRY, 1922, Acad. Nat. Sci. Phila., Proc., v. 73, p. 353.

*Diagnosis*: "Shell broadly fusiform, whorls eight, rounded, varices three, small, having small, sharp spines variable in number; body whorl inflated, rounded in broadly to the suture, without any marked angle above, below tapering convexly to a nearly straight, short canal; spire elevated, about as long as the mouth, less the canal. Surface ornamented by numerous, more or less alternating, acute, revolving ribs, with concave outer spaces; crossing these are rather indistinct longitudinal ribs, four or five between each pair of varices. These ribs are better marked where they cross the revolving lines, than in the interspaces. Nuclear whorls polished, rounded, and without ornament. Aperture ovate, constricted in advance, canal about equal in length to that of the mouth proper. Inner lip expanded, showing transverse striations; outer lip more strongly striate internally. Length 1.15 in.; width .75 in.

"A rare shell whose rounded form, thinner structure, more delicate varices and

sculpture, and smaller size will all serve to distinguish it from the two preceding [*M. domingensis* and *M. recurvirostris*]." (Gabb, 1873)

"As Gabb's name is pre-occupied by Hinds, the fossil requires a new name and *yaquensis* seems appropriate [Rio Yaque].

"This species intergrades with *M. domingensis*. I have specimens with the form of the latter and the ribbing of the former species. Our typical shell is a metatype of Gabb's *antillarum*." (Maury, 1917)

*Discussion*: This *Murex* from the middle Miocene Gurabo Formation of Santo Domingo is probably only a form of *M. domingensis*, as Maury suggested. However, without the study of a series of specimens it is considered unwise to place them in synonymy, and the writer provisionally accepts *M. yaquensis* as a valid species.

#### MUREX (MUREX) ANTILLARUM Hinds

Plate 3, figures 1-2

*Murex antillarum* HINDS, 1844, Zool. Soc. London, Proc., pt. 11, p. 126.

*Murex (Murex) recurvirostris* Broderip. WOODRING, 1928, Carnegie Inst. Washington, Pub. 385, p. 288, pl. 17, figs. 7, 8. (*not* of Broderip)

*Murex (Murex) antillarum* Hinds. CLENCH and PÉREZ FARFANTE, 1945, Johnsonia, v. 1, no. 17, p. 12, pl. 6.

*Diagnosis*: "Mur. testa subfusiformi, pallida, trivariata; anfractibus septenis rotundatis; varicibus tribus rotundatis, spiniferis, postice fornicatis; ad angulum anfractuum spina unica elongata, deinde quinque breviusculis; interstitiis, tri-, vel rarius, quadrifarium nodulose-costatis, lineis transversis fuscis pencillatis; canali elongato, aperto, prope anfractum basalem subflexo, spinis duabus cavis gerente. Axis 18 lin. Hab. Tortola, West Indies. Mus. Cuming." (Hinds, 1844)

"Shell medium in size, from 50 to 100 mm (2 to 4 inches) in length, rather solid and very spinose. Whorls eight or nine, moderately convex. Color from cream to rusty or purplish brown with three rather indistinct bands of a darker shade on each whorl. Spire extended. Suture irregular and deeply indented. Aperture oblique and oval, porcellaneous white, sometimes with a purple tint. Parietal lip reflected and adherent to the body whorl. The upper portion completely attached, the lower part somewhat erect and standing free. Below the margin of the parietal lip there are two sets of small denticles; there are three or four denticles on the inner wall near the siphonal canal and generally two denticles at the upper portion near the union with



the outer lip. One, in this latter group, is situated close to the margin, the other fairly well within the aperture. The palatal, or outer lip, is rather thin, erect and crenulated. The crenulation opposite the shoulder spine is drawn out to form a small tooth-like process. Siphonal canal short to medium in length in young specimens. Adults have the siphonal canal greatly extended, moderately recurved upwards and tapering to a rather narrow extremity. Two previous stages of the siphonal canal remain as scale-like spines and are to be seen on the aperture side of the shell at the lower left of the aperture.

"There are three prominent equidistant varices on each whorl. These are more or less aligned with the varices on the whorls above. Each varix supports a series of rather long and pointed spines, the largest being produced at the shoulder of the whorl. Remaining spines more or less irregular as to size. There are two fairly strong spines immediately below each varix on the siphonal canal. All the spines are open on their forward or apertural side, though many may have the opening reduced to a mere slit. In between the varices there are two to four axial ridges, two and three on the early whorls and generally four on the last whorl. In between the last two varices formed, these axial ridges may be reduced to one large and generally one or two smaller ridges. Spiral sculpture consists of numerous cords. Six or seven of these are larger and terminate at the spines on the varices; the remaining cords are much smaller and terminate on each varix in between the base of the spines. In addition, there exist very fine axial growth lines which appear as fine threads in between the cords. Nuclear whorls one and one-half, smooth, rounded and brownish in color; the three following whorls sculptured with numerous equal axial ridges and revolving raised threads. Remaining whorls as described above." (Clench and Pérez Farfante, 1945)

*Figured specimens:* Fig. 2, USNM 643757; height 31 mm, greatest diameter, including terminal varix, 19 mm; locality, Bowden, Jamaica. Fig. 1, USNM 634487; height 49 mm, diameter 22 mm; locality, Recent, Jamaica (40 fms.).

*Discussion:* Woodring (1928) figured a *Murex* from the Bowden Formation of Jamaica (middle Miocene) which he identified as "*M. recurvirostris* Broderip". This shell certainly is not *M. recurvirostris*, nor is it *M. woodringi* (= *M. messorius*), as suggested by Clench and Pérez Farfante (1945, p. 9). This writer believes that the specimen figured is actually *M. antillarum* with the spines broken away. The factors influ-

encing this decision are: 1) the type of protoconch, which in *M. antillarum* consists of 1½ bulbous whorls in the manner of *M. domingensis* (see Plate 2, figure 9), and 2) the nature of the siphonal canal, which in *M. recurvirostris* and *M. messorius* is straight with previous canal so fused as to be quite obscure; in Woodring's figure, and in specimens from Bowden, the canal is deflected, with the termini of the antecedent canals divaricate, as in *M. antillarum*. Rutsch (1934, p. 65) came to the same conclusion on the basis of the much higher spire of the Bowden shell. Woodring later (1959, p. 215) reaffirmed his earlier identification, stating that *M. antillarum* "is larger, more spinose, and has a longer bent siphonal canal" than the Jamaican fossil. Specimens clearly show that spines were originally present and have been broken in the vicissitudes of fossilization. Woodring himself stated that "all except the shortest spines are broken" on all of the Bowden specimens (1928, p. 289). Plate 3, figure 2 is a small Recent specimen from Jamaica, approximately the same size as the fossil, included for comparison.

#### MUREX (MUREX) RUBIDUS Baker

Plate 4, figures 3-4

*Murex messorius* Sowerby. DALL, 1889, "Blake Report," Harvard Mus. Comp. Zool., Bull., v. 18, no. 29, pt. 2, p. 196 (in part); DALL, 1890, Wagner Free Inst. Sci., Trans., v. 3, pt. 1, p. 139 (in part). "*Murex messorius* var *rubidum* Dall". BAKER, 1891, Rochester Acad. Sci., Proc., p. 157 (*nom. nud.*); BAKER, 1897, St. Louis Acad. Sci., Trans., v. 7, no. 16, p. 377.

*Murex (Murex) recurvirostris rubidus* Baker. CLENCH and PÉREZ FARFANTE, 1945, *Johnsonia*, v. 1, no. 17, p. 6, pl. 3, figs. 1-7.

*Murex (Murex) recurvirostris rubidus* Baker. OLSSON and HARBISON, 1953, Acad. Nat. Sci. Phila., Mon. 8, p. 242, pl. 36, fig. 3.

*Diagnosis:* "The shell is small, solid, the body whorl large, convex, roundly triangular in section, with 3 strong, humped varices at each corner, the summit of each rounded and crossed by spiral threads, a few of which, such as those placed on the shoulder and on the canal, especially in the young, may be elevated into short spines. Intervarical space wide, usually with two small ribs or humps in the middle. Spirals consist of strong, evenly spaced cords between wide, concave intervals. Anterior canal is long, straight, and slender (end often broken off). nearly closed, the si-



phonal channel remaining open only as a narrow slit. The protoconch is small, turbinate, of about  $1\frac{1}{2}$  whorls, smooth, the nuclear stage ending at a prominent rib. The early nepionic sculpture is coarsely reticulate, formed by about 9 subequal ribs intersected by 3 or 4 spirals, but on the third whorl each third rib is enlarged to form the varices of the later turns. Aperture subcircular, its peristome continuous in the form of a narrow rim, the inner and outer lips denticulate within." (Olsson and Harbison, 1953)

*Figured specimens:* Fig. 4, USNM 643755; height 28.8 mm, greatest diameter, including terminal varix, 14.8 mm; locality TU 520. Fig. 3, USNM 643756; height 29.6 mm, diameter 16 mm; locality TU 519. Other occurrences: TU locality nos. 68, 79, 201, 202, 203, 519 (over 200 specimens), 523, 527, 529, 539, 540.

*Discussion:* *M. rubidus*, a common species in Florida since the beginning of the Pliocene, has had a long and complicated nomenclatorial history. In the past it has often been confused with *M. messorius* Sowerby, as a result of Dall's statement in the "Blake Report" (1889, p. 196) that "the specimens [of *M. messorius*] off Florida are reddish pink." He gave no indication that he considered these to be a separate variety. The following year he reported "*M. messorius*" fossil in the "Pliocene marls of the Caloosahatchee River and Alligator Creek, Fla." as well as in Costa Rica and Santo Domingo, and living "in the Antilles and on the western coast of Florida and the Keys" (1890, p. 139). It is assumed that Dall considered the two forms identical, for Clench and Pérez Farfante report that, "so far as our records indicate *M. recurvirostris rubidus* is limited to Florida and the Bahamas, and does not extend into the remaining islands of the West Indies" (1945, p. 9) while *M. messorius* occurs only to the south of Florida.

F. C. Baker, in a catalogue of the family Muricidae (1891) apparently first recognized that the Florida shell was different from *M. messorius* and accordingly cited "*M. messorius* var. *rubidum* Dall, Blake Gastropoda, 1889, Cedar Keys." Because Dall had not named a *rubidum*, this reference must be considered a nomen nudum. In 1897 Baker again made reference to the form, stating in his discussion of *M. messorius* that "Dr. W. H. Dall has characterized a variety *rubidum* from Cedar Keys, the shell

being of a deep pink color." Since, as noted above, Dall had not in fact "characterized" *rubidum* this name must be attributed to Baker.

Clench and Pérez Farfante (1945), considering *M. messorius* to be a synonym of *M. recurvirostris*, changed the name to *M. recurvirostris* subspecies *rubidus*. Olsson and Harbison (1953) likewise kept the subspecific designation, while remarking "the Florida shell is sufficiently distinct to be separated either in a subspecific or specific sense." As the species was never fully described by Baker, the description of Olsson and Harbison is cited above. This writer believes *M. rubidus* is a valid species, bearing no more than a subgeneric relationship to *M. recurvirostris* or *M. messorius*.

This species has been successful since it first appeared in the uppermost Miocene (? lowermost Pliocene, TU locality 520) of southern Florida. It has maintained its identity and abundance until the present time and exhibits remarkably little variation. This is unusual in such a prolific species; however the color of Recent specimens varies from pink to orange or yellow, and even brown. The earliest form (Miocene?) may be distinguished by the varices which are somewhat more deeply excavated behind (Pl. 4, fig. 4), similar to *M. recurvirostris*. The degree of development of this trait gradually diminishes from the Pliocene to the Recent and is not sufficient basis for separation.

MUREX (MUREX) CHRYSOSTOMUS Sowerby  
Plate 4, figures 9a, b

- Murex chrysostoma* "Gray" SOWERBY, 1834, Conchological Illustrations, pl. 58, fig. 1.  
*Murex (Murex) chrysostoma* Sowerby. CLENCH and PÉREZ FARFANTE, 1945, Johnsonia, v. 1, no. 17, p. 10, pl. 5, figs. 1, 2.  
*Murex (Murex) chrysostomus* Sowerby. WEISBORD, 1962, Bull. Amer. Paleontology, v. 42, no. 193, p. 282, pl. 25, figs. 17, 18.

*Diagnosis:* "Shell medium in size, from 55 to 70 mm (about 2 to 3 inches) in length and solid. Whorls convex, seven to eight. Ground color buff with occasional specimens having bands and the spiral threads brownish. The siphonal canal may be stained irregularly with brownish patches. Spire moderately extended. Suture indented and irregular. Aperture large, oval, highly polished and of a cream color. The lower half of the parietal lip erect and extended forward, remaining upper half adherent to the body whorl. There are three spots of



yellow, two about midway on the lip and the other at its superior margin. In addition, there are a series of parallel denticulations a little below the margin and a well-developed tooth at the upper end. Outer lip strongly denticulated within, the ends of the denticulations forming a crenulated edge. Siphonal canal moderately long and tapering, broader on the columellar side. Earlier siphonal canals are obscure and in most cases completely adherent to the new canal. Axial sculpture consisting of three pronounced varices on each whorl which are rounded and nodulose instead of spinous. After the varix is produced, it is carried forward for a short distance and with the denticulations, there is formed a crenulated edge. The animal then proceeds to grow forward from below, leaving behind this crenulated margin as a sculpture character on the outer surface of the whorls. In between the varices there may be one to three axial and nodulose ridges which possess a strong knob at the whorl shoulder. At the base of the siphonal canal there may be one to three spur-like spines. Spiral sculpture consists of numerous raised threads which are developed into narrow and keeled ridges on both the varices and the axial ridges. Periostracum probably absent. Operculum unguiculate, possessing rather fine concentric ridges." (Clench and Pérez Farfante, 1945).

*Figured specimen:* USNM 643760; height 47 mm, greatest diameter, including terminal varix, 29 mm; locality USGS 18253.

*Discussion:* *Murex chrysostomus* was originally figured by Sowerby in the "Conchological Illustrations" without description; only the name appears in the accompanying list of species. Sowerby credited this species to "Gray", but it was never described by that person, and Sowerby is the true author; however Gray is frequently cited in the older literature.

Weisbord reported *M. chrysostomus* from the Mare Formation (Pliocene) of northern Venezuela. The fossil appears to be identical with the Recent form.

#### MUREX (MUREX) ANNIAE M. Smith

Plate 4, figures 2a, b

*Murex anniae* M. SMITH, 1940. Nautilus, v. 54, no. 2, p. 44, pl. 2, fig. 1.

*Murex (Murex) anniae?* Smith. DUBAR, 1958, Florida Geol. Surv., Bull. 40, p. 196, pl. 11, fig. 5.

*Diagnosis:* "Shell of moderate size. Nucleus of 1½ whorls, the portion following the first half rounded and prominent, very similar to *M. cabritii* nucleus. Anterior

canal comparatively short, straight, tip not recurved. Edge of outer lip bearing inside a series of blunt inconspicuous and widely separated denticles; outer lip well denticulated with in addition about seven long low processes upon the adjacent inner wall. There are three varices upon each whorl together with secondary spineless intermediate ribs. Spiral threads of two sizes cover the surface and extend over the varices. Certain of the primary threads form spines on the varices, these spines of fairly uniform size and few in number adjacent to the anterior canal; early whorls of spire presenting a reticulated appearance. The holotype, in the writer's collection, measures: length 33 mm, breadth 20 mm. A fragment exhibiting the aperture agrees perfectly with the holotype. Named in honor of the writer's mother Annie Lum Smith.

"This remarkable little *Murex* may be the progenitor of *Murex cabritii* now living in the Gulf of Mexico. The nucleus is almost identical with that species. The abbreviated canal of *M. anniae*, fewer and shorter spines, separate it from the latter species. From *M. [re-] curvirostris* Sowerby [*sic*] it differs in the straighter canal and in possessing fewer and coarser spines upon the varices." (Smith, 1940)

*Figured specimen:* DuBar 906; height 37 mm, greatest diameter, including terminal varix (excluding spines), 17.7 mm; locality, DuBar A31. Other occurrences: TU locality no. 531.

*Discussion:* This rare Caloosahatchee fossil is more closely related to *M. tryoni* Hidalgo than to either *M. cabritii* or *M. recurvirostris*. It differs from *M. tryoni* principally in the nature of the intervarical nodes. *M. anniae* has two strong axial nodes, in contrast to the four or five weak ridges characteristic of *M. tryoni*. Other minor differences include the number of varical spines, and the presence of about eight denticles on the outer lip, well within the aperture.

Smith gave no locality other than "Florida" for his shell, but Clench and Pérez Farfante (1945, p. 6) cite "Ortona Locks, Pliocene", stating that this information was "given in letter". This writer has not found *M. anniae* at Ortona, but DuBar (1958) figured a specimen (refigured here) collected near there, from his Station A31, Ayers Landing Marl Member of the Caloosahatchee Formation. (*Not* Station A19, Fort Thompson Formation, erroneously cited, DuBar, p. 196. Correct data from DuBar, personal communication.) A few specimens have been



collected at Port Charlotte, Florida (TU locality 531) which agree with the type.

MUREX (MUREX) ANNIAE BELLEGLADE-  
ENSIS E. H. Vokes, n. subsp.

Plate 4, figures 1a, b

*Diagnosis:* Shell of moderate size. Spire not elevated, body whorl inflated. Protoconch smooth, bulbous, consisting of 1½ whorls; adult conch having six whorls, the first three with no varices, but instead eight or nine equal axial ridges. The last three whorls ornamented by three strong varices bearing short, stout spines at the intersection of the primary spiral threads; two to three swollen intervarical nodes between each pair of varices. One or two series of spines on the anterior prolongation of the varices. Spiral ornamentation consisting of regularly alternating primary and secondary threads, about 20 primaries on the body whorl and pillar. Aperture oval, labium smooth and standing almost entirely free of the body wall. Seven to eight denticles on the outer lip well within the aperture. Canal long, straight, with no trace of previous canals, almost entirely roofed over by a thin laminar plate.

Dimensions of holotype: height 40 mm, greatest diameter, including terminal varix (excluding spines), 20.5 mm.

Holotype: USNM 643758.

Type locality: TU 201, two miles south of Belle Glade, Palm Beach County, Florida.

*Figured specimen:* USNM 643758 (holotype).

*Discussion:* This new subspecies, found only at the type locality, differs from the typical *M. anniae* in having stronger varices and much coarser ornamentation. Although the spines are located in the same relative position they tend to be shorter in the subspecies. In the early whorls of *M. anniae* the combination of the axial ridges and the pronounced spiral threads gives a reticulate appearance. In *bellegladeensis* the axial ornamentation is much stronger than the spiral, and predominates over it. This subspecies is closely related to *M. recurvirostris sallasi* which lives off Yucatán today. The latter species is even less spinose than *bellegladeensis*, and has much weaker intervarical nodes, but otherwise they are quite similar.

*M. anniae bellegladeensis* occurs in a formation which is as yet unnamed, although it has been termed locally the "Glades" formation. It unconformably overlies the Caloosahatchee, and is probably lower Pleistocene in age.

NOTES ON RECENT SPECIES

Those Recent species of *Murex* s.s. which have no fossil representatives have not been treated systematically in this work as they have been covered adequately by Clench and Pérez Farfante in their monograph "The genus *Murex* in the Western Atlantic" (1945 *et seq.*). References to original descriptions may be found in Appendix I.

Special mention should be made of *M. beaui* Fischer and Bernardi, and of *M. branchi* Clench. These two species (if they are not in fact conspecific) were not included by this writer in Table I because of their ambiguous nature. Although placed by Clench and Pérez Farfante in *Murex* s.s., they more closely resemble certain Japanese species\* which have been placed in the subgenus *Siratus* Jousseume. They seem to have no American Tertiary ancestors and presumably are very late arrivals on the scene.

It should also be noted that the name *M. pulcher* A. Adams is pre-occupied by *M. pulcher* J. Sowerby, 1813 (and also by Defrance, 1827). The next available name is *M. consueta* Verrill which was originally described as a subspecies of *M. pulcher* but which clearly is conspecific with it. Although there are those who do not approve of publication in a mimeographed paper, it is sanctioned by the International Commission for Zoological Nomenclature, albeit in a back-handed fashion. (Recommendation 8A states "Zoologists are strongly urged not to use mimeographing . . .", Intl. Code Zool. Nomen., 1961, p. 7.) Therefore we must accept *M. consueta* as the valid name for *M. pulcher* A. Adams, corrected here to *M. consuetae*, *emend.* E. H. Vokes.

V. APPENDIX I

REFERENCES FOR SPECIES CITED  
BUT NOT TREATED IN  
SYSTEMATIC DESCRIPTIONS.

- M. aguayoi* Clench & Pérez Farfante, 1945, *Johnsonia*, v. 1, no. 17, p. 15, pl. 8, figs. 1-3.  
*M. beaui* Fischer & Bernardi, 1857, *Jour. de Conchyl.*, v. 5, p. 295, pl. 8, fig. 1.  
*M. branchi* Clench, 1953, *Johnsonia*, v. 2, no. 32, p. 360, pl. 179.  
*M. cabritii* Bernardi, 1858, *Jour. de Conchyl.*, v. 7, p. 301, pl. 10, fig. 3.

\* *M. pliciferoides* (Kuroda), *M. superbus* Sowerby, *M. propinquus* Kuroda and Azuma, and perhaps others.



- M. cailleti* Petit, 1856, Jour. de Conchyl., v. 5, p. 87, pl. 2, figs. 1, 2.
- M. cailleti* var. *kugleri* Clench & Pérez Farfante, 1945, Johnsonia, v. 1, no. 17, p. 19, pl. 9, figs. 1, 2. New name for *M. similis* Sowerby, 1841, non *M. similis* Schroeter, 1805.
- M. ciboney* Clench & Pérez Farfante, 1945, Johnsonia, v. 1, no. 17, p. 20, pl. 10, figs. 1-3.
- M. elenensis* Dall, 1909, U. S. Natl. Mus., Proc., v. 37, p. 218. New name for *M. plicatus* Sowerby, 1834, non *M. plicatus* Gmelin, 1791.
- M. finlayi* Clench, 1955, Harvard Mus. Comp. Zool., Breviora, no. 44, p. 1, text figs. 1-3.
- M. maculatus* Verrill, 1950, Nautilus, v. 63, no. 4, p. 126, pl. 9, fig. 3. (non *M. maculatus* Reeve, 1845; probably synonymous with *M. cabritii*.)
- M. motacillus* Gmelin, 1791, Systema Naturae, ed. 13, v. 1, pt. 6, p. 3530.
- M. propinquus* Kuroda & Azuma, 1961, Venus, v. 21, no. 3, p. 30, text figure 3.
- M. pulcher* A. Adams, 1853, Zool. Soc. London, Proc., pt. 19, p. 270.
- M. pulcher* DeFrance, 1827, Dict. Sci. Nat., v. 45, p. 547.
- M. pulcher* J. Sowerby, 1813, Mineral Conchology of Great Britain, v. 1, p. 63.
- M. pulcher consuela* Verrill, 1950, Conch. Club So. Calif., Mins., no. 101, p. 7, text figure.
- M. recurvirostris* Broderip, 1833, Zool. Soc. London, Proc., pt. 2, p. 174.
- M. recurvirostris lividus* Carpenter, 1857, Cat. Reigen Coll. Mazatlán Mollusca, p. 517.
- M. recurvirostris sallasi* Rehder & Abbott, 1951, Soc. Malac. "Carlos de la Torre", Rev., v. 8, no. 2, p. 58, pl. 9, figs. 7, 8.
- M. superbus* Sowerby, 1889, Zool. Soc. London, Proc. for 1888, p. 565, pl. 28, figs. 10, 11.
- M. tribulus* Linnaeus, 1758, Systema Naturae, ed. 10, v. 1, p. 746.
- M. tryoni* Hidalgo in Tryon, 1880, Manual of Conchology, v. 2, p. 134, pl. 70, fig. 427.
- M. tumulosus* Sowerby, 1841, Conchological Illustrations, pl. 189, fig. 71; Zool. Soc. London, Proc., pt. 8, p. 144.
70. Chipola Fm., Ten Mile Creek, at bridge of Florida Highway 73 (NW $\frac{1}{4}$  Sec. 12, T1N, R10W), Calhoun Co., Florida.
79. Caloosahatchee Fm., Ortona Locks, Caloosahatchee River, Glades Co., Florida.
91. Oak Grove Sand, type locality, west bank of Yellow River, about 100 yards below bridge at Oak Grove, Okaloosa Co., Florida.
196. Chipola Fm., Ten Mile Creek, about  $\frac{1}{2}$  mile upstream from bridge of Florida Highway 73 (NE $\frac{1}{4}$  Sec. 11, T1N, R10W), Calhoun Co., Florida.
201. Unnamed post-Caloosahatchee formation, spoil banks, two miles south of Belle Glade, Palm Beach Co., Florida.
202. Caloosahatchee Fm., south bank of Caloosahatchee River, about two miles west of La Belle, Hendry Co., Florida.
203. Caloosahatchee Fm., north bank of Caloosahatchee River, about two miles east of Fort Denaud, Hendry Co., Florida.
430. Guajalote Fm., north bank of Rio San Fernando, at bridge of Mexico Highway 101, San Fernando, Tamalipas, Mexico.
456. Chipola Fm., Ten Mile Creek, about  $\frac{1}{2}$  mile downstream from bridge of Florida Highway 73, (NW $\frac{1}{4}$  Sec. 12, T1N, R10W), Calhoun Co., Florida.
457. Chipola Fm., west bank of Chipola River (SW $\frac{1}{4}$  Sec. 17, T1N, R9W), Calhoun Co., Florida. (same as USGS 2213)
458. Chipola Fm., east bank of Chipola River, just above Farley Creek, (Center Sec. 20, T1N, R9W), Calhoun Co., Florida.
519. Caloosahatchee Fm., Harney Pond Canal spoil banks, northwest side of Lake Okeechobee, Glades Co., Florida.
520. Unnamed formation, spoil banks, canal  $\frac{1}{3}$  mile east of Brighton, Highlands Co., Florida.
523. Caloosahatchee Fm., Harney Pond Canal spoil banks, 6 miles north of Florida Highway 78, Brighton Indian Reservation, Glades Co., Florida.
527. Caloosahatchee Fm., Pumping station 127, north shore Laké Okeechobee, Glades Co., Florida.
529. Caloosahatchee Fm., north bank of Caloosahatchee River, about three miles west of La Belle, Hendry Co., Florida.
531. Caloosahatchee Fm., Port Charlotte Development, spoil banks one mile west of Murdock railroad station on Florida Highway 771 (Sec. 12, T40S, R21E), Charlotte Co., Florida.
539. Caloosahatchee Fm., Shell Creek (Dall's locality), lower beds. About eight miles east of Cleveland, Charlotte Co., Florida.
540. Caloosahatchee Fm., Miami Canal spoil banks, one to three miles south of Palm Beach county line, Broward Co., Florida.
546. Chipola Fm., Ten Mile Creek, about  $\frac{1}{2}$  miles west of Chipola River (NE $\frac{1}{4}$

## VI. APPENDIX II

## LOCALITY DATA

The following are Tulane University locality numbers:

68. Caloosahatchee Fm., North St. Petersburg, 70th Ave. at 9th St. N., Pinellas Co., Florida.
- 69A. Shoal River Fm., first ravine upstream from Shell Bluff, Shoal River (NW $\frac{1}{4}$  Sec. 4, T3N R21W), about  $3\frac{1}{2}$  miles north of Mossyhead, Walton Co., Florida.



- Sec. 12, T1N, R10W), Calhoun Co., Florida. (?same as USGS 2212)
548. Chipola Fm., west bank of Chipola River (NW¼ Sec. 29, T1N, R9W), Calhoun Co., Florida.
549. Chipola Fm., east bank of Chipola River, about ¼ mile below Four Mile Creek (NE¼ Sec. 32, T1N, R9W), Calhoun Co., Florida.
554. Chipola Fm., east bank of Chipola River (NW¼ Sec. 20, T1N, R9W), Calhoun Co., Florida.
- The following are Louisiana State University locality numbers:*
853. Shoal River Fm., Whites Creek (SW¼ Sec. 23, T2N, R18W), about eight miles southeast of DeFuniak Springs, Walton Co., Florida.
962. Shoal River Fm., southeast of bridge over Adams Mill Creek, a tributary of Shoal River (NW¼ Sec. 11, T3N, R21W), about three miles north of Mossyhead, Walton Co., Florida.
- The following are United States Geological Survey locality numbers:*
2212. Chipola Fm., Ten Mile Creek, one mile west of Bailey's Ferry\* on Chipola River, Calhoun Co., Florida.
2213. Chipola Fm., one mile below Bailey's Ferry\* on the Chipola River, Calhoun Co., Florida.
8516. Gurabo Fm., bluff on right bank Rio Amina at ford near Potrero, Province of Santiago, Dominican Republic.
8528. Gurabo Fm. Long bluff on left side Rio Mao about 3.5 kilometers below Cercado de Mao, Province of Santiago, Dominican Republic.
16909. Gatun Fm., Transisthmus Highway, 2.1 miles east of entrance to Coco Solo Naval Hospital, Canal Zone.
16926. Gatun Fm., South of Fort Davis, Canal Zone.
18253. Mare Fm., Cabo Blanco area, Distrito Federal, Venezuela.
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PLATES I-IV

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*Explanation of symbols*

USNM—United States National Museum

USGS—United States Geological Survey

TU—Tulane University

LSU—Louisiana State University.

PRI—Paleontological Research Institution



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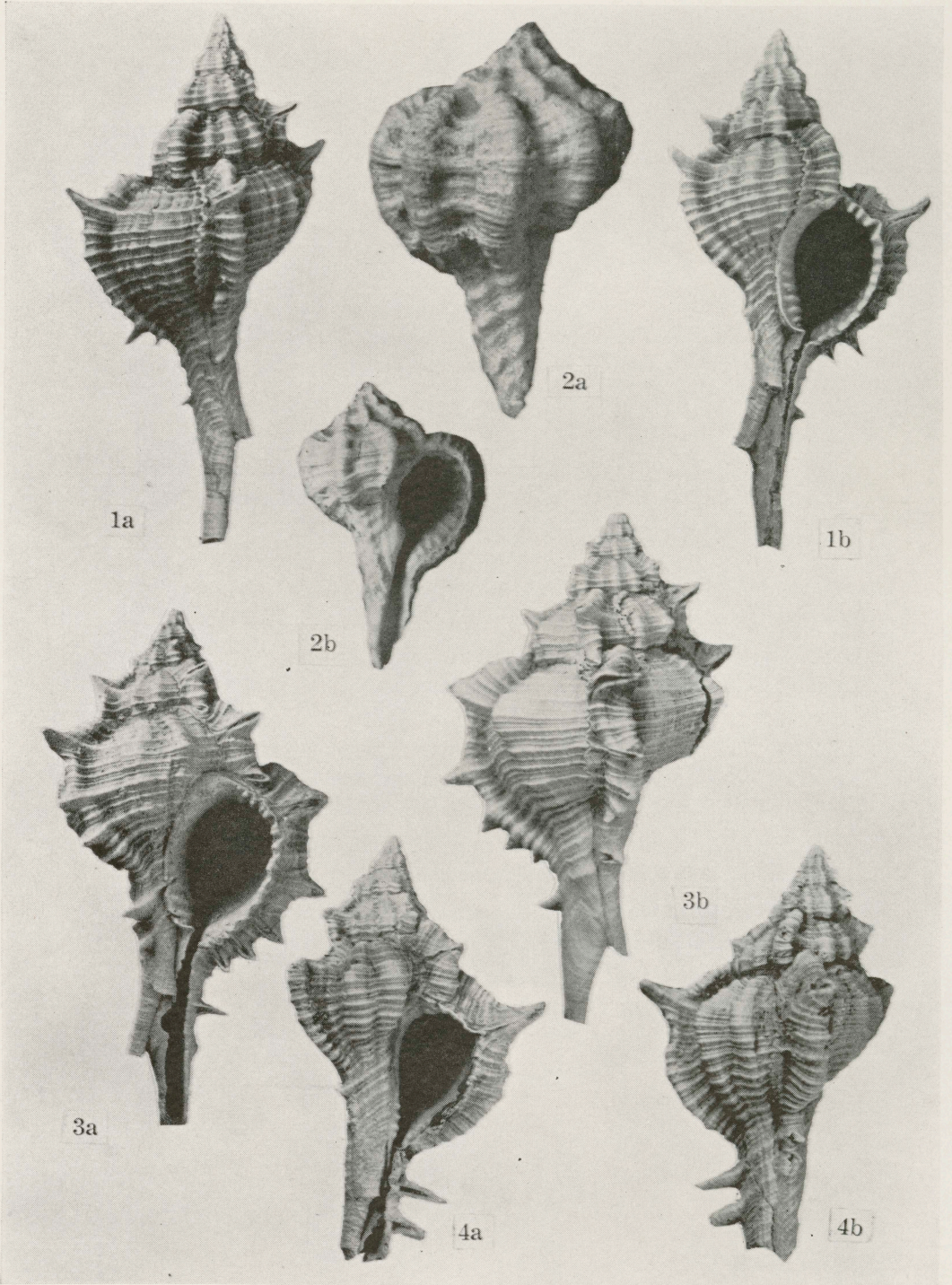


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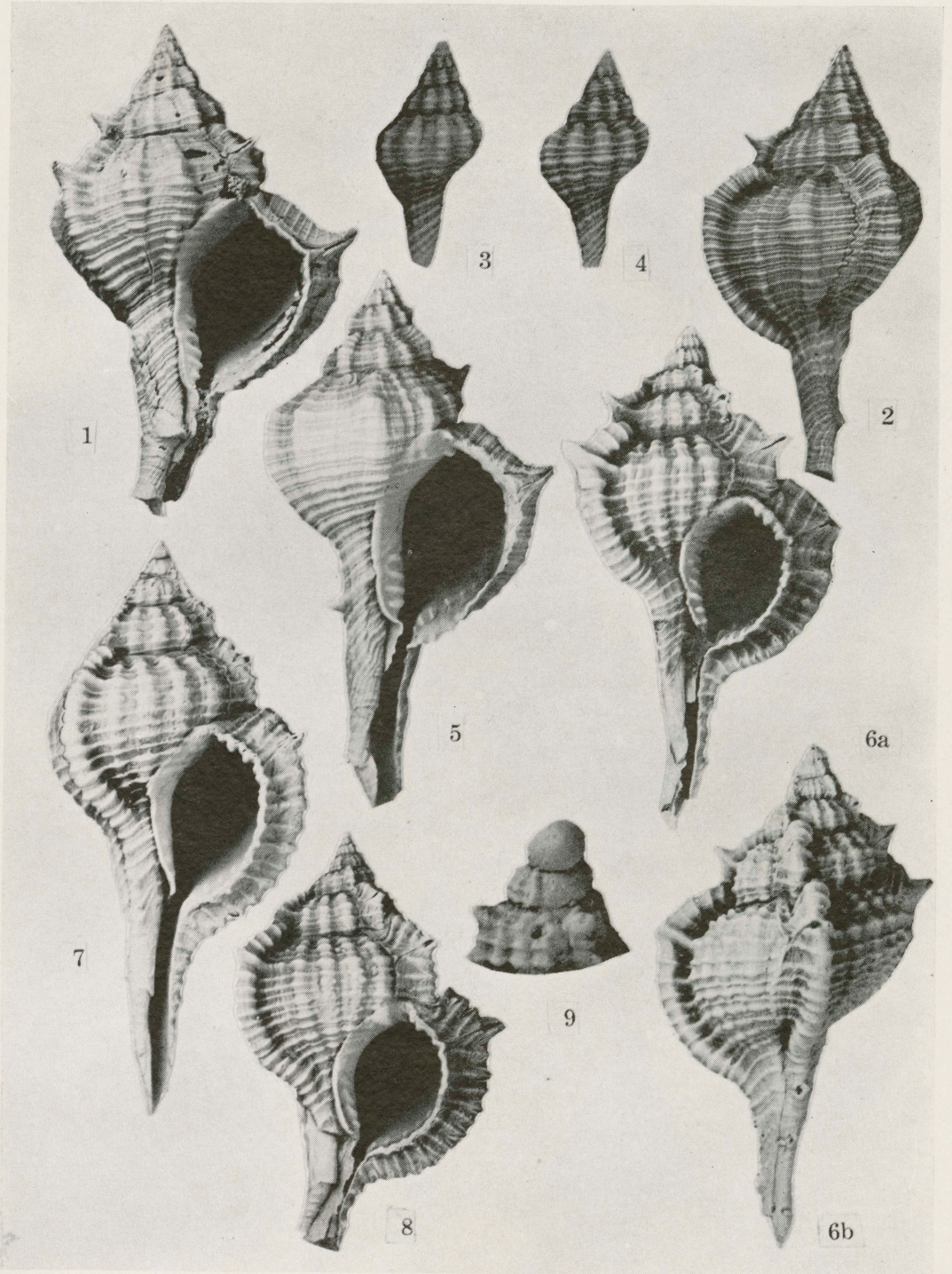


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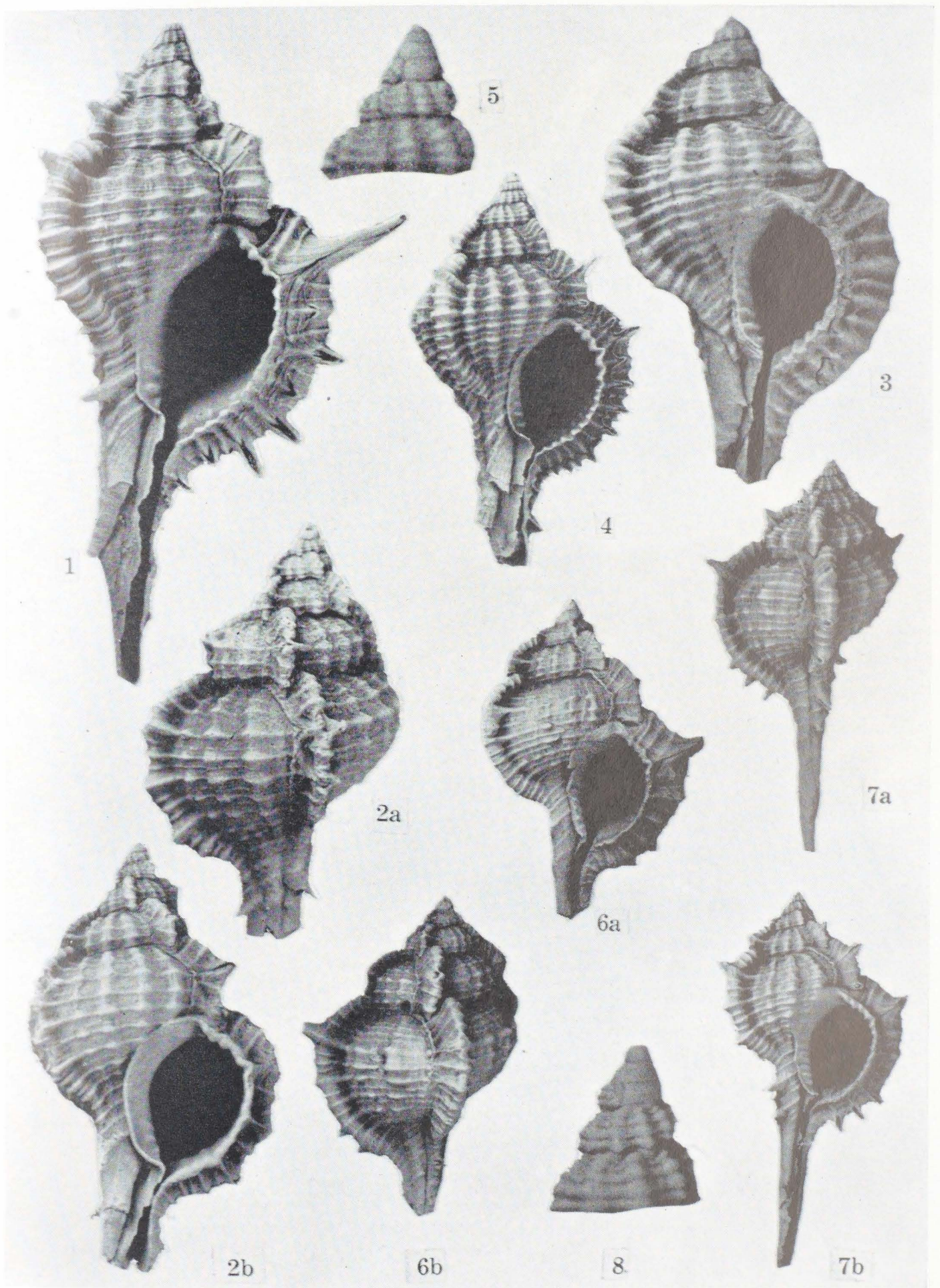


PLATE III



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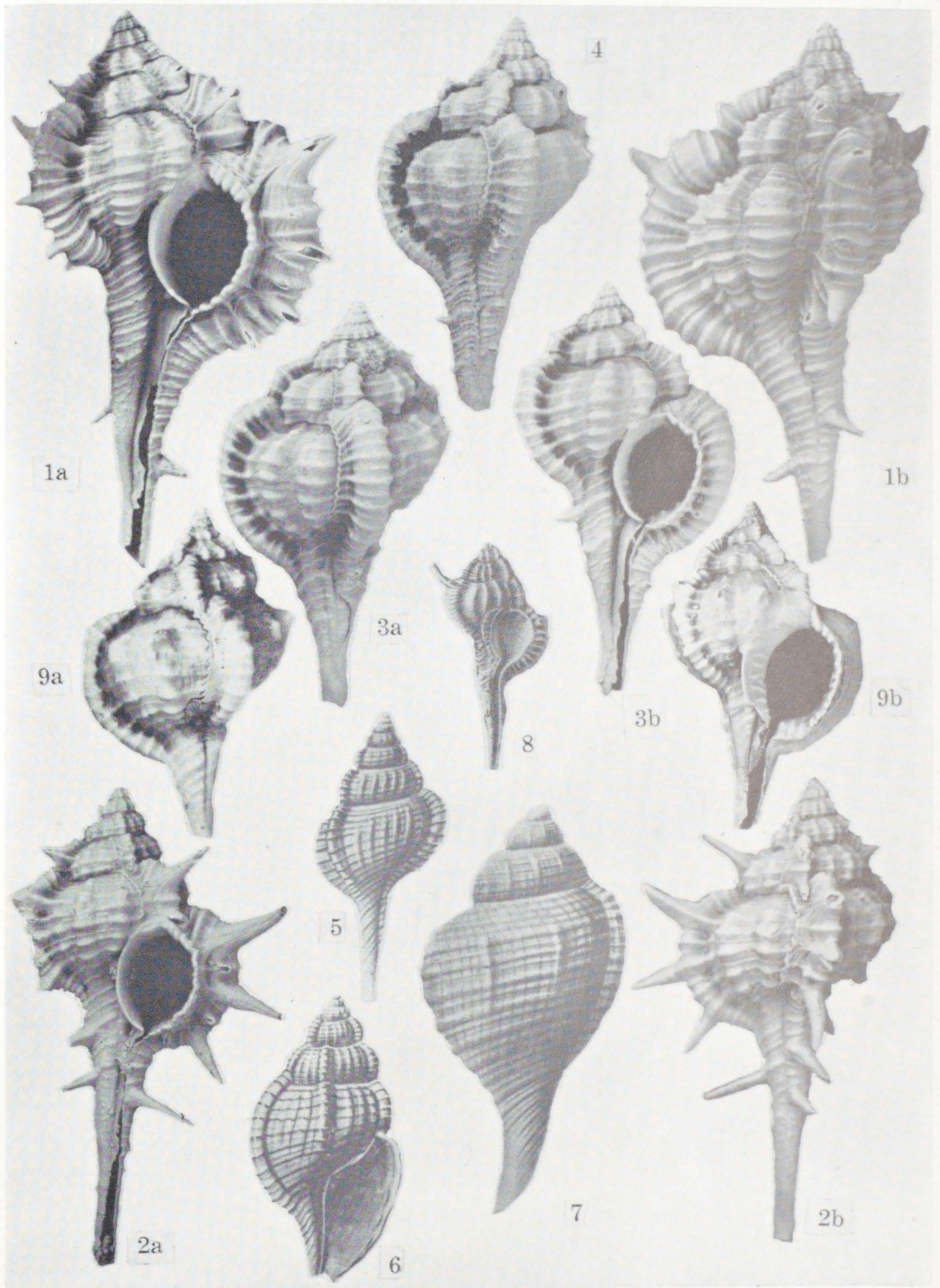


PLATE IV