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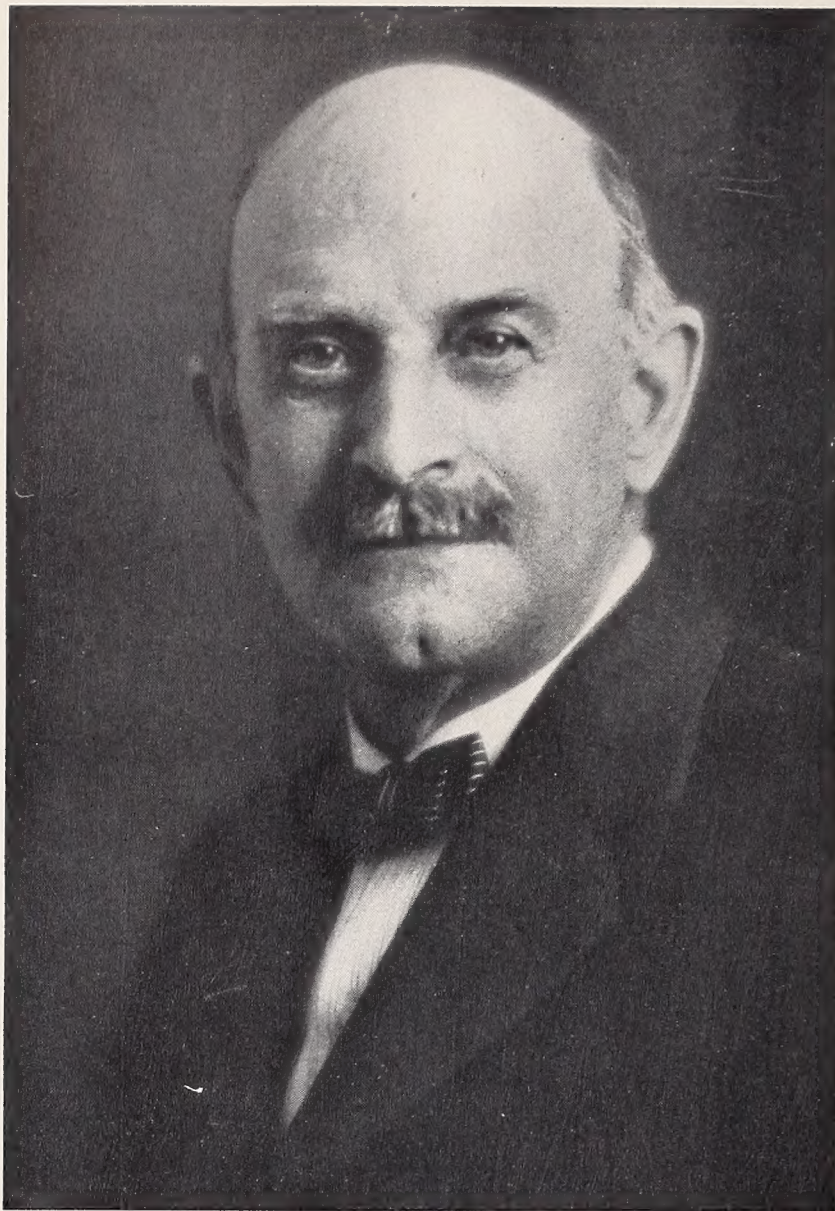
## MONOGRAPHS OF THE MARINE MOLLUSKS OF THE WESTERN ATLANTIC

VOLUME I  
NUMBERS 1 TO 18

Edited by  
WILLIAM J. CLENCH  
*Curator of Mollusks*  
Museum of Comparative Zoölogy

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Brooks, W. Sprague, October 1932: Charles Willison Johnson. Bulletin Boston Society Natural History Number 65, pp. 3-5, Portrait.

Gray, Arthur F., April 1933: Charles Willison Johnson, 1863-1932. The Nautilus, 46, number 4, pp. 129-134.

Rehn, James A. G., September 1932: Charles Willison Johnson. Science (n.s.) number 1967, pp. 226-227.



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## PREFACE

A MONOGRAPH of our Western Atlantic mollusks has been long delayed. Through the years there has appeared a very large body of literature that has dealt with this vast region. The majority of such reports, however, have been generally limited to restricted portions of this area or have been concerned with specialized groups of mollusks. This literature has appeared in many different journals or special reports, much of it inaccessible to the general student.

*Johnsonia* came into being as an idea several years ago. During the summer of 1941, it became a reality through the generosity of a friend, the ready response of a devoted staff, and the hearty coöperation of an understanding Director. Its continuance as a publication is due entirely to a large number of subscribers many of whom have not only supported its issues, but in addition, have supplied material upon which these studies have been based. Additional financial support has been given, wholly unsolicited, by many friends throughout the past four years. To all these friends, to the Milton Fund and to the Coolidge Foundation I want to express my gratitude for this very substantial aid which enabled *Johnsonia* to continue, particularly during the early years of the war.

To my staff, thanks are hardly adequate to express my indebtedness for their devotion and enthusiasm, which even a war could not lessen. To the few of us who remained at home, ideas came from Florida, Cuba, Liberia, France and the Philippines; even sketches, made in the field, were sent in to aid in a better understanding of certain species. To Julia, my wife, I am particularly indebted for her encouragement, her ideas and the uninspiring task of typing the original manuscripts.

Much remains to be accomplished in the Western Atlantic. Scattered records cover most of the shoreline from Greenland to Patagonia, yet few places have been intensely studied or adequately collected. Gaps in the ranges are extensive, particularly along the Atlantic shores of Central and South America and when many of these unsurveyed places have been well collected, the ranges of several species will be considerably extended beyond their present known limits.

The above deals only with our inter-tidal area. Research and exploration of our off-shore waters will yield a rich harvest to any investigator interested in making studies of this kind. Even waters of moderate depth have been explored but little other than off portions of southeastern Canada, New England and south to the Carolinas. Shallow water areas off the West Indies, Central and South America are practically unknown. Deep water dredging will, of course, continue to yield very many new forms as well as new data for years to come.

Local collectors can add enormously to our knowledge of life histories and ecology, even of our common species. There are probably no more than ten species in the Western Atlantic that have been adequately studied. Though the anatomy of several genera has been studied sufficiently to place them in their proper taxonomic position, many have not been investigated at all and but very few have been worked out in any detail. Thus the future holds much in store for the student of our marine mollusks.

## CONTRIBUTORS

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C. Guillermo Aguayo . . . . .	8
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\* \* \* \*

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The Department of Mollusks is greatly indebted to numerous friends for the gift or loan of choice material. Their names appear after many of the records, and the number of these records indicates the high value of their contributions. This applies not only to known species, but also to new forms which they generously allowed us to describe.

To Marion A. Bills and Frederick P. Orchard, we are more than ordinarily indebted for a very superior grade of photographic work. Without their expressed ability and knowledge, the plates on the following pages would have fallen far short of their present excellence.

Our obligation to Howard J. Allgaier, Printer, is rather clearly indicated on all of the printed pages of this book. To Walter Duncan of the Storrs & Bement Paper Company and Ernest W. Sprague of the Folsom Engraving Company, both of Boston, we are grateful for their aid and their willingness to approach many vexing problems from our point of view. Last, and by no means least, we owe many thanks to Samuel Fish of the McNamee Bookbinding Company of Cambridge, who always finds time to bind *Johnsonia* before the date of mailing.

\* \* \* \*

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# CONTENTS

Figures in *italics* refer to Johnsonia numbers

## GENERA AND SUBGENERA

Acrosterigma, <i>13</i>	Cremides, <i>10</i>	Livona, <i>12</i>	Pterynotus, <i>17</i>
Americardia, <i>13</i>	Cypraecassis, <i>9</i>	Lucapina, <i>10; 18</i>	Pteropurpura, <i>17</i>
Amiantis, <i>3; 5</i>	Dalium, <i>9</i>	Lucapinella, <i>10</i>	Sconsia, <i>9</i>
Bathymurex, <i>17</i>	Dallocardia, <i>13</i>	Macrocallista, <i>3</i>	Semicassis, <i>16</i>
Batillaria, <i>5</i>	Dinocardium, <i>13</i>	Microcardium, <i>13</i>	Serripes, <i>13</i>
Callogaza, <i>12</i>	Diodora, <i>11; 18</i>	Modulus, <i>14</i>	Siratus, <i>17</i>
Casmaria, <i>16</i>	Dosinia, <i>3</i>	Morum, <i>9</i>	Strombus, <i>1; 18</i>
Cassis, <i>16</i>	Echinus, <i>4</i>	Murex, <i>17</i>	Tectarius, <i>4</i>
Cerastoderma, <i>13</i>	Favartia, <i>17</i>	Murexiella, <i>17</i>	Trachycardium, <i>13</i>
Cerithidea, <i>5</i>	Ficus, <i>1; 18</i>	Murexsul, <i>17</i>	Trigoniocardia, <i>13</i>
Chicoreus, <i>17</i>	Fissurella, <i>10; 11</i>	Muricanthus, <i>17</i>	Trochotugurium, <i>8</i>
Clinocardium, <i>13</i>	Galeodea, <i>16</i>	Papyridea, <i>13</i>	Tugurium, <i>8</i>
Clypidella, <i>10</i>	Gaza, <i>12</i>	Phalium, <i>16</i>	Xenophora, <i>8</i>
Columbarium, <i>15</i>	Laevicardium, <i>13</i>	Phyllonotus, <i>17</i>	
Conus, <i>6; 18</i>	Littorina, <i>7</i>	Poirieria, <i>17</i>	

## FAMILIES COMPLETED FOR THE WESTERN ATLANTIC

Cardiidae	Conidae	Potamididae
Cassididae	Ficidae	Strombidae
Columbariidae	Modulidae	Xenophoridae

## COLLECTING LOCALITIES

Cienfuegos, Cuba, <i>7</i>	Guantánamo Bay, Cuba, <i>12</i>	Santa Bárbara de Samaná, Santo Domingo, <i>5</i>
----------------------------	---------------------------------	--

## VOYAGES

Voyage of the "Argo," <i>12</i>	Voyage of the "Chazalie" <i>12</i>
The Voyage of H.M.S. "Challenger," <i>8</i>	

## EXPEDITIONS

Harvard-Bahama Expedition 1904, <i>14</i>	Harvard-Grand Bahama Expedition 1936, <i>14</i>
---	---

## BOOK REVIEWS

Apgar, A.C., 1891, <i>13</i>	Gualtieri, N., 1742, <i>12</i>	Whiteaves, J. F., 1901, <i>12</i>
Dall, W.H. and C. T. Stimpson, 1901, <i>14</i>		

## NEW GENERA, SUBGENERA, SPECIES, SUBSPECIES AND NAMES

Balboiana, <i>10: 2</i>	Conus juliae, <i>6: 26</i>	Lucapinella l. hassleri, <i>10: 20</i>
Bathymurex, <i>17: 44</i>	Conus b. lymani, <i>6: 35</i>	Murex aguayoi, <i>17: 15</i>
Casmaria atlantica, <i>16: 2</i>	Conus perryae, <i>6: 31</i>	Murex f. arenarius, <i>17: 34</i>
Cassis m. spinella, <i>16: 15</i>	Conus v. piraticus, <i>6: 14</i>	Murex argo, <i>17: 31</i>
Cerithidea c. beattyi, <i>5: 3</i>	Dinocardium r. vanhyningi, <i>13: 11</i>	Murex ariomus, <i>17: 39</i>
Cerithidea p. veracruzensis, <i>5: 5</i>	Diodora aguayoi, <i>11: 11</i>	Murex atlantis, <i>17: 41</i>
Conus r. abbotti, <i>6: 6</i>	Diodora wetmorei, <i>18: 6</i>	Murex bequaerti, <i>17: 40</i>
Conus s. atlanticus, <i>6: 20</i>	Echinus, <i>4: 5</i>	Murex burryi, <i>17: 47</i>
Conus bermudensis, <i>6: 34</i>	Ficus carolae, <i>18: 3</i>	Murex carnicolor, <i>17: 48</i>
Conus f. burryae, <i>6: 29</i>	Fissurella barbouri, <i>10: 9</i>	Murex ciboney, <i>17: 20</i>
Conus brasiliensis, <i>6: 24</i>	Fissurella clenchi, <i>10: 11</i>	Murex c. kugleri, <i>17: 19</i>
Conus caribbaeus, <i>6: 23</i>	Fissurella n. crusoe, <i>10: 5</i>	Murex woodringi, <i>17: 9</i>
Conus fosteri, <i>6: 34</i>	Lucapina eolis, <i>18: 4</i>	Murexiella, <i>17: 49</i>
	Lucapinella s. tobagoensis, <i>18: 5</i>	

## INTRODUCTION

**R**EGIONAL SCOPE: The area covered by *Johnsonia* extends from Baffin Land and Greenland in the north to Golfo de San Jorge, Argentina in the south. This southern limit includes the Patagonian fauna but not the Magellanic which is primarily developed along the southwestern coastal area of South America and extends through the Straits of Magellan and north on the east coast to the Golfo de San Jorge. The vast eastern American coastal area, the islands composing the West Indies and the open ocean of the North and South Atlantic east to the thirtieth meridian is considered the Western Atlantic Region. Our plans as outlined on page 16 (*Johnsonia*, no. 1) have been changed to include species from all depths and are not limited to those occurring in water of less than 25 fathoms.

*Scientific Name.* All names employed are the earliest known to us that are acceptable under the International Rules. In a few cases where a personal opinion had to be rendered, the name most widely used was accepted.

*Synonymies.* The first reference is to the original and all subsequent references are to known or believed synonyms. Localities in parentheses are the original localities as cited by the author of the name in question. A few supplementary references are given in cases where much additional information is available and where there are better figures.

*Description.* As far as possible our descriptions follow a standard pattern so that comparative statements can be found readily. Attempts are made to have the description supplement the figures rather than parallel them. Important characteristics, however, are mentioned in the description even though such characteristics are apparent in the figures. In our formal description we do not describe a particular specimen or a few selected specimens, but the species as a whole. As a consequence, certain characters are described which do not always agree with those of the specimens figured. To describe or figure all variations of a single species would be impossible, both as to cost and as to space at our command.

*Measurements:* Under measurements we usually list large, average and small. By *large*, we mean the largest specimen that we have seen. The *average* specimen is generally one that appears typical in size for the species and not the average of a long series of measurements. When a series of measurements seems to be necessary, it will be indicated for that particular species. The measurements under *small* are given only when a small specimen can be determined as adult.

*Types.* A reference to type figures is given when such is available in the original diagnosis of the species. The location of the actual specimens used by the original author is given when such information is known. When the original type specimens are known to be lost, we have selected others to represent them under the term Neotypes.

*Common Name.* A common name will be given when such a name is available or when one can be derived obviously from the original Latin designation. Very many of our Western Atlantic species are without such names.

*Remarks.* In this category attempts are made to give comparisons with related species and other data of diagnostic value. In addition, general information of interest regarding life histories, ecology and economic value is included.

*Range.* Under this caption, the extremes in the range of a species is given. The range is based upon our own material and the published record. Limitation of the range, based upon the published record, is made only when we question the accuracy of new data or when the original was apparently in error. Such is indicated with a query. The range, however, only sets the known or believed limits in the distribution of a species. It should not be assumed that any species is to be found everywhere between these limits, as species found only on sandy beaches would not occur along rugged rocky shores. Also species showing a preference or even a tolerance for brackish water seldom occur in localities free of any admixture of fresh water.

*Records.* All records are based upon our own specimens or upon specimens that have been loaned to us for study. To accept published records would be to include possible errors in determination. We certainly do not mean to indicate that our own work will be free of errors, but only that if we are at fault in our understanding of a species, our error will be more or less consistent for the records involved.

Records will be given at length whenever possible, limiting them only when the localities are close to each other. This procedure will give the necessary data for an understanding of the geographical distribution, the relative abundance or rarity of a species, and the localities that have been collected.

*Voyages.* Under this caption there will appear a brief description of certain voyages that have been made in the Western Atlantic region. These are important as they serve as part of the historical background of investigation in this area and their names will appear in the records many times. Names of vessels such as the *Albatross*, *Atlantis*, *Bache*, *Bibb*, *Blake*, *Challenger*, *Hassler* and others will appear frequently and their significance and the extent of their investigations will thus be made clear. In addition, the included references about their explorations will lead to much information for those who are interested.

*Collecting Localities.* From time to time and as space allows, we will publish data on certain localities that are known to be rich in material. This is part of our over-all plan to make *Johnsonia* encyclopedic, not only concerning our mollusks, but also on other data that have a direct bearing on them.

*Expeditions.* Accounts regarding expeditions that have been made in various parts of the Western Atlantic area will be included. The personnel and places visited will be given as well as general data of interest and importance. Published material on these expeditions will be referred to so that others planning similar trips will be able to obtain all the information possible regarding regions in which they are interested.

*Book Reviews.* Where space allows we will include sketches regarding publications dealing with shells of the Western Atlantic. This is to give a more detailed account than could possibly be obtained from references that are given in the synonymies. Many of

these sketches will cover books that are rare and not accessible to many students. Some idea about them can thus be had for those not able to consult the originals.

*Plates.* Specimens figured on our plates are the most perfect examples that we are able to obtain. Selection is made to represent best the species in question. If we are unable to figure a specimen, we refigure the original plate, if such a published figure exists.

*Review Number.* The final number in the volume is a review of all the previous issues. In this number there are included species overlooked or those described since the original issue was published. In addition, we plan to include new or overlooked information, additional synonyms and records. Each succeeding volume will bring up to date all genera that have been previously published and indexed so that the last volume will cover its own subject matter together with the aforementioned material.

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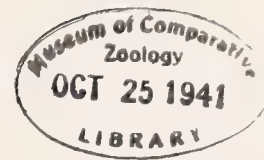
#### ERRATA

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- No. 1, page 2, line 26, read *bituberculatus*
- No. 1, page 3, line 13, read *bituberculatus*
- No. 1, page 5, line 14, read *pugilis pugilis*
- No. 1, page 5, line 15, read *pugilis*
- No. 1, page 5, line 16, read *pugilis*
- No. 1, page 15, line 25, read Charleston
- No. 2, page 2, line 3, read *papyratia*
- No. 9, page 1, line 22, read Plate 1 and Plate 2
- No. 12, page 12, line 13, read *barbudensis* and *Chicoreus*
- No. 15, page 4, line 31, read **pagodum**
- No. 15, page 4, line 32, read *pagodus*
- No. 16, page 2, line 43, read *cicatricosum*
- No. 16, page 9, line 12, read *P. cicatricosum*
- No. 17, page 28, line 24, read *Cichoreus* Agassiz

# JOHNSONIA

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NUMBER 1

## THE GENUS *STROMBUS* IN THE WESTERN ATLANTIC

BY

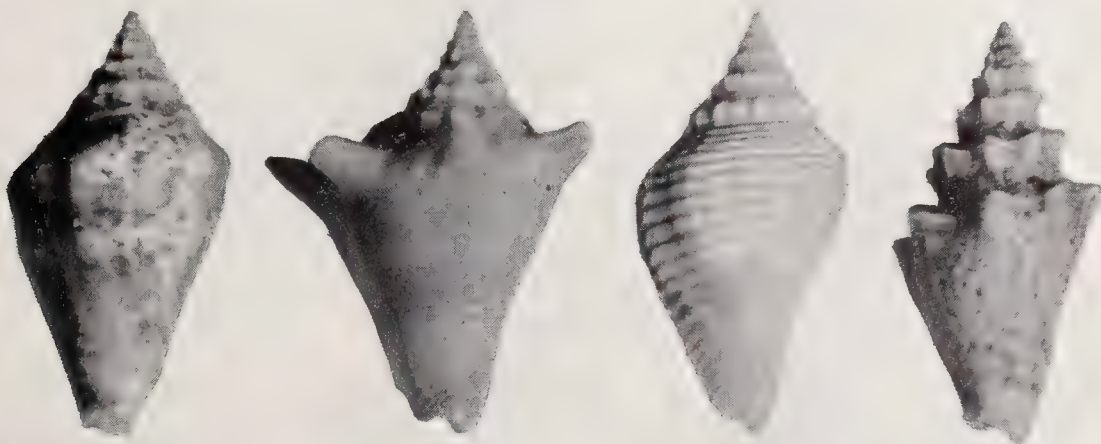
W. J. CLENCH AND R. T. ABBOTT

The genus *Strombus* is widely distributed throughout the tropical portions of the globe, though in certain areas various species extend into subtropical and temperate zones. In the western Atlantic region there are nine species and subspecies, and these collectively range from North Carolina and Bermuda south through the West Indies to southern Brasil.

Only one species appears to be at all of any great economic value, namely *Strombus gigas*. This species is employed extensively for food and fish bait in the West Indies, especially in the Bahamas. Cameos are often made from the shell, and in a pulverized state it is used in the manufacture of finer porcelains. This species is the source of the pink pearls which a few years ago were highly valued in European markets. As a food, especially in the form of chowder, it ranks with clams and scallops in taste and nutrition.

*Strombus* may be exceedingly abundant in certain areas. Though obtainable nearly everywhere in the West Indies, *S. gigas* is really only locally abundant in a few places. West End, Grand Bahama is such a locality. During the senior author's short stay of two weeks in 1936 at this settlement, 16,000 specimens were shipped to Florida for the novelty trade. These specimens were collected on the shallow grassy sand-flats within two or three miles of the settlement. Fortunately, the Bahama government has now restricted such wholesale collecting.

We have also seen thousands of *S. pugilis alatus* during certain seasons on the sand-bars at Sanibel Island, Florida. At Santa Barbara de Samana at the eastern end of Santo Domingo *S. pugilis* occurs in considerable numbers. Across the bay at San Lorenzo we found



*raninus*

*pugilis*

*alatus*

*gigas*

Plate 1. Young specimens, natural size.

this species six to eight feet deep on the floors of the vast caves that were originally the homes of the aborigines. It must have formed a very important food supply. Fluck (*Nautilus*, **19**, p. 33, 1905) mentions the abundance of *S. pugilis nicaraguensis*, and states that "the natives find it in such quantities that it is regularly sought after as an article of food."

All of the species in this genus live in comparatively shallow water, occurring in the intertidal zone and down to a depth of ten fathoms. We have seen *S. gigas* in six to eight fathoms of water in the Bahamas, though it generally prefers much shallower water.

Young specimens differ considerably from the adults. We have figured four of the common species for comparison. All are natural size. (Plate 1).

### **Strombus** *Linné*

*Strombus* Linné 1758, *Syst. Nat.*, ed. 10, **1**, p. 742, no. 289. Genotype, *Strombus pugilis* Linné (Montfort, 1810).

Shell generally subovate to fusiform with a narrow, oblique aperture and a wing-like or expanded lip in adult specimens. The canal is short and recurved to the right. A shallow depression or "stromboid notch" occurs near the canal at the base of the aperture, forming a "wave" in the aperture margin. Young shells are likely to appear quite different from the adults owing to the lack of the widely expanded lip.

The animal is furnished with large eyes at the ends of thick pedicels. The tentacles are slender and arise from the middle of the eye-pedicels. The foot is narrow, arcuate and without ventral sole. It creeps with an interrupted motion and when out of water and turned over it can push itself over onto its ventral surface and certain species can even jump a few inches by means of the very muscular foot.

#### Subgenus **Strombus** *Linné*

### **Strombus raninus** Gmelin, Plate 2

*Strombus raninus* Gmelin 1790, *Syst. Nat.*, **1**, p. 3511 (no locality).

*Strombus bituberculata* Lamarck 1822, *Anim. s. Vert.*, **9**, p. 690 (Seas of Antilles).

*Description.* Shell 40 to 110 mm. in length, solid, bluntly spinose, mottled in color and strongly sculptured. Whorls 9.5 to 10, regularly increasing in size. Color a mottled chocolate brown interspersed with a dirty white which renders the whole shell greyish. Occasional specimens have a pinkish tinge. Two or three rather broad and lighter bands occasionally occur around the middle of the body whorl. An aluminum-like glaze is sometimes present on the parietal wall and outer lip. Interior of aperture is usually suffused with light to dark salmon pink. Parietal wall glazed, with a milky white deposit on the lower half, and the color mottlings showing through the upper half. Aperture long, comparatively narrow, slightly oblique, and with the characteristic stromboid notch strongly developed near the base of the outer lip. Basal canal moderately short and recurved toward the right. Outer lip thickened and extended above into a short wing which is generally no higher than the spire. Spire moderately pointed. Suture indistinct and slightly wavy. Nuclear whorls smooth. Spiral sculpture consists of very fine thread-like striae on the early post-nuclear whorls. These later become larger and much coarser, and fan out over the expanded lip in the last whorl. Axial sculpture consists of fine, then rather coarse, costae which on the penultimate and last whorls pinch up to form large blunt spines just below the suture. The last two spines on the body whorl are by far the largest. Sometimes one or two spiral rows of small nodules are formed around the middle of the body whorl. Within the aperture, between the canal and the stromboid notch, there are usually small submarginate costae or wrinkles. On the upper and inside corner of the aperture



two or three heavy folds or lamellae run along the inner parietal wall. Operculum much smaller than the aperture, somewhat sickle-shaped, chitinous brown, and without marginal serrations. A thin, horny periostracum generally covers the outer shell, though in some cases it is absent when the specimen has undergone considerable wave action and wear.

	length	width (including spines)	
(large)	102	82 mm.	Pelican Id., Barbados.
(average)	90	65	Alicetown, Bimini Ids., Bahamas.
(small)	40	25	Lake Worth, Palm Beach Co., Florida.

*Types.* As the type locality was not given by Gmelin, we here designate it as Puerto Plata, Hispaniola. Gmelin connects his description of *raninus* with Knorr's figure (Vergnugen Schnecken Muscheln, 6, pl. 29, fig. 8, Nurnberg, 1772). We now select this illustration as the type figure.

*Remarks.* For many years this species has been known as *bituberculata* Lamarck. However, in conformity with the present rules of nomenclature we are obliged to accept the name *raninus* which Gmelin applied to this species some thirty years prior to that of Lamarck.

*Strombus raninus* Gmelin and *S. gallus* Linné are closely related species. The latter is characterized by the long extension or wing of the outer lip, and by its higher spire. The former, unlike *gallus*, possesses rather heavy folds or lamellae in the upper and parietal corner of the aperture. There are only two large spines on the body whorl of *raninus*, the other spines being much smaller, whereas in *gallus* there are three to five moderately long spines regularly increasing in size.

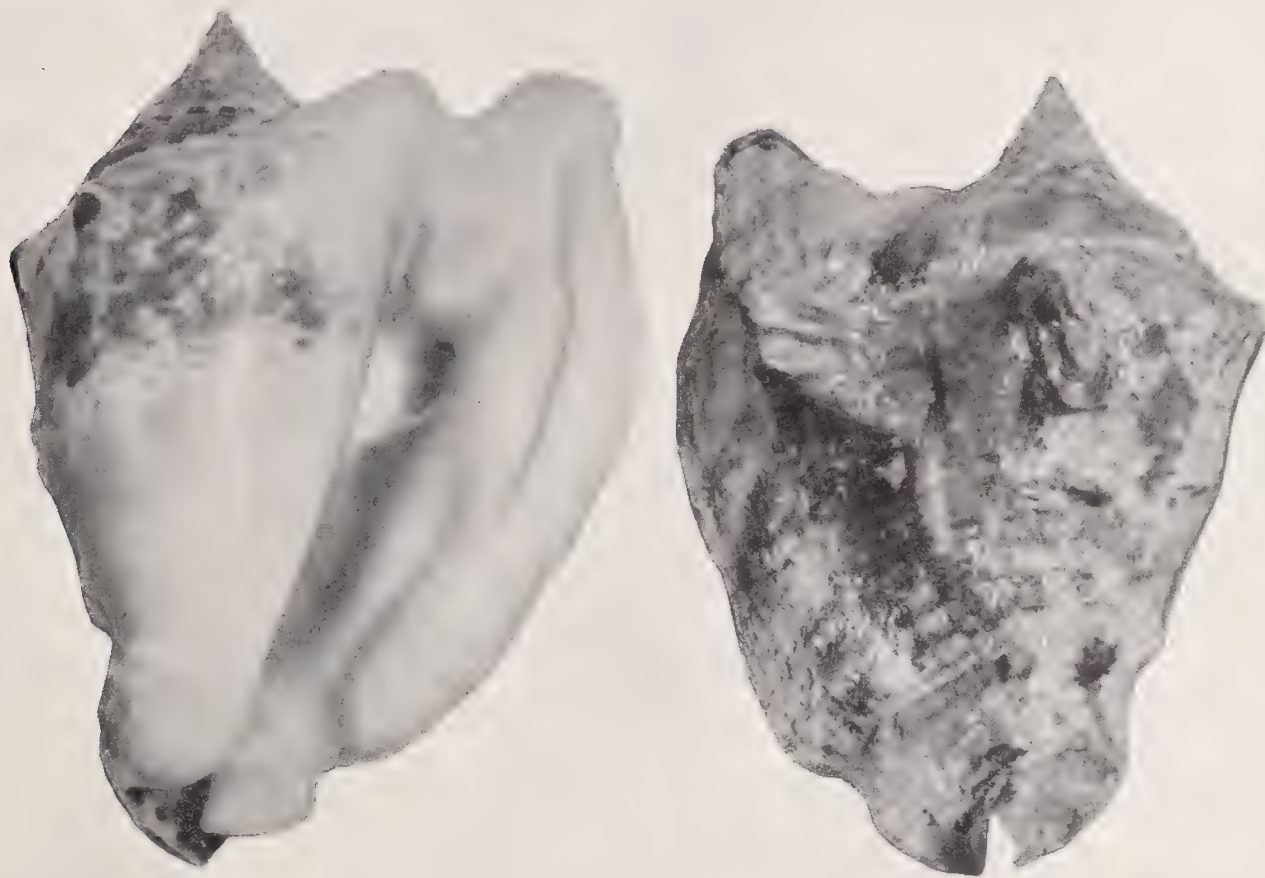


Plate 2. *Strombus raninus* Gmelin. Natural size.

*Range.* This species is found from southeastern Florida, through the West Indies, south to Colombia, South America.

*Records.* FLORIDA: Pelican Shoals, off Key West; Lake Worth. BAHAMAS: Bimini Islands; Cat Island; Eleuthera; Grand Bahama; Great Inagua; Long Island. CUBA: Cayo Frances, Caribarien; Cienfuegos. HISPANIOLA: Monte Christi; Santa Barbara de Samana; Puerto Plata; Gonave Island. JAMAICA: Montego Bay; Port Antonio. LESSER ANTILLES: Barbados. CENTRAL AMERICA: Bluefields, Nicaragua; Porto Bello, Panama. SOUTH AMERICA: Cartagena, Colombia.

### *Strombus gallus* Linné, Plate 3

*Strombus gallus* Linné 1758, Syst. Nat., ed. 10, 1, p. 743, no. 428 (no locality).

*Description.* Shell 95 to 150 mm. in length, solid, bluntly spinose, mottled in color and strongly sculptured. Whorls 9.5 to 10, regularly increasing in size. Color a light mottled brown over a dirty white, and sometimes with a pinkish background. Lower three fourths of parietal wall and outer lip glazed with a creamy orange. Interior of aperture white. An aluminum-like glaze is rarely found in this species. Aperture long, comparatively narrow, slightly oblique, and with a slightly developed stromboid notch near the base of the outer lip. Basal canal slightly lengthened and recurved toward the right. Outer lip expanded, slightly thickened, and extending above into a long wing which is always much higher than the spire. Spire somewhat high and pointed. Suture distinct and moderately indented. Nuclear whorls smooth. Spiral sculpture consists of thread-like striae on the whorls of the spire. These later develop into thick smooth lines on the body whorl and fan out over the expanded lip. Axial sculpture on the first post-nuclear whorls consists of fine costae which on the succeeding whorls pinch up to form a series of evenly spaced rounded nodules just under the suture. On the body whorl the nodules give place to moderately long spines which regularly increase in size. On the upper and parietal corner

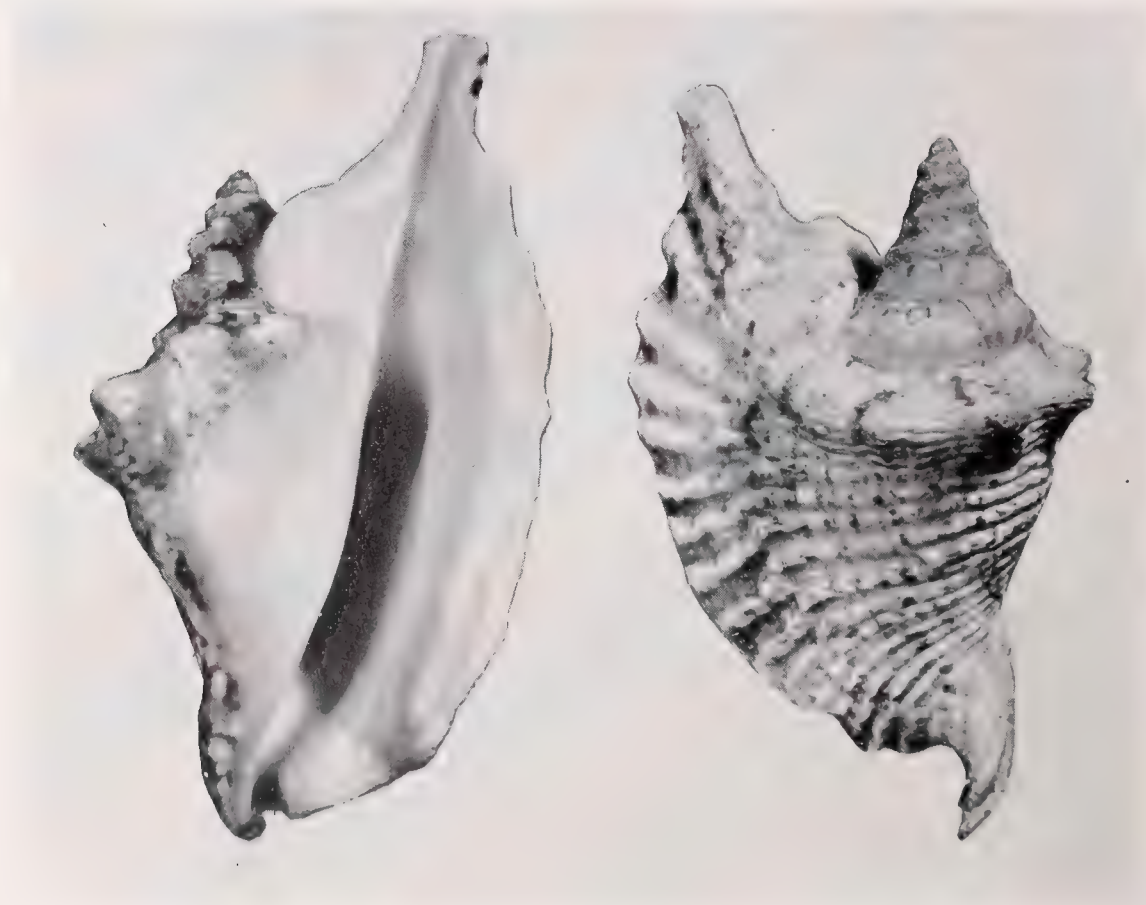


Plate 3. *Strombus gallus* Linné. Four fifths natural size.

## ERRATA

Page 2, line 26 read bituberculatus

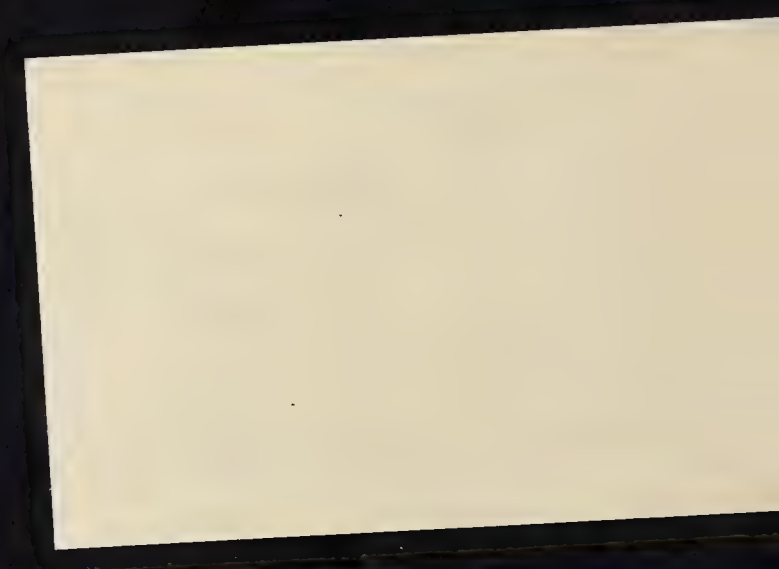
Page 3, line 13 read bituberculatus

Page 5, line 14 read pugilis pugilis

Page 5, line 15 read pugilis

Page 5, line 16 read pugilis

Page 15, line 25 read Charleston



of the aperture there are sometimes three or four very fine lamellae running back out of sight. Operculum similar to that of *S. raninus*. The periostracum is usually wanting.

	length	width (including spines)	
(large)	150	70 mm.	Port Antonio, Jamaica.
(average)	115	70	Barbados.
(small)	95	55	Matthewtown, Great Inagua, Bahamas.

*Types.* Port Antonio, Jamaica is here selected as the type locality. We also select as type figures those of Bonnani in his *Recreatio Mentis Oculi*, Rome, 1684, **3**, figs. 309, 310.

*Remarks.* See under *S. raninus*.

*Range.* West Indies south to Brasil.

*Records.* BAHAMAS: Great Inagua; Little San Salvador. JAMAICA: Port Antonio. VIRGIN ISLANDS: Guana Id., Tortola. LESSER ANTILLES: Barbados. SOUTH AMERICA: Bahia, Brasil. (Dall, 1897, p. 122).

### *Strombus pugilus pugilus* Linné, Plate 4

*Strombus pugilus* Linné 1758, *Syst. Nat.*, ed. 10, **1**, p. 744, no. 430 (Jamaica).

*Strombus pugilus peculiaris* M. Smith 1940, *World Wide Sea Shells*, Lantana, Florida, p. 35, sp. 500 (Florida).

*Description.* Shell 52 to 100 mm. in length, solid, always spinose, with the longest spines on the penultimate whorl. Whorls 8 to 9, regularly increasing in size. Color a rich uniform salmon pink, with a deep orange glaze on the parietal wall and within the aperture. End of canal tipped with bluish purple. On occasion, an aluminum-like glaze is superimposed on the parietal wall and palatal lip. Aperture long, comparatively narrow, slightly oblique, and with the stromboid notch near the base of the outer lip. Basal canal short. Outer lip expanded or winged, and in fully adult specimens the upper shoulder extends up to form a definite projection or point. Parietal wall smooth and with a high

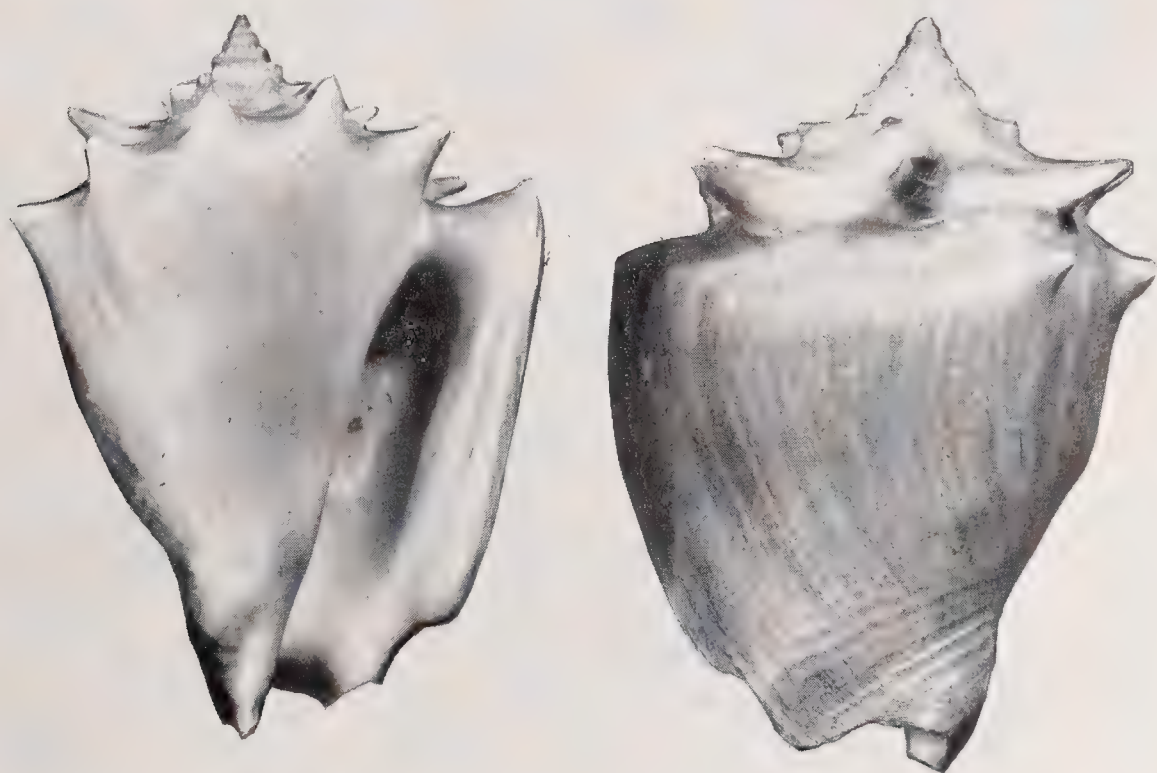


Plate 4. *Strombus pugilis* Linné. Natural size.

glaze. Base of columella moderately recurved to the right. Spire extended slightly. Suture slightly indented and over-lapping the whorl above. Nuclear whorls smooth. Sculpture consists of a series of moderately coarse axial costae on the first few post-nuclear whorls. From the fourth whorl on, these costae pinch up to form a single row of spines just below the suture. In this species the spines are longest in the penultimate or second to last whorl, and usually disappear one half whorl before the aperture. Spiral sculpture consists of numerous thread-like striae. In young specimens, as in the adults, these threads are confined to the very upper shoulder of the whorls, as well as a small portion at the base. Occasionally short submarginate costae or wrinkles are developed on the inside of the lip, and at times on the lower inside of the columella. A thin velvet-like, greyish periostracum covers the outer shell. Operculum much smaller than the aperture, somewhat sickle-shaped, chitinous brown, and with 7 to 10 small saw-like teeth on its outer margin.

	length	width (including spines)	
(large)	103	65 mm.	Puerto Plata, Hispaniola.
(average)	85	56	Montego Bay, Jamaica.
(small)	52	34	Itaparica, Estado da Bahia, Brasil.

*Types.* In Linné's *Systema Naturae* "Jamaica" is given as the type locality for *pugilis*, and reference is made to the figures of Lister (*Conch. pl.* 864, fig. 19) and P. Bonnani (*Recreatio Mentis Oculi*, Rome, 1864, 3, fig. 299). Lister's figure is valueless, but Bonnani's is a distinguishable illustration of the West Indian form. We therefore designate that of Bonnani as the type figure for *pugilis* Linné. We also select Montego Bay, Jamaica as the type locality.

*Remarks.* In the past there has been considerable confusion regarding both the nomenclature and the identity of *Strombus pugilis* Linné and *S. alatus* Gmelin. A large series of carefully localized material reveals different and distinct characters as well as separate geographical distribution. In addition, recourse to the earliest publications clarifies the position of these two forms.

There is no doubt that *alatus* Gmelin, illustrated in Martini *Conchy-Cab.*, (1), 3, 1777, pl. 91, fig. 894, is the Florida form, though unfortunately this figured specimen is without spines, a fact which has led people to believe erroneously that this is characteristic of Gmelin's species.

Thus as the nomenclature now stands, the typical form is *Strombus pugilis pugilis* Linné of the West Indies, and the Florida form which we consider a variety will stand as *Strombus pugilis alatus* Gmelin. However, *S. pugilis pugilis* does reach southeastern Florida at Lake Worth, the only locality so far reported. This locality has a few typically West Indian species not recorded elsewhere north of the West Indies.

The three forms of *pugilis* are readily separated. Typical *pugilis* is uniformly colored a rich salmon, and we have never seen West Indian specimens that possess the browns, purples or mottlings found in *alatus*. In addition, the peculiar development of the longest spines on the penultimate whorl is quite different from the general uniformity in size of the spines of *alatus*. On the whole, typical *pugilis* has a shorter spire than *alatus*, and also possesses the upturned and pointed shoulder of the outer lip. *S. pugilis nicaraguensis* Fluck differs in its much smaller size and its youthful spiral sculpture covering the last whorl in the adults. It resembles typical *pugilis* somewhat in coloration, and its spines are like those of *alatus*. It appears to be a well marked subspecies.

An indistinguishable form of *pugilis* in which the spines are distorted and somewhat

flattened has been named *peculiaris* by M. Smith. We have before us similar specimens which are only aberrant individuals and as such do not warrant names.

*Range.* This species ranges from southeastern Florida, through the West Indies, to Central America and south as far as southern Brasil.

*Records.* FLORIDA: Lake Worth. BAHAMAS: Great Inagua. CUBA: Cayo Frances, Caribarien; off Havana. HISPANIOLA: Monte Christi; Puerto Plata; Santa Barbara de Samana; Miragoane. PUERTO RICO: Mayaguez; Ponce. VIRGIN ISLANDS: Tortola. JAMAICA: Montego Bay. LESSER ANTILLES: Tobago. CENTRAL AMERICA: San Blas, Panama; Cavech, Guatemala (Hinkley, 1920, p. 41). SOUTH AMERICA: Cartagena, Colombia; Praguary, Sao Paulo; Ilha de Sao Sabastiao, Sao Paulo; Cidade da Bahia; Sao Goncalo, Rio de Janeiro; Brasil. Santa Caterina, south lat. 26°, Brasil (Dall, 1893, p. 111).

***Strombus pugilis alatus* Gmelin, Plate 5**

*Strombus alatus* Gmelin 1790, Syst. Nat., 1, p. 3513, no. 14 (no locality).

*Description.* Shell 70 to 100 mm. in length, solid, generally spinose, and color variable. Whorls 9 to 10, regularly increasing in size. Color ranging from mottled salmon or orange brown to dark uniform brownish red. Many specimens, especially young, have a zig-zag pattern, and in others there is a tendency towards banding. Within the aperture the color varies from purplish to very dark purple. End of canal tipped with purple. Often an aluminum-like glaze is superimposed on the parietal wall and outer lip. Aperture long, comparatively narrow, slightly oblique, and with the stromboid notch near the base of the outer lip. Short basal canal. Outer lip expanded or winged, the upper margin or shoulder sloping down. Parietal wall smooth and glazed. Base of columella moderately recurved

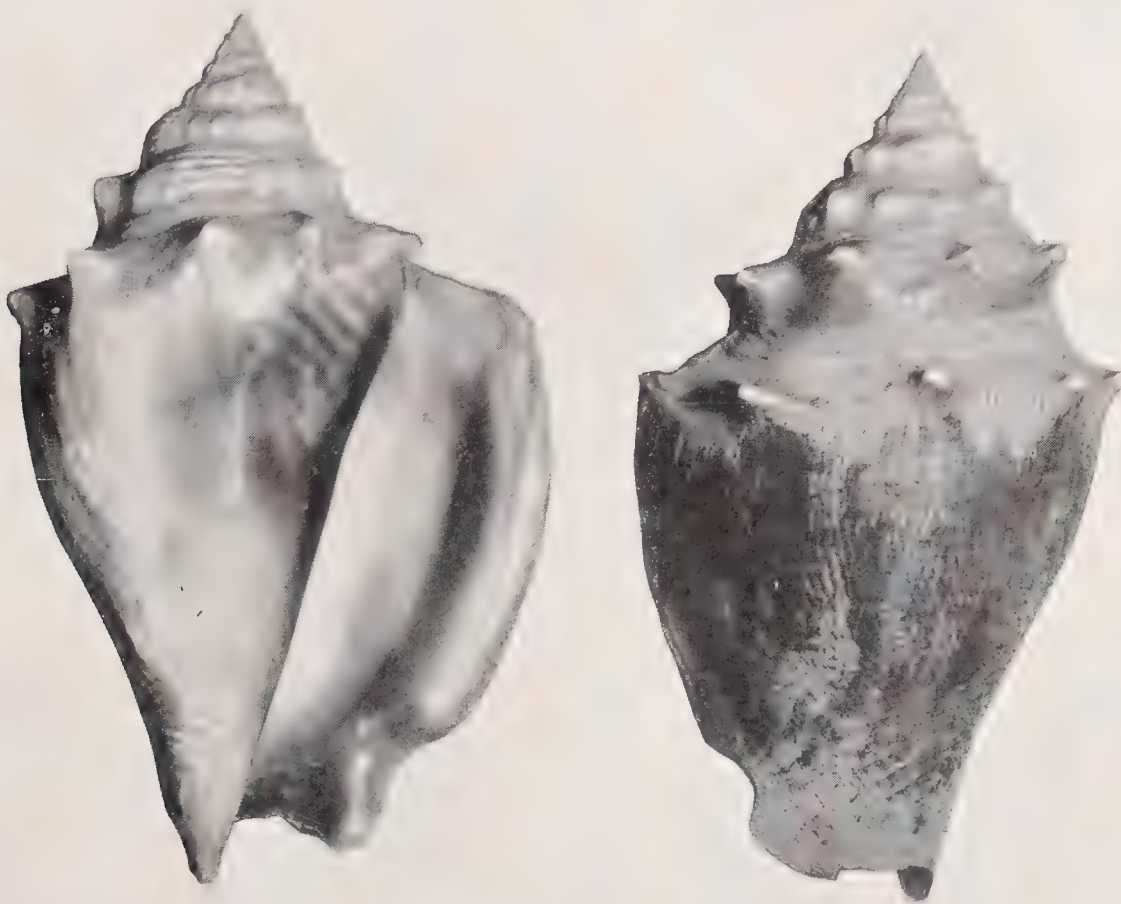


Plate 5. *Strombus pugilis alatus* Gmelin. Natural size.

towards the right. Spire extended. Suture slightly indented and over-lapping the whorl above. Nuclear whorls smooth. Sculpture consists of a series of moderately coarse axial costae on the first few post-nuclear whorls. From the fourth whorl on, however, these costae pinch up to form a single row of subsutural spines which in this species are longest and generally of the same size on the last two whorls. Occasionally completely non-spinose specimens are found. Spiral sculpture consists of numerous thread-like striae. In young specimens the entire shell possesses these fine threads. In adults, however, the last two whorls are lacking in these striae except near the base of the body whorl. Often submarginate short costae or wrinkles are developed on the inside of the lip, and occasionally on the inside of the columella. A thin velvet-like greyish periostracum covers the outer shell. Operculum similar to that found in typical *pugilis*. We have before us several albino specimens from Sanibel Island, Florida. In some the aperture is slightly tinged with pink.

	length	width	
(large)	100	54 mm.	Passagrille, Sarasota, Florida.
(average)	81	52	Sanibel Id., Lee Co., Florida.
(small)	70	47	Naples, Lee Co., Florida.

*Types.* We here select as type figure Martini, Conchy-Cab. (1), **3**, 1777, p. 191, fig. 894. No locality was mentioned by Gmelin, and we now designate Sanibel Island, Lee Co., Florida as the type locality.

*Remarks.* See under *pugilis*.

*Range.* This subspecies is known to occur only on the southeastern coast of North America, from North Carolina south to Florida and west to Texas.

*Records.* NORTH CAROLINA: Shackleford Island. SOUTH CAROLINA: (Mazyck, 1913 p. 13). FLORIDA: North Inlet, Lake Worth; Pavilion Key, Chokoloskee; Bonita Springs; Naples; Sanibel Id.; Egmont Key, Manatee Co.; Cape Romano; Long Key, Sarasota Co.; Lemon Bay, Hillsboro Co. TEXAS: (record for state only).

### ***Strombus pugilis nicaraguensis* Fluck, Plate 6**

*Strombus pugilis nicaraguensis* Fluck 1905, Nautilus **19**, p. 32.

*Description.* Shell 35 to 62 mm. in length, solid, spinose, with the color slightly vari-

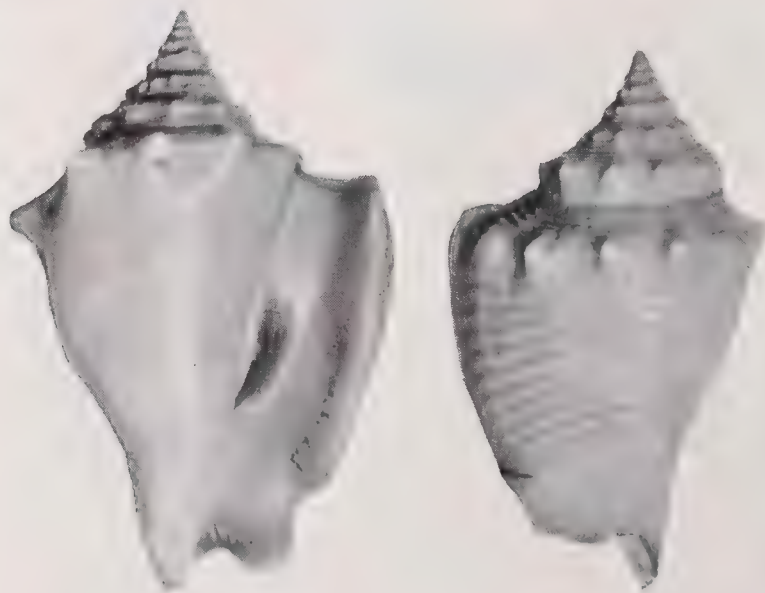


Plate 6. *Strombus pugilis nicaraguensis* Fluck. Natural size.



able. Whorls 8.5 to 9, regularly increasing in size. Color a light salmon to rosy salmon, usually with a lighter band midway across the body whorl. End of canal tipped with bluish purple. Aperture a glazed orange within. Aperture long, comparatively narrow, slightly oblique, and with a moderately indented stromboid notch near the base of the outer lip. Short basal canal. Outer lip expanded or winged, and in fully adult specimens the upper margin or shoulder extending up, but hardly forming a definite point. Parietal wall highly glazed. Base of columella moderately recurved to the right. Spire extended. Suture slightly indented and somewhat overlapping the whorl above. Nuclear whorls smooth. Axial sculpture consists of a series of coarse costae on the first few post-nuclear whorls; from the fourth whorl on, however, these costae pinch up to form a single row of subsutural spines, which in this subspecies continue to increase regularly in size to the last whorl. Spiral sculpture consists of numerous thread-like costae which completely cover the whorls even in adult specimens. At times short submarginate costae or wrinkles are developed on the lower part of the inside of the lip. A thin velvet-like greyish peristracum covers the outer shell. Operculum similar to that found in typical *pugilis*.

	length	width (including spines)	
Holotype	61	41 mm.	Wawa River, Nicaragua (Plate 6, left figure).
Paratype	55	37	Wawa River, Nicaragua (Plate 6, right figure).

*Types.* Holotype no. 87959 and paratype no. 141218, Mus. Comp. Zoöl. Beaches between Principolka and Wawa Rivers, Mosquito coast, Nicaragua. William Fluck collector.

*Remarks.* (For comparison with other species see under remarks of *S. pugilis pugilis*).

*Range and Records.* Known only from the type locality.

### ***Strombus costatus* Gmelin, Plate 7**

*Strombus costatus* Gmelin 1790, Syst. Nat., **1**, Part 6, p. 3520 (no locality).

*Strombus accipitrinus* Lamarck 1822, Anim. s. Vert., **7**, p. 200 (no locality).

*Strombus inermis* Swainson 1822, Appendix of Bligh Catalogue, p. 7 (no locality).

*Description.* Shell 80 to 185 mm. in length, solid, heavy, bluntly spinose, uniform in color, and strongly sculptured. Whorls 10 to 11, regularly increasing in size. Color a uniform white to a yellowish white. Parietal wall and outer lip glazed white or cream. An aluminum-like glaze is often found on the parietal wall, columella and outer lip of heavy shells. Interior of aperture white or creamy white. Aperture long, comparatively narrow, oblique, with a slightly developed stromboid notch near the base of the outer lip. Basal canal short and slightly recurved. Outer lip expanded, very much thickened in some specimens and not in others. Spire pointed. Suture slightly indented and overlapping the nodules on the whorls above. Nuclear whorls smooth. Spiral sculpture consists of thread-like striae on the whorls of the spire. These later develop into rather thick corrugations on the body whorl. Axial sculpture on the first post-nuclear whorls consists of fine, irregularly placed nodules. On the succeeding whorls the subsutural nodules are larger, evenly spaced, but rather flattened. Four to six moderately long, blunt spines are developed on the body whorl. On the upper and parietal corner of the aperture there are five or six fine lamellae or wrinkles which disappear within the aperture. Operculum much smaller than the aperture, slightly sickle-shaped, brown, and without the saw-like teeth at the margin. Periostracum generally covering the entire shell.

	length	width (including spines)	
(large)	185	140 mm.	Arthurstown, Cat Id., Bahamas.
(average)	150	115	Clarencetown, Long Id., Bahamas.
(small)	80	65	Santa Barbara de Samana, Hispaniola.

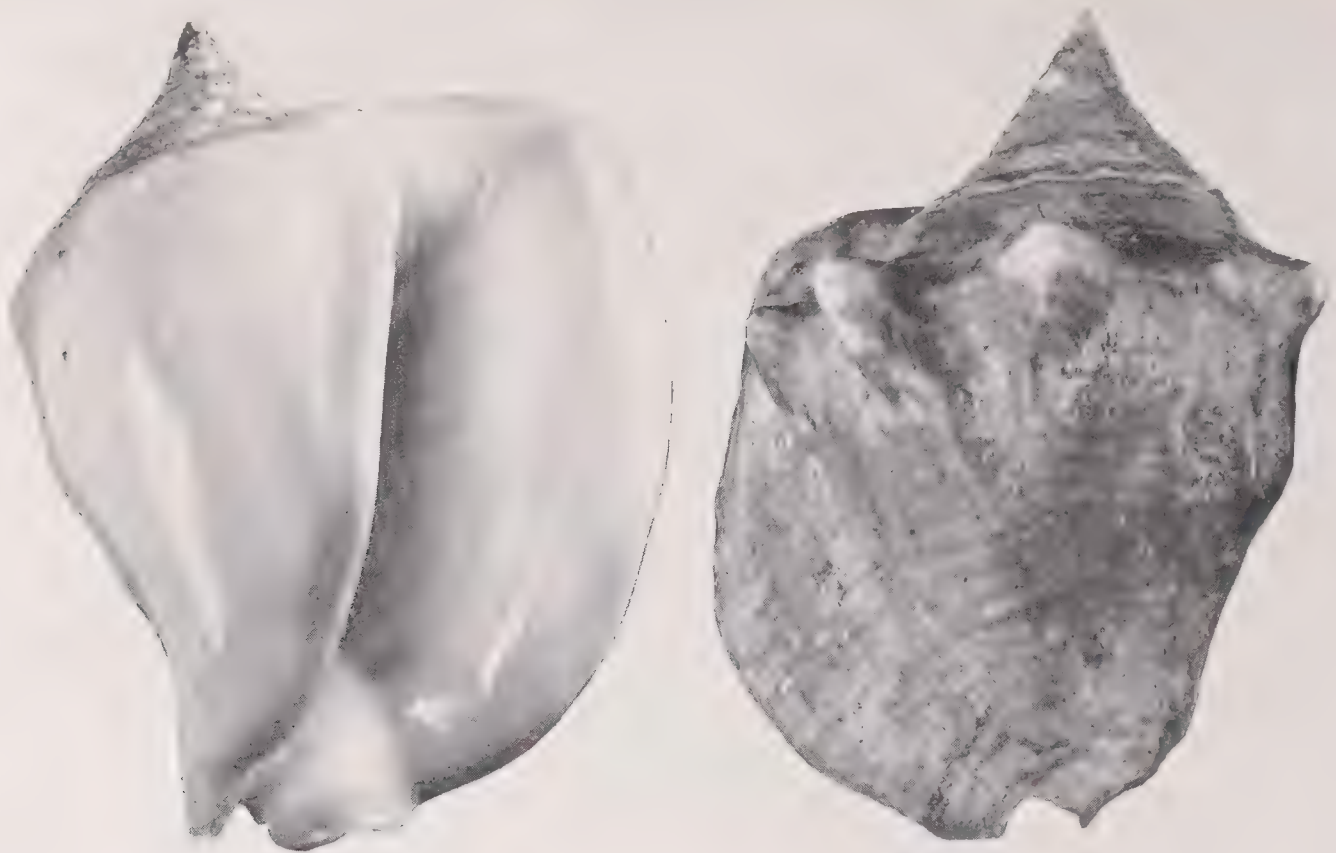


Plate 7. *Strombus costatus* Gmelin. One half natural size.

*Types.* We here select fig. 829, pl. 81, Martini, Conchy-Cab., (1), 3, 1777, as the type figure. No locality was given by Gmelin, and we now designate Clarendetown, Long Island, Bahamas as the type locality.

*Remarks.* This species occurs quite commonly in the Bahamas on reefs and sand flats. The development of spines or nodules is quite variable even among specimens from the same locality. This is generally a rather massive shell, becoming much thickened in old specimens, especially at the lip. The aperture is always white, and generally with considerable aluminum-like glaze on the lip areas.

Both Gmelin and Lamarck refer to the same figure in Martini as the type of their species (see above). The earliest name, *costatus*, of Gmelin has preference over Lamarck's name *accipitrinus*. Swainson in his description of *inermis* refers to Lister's figure (Conchyliorum, 1770, fig. 856) which is unquestionably *costatus* with only moderately developed spines.

*Range.* Florida, through the West Indies, to Central and South America as far south as Brasil.

*Records.* FLORIDA: Sanibel Island; Tortugas; 40 miles N. W. of Tortugas. BERMUDA: St. Georges (fossil). BAHAMAS: Bimini Islands; Cat Island; Eleuthera; Grand Bahama; Great Abaco; Great Inagua; Long Island. HISPANIOLA: Puerta Plata; Santa Barbara de Samana. JAMAICA: Port Antonio. LESSER ANTILLES: St. Kitts. CENTRAL AMERICA: Bluefields, Nicaragua. SOUTH AMERICA: Bahia, Brasil (Dall, 1897, p. 122).

### ***Strombus samba* Clench, Plate 8**

*Strombus samba* Clench 1937, Proc. New England Zool. Club, 16, p. 18, pl. 1, fig. 1.

*Description.* Shell 150 to 180 mm. in length, solid, spinose, roughly sculptured. Whorls 9 to 10, regularly increasing in size. Color of shell pale yellowish. Parietal wall and outer

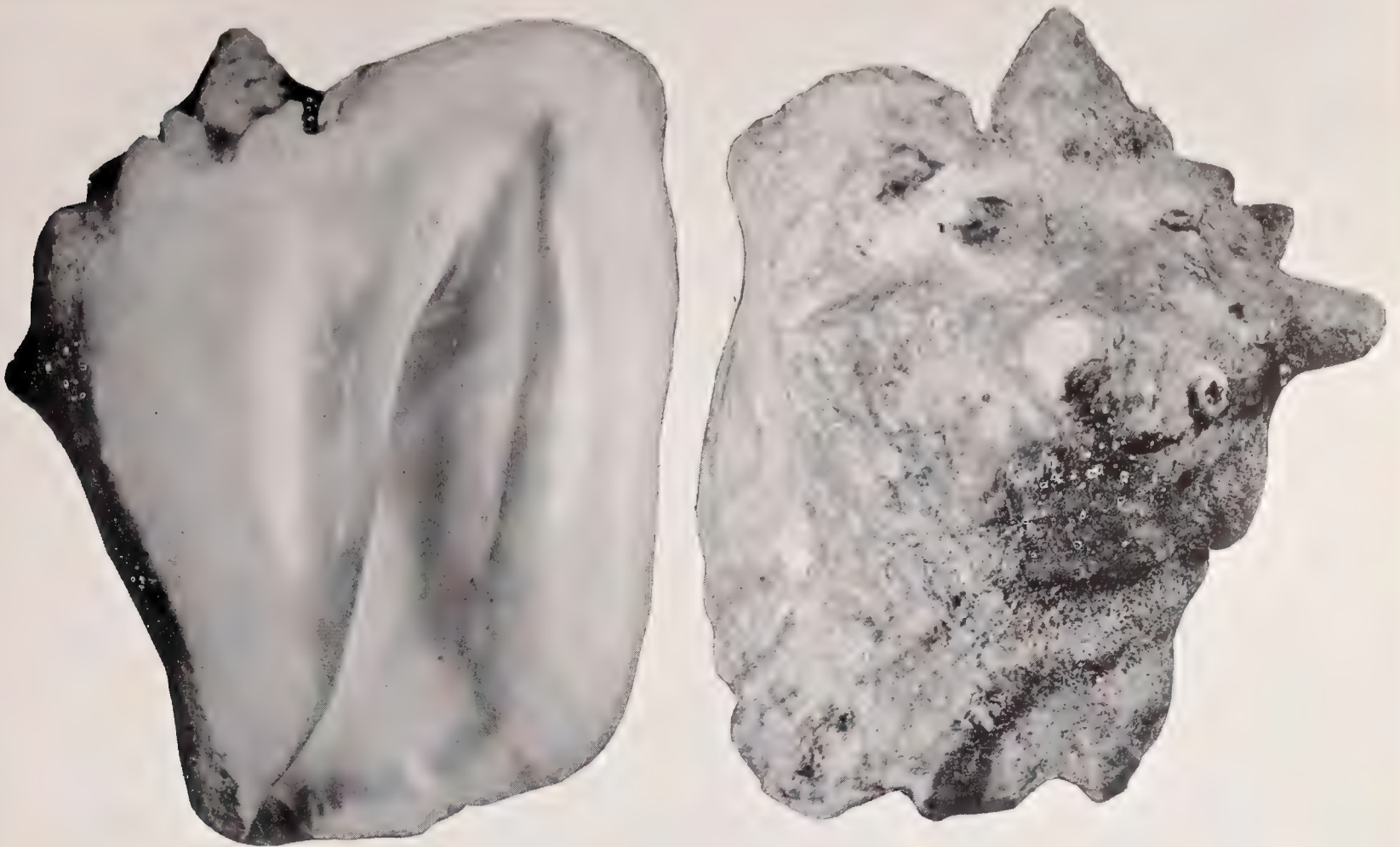


Plate 8. *Strombus samba* Clench. Two thirds natural size.

lip brownish yellow, merging into deep pink within the aperture. A heavy aluminum-like glaze is always present on the parietal wall and outer lip. Aperture long, comparatively narrow, slightly oblique, and with a moderately developed stromboid notch near the base of the outer lip. Basal canal short and slightly recurved. Outer lip slightly flaring and greatly thickened, the upper portion or shoulder extending above to the height of the spire. Columella short. Spire pointed. Suture rather indistinct, slightly indented, and at times overlapping the spines on the whorl above. Nuclear whorls smooth. Spiral sculpture on the first few post-nuclear whorls consists of fine striae. On the body whorl these develop into coarse thread-like lines, and in some specimens become rough corrugations. Axial sculpture on the spire often consists of pointed nodules, while on the last two whorls, moderately long spines are present. Operculum much smaller than the aperture, somewhat sickle-shaped, brown, and without saw-like teeth on its outer margin. Periostracum horny, yellowish brown, and generally covering the entire outer shell.

	length	width (including spines)	
(large)	180	140 mm.	Paratype. West End, Grand Bahama.
(average)	159	130	Holotype. West End, Grand Bahama (Plate 8, left fig.)
(small)	150	135	Paratype. West End, Grand Bahama (Plate 8, right fig.)

*Types.* Holotype no. 116054, Mus. Comp. Zoöl. Wood Cay, West End, Grand Bahama, Bahamas. William J. Clench collector.

*Remarks.* This species is closely related to *S. gigas*, though it possesses characters somewhat approximating *S. costatus*. It differs from *S. gigas* by its smaller size, very much

thickened and shorter lip, and by the presence of a great deal of aluminum-like glaze. The soft parts, particularly the portion extruded while crawling, are nearly entirely black, while the color of *S. gigas* is orange red.

*S. samba* approximates large specimens of *S. costatus* in size, in thickened lip and in the presence of the aluminum-like glaze, but differs in possessing pink within the aperture, and in having at times blunt spines on the spire.

*Range and Records.* Known only from the type locality.

### ***Strombus gigas* Linné, Plate 9**

*Strombus gigas* Linné 1758, Syst. Nat., ed. 10, 1, p. 745, no. 435 (America).

*Strombus gigas horridus* M. Smith 1940, World Wide Sea Shells, Lantana, Florida, p. 131, sp. 1629a, (Lake Worth, Florida).

*Description.* Shell 190 to 300 mm. in length, solid, massive, spinose, color varying, and roughly sculptured. Whorls 9 to 11, regularly increasing in size. Color of outer shell yellowish. Half of parietal wall farthest from aperture yellow, flecked with brown; half nearest aperture glazed, brownish or deep pink. Outer lip glazed, white to pinkish white. Interior of aperture suffused with pink. The aluminum-like glaze is rarely found in this species. Aperture long, comparatively narrow, oblique and with a slightly developed stromboid notch near the base of the outer lip. Basal canal short and slightly recurved. Outer lip large and flaring, moderately thickened, but never to any great degree. Usually the outer edge is irregularly waved. Upper end of the lip is broad and raised, but usually



Plate 9. *Strombus gigas* Linné. One half natural size.

no higher than the spire. Collumella short. Spire pointed. Suture rather indistinct, slightly indented, and sometimes overlapping the above whorl as far as the base of the spines. Nuclear whorls smooth. Spiral sculpture on the first post-nuclear whorls consists of very fine striae which on the succeeding whorls become larger and more indistinct. On the body whorl and expanded lip these striae develop into larger and rough corrugations. Axial sculpture on the early whorls consists of small evenly spaced nodules. There are present on all succeeding whorls pointed nodules, regularly increasing in size, which culminate on the body whorl in rough and moderately long spines. Coarse longitudinal striae often are present on the body whorl. Operculum much smaller than the aperture, somewhat sickle-shaped, and chitinous brown. Periostracum horny, yellowish brown, and generally covering the entire outer shell.

	length	width	
(large)	300	210 mm.	Puerto Plata, Hispaniola.
(average)	250	180	Wood Cay, Grand Bahama, Bahamas.
(small)	190	160	Middle Sambo Id., Key West, Florida.

*Types.* We here select as type figure that of Bonnani (*Recreatio Mentis Oculi*, 1684, 3, pl. 321. Montego Bay, Jamaica is here designated as the type locality, since Linné only gave "America" in his original description.

*Remarks.* *S. gigas* occurs from low water to depths of six or eight fathoms. Its favorite haunt is the sandy and grassy bottom, though it may also be found among coral and loose rock. Its widely expanded lip and deep pink coloration differentiates it from all other species of this genus. M. Smith (1940, p. 131) has given the name *horridus* to a malformed specimen from Lake Worth, Florida. It appears to us to have no value, even as a subspecies.

*Range.* Bermuda and southern Florida, south through the West Indies to northern South America.

*Records.* FLORIDA: Bahia Honda Key; Middle Sambo Id., off Key West; Lake Worth. BERMUDA: Castle Harbor; Hamilton Sound. PUERTO RICO: San Juan; Tal-laboa Bay; Guanica Harbor. BAHAMAS: Middle Bight, Andros; Bimini Islands; Cat Island; Fortune Island; Grand Bahama; Great Abaco; Great Inagua; Long Island. CUBA: Cienfuegos; Havana; Guantanamo Naval Base; Bahia Honda. HISPANIOLA: Miragoane; Gonave Id.; Monte Cristi; Puerta Plata; Santa Barbara de Samana. JAMAICA: Montego Bay. VIRGIN ISLANDS: St. John; St. Thomas; Tortola; Virgin Gorda. LESSER ANTILLES: Barbados; Trinidad. CARIBBEAN ISLANDS: Swan Island. CENTRAL AMERICA: Progreso, Mexico (Weisbord, 1926, p. 86). SOUTH AMERICA: Cartegena, Colombia (Dall, 1889, p. 136).

### ***Strombus goliath* Sowerby, Plate 10**

*Strombus goliath* Sowerby, 1842, *Thesaurus Conchyliorum* 1, p. 35, pl. 10, fig. 118 (no locality).

*Description.* Shell about 200 to 300 mm. in length, solid, massive and nodulose. Color cream to yellowish brown, and according to Reeve's figure (1851) there are clear spiral bands of dark brown on the body whorl and parietal wall. The specimen we have examined, however, is cream colored throughout, other than a few axial streaks of dark brown on the spire. Interior of aperture a deep cream with a slightly pinkish caste. The upper margin of the outer lip is expanded and forms a flattened shield in front of the spire, and joins the shoulder of the body whorl. The shell is rather coarsely nodulose along the shoulder



Plate 10. *Strombus goliath* Sowerby. Two thirds natural size.

of the body whorl. In addition there are several coarse and deeply incised spiral grooves running over the body whorl which fan out over the expanded lip.

length	width (including lip)
310	231 mm. American Mus. Nat. Hist. no. 13124

*Remarks.* The exact locality of this species is unknown. On various occasions it has been reported from the West Indies and the west coast of South America. We suspect that this species may be found eventually along the northeastern coast of South America.

This species is closely allied to *S. latissimus* Linné of the South Pacific, though the latter differs in its much smaller size, its lack of nodules, the deeper stromboid notch, and the fact that its spire is half buried in the upper expansion of the outer lip. We are indebted to the American Museum for the loan of the specimen from which our description was made. Our plate 10 is a copy of Reeve's figure which was originally drawn from a small specimen.

## Key to the Western Atlantic Strombus (adults)

1. Shell longer than 190 mm. ( $6\frac{3}{4}$ inches)	3
2. Shell shorter than 190 mm. ( $6\frac{3}{4}$ inches)	5
3. Aperture colored deep pink	<i>gigas</i>
4. Aperture colored a pale salmon or cream	<i>goliath</i>
5. Shell heavy with a greatly thickened outer lip	7
6. Shell solid with a strong but not thickened outer lip.	9
7. Aperture colored white	<i>costatus</i>
8. Aperture colored pink	<i>samba</i>
9. Outer lip definitely winged above	11
10. Outer lip not definitely winged above	13
11. Wing as high or higher than spire	<i>gallus</i>
12. Wing shorter than height of spire	<i>raninus</i>
13. Spines on penultimate and last whorl equal	15
14. Spines on penultimate whorl longest	<i>pugilis</i>
15. Shell longer than 65 mm. ( $2\frac{1}{2}$ inches)	<i>alatus</i>
16. Shell shorter than 65 mm. ( $2\frac{1}{2}$ inches)	<i>nicaraguensis</i>

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## JOHNSONIA

During the past several years there has developed an ever increasing interest in the study of shells. This interest is not only in the shells alone, but also in the life histories of the animals, their distribution, and other information concerning them.

"Johnsonia" aims to aid in this study, to present both descriptions and figures of shells, particularly the species that are to be found along the Atlantic shores of the Americas.

Parts will be published, each complete for a genus, giving all of the species known to occur in the Western Atlantic. The term Western Atlantic includes the shore line from Greenland south to Patagonia, with Bermuda and the West Indies considered as part of this province.

All species that are to be found in depths of less than 25 fathoms of water will be considered fully, with descriptions, figures and original references. Deep water species, those known only from depths exceeding 25 fathoms, will be listed and the original citation included.

All parts will be sold at the cost of printing and mailing. Genera will appear not in any systematic order but on the basis of interest and the availability of material for study.

A general introduction will be included for each genus, followed by a short description of the genus. Each species will include the original citation, a list of the recently considered synonyms, and a detailed description with measurements.

Under the remarks, comparisons will be made with all of the closely allied species as well as other data of general interest. Following this, there will be the type designation and type locality. Under distribution the full extent of the range will be given as well as several specific locality records. These records are based upon material that is contained in the Museum of Comparative Zoölogy, unless otherwise noted. We will attempt to give as much information as it is possible for each species. At the end of each genus a few references will be added that lead to additional information.

Our present plan is a "pay as you go" policy. A single work, embracing all of the species of this vast area, would cost far beyond our resources and would take many years of work to complete. This plan makes possible the immediate publication of several genera. Each genus will be sold separately, the cost of each will be based upon the number of pages that are included.

Much of the Western Atlantic region still remains unexplored for shells. Many sections of this coastline, sometimes hundreds of miles in extent, are but partially and even wholly unknown. Material from these areas is much to be desired. The gulf coasts of Alabama, Louisiana, Texas and Mexico are very poorly known, and all sections of the Central American coast have hardly been touched. Very little of the Atlantic of South America is known at all, at least as far south as Rio de Janeiro, and beyond Rio de Janeiro much information is wanting except in the vicinity of Uruguay and northern Argentina.

The name "Johnsonia" that we have selected is a tribute to Charles W. Johnson, a scientist who did so much for the study of our Western Atlantic mollusks.

William J. Clench, *general editor*  
Museum of Comparative Zoölogy  
Cambridge, Massachusetts



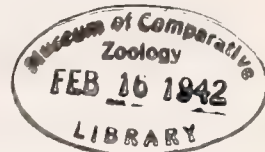
# JOHNSONIA

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79937

FEBRUARY 15, 1942

FICIDAE



NUMBER 2

## THE GENUS *FICUS* IN THE WESTERN ATLANTIC

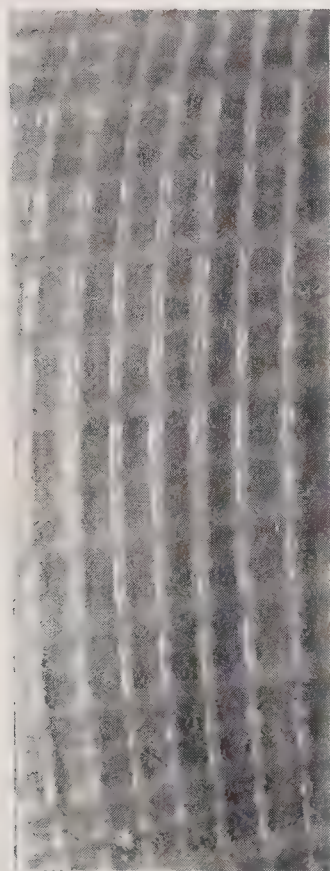
BY  
WILLIAM J. CLENCH

The genus *Ficus* (fig or pear shells) is rather widely distributed throughout the tropical and south temperate portions of the globe. As a rule specimens would appear to be rather rare with the exception, perhaps, of those of our own species, *F. papyratus*, which is quite abundant especially along the west Florida coast between Pavilion Key and the Cedar Keys. There are now eighteen species and subspecies known, three of these occurring in the Western Atlantic. Two of the latter are known only from deep water. This genus has long been known under the name of *Pyrula* Lamarck (*Pirula*) but unfortunately Röding's name, *Ficus*, has one year priority.

### *Ficus* Röding

*Ficus* Röding 1798, Museum Boltenianum, p. 148 (Sherborn and Sykes reprint, 1906).

Shell fig or pear shaped, rather thin but strong, highly glazed within, outer surface moderately sculptured with rather fine axial and spiral ridges, usually forming a reticulated surface. Color generally a dull brownish or grayish white which is not always regularly suffused throughout the shell. Normally there is a series of dots or blotches and even of



Sculpture, five times natural size.

*Ficus papyratus* Say Natural size.

bands of darker color which are spirally arranged. Soft parts of the animal extend and nearly envelop the shell, foot capable of great expansion. No operculum.

### ***Ficus papyratus* Say**

*Pyrula papyratia* Say June, 1822, Jour. Acad. Nat. Sci. Phila. **2**, p. 238 (Georgia and East Florida).

*Pyrula reticulata* Lamarek August, 1822, Anim. s. Vert. **7**, p. 141, no. 9 (Indian Ocean).

*Pyrula fortior* Mörch 1877, Malak. Blätt. **24**, p. 43 (Antilles; Campeche [Mexico]).

*Description.* Shell 60 to 100 mm. in length, thin but strong and generally evenly and moderately sculptured. Whorls 4 to 5, regularly increasing in size and strongly convex. Color a dull pinkish or whitish brown, not always evenly disposed but occasionally somewhat mottled owing to the uneven disposition of the darker brown color deposited on the inside of the whorls. Spirally arranged spots are sometimes present though they are usually small and faint. Interior of aperture glazed brown usually well below the lip margin. Inner or parietal wall thinly glazed. Outer edge thin, not produced to form a definite lip. Aperture subovate, and nearly as long as the shell and extending below to include the canal. Spire depressed, sometimes to the extent that the shell is flattened on top. Nuclear whorls smooth, following whorls reticulated by the crossing of axial and spiral ridges or cross threads. Spiral threads generally a little stronger, especially every second or fourth thread. Occasionally irregular growth ridges are present which are usually a little thickened on the inner side of the whorls.

	length	width	whorls
(large)	95	53 mm.	4½ Sanibel Id., Florida
(average)	75	55	4½ Bonita Springs, Florida

*Types.* Neoholotype, Acad. Nat. Sci., Phila. No. 39373, St. Augustine, Florida (here selected by H. A. Pilsbry). Swift collection, W. Stimpson collector. Length 86.3; width 39 mm. (Say's original type is lost.)

*Remarks.* This species cannot be confused with any other in the Western Atlantic as it is the only shallow water *Ficus* in this area. It is generally distributed along the coast but rather uncommon other than on the coast of Florida. Though listed as occurring in the West Indies, the only specific record that we have been able to obtain is that of Grand Bahama Island listed below.

*Range.* North Carolina south to Venezuela along the coast.

*Records.*<sup>1</sup> NORTH CAROLINA: Beaufort (ANSP); Cape Lookout (USNM). SOUTH CAROLINA: Bird Key, Ball's Bay; Isle of Palms; Magnolia Beach; Sullivan's Id., Charleston (all CM). FLORIDA: St. Augustine (MCZ; ANSP); Miami (USNM); Key West; Pavilion Key; Sanibel Id.; Cedar Keys (all MCZ); Crooked Id., Calhoun Co., Santa Rosa Id. (all ANSP). TEXAS: (MCZ). MEXICO: Progresso; Silan (all ANSP). VENEZUELA: Maracaibo (ANSP). BAHAMA IDS. East End Bush, Gd. Bahama Id. (MCZ).

The references below are for the two deep water forms.

*Ficus howelli* Cl. and Ag. 1940, Mem. Soc. Cubana Hist. Nat. **14**, p. 85, pl. 14, fig. 2 (Bahia de Cochinos, Santa Clara Prov., Cuba). Dredged by the "Atlantis," station no. 3332, in 175-225 fathoms, 1939. Holotype, MCZ, no. 135140.

*Ficus atlanticus* Cl. and Ag. 1940, Mem. Soc. Cubana Hist. Nat. **14**, p. 85, pl. 14, fig. 1 (off Sao Salvador, Bahia, Brasil; S. Lat. 11° 49'; W. Long. 37° 10'). Dredged by the "Hassler," station no. 12, in 450 to 500 fathoms, 1872. Holotype, MCZ, no. 104657.

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Smith, E. A., 1894: A list of the Recent Species of the Genus of Pirula Lamarek. Jour. of Malacology **3**, pp. 64-69.

<sup>1</sup> ANSP (Acad. Nat. Sci. Phila.); CM (Charleston Mus.); MCZ (Mus. Comp. Zoöl.); USNM (United States Nat. Mus.).

# JOHNSONIA

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VENERIDAE



NUMBER 3

## THE GENERA DOSINIA, MACROCALLISTA AND AMIANTIS IN THE WESTERN ATLANTIC

BY  
WILLIAM J. CLENCH

### *Dosinia Scopoli*

*Dosinia* Scopoli 1777, *Introductio Historiam Naturalem*, p. 399.

This genus possesses about 100 species, most of which are to be found in the tropics, though a few occur well into temperate seas. It is a remarkably compact group that does not show much variation among its several species, though the characters upon which specific differentiation exists are rather surprisingly constant.

The shells are subcircular to circular in shape, generally compressed and usually sculptured with concentric ridges. The color is white, yellow, or pale brown, rarely with a secondary color pattern of rays or spots. The animal has a large muscular foot which projects below. The two siphons are united and possess simple orifices.

Only three recent species occur in the Western Atlantic, and these are found from Virginia to Brasil.

### *Dosinia elegans* Conrad, Plate 1

*Dosinia elegans* Conrad 1846, *American Jour. of Science* (2) 2, p. 393 (Mullet Key, Tampa Bay, Florida).

*Description.* Shell subcircular, compressed, rather thin and sculptured with concentric ridges. Color generally yellow to straw-yellow which is invested in the periostracum.

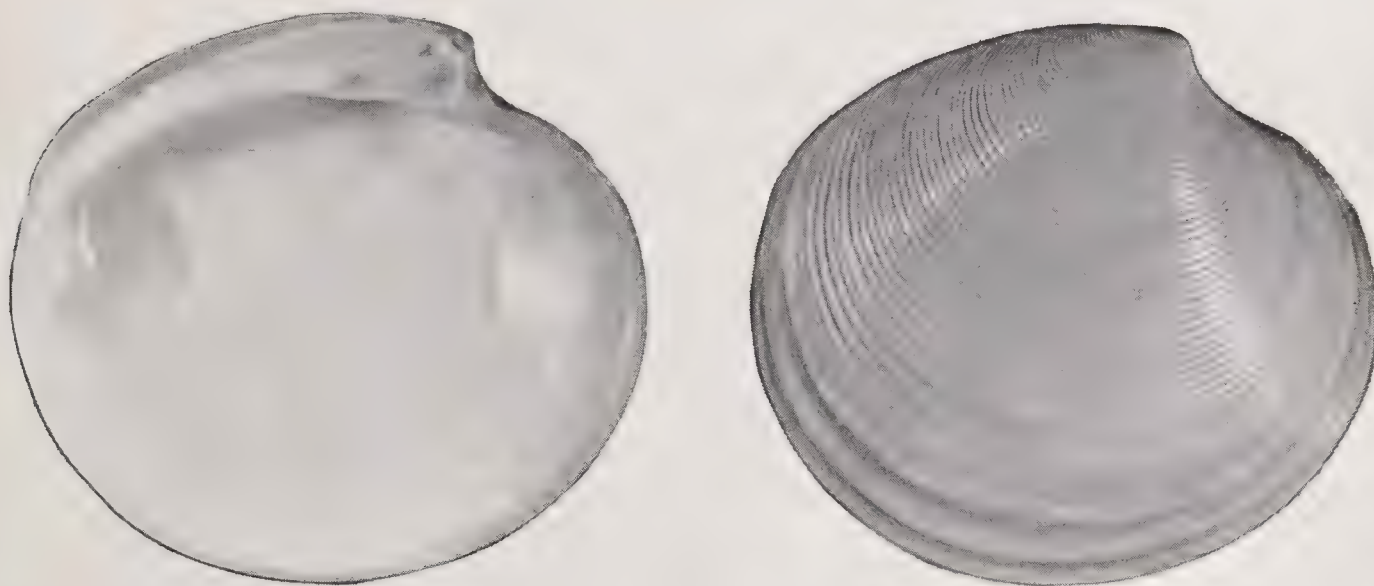


Plate 1. *Dosinia elegans* Conr. Natural size. Gulfport, Florida.

Beaks high, rather sharp and pointing forward. Ligament deeply immersed. Lunule well defined and deeply impressed. Escutcheon weakly defined. Sculpture consisting of moderately fine concentric ridges with about 8 to 10 to one centimeter on the central portion of the disc. Interior of shell a flat white with the muscle scars and pallial complex highlighted. Hinge-plate broad. Right valve with the posterior cardinal bifid. Anterior lateral tooth small and tubercular. Beak cavities deep. Pallial sinus triangular and deep with its apex sharply pointed.

	length	height	width	
(large)	71	65	24 mm.	Sanibel Id., Florida
(average)	66	60	26	Sanibel Id., Florida

*Types.* The type locality is Mullet Key, Tampa Bay, Florida. Conrad's type specimens are not in existence. We here indicate a new neoholotype (MCZ 45308) and a neoparatype, this latter deposited in the ANSP. They are from Egmont Key at the entrance of Tampa Bay, Florida.

*Remarks.* The two North American species *elegans* and *discus* are quite readily told apart. *D. elegans* possesses 8 to 10 ridges per centimeter and *D. discus* has 20 ridges per centimeter in the mid area of the disc. Conrad's original description of *elegans* leaves much to be desired as certain of his statements seem to be conflicting with the facts as now known.

The remaining Western Atlantic species, *concentrica*, occurs in the West Indies and extends south to Brasil. Its distribution on the Central American coast is unknown. If it does exist in this area it may possibly overlap the distribution of *elegans* and, consequently, cause some confusion in determination. Though the two are remarkably similar, they can be differentiated, however, on the greater width of *concentrica* which appears from the specimens we have examined to be nearly proportionate at all stages of growth. A ratio can readily be worked out based upon the measurements we have given for the two species. The ridges which compose the concentric sculpture number about 8 to 10 per centimeter for both *elegans* and *concentrica*.

Other differences exist in all three species, but, similar to the characters given above, they are relative and difficult to give quantitatively in an outline description.

*Range.* Along the coast from Cape Hatteras, North Carolina to Yucatan, Mexico; also Cuba and possibly elsewhere in the Greater Antilles.

*Records.* FLORIDA: Cape Sable; Pavilion Key (MCZ); Cape Romano (ANSP); Naples; Sanibel Id.; Lemon Bay (all MCZ); Osprey (ANSP); Sarasota; Egmont Key; Gulfport; Clearwater (all MCZ); MEXICO: Progreso, Yucatan (ANSP); Isla Mujeres, Yucatán (C.G. Aguayo); CUBA: Caibarien (C.G. Aguayo).

### *Dosinia concentrica* Born, Plate 2

*Venus concentrica* Born 1780, Testacea Musei Caesarei Vindobonensis, p. 71, pl. 5, fig. 5 (Mauritius and Jamaica).

*Cytherea patagonica* Philippi 1844, Abbildungen Neuer Conchylien 1, p. 169, pl. 2 [41] fig. 1 (Patagonia).

*Venus philippi* d'Orbigny 1846, Voyage L'Amérique Meridionale 5, p. 553 (Martinique to Rio de Janeiro).

*Dosinia floridana* Conrad 1866, American Jour. Conchology 2, p. 280, pl. 15, fig. 4 (Florida Keys, Gulf of Mexico). Holotype, ANSP. no. 53958.

*Description.* Shell subcircular, compressed, rather thin and sculptured with concentric ridges. Color a light yellow which is invested in the periostracum. Beaks high and rather sharp and pointing forward. Ligament deeply immersed. Lunule well defined and deeply impressed. Escutcheon weakly defined. Sculpture consisting of rather fine concentric ridges with about 9 per centimeter on the central portion of the disc. Interior of shell a flat white with the muscle scars and pallial complex high-lighted. Hinge plate broad. Right valve with the posterior cardinal bifid. Anterior lateral tooth small and tubercular. Beak cavities deep. Pallial sinus triangular and deep with its apex sharply pointed.

	length	height	width	
(large)	80	77	34 mm.	Monti Cristi, Hispaniola
(average)	68	66	31	Virgin Islands

*Types.* We select Born's figure as cited above, with Jamaica as the type locality.

*Remarks.* See also under *D. elegans*. Born's reference to this species as occurring in Mauritius either was an error or possibly he had confused more than one species with *concentrica*.

As far as we have been able to determine, most West Indian records of *elegans* refer to this species.

Philippi's citation of this species from Patagonia (as *patagonica*) is certainly in error. As far as now known, Brasil is the southern limit of the genus *Dosinia* in the Western Atlantic.

Conrad's *floridana* is unquestionably a synonym of *concentrica*. We have seen the holotype specimen. His statement relative to the color markings "a few yellowish-brown irregular linear stains" is true but these are not natural as one would infer from his description. These linear marks appear under a lens to be iron rust.

*Range.* West Indies from Cuba south and from Panama south to Brasil.

*Records.* HISPANIOLA: Monti Cristi; Puerto Plata (MCZ); PUERTO RICO: Ponce (MCZ: ANSP); VIRGIN ISLANDS: Long Bay, St. Thomas (ANSP); BRASIL: Victoria: Bahia; Salinas; Reconcavo; Ilha de Itaparica; Nictheroy; Bahia de Guanabara (all P. E. de Oliveira); Rio de Janeiro (ANSP).

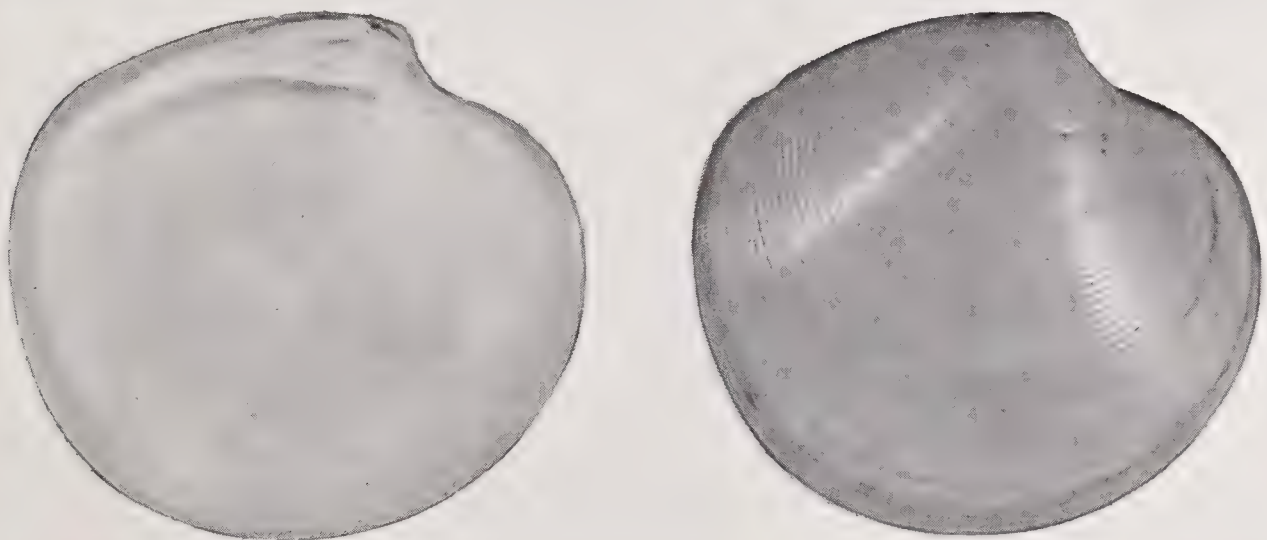


Plate 2. *Dosinia concentrica* Born. Natural size. Cidade de Bahia, Brasil.

**Dosinia discus** Reeve, Plate 3

*Artemis discus* Reeve 1850, Conchologia Icon. 6, *Artemis*, pl. 2, fig. 9 (United States).

*Description.* Shell subcircular, compressed, rather thin and sculptured with concentric ridges. Color a dirty straw-yellow, generally with a few darker brownish-yellow concentric bands somewhat irregularly disposed. Color invested in the periostracum. Beaks high and rather sharp and pointing forward. Ligament deeply immersed. Lunule well-defined and moderately impressed. Escutcheon weakly defined. Sculpture consisting of very fine concentric ridges with about 20 to one centimeter on the central portion of the disc. Interior of shell a flat white with the muscle scars and pallial complex high-lighted. Hinge plate broad. Right valve with posterior cardinal bifid. Anterior lateral tooth small and tubercular. Beak cavities deep. Pallial sinus triangular and deep with its apex somewhat rounded.

	length	height	width	
(large)	74	65	24 mm.	Cape Canaveral, Florida
(average)	65	58	19	Beaufort, North Carolina

*Types.* As Reeve gave only "United States" as a type locality, we here designate it to be St. Augustine, Florida, as this location is well within the range limit of this species. The type specimen is in the Cuming collection (British Museum).

*Remarks.* See also under *D. elegans*. Both *D. discus* and *elegans* were long confused with *concentrica* and, consequently, the older published records are not at all reliable as to just what species was indicated. The ranges for all these three species extend beyond the records that we have seen. The records, however, have all been studied by Mr. McLean or myself.

It is to be borne in mind that any given species may not necessarily occur throughout the range that is indicated for it. Factors in its environment necessary for its existence may be absent in portions of this range and thus considerable distances may occur between records. The area along the west Florida coast from Tampa Bay south to Cape Sable is a region of this sort. Many species found in the northern Gulf area and again along the northeast coast of Florida from Cape Canaveral and north to the Carolinas are absent in southwest Florida. Temperature might be the limiting factor, but the data are as yet too

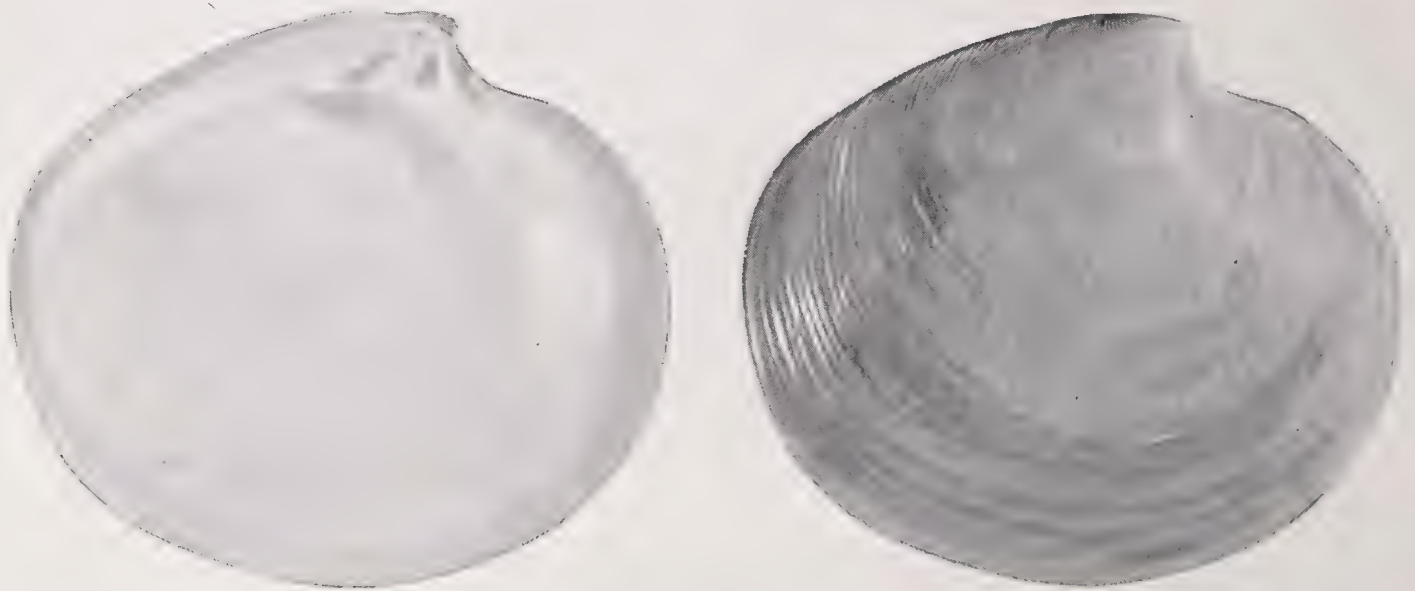


Plate 3. *Dosinia discus* Reeve. Natural size. Amelia Island, Florida.

incomplete, even for the distribution of our common species. There is a paucity of records for the Gulf coast of Mexico and the Atlantic shores of Central America.

*Range.* Along the coast from Virginia to Yucatan.

*Records.* NORTH CAROLINA: Bogue Island; Beaufort (MCZ); Ocracoke; Swansboro (ANSP); SOUTH CAROLINA: Isle of Palms; St. Helena; Folly Id.; Sullivan's Id. (MCZ); Long Id. (ANSP); GEORGIA: St. Simon's Id. (MCZ); FLORIDA: Amelia Id.; St. Augustine; Cape Canaveral; Coronado; Daytona (MCZ); Mayport; Fernandina; Clearwater; Tampa Bay; Alligator Harbor; St. Joseph Bay; Crooked Id.; St. Andrew's Sound (ANSP); MISSISSIPPI: Horn Id. (ANSP); LOUISIANA: Shell Id.; Grand Isle (MCZ); TEXAS: Indianola; Corpus Christi (MCZ); Port Aransas; near Galveston (ANSP); MEXICO: Frontera (ANSP); Vera Cruz (MCZ: ANSP: M. E. Bourgeois); BAHAMAS: Cat Cay, Bimini Islands (MCZ).

### **Macrocallista Meek**

*Macrocallista* Meek 1876, Rept. United States Geol. Survey Terr. **9**, p. 179 (genotype, *Venus gigantea* Gmel.).

This genus contains some of the most colorful members of the Veneridae. As the status of the genus is still unsettled the exact number of species cannot be given. The genus even in the broad sense, however, is not large and would, perhaps, include not more than twenty-five species. Most of these occur in the tropics, though a few range into temperate seas.

The shell is generally ovate to elongate, usually with radial bands of color, smooth or with fine to moderate concentric ridges. Nearly all species possess a rather heavy though translucent periostracum, most of which flakes off, however, when the shells are dried. The lunule is usually defined but sometimes only poorly so. The pallial sinus is usually deep and generally obliquely truncated. There are three cardinal teeth in each valve, smooth, with the right posterior tooth bifid. Only two species occur in the Western Atlantic and these are to be found a little below low water line.

### **Macrocallista nimbosea Solander, Plate 4**

*Venus nimbosea* Solander 1786, Catalogue of the Portland Mus. pp. 161 and 175 (Florida). Reference is made to De Favanne 1780, La Conchyliologie ou Hist. Nat. des Coquilles, Paris, pl. 49, fig. I, 1.

*Venus gigantea* Gmelin 1790, Syst. Nat. ed. 13, **1**, p. 3282.

*Paphia ala avis* Röding 1798, Mus. Boltenianum, pt. 2, p. 175.

*Venus multiradiata* Menke 1829, Verzeichnis Conchy.-Samm., Malsburg, p. 119.

*Callista (Macrocallista) gigantea* Gmel., Meek 1876, Rept. United States Geol. Survey Terr. **9**, p. 179.

*Description.* Shell broadly ovate, moderately compressed, rather thin but strong, smooth and ornamented with radial bands of color. The color is dull to reddish salmon, paler in older and larger specimens. Moderately curved radial bands of darker salmon cross the shell from umbones to margin. These bands of color are not solid but are interrupted by clear areas. Most of this color is invested in the shell. Beaks fairly high and pointing forward. Ligament moderately immersed. Lunule long and slightly impressed. Escutcheon outlined by a change in color. Sculpture consists only of very fine growth lines. Interior of shell dull white with a reddish blush diffused over the central area. Pallial line and sinus

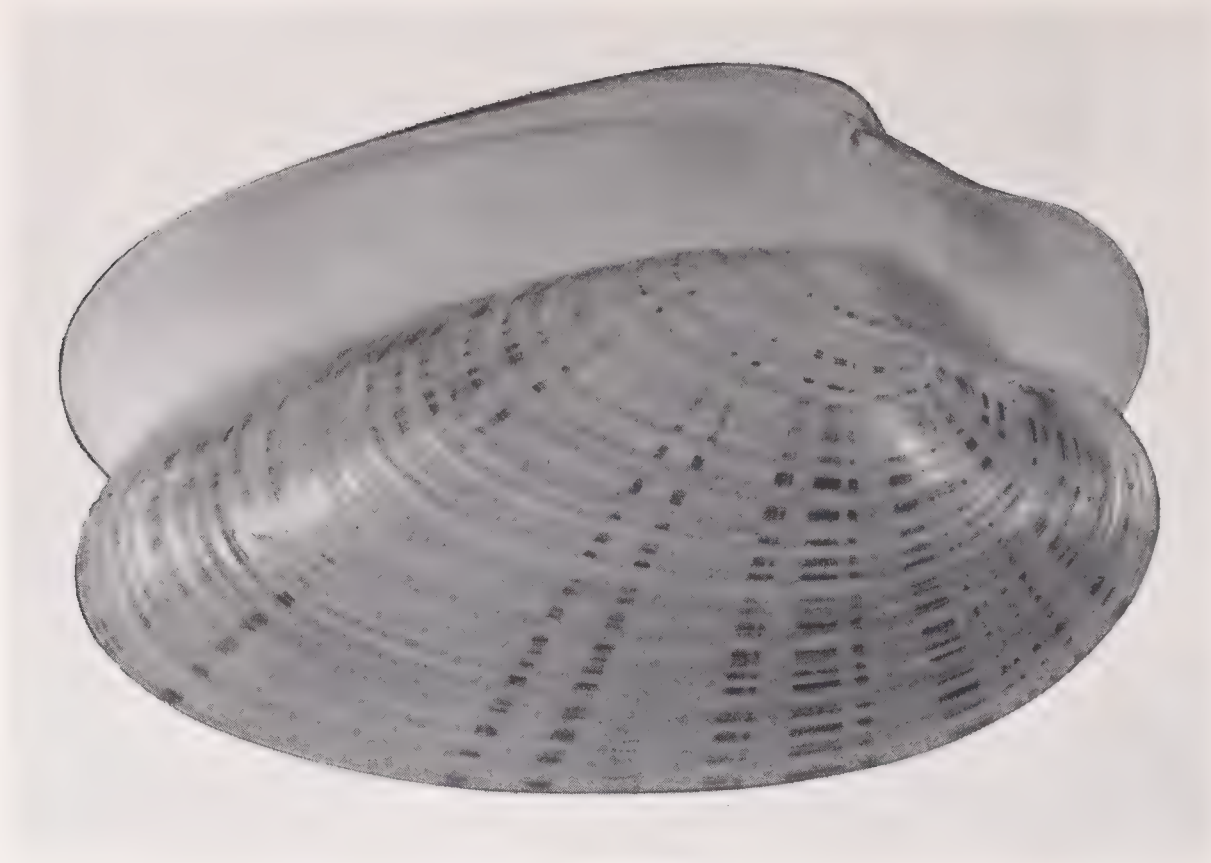


Plate 4. *Macrocallista nimbosa* Sol. Natural size. Marco, Florida (Neoholotype).

sharply defined, the sinus deep and somewhat obliquely truncated. Hinge plate long and narrow. Beak cavities moderately deep.

	length	height	width	
(large)	150	72	31.5 mm.	Sanibel, Florida
(average)	121	60	29	Sanibel, Florida

*Types.* Type figure [here selected] De Favanne 1780, pl. 49, fig. 1, 1 (reference above). Type locality [here selected] Marco, Florida. Neoholotype, MCZ 76665. Neoparatypes from the same locality. We have selected this locality as it is near the center of the range of this species.

*Remarks.* This species is the genotype of *Macrocallista*. Though not rare within its range, it does not appear to be excessively common at any locality. It is easy to recognize as there is no other species in the genus that approaches it in size, shape or color.

*Range.* North Carolina south to Florida and west to Texas. (Cuba?)

*Records.* NORTH CAROLINA: Beaufort (MCZ; ANSP); Schackleford Id. (MCZ). SOUTH CAROLINA: Charleston (MCZ). FLORIDA: St. Augustine (ANSP); Cape Canaveral (MCZ); Cape Sable (MCZ); Cape Romano; Sanibel Id. (MCZ; ANSP); Pavilion Key; Marco; Naples; Sarasota; Mullet Key, Tampa Bay; Clearwater; (MCZ); Santa Rosa Id.; St. Joseph Bay; St. Andrew's Bay; (ANSP); Beacon Hill (MCZ). TEXAS: Port Aransas (MCZ).

### **Macrocallista maculata** Linné, Plate 5

*Venus maculata* Linné 1758, Syst. Nat. ed. 10, p. 686 (O. Americano).

*Description.* Shell subovate, rather compressed, rather thin but strong, shining, smooth and ornamented with rather regularly disposed squares of color. The shell is dull white with brownish red "squares" irregular in shape, but generally somewhat evenly arranged over the entire surface of the shell. In addition, many specimens have two radial bands



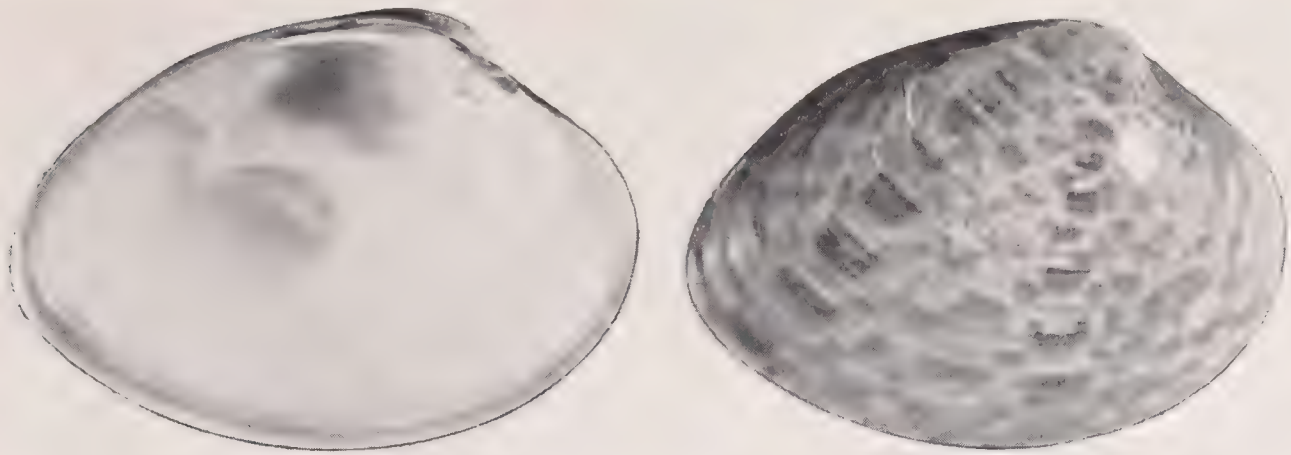


Plate 5. *Macrocallista maculata* Linné, Natural size, Sanibel Island, Florida.

of these markings showing up a little darker than the remainder. This color is invested in the body of the shell. The periostracum, when present, is dull yellowish and tends to diffuse the markings below. Beaks fairly high and directed forward. Ligament rather small and moderately immersed. Lunule rather long, slightly impressed, and not evenly divided by the two halves of the shell. Escutcheon not defined or only very indistinctly so by a change in color. Sculpture consists of exceedingly fine growth lines. Interior of shell a flat white. Pallial line and sinus sharply defined, the sinus large and obliquely truncated. Hinge plate short. Beak cavities moderately deep.

	length	height	width	
(large)	77	60	36 mm.	Rio de Janeiro, Brasil
(average)	66	45	26	Cayo Frances, Caibarien, Cuba

*Types.* Linné did not figure this species and we take as type figure that of his first reference, namely, Gualtieri 1742, Testarum Conchyliorum, pl. 86, fig. I. As type locality we here select Cayo Frances, Caibarien, Cuba.

*Remarks.* This is a species of rather wide distribution, extending as it does from North Carolina to Southern Brasil. We have never found it abundant at any locality during our several field trips. This, like the last species, is very readily determined, as there is no other species that approximates it.

*Range.* North Carolina south to Brasil including the West Indies.

*Records.* FLORIDA: Palm Beach; Sanibel Id.; (MCZ; ANSP); Sarasota; Naples; (MCZ); Osprey (ANSP). BERMUDA (fossil) (MCZ). BAHAMAS: Gt. Abaco Id.; Eleuthera Id.; Cat Cay, Bimini Ids.; (MCZ). CUBA: Cardenas (ANSP); Cayo Frances, Caibarien; Cienfuegos; (MCZ). HISPANIOLA: Monte Cristi (MCZ). VIRGIN ISLANDS: Guana Id., Tortola; Caneel Bay, St. John; (MCZ); St. Thomas (ANSP). LESSER ANTILLES: St. Kitts (ANSP); Nevis; Tobago; (MCZ). MEXICO: Vera Cruz (M. E. Bourgeois); Isla Mujeres (C. G. Aguayo). VENEZUELA: Cumana (MCZ). BRASIL: Cidade da Bahia; São Goncalo, Est. Rio de Janeiro; Ilha de S. Sebastiao, Est. São Paulo; (P. de Oliveira).

### *Amiantis purpurata* Lamarek, Plate 6

*Cytherea purpurata* Lam. 1818, Anim. s. Vert. 5, p. 563 (Brasil).

*Chione purpurascens* Gray 1838, The Analyst, 8, p. 306.

*Venus brasiliiana*, var.  $\beta$  Gmelin 1790, Syst. Nat. ed. 13, p. 3289 (non Gmelin 1792).

*Description.* Shell subcircular, rather wide, moderately thin but strong, smooth to moderately ridged. Color creamy white or brownish (rare) or dull purplish with deeper purplish concentric bands at irregular intervals. Periostracum thin and dull yellowish in color. Beaks high and pointing forward. Ligament moderately immersed. Lunule long, deeply impressed and white in color. Escutcheon not defined. Sculpture consists of fine concentric ridges on the earlier portion of the shell with larger and well-flattened irregular ridges indicating growth periods. These are, in addition, intensified in appearance by a darker development of the purple coloration on and below these ridges. This deeper color is well indicated in the figure. Interior of shell a dull white with the pallial line and sinus well high-lighted. Pallial sinus broad and pointed. Anterior muscle scars deeply impressed. Hinge plate broad and strong. Beak cavities deep.

	length	height	width	
(large)	67	58	37 mm.	Punta Médanos, Argentina
(average)	58	51	26	Rio de Janeiro, Brasil

*Types.* As Lamarek did not figure this species, we select as type figure, that of Reeve 1863, *Conchologia Iconica* 14, pl. 8, fig. 32. The type locality [here selected] to be Rio de Janeiro, Brasil.

*Remarks.* A distinctive species owing to its rather unusual purplish coloration. The large flattened concentric ribs are strongly developed (figured specimen) only in certain specimens. In others they are apparent but not so pronounced. Occasional examples are creamy white, completely devoid of the purplish color. Dall (1902, p. 370) gives Cuba as a locality from a citation of Arango but this record is very probably based on an incorrectly determined specimen.

*Range.* Brasil south to Argentina. (Cuba?)

*Records.* BRASIL: Praia de Copacabana, Rio de Janeiro; São Gonçalo, São Paulo; Imbituba, Sta. Catarina (P. de Oliveira). URUGUAY: Cabo Sta. Maria (MCZ). ARGENTINA: Punta Médanos (A. Carcelles).



Plate 6. *Amiantis purpurata* Lam. Natural size. Punta Médanos, Argentina.

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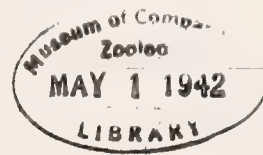
Dall, W. H., 1902: Synopsis of the Family Veneridae and of the North American Recent Species. Proc. United States Nat. Mus. 26, pp. 335-412, 5 plates.

# JOHNSONIA

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MAY 1, 1942 79,937

LITTORINIDAE



NUMBER 4

## THE GENERA TECTARIUS AND ECHININUS IN THE WESTERN ATLANTIC

BY  
W. J. CLENCH AND R. T. ABBOTT

The species of these two genera are found abundantly along the rocky shores of the West Indian region. The Spiny Periwinkles are familiar to those who have collected in tide pools and along stretches of sun and spray beaten rocks well above high tide.

### *Tectarius Valenciennes*

*Tectarius Valenciennes* 1833, [in] Humboldt and Bonpland, Voyage Regions Equin. Nouv. Contin., pt. 2, p. 271 (genotype, *Tectarius coronatus* Val., monotypic).

*Echinella* Swainson 1840, Treat. Malac., p. 352 (genotype, *Monodonta coronarius* Lam.) non *Echinella* Bory de St. Vincent 1824.

*Echinellopsis* Rovertto 1899, Atti Soc. Ligustica, 10, p. 109 (for *Echinella* Swain.).

The genus *Echinella* Swain. was based upon *T. coronarius* Lam., a species very close to *T. coronatus* Val., the type of *Tectarius* s. s. The shells of this genus are conical, extended or occasionally subdepressed and usually roughly sculptured by strong tubercles that are generally arranged in spiral rows. A few species are strongly carinated. Operculum paucispiral, chitinous and thin. (see plate 2, fig. 5)

### *Tectarius muricatus* Linné, Plate 1

*Trochus muricatus* Linné 1758, Syst. Nat. ed. 10, p. 761 (Europa Australis).

*Description.* Shell 15 to 30 mm. in length, solid and sculptured with small tubercles. Whorls 8 to 10. Color ash gray with white tubercles. Tip of spire often tinged with pink. Lip and columella white. Interior of the aperture light tan to chocolate brown. Aperture subcircular. Outer lip simple, thickened and slightly flaring at the base. Columella grooved.

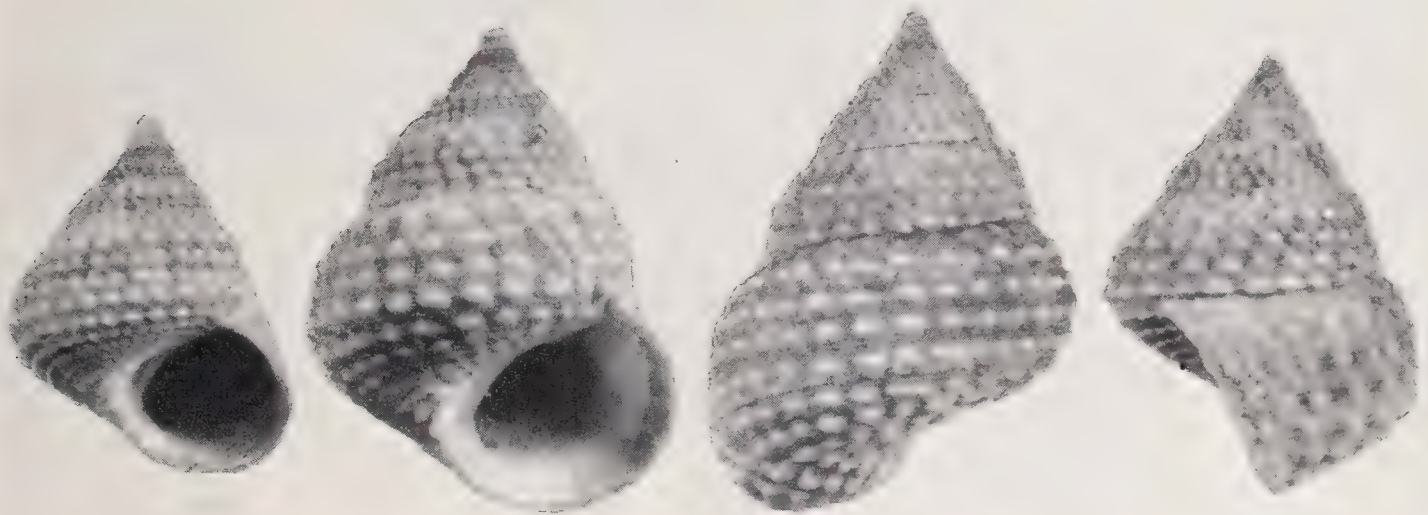


fig. 1 (Navassa Id.)

fig. 2 (Navassa Id.)

fig. 3 (Cienfuegos)

fig. 4 (Cienfuegos)

Plate 1. *Tectarius muricatus* Linné. Twice natural size.

Umbilicus a narrow oblique slit. Suture slightly indented, somewhat overlapped by the whorl above. Nuclear whorls possess very fine spiral threads. Succeeding whorls beaded by 3 to 4 rows of small rounded nodules. The nodules of the top row are usually larger and form a slightly angular shoulder on each whorl. The last whorl has 10 to 11 beaded rows, between which are often developed one or two unbeaded spiral threads. The inside of the outer lip is minutely indented opposite each bead row of tubercles. The operculum is paucispiral, dark brown and chitinous. This fits snugly and well within the aperture.

	length	width	
(large)	30	21 mm.	Swan Island, Caribbean Sea
(average)	21	15	Havana, Cuba
(small)	15	13	Gonave Island, Haiti

*Types.* Gaultieri 1742 (Index Testarum Conchy.) pl. 45, fig. E, referred to by Linné, is here selected as the type figure. As Linné's reference to southern Europe was in error for this species, we here select Havana, Cuba, as the type locality.

*Common name.* Spiny Periwinkle.

*Remarks.* This is one of the most abundant species in the West Indies. It is found generally well above the high water line along rocky coasts. Though commonly occurring within the spray zone, it is also capable of withstanding long periods of dryness and heat. The more active snails in the wetter zone grow to a large size because of their lengthened periods of feeding. On the windward side of Navassa Id. in the Caribbean Sea we found larger specimens than we did on the lee side where there was far less spray, (pl. 1, figs. 1 and 2). *T. muricatus* Linné belongs to the subgenus *Cenchritis* V. Martens 1900.

*Range.* Bermuda, southern Florida, the West Indies, and Central America south to Trinidad.

*Records.* FLORIDA: Jupiter; Key West; Tortugas. BERMUDA: Coopers Id. BAHAMAS: Grand Bahama Id.; Bimini Ids.; Nassau, New Providence Id.; Mariguana Id.; Great Inagua Id.; Caicos Ids. CUBA: Havana; Banes; Cienfuegos. HISPANIOLA: Miragoane; Gonave Id.; Puerto Sosua; Beata Id. JAMAICA: Dunn's River. PUERTO RICO: San Juan; Guanica. VIRGIN ISLANDS: St. Thomas; St. Croix; Tortola. LESSER ANTILLES: Antigua; St. Kitts; Martinique; Barbados; Brighton, Trinidad (H.G. Kugler). CARIBBEAN ISLANDS: Navassa; Swan; Old Providence; Buen Ayre. CENTRAL AMERICA: Limon, Costa Rica; Porto Bello, Panama.

### **Tectarius tuberculatus** Wood, Plate 2

*Trochus nodulosus* Gmelin 1790, Syst. Nat. ed. 13, no. 1, p. 3582 (Oceano Australi) non Solander 1766.

*Turbo trochiformis* Dillwyn 1817, Desc. Cat. of Recent Shells, London, 2, p. 826 (Southern Ocean) non Brocchi 1814.

*Turbo tuberculatus* Wood 1828, Index Testac., Suppl., p. 19, pl. 6, fig. 30 (locality unknown).

*Litorina tuberculata* Menke 1828, Synop. Meth. Moll., Pyrmont, p. 25 (refers to Gmelin).

*Litorina thiarella* Anton 1839, Verz. Conch. p. 53.

*Littorina dilatata* d'Orbigny 1841, [in] de la Sagra, Hist. L'Ile de Cuba, Moll. 1, p. 207, pl. 14, fig. 20-23 (Havana).

*Description.* Shell 12 to 20 mm. in length, solid and sculptured with fairly sharp tubercles. Whorls 7 to 8. Color brownish gray to lead gray with whitish tubercles. Edge of outer lip white. Columella and aperture dark brown with a clear white stripe below. Aperture subcircular. Outer lip simple, rather thin and projecting just below the columella. Columella wide, often excavated and forming a shelf. This shelf often runs to the upper corner of the aperture. Rarely, a small conical umbilicus is present. Suture indistinct.

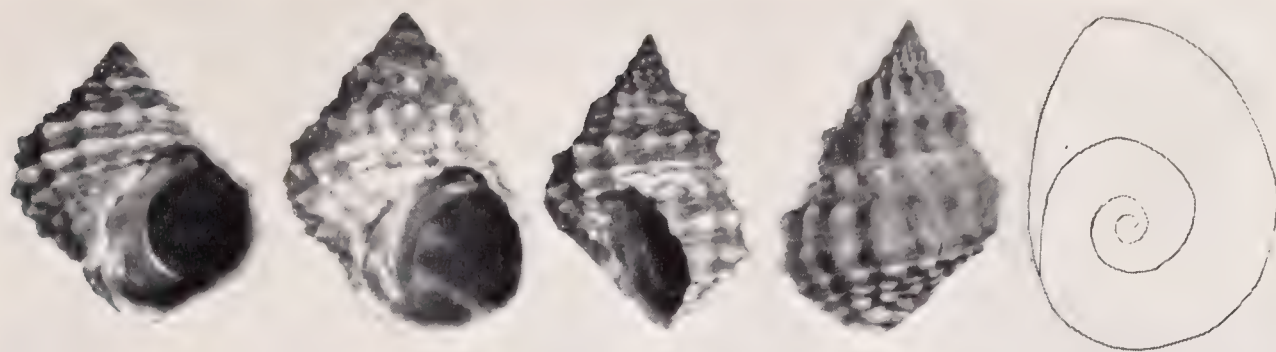


fig. 1 (Havana) fig. 2 (Havana) fig. 3 (Swan Id.) fig. 4 (Swan Id.) fig. 5 (Operculum, 6×)

Plate 2. *Tectarius tuberculatus* Wood. Twice natural size.

Nuclear whorls possess very fine spiral threads. Succeeding whorls beaded by two or three rows of small pointed nodules. The second and third rows on each whorl usually have the largest nodules. The last whorl has seven beaded rows, between which run one or two rough spiral threads. These are crossed by rather coarse growth lines. Operculum (pl. 2 fig. 5) is paucispiral, dark brown and chitinous.

	length	width	
(large)	20	14 mm.	Bermuda
(average)	15	12	Havana, Cuba
(small)	12	9.5	Knights Key, southern Florida

*Types.* Gmelin refers to Chemnitz 1781, Conchy-Cab. (1), 5, pl. 168, fig. 1545-6, which are here selected as the type figures. We also designate Havana, Cuba, as the type locality.

*Common name.* Common Prickly-winkle.

*Remarks.* This species is often confused with *Echininus nodulosus* Pfr. (see next species). The two are superficially very similar in appearance and only close examination discloses the significant differences. *Tectarius tuberculatus* possesses a paucispiral operculum, a strongly developed columellar ledge and nearly always a projecting lip just below the columella. On the other hand, *E. nodulosus* Pfr. possesses a multispiral operculum, has no columellar ledge and the aperture, though somewhat flaring, is never pointed below.

The ecology of *T. tuberculatus* differs materially from that of *Echininus*. The former lives solely in tide and splash pools, while the latter is associated with *T. muricatus* high up on the dry rocks.

*Tectarius tuberculatus* Wood belongs to the subgenus *Nodilittorina* v. Martens 1897.

*Range.* Bermuda, southern Florida, south through the West Indies and Central America to Trinidad.

*Records.* FLORIDA: Tavernier; Jupiter; Knights Key; Tortugas. BERMUDA: Doe Bay. BAHAMAS: Grand Bahama Id.; Bimini Ids.; Cat Id.; Long Id.; Eleuthera; Great Abaco. CUBA: Havana; Cienfuegos; Matanzas. HISPANIOLA: Jeremie; Cap Haitien; Monte Cristi; Puerto Sosua. JAMAICA: Port Antonio. PUERTO RICO: Guanica; Ponce. VIRGIN ISLANDS: St. Croix; Virgin Gorda. LESSER ANTILLES: Carriacou Id., Grenadines; Martinique; Barbados; Trinidad. CARIBBEAN ISLANDS: Navassa; Roatan; Swan. CENTRAL AMERICA: Colon (Aspinwall), Panama.

### *Echininus*, new name

*Nina* Gray 1850, Figures of Molluscous Animals, London, 4, p. 78 (genotype, *Trochus cumingii* Phil.), non *Nina* Horsfield 1829, non *Nina* Gray 1855 (Echinoderm).

This genus is similar to *Tectarius* in appearance, but differs in having a multispiral operculum. (see plate 3, fig. 5)

### *Echininus nodulosus* Pfeiffer, Plate 3

*Litorina nodulosa* Pfeiffer 1839, Archiv für Natur., (Wiegmann), 1, p. 357 (Cuba), exclusive of synonymy.

*Litorina scabra* Anton 1839, Verz. Conch., p. 53, non Linné 1758.

*Litorina antoni* Philippi 1847, Abbild. Besch. Conchy., 2, p. 145, pl. 2, fig. 18 (new name for *scabra* Anton).

*Litorina (Tectarius) pfeifferianus* Weinkauff 1882, Conchy.-Cab. (2), 2, pt. 9, p. 46, pl. 5, figs. 15-16.

**Description.** Shell 12 to 20 mm. in length, solid and sculptured with fairly sharp tubercles. Whorls about 7. Color brownish gray to lead gray. Edge of outer lip white. Columella and aperture black brown with a white stripe below. Aperture nearly circular. Outer lip simple, thin and with the base not projecting below. Columella rounded but not forming a ledge. Without an umbilicus. Suture indistinct. Nuclear whorls possess very fine spiral threads. Succeeding whorls beaded by one or two rows of sharp nodules. The second row usually has the largest nodules, though in the last whorl the second and third rows are prominent. There are six rows on the last whorl, between which are often two or three coarse spiral threads. These are crossed by fine growth lines. Operculum (pl. 3, fig. 5) is multispiral, dark brown and chitinous.

	length	width	
(large)	20	15 mm.	Matanzas, Cuba
(average)	16	13	Havana, Cuba
(small)	10.5	9	Tavernier, Florida

**Types.** As Pfeiffer did not figure his species, we here select that of d'Orbigny 1841 [in] de la Sagra, Hist. L'Isle de Cuba, 1, pl. 14, fig. 17 and 19. In addition we select the type locality as Havana, Cuba.

**Common name.** False Prickly-winkle.

**Range.** Southern Florida, the Greater Antilles including the Bahamas (and probably southwards into the Lesser Antilles).

**Remarks.** For comparisons and ecological data see remarks under *Tectarius tuberculatus* Wood. The umbilicated species, *E. cumingii* Phil., of the East Indies is an *Echininus* s.s. We propose a new subgenus, *Tectininus*, with the non umbilicated *E. nodulosus* Pfr. as its subgenotype.

**Records.** FLORIDA: Jupiter (McGinty); Bonefish Key (Bales). BAHAMAS: Grand Bahama Id.; Bimini Ids.; Acklin Id.; Great Abaco; Little San Salvador; Great Inagua; Eleuthera. CUBA: Bahia Honda; Matanzas; Havana. HISPANIOLA: Jeremie; Puerto Plata. JAMAICA: Port Antonio. CARIBBEAN ISLANDS: Swan Id.

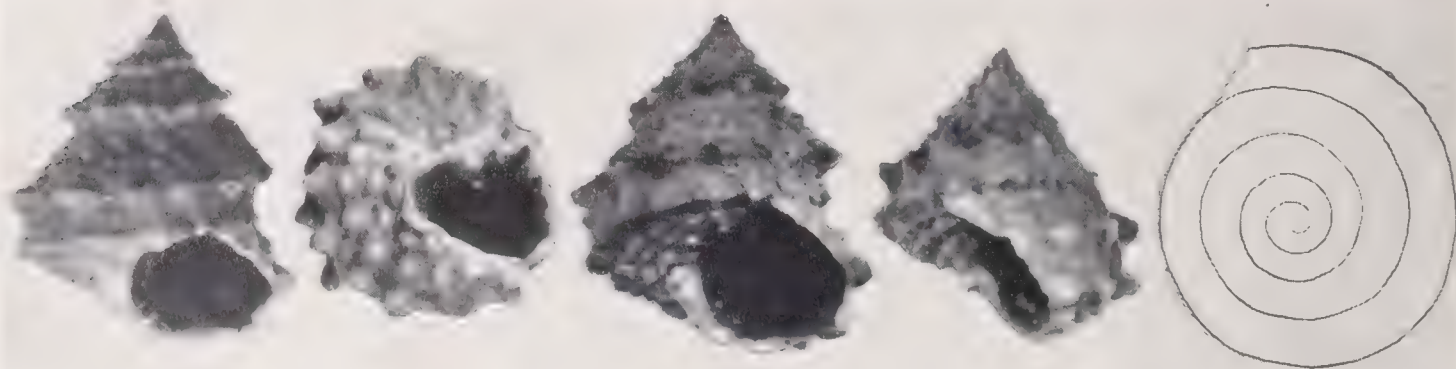
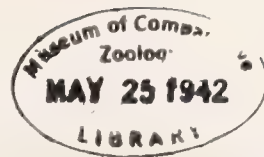


fig. 1 (Matanzas) fig. 2 (Matanzas) fig. 3 (Bimini Ids.) fig. 4 (Bimini Ids.) fig. 5 (Operculum, 6×)

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POTAMIDIDAE

NUMBER 5

## CERITHIDEA AND BATILLARIA IN THE WESTERN ATLANTIC

BY  
JOSEPH C. BEQUAERT

*Cerithidea* and *Batillaria* are the two Western Atlantic genera of Potamididae. They are brackish water snails of our tropical and subtropical coasts, from South Carolina and Bermuda to Trinidad and Barbados and are often found in abundance on intertidal flats, in lagoons, or in mangrove swamps.

### *Cerithidea Swainson*

*Cerithidea* Swainson, 1840, Treatise of Malacology, pp. 198, 203, and 342. Genotype, by designation of Pilsbry and Harbison (1933): *Melania lineolata* Griffith and Pidgeon, 1834 (not *Strombus lineolatus* Gray, 1828) = *Cerithium obtusum* Lamarck, 1822.

Shell turriculate, often decollate, with many convex whorls, strongly sculptured. Vertical ribs regularly spaced, either even or more or less cut into tubercles and stopping at the periphery of the body-whorl; in addition, weak vertical growth-striae and, in the intervals between the ribs, fine spiral striae; base, below the periphery, often with coarse spiral grooves and ridges, cut by fine growth-striae. Aperture with the columellar margin nearly straight, ending below in a slightly produced, very shallow groove; lower half of outer lip somewhat projecting beyond the base of the columella; edge of outer lip thickened, particularly over the upper two-thirds, smooth inside. In some cases the thickened lip is repeated several times during life, older shells showing a series of varices along the spire. Operculum corneous, subcircular, spiral, closely coiled about a central nucleus. Animal with an anterior snout and a subcircular foot, obtuse behind; eyes on the tentacles, some distance from the tips; siphon long or short, usually fringed.

The three Western Atlantic species are placed in the subgenus *Cerithideopsis* Thiele (1929, Handbuch der Weichtierkunde, 1, p. 206) with *Potamides iostomus* Pfeiffer, 1839 (= *Cerithium pliculosum* Menke, 1829) as the type. This subgroup is defined by peculiarities of the radula only.



*Cerithidea*

*Batillaria*

*Cerithium*

Plate 1. Body-whorls and opercula. Enlarged

**Cerithidea costata** da Costa, Plate 1, fig. 1; Plate 2, figs. 1-7.

*Strombiformis costatus* da Costa, 1778, British Conchology, p. 118, pl. 8, fig. 14 (supposedly from the coast of Cornwall, England, but now known not to occur in Europe).

*Cerithium lafondii* Michaud, 1829, Bull. Soc. Linn. Bordeaux, **3**, p. 264, pl., figs. 7-8 ("Sea of the Indies"). Kiener, 1841-1842, Spéc. Gén. Icon. Coq. Viv., **6**, *Cerithium*, p. 97, pl. 24, fig. 3.

*Cerithium ambiguum* C. B. Adams, 1845, Proc. Boston Soc. Nat. Hist., **2**, p. 4 (Jamaica).

*Cerithium salmacidum* Morelet, 1849, Testac. Noviss. Insulae Cubanae Amer. Centr., **1**, p. 27 (Sisal, Yucatan).

*Cerithium petitii* "Kiener" Schramm, 1869, Catalogues Coquilles Crustacés Guadeloupe, 2nd Ed., p. 11 (*nomen nudum*; Guadeloupe). Tryon, 1887, Man. of Conchology, (1) **9**, pp. 164 and 216 (as a synonym of *C. costata*).

*Cerithidea pupoidea* Mörch, 1876, Malak. Blätt., **23**, p. 93 (Antilles).

**Description.** Shell small, translucent, elongate turriculate, of 9 to 12 very convex whorls, either complete or with only the very earliest whorls lost in the adult; body-whorl evenly rounded at the periphery. Sculpture of prominent, thick, somewhat curved, vertical ribs, extending from suture to suture, of variable width, usually somewhat narrower than the intervals; from 25 to 30 ribs on the penultimate whorl; in fully adult shells they fade away on the body-whorl toward the outer lip, being gradually replaced by the strengthened growth-striae, which elsewhere are very fine. The ribs are smooth, bluntly rounded and even in typical *costata*. At least traces of an exceedingly minute spiral striation may be seen in the intervals between the ribs. On the body-whorl the ribs stop below the periphery, usually at a low spiral ridge, sometimes followed by a weaker one; peripheral ridge sometimes visible above the suture of earlier whorls; base otherwise with growth-striae only. Aperture obliquely oval; columellar margin deeply concave;

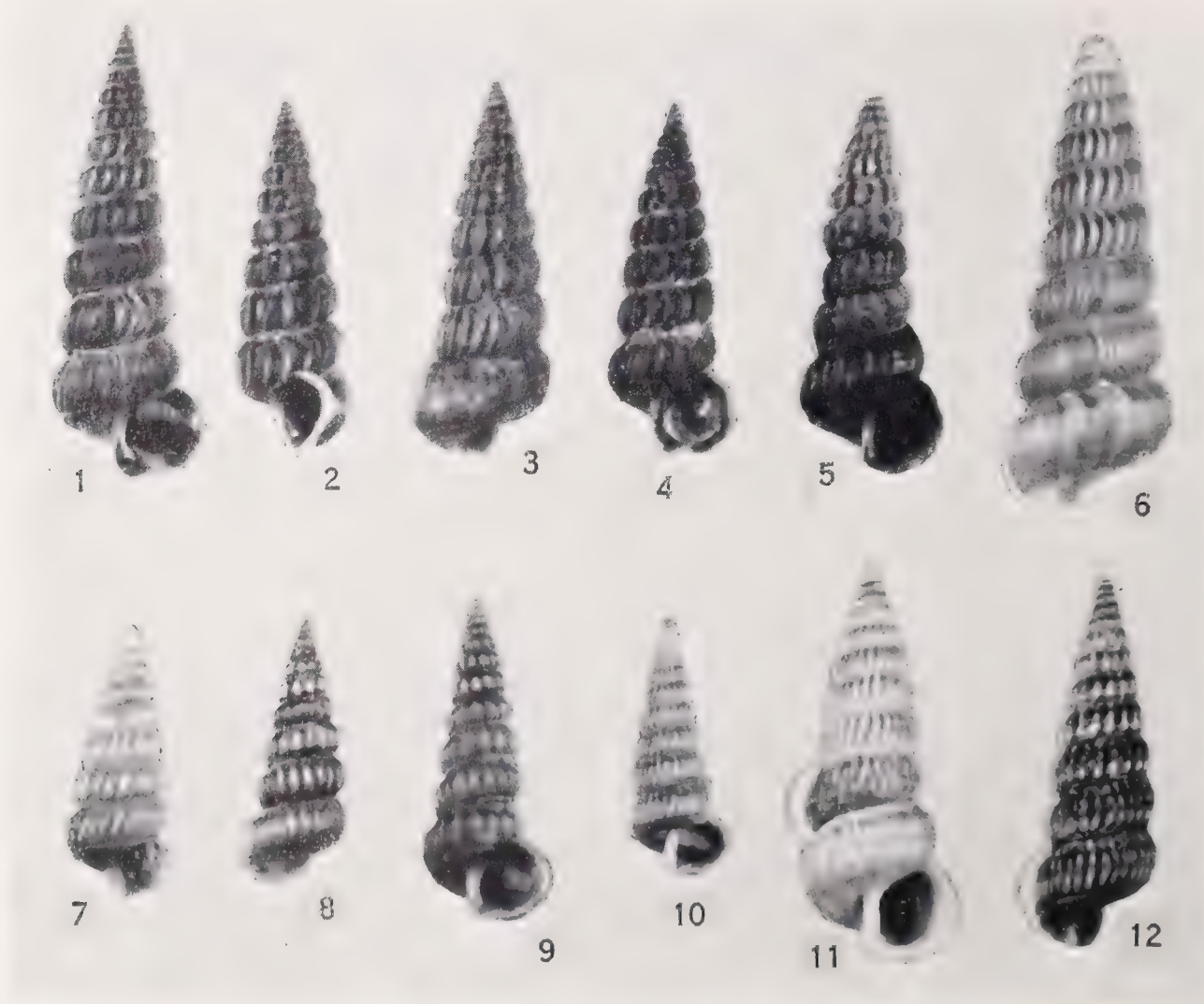


Plate 2. *Cerithidea costata* da Costa and subspecies. Enlarged



outer margin evenly and strongly convex; basal margin nearly horizontal and separated from the columella by a very shallow groove; outer lip usually thin or slightly thickened (very rarely varicose), smooth inside, moderately produced over basal half where it projects beyond the base of the columella in side view. Varices absent or very weak on the spire, exceptionally more pronounced. Color as a rule uniformly pale yellowish-brown; sometimes with faint paler spiral banding over the middle of the whorls or on the base of the body-whorl.

length	width (at body-whorl)	
8.5	3.6 mm.	Cat Id., Bahamas
11	3.8	Yucatan (cotype of <i>salmacidum</i> ) Pl. 2, fig. 7
11.5	3.7	Grassy Key, Florida
13.1	4.5	Jamaica (cotype of <i>ambiguum</i> ) Pl. 2, fig. 5
17	5.7	Santa Fé, Havana, Cuba

*Types.* The type figure is that of da Costa (1778), but his locality is erroneous. As the first synonym with a correct, definite locality is *C. ambiguum*, Montego Bay, Jamaica, is herewith designated as the type locality of *C. costata*.

*Range.* Typical race: The coast of South Carolina (Pawley's Id., according to Mazyck, 1913), Georgia (presumably) and Florida (common); West Indies; and the Caribbean shores of Central and South America, as far east as Venezuela. In Mexico, known only in Yucatan. The supposed occurrence alive in the Mediterranean is open to question.

*Records.* FLORIDA: many east coast localities to Key West. BAHAMAS: New Providence; Great Abaco; Watling Id.; Bimini Ids.; Long Island; Ragged Ids.; Eleuthera; Great Inagua; Cat Id. CUBA: Cayo de los Cinco Leguas; La Coloma, Pinar del Rio; Cabo Cruz; Mariel; Santa Fé, Habana. HISPANIOLA: Gonave Id.; Monte Cristi; Barahona. JAMAICA: Montego Bay. MEXICO: Talcha, Progreso and Dzixulub, Yucatan. VENEZUELA: La Cabrera, Lake Valencia. Mörch records it from Guadeloupe, St. Thomas, St. Martin and St. Bartholomew.

### ***Cerithidea costata turrata* Stearns, Plate 2, figs. 8-9.**

*Cerithidea turrata* Stearns, 1872, Proc. Boston Soc. Nat. Hist., 15, p. 24 (Point Penallis, Tampa Bay, west coast of Florida, herewith designated as type locality). Tryon, 1887, Man. of Conchology, (1) 9, p. 164, pl. 34, fig. 83.

*Description.* Differs mainly from the typical form in the more widely spaced and straighter ribs, of which there are 15 to 20 on the penultimate whorl. It averages smaller.

length	width (at body-whorl)	
8.5	3.8 mm.	Sanibel Id., Florida
11	3.7	Tampa Bay, Florida
13	4.2	Sanibel Id., Florida

*Range.* Restricted to the west coast of Florida, from the Cedar Keys southwards. Published records from elsewhere based on small specimens of typical *costata*.

*Records.* FLORIDA: Tampa Bay; Sanibel Id.

### ***Cerithidea costata beattyi*, new subspecies. Plate 2, figs. 10-12**

*Cerithidea ambigua* Reeve, 1866, Conchol. Iconica, 15, *Cerithidea*, pl. 2, figs. 9a-b (Jamaica). Not *Cerithium ambiguum* C. B. Adams, 1845.

*Description.* Differs from typical *costata* in the vertical ribs being more or less divided by two or three spiral grooves into tubercles varying from low and elongate to rounded

and bead-like; one groove runs below the suture, another, usually wider, about midway between suture and periphery. The outer lip is often much more swollen and varicose than in the typical race. In some lots transitional specimens connect *beattyi* with typical *costata*.

whorls	length	width (of body-whorl)	
12	14.2	5 mm.	St. Croix, holotype. Pl. 2, fig. 10
12	15.7	5.5	Long Island, Bahamas, paratype

*Types.* Holotype, MCZ No. 118619, Salt Pond, St. Croix, Virgin Ids., H. A. Beatty collector. Paratypes, MCZ No. 137213 and USNM No. 522531, from locality of holotype; ANSP No. 18033, St. Croix; MCZ No. 104630, Riding Point, Grand Bahama; MCZ No. 143076, Bretts Hill, Long Island, Bahamas; USNM No. 391345, E. side of Little Halfway Creek, Grand Caicos Id., Bahamas; USNM Nos. 322322 and 322327, N. side of Barbuda Id.; ANSP No. 18034, Trinidad.

*Remarks.* Reeve, followed by Tryon, used the name *ambigua* Adams for this race of *C. costata* with slightly nodulose ribs; but Adams did not mention that character in the original description of *Cerithium ambiguum* and it is not present in his cotypes at M. C. Z. The name *lafondii* does not apply to this form, as both Michaud's and Kiener's figures show smooth, even ribs.

*Range.* Probably sporadically throughout the range of the species; known with certainty at present from the Bahamas, Virgin Islands, Barbuda and Trinidad. Reeve's locality "Jamaica" is doubtful. The form of *C. costata* with subnodose ribs, listed by Mörch from Guadeloupe, was presumably *beattyi*.

### *Cerithidea pliculosa* Menke, Plate 3, figs. 1-3

*Cerithium pliculosum* Menke, 1829, Verzeichn. Conch.-Samml. Malsburg, p. 27 (with description; no locality). Mörch, 1876, Malak. Blätt., 23, p. 88 (Jamaica; Puerto Caballo, Venezuela; a doubtful variety from Haiti; saw Menke's type at the Copenhagen Museum).

*Potamides iostomus* Pfeiffer, 1839, Arch.f. Naturg., 5, pt. 1, p. 357 (Cuba).

*Cerithium lavalleanum* d'Orbigny, 1842, in de la Sagra, Hist. Phys. Pol. Cuba, Moll., Atlas, pl. 23, fig. 16 (binomial printed on plate); Text, 2, (1847-1853), p. 156 (Cuba).

*Cerithidea varicosa* Mörch, 1876, Malak. Blätt., 23, p. 88. Not *Cerithium varicosum* Sowerby, 1834; nor of Valenciennes, 1832.

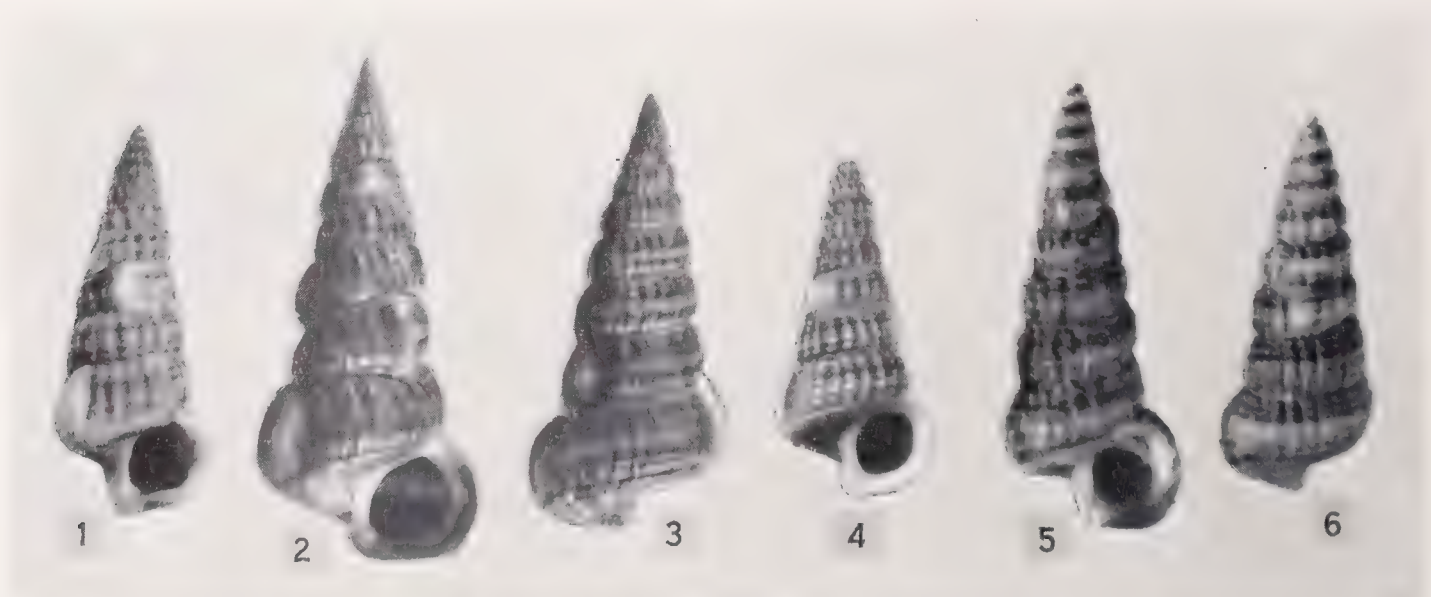


Plate 3. *Cerithidea pliculosa* Menke and subspecies. Enlarged

*Description.* Shell medium-sized, opaque, broadly turriculate, of 11 to 13 slightly convex whorls, complete or with only the first whorl lost in the adult; body-whorl evenly rounded at the periphery. Coarsely sculptured with vertical ribs and much weaker spiral ridges and, as a rule, with 5 to 8 prominent varices, often beginning with the sixth whorl. Vertical ribs strong, blunt, slightly curved, unevenly spaced, often nearly as wide as the intervals; from 18 to 25 on the penultimate whorl and continued on the body-whorl to near the outer lip. Many fine, well-marked, spiral striae in the concave intervals between the ribs; sometimes stronger but low spiral ridges, producing traces of unevenness where they cut the ribs. On the body-whorl the ribs stop below the periphery at a moderately strong spiral ridge, the base itself bearing 6 to 9 similar but weaker spiral ridges. Growth-striae very weak, except on varices and base. Aperture subcircular; columellar margin concave; outer margin evenly and strongly convex; basal margin horizontal, separated from the columella by a very shallow depression. Outer lip very thick, particularly in upper half, which is strongly set off as a varix from the body-whorl and is covered with many fine growth-striae; varix often separated by a crest from the smooth inner surface of the aperture. In profile the outer lip regularly produced below, where it projects slightly beyond the base of the columella. Color as a rule brownish-black with the varices of outer lip and spire bone-yellow or pale orange-yellow; sometimes with a narrow, dirty-yellow spiral band over middle of whorls.

length	width (of body-whorl)	
20.6	8 mm.	Matanzas, Cuba
24.3	8.9	Indianola, Texas
26.5	9.5	Sabana la Mar, Cuba
27	11	Caibarien, Cuba

*Types.* Menke's type of *C. pliculosum* has not been figured and he gave no locality. Pfeiffer's *P. iostomus*, also unfigured, was from Cuba, and I herewith designate Havana as the type-locality, as Pfeiffer most probably collected his specimens in that vicinity.

*Remarks.* Young *C. pliculosa* are much like small specimens of *C. costata*, but the whorls are flatter and the shell is relatively wider for the same number of whorls. *Cerithium hanleyi* Sowerby (1855) and *C. lafondii* Michaud (1829) are not synonyms of this species, as Tryon stated.

*Range.* The West Indies and the coast of the Caribbean as far east as Venezuela. Along the Gulf of Mexico it extends northward to Louisiana. Not known from Florida nor the Bahamas.

*Records.* TEXAS: Indianola, Matagorda Bay, Calhoun Co.; Corpus Christi; Port Aransas, Nueces Co. LOUISIANA: Chandeleur Id. CUBA: Muelles and Punta Brava, Caibarien; Caonao River, Soledad; Sabana la Mar; Havana; Rio Yumuri and Rio Conimar, Matanzas; La Coloma, Pinar del Rio; Laguna del Quibre, Havana Prov. HISPANIOLA: Jeremie, Haiti. Old Providence Id., off the coast of Honduras. PANAMA: Limon Bay, C.Z. COLOMBIA: Cartagena. There are published records from Jamaica and Venezuela.

### ***Cerithidea pliculosa veracruzensis*, new subspecies. Plate 3, figs. 4-6**

*Description.* Differs from typical *pliculosa* in the unusual development of the spiral ridges, which are often more pronounced than the vertical ribs and produce slight, smooth tubercles where they intersect the latter; the surface becoming reticulate. The varices are often weaker than in the typical race. Specimens from Tampico are transitional between *veracruzensis* and typical *pliculosa*.

length	width (of body-whorl)	
17.6	7.6 mm.	Vera Cruz, Mexico, holotype. Pl. 3, fig. 4
22.8	8.3	Puerto Barrios, Guatemala, paratype

*Types.* Holotype, MCZ No. 143087 and paratypes, MCZ No. 113739, Vera Cruz, Mexico. Paratypes, MCZ No. 88860, Puerto Barrios, Guatemala; ANSP Nos. 124569 and 124580, Esterro de Espantaperros, Isthmus of Tehuantepec, Mexico; USNM Nos. 220010 and 466164, 20 kilom. W. of Tampico, Mexico; USNM No. 150295, Belize, British Honduras; USNM No. 421632, Greytown, Nicaragua.

*Range.* The Atlantic coast of Mexico and Central America.

### **Cerithidea scalariformis** Say, Plate 4, figs. 1-5

*Pirena scalariformis* Say, 1825, Jr. Ac. Nat. Sci. Phila., 5, p. 128 (Florida Keys).

*Potamides tenuis* Pfeiffer, 1839, Arch. f. Naturg., 5, pt. 1, p. 357 (Cuba).

*Cerithidea hanleyana* Reeve, 1866, Conchol. Iconica, 15, *Cerithidea*, pl. 3, figs. 16a-b (no locality). Not *Cerithium hanleyi* Sowerby, 1855.

*Description.* Shell medium-sized, translucent, elongate turriculate, of 10 to 13 strongly convex whorls, usually with only the first whorl lost in the adult; body-whorl evenly rounded at periphery. Coarsely sculptured with vertical ribs; spire without varices; normally with only a few strong spiral cords at sutures and on base of body-whorl. Vertical ribs strong, blunt, scarcely curved, evenly spaced, about as wide as their intervals; from 25 to 30 on penultimate whorl and continued on body-whorl to near outer lip. Normally no visible spiral sculpture on spire and above periphery of body-whorl; the ribs stop abruptly below the periphery at a sharply marked, rounded spiral ridge, which is prominent in the sutures of the spire; below this ridge, the base of the body-whorl bears 5 more very broad spiral ridges, separated by much narrower grooves. Growth-striae very weak everywhere. Aperture subcircular; columellar margin concave; outer margin strongly and evenly convex; basal margin somewhat produced and slightly flaring, barely separated from the columella by an extremely shallow concavity. Outer lip very thick, particularly in upper half, which is strongly set off as a varix from the body-whorl; outer portion of varix with a few coarse growth-striae, inner portion smooth and continued in the smooth inner surface of the aperture, without intervening crest. In profile, outer lip a little pro-

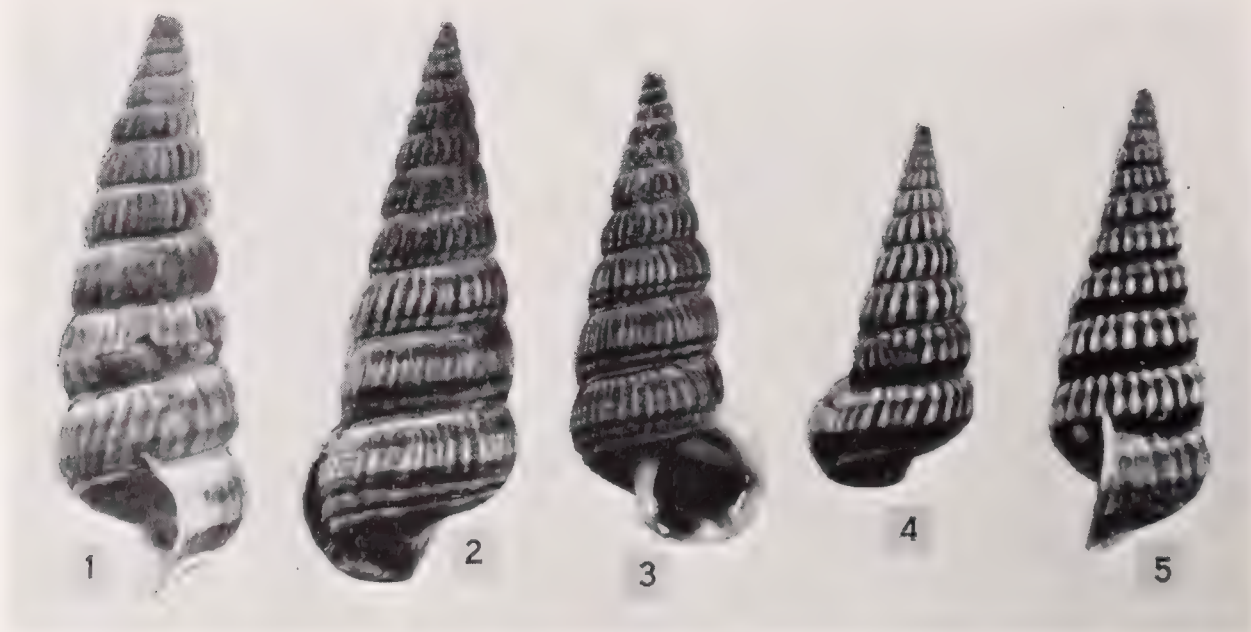


Plate 4. *Cerithidea scalariformis* Say. Enlarged

duced below, where it projects beyond base of columella. Color a pale russet-brown, slightly violaceous, usually with many conspicuous dirty-white spiral bands, of variable width, which may be seen in the translucent mouth.

length	width (at body-whorl)	
16	7 mm.	Terraceia, West Florida
23.7	9.2	South Carolina
29	11.2	Key West, Florida
30	10.6	Cayo Romano, Cuba

*Types.* Say's type and two paratypes are at A. N. S. P. (No. 18015); they have not been figured. The Florida Keys being rather indefinite as locality, Key West is herewith designated as the type locality, as it may well have been visited by Titian Peale.

*Remarks.* In this species growth is concluded with the formation of the varix of the outer lip of the mouth, regardless of the size reached. The number of whorls of adult shells varies from 10 to 13, even in the same lot. Tryon was no doubt correct in regarding *P. tenuis* as an immature *scalariformis*. Pfeiffer mentioned the characteristic impressed line above the suture, as well as the spiral grooving on the base of the body-whorl. *C. scalariformis* lives a great portion of the day out of water, frequently crawling up the stems of grass.

*Range.* East coast of Florida and northward as far as South Carolina (rather rare according to Mazyek). West coast of Florida from Cedar Keys southward. Cuba (known only from some of the Keys off the north coast). Hispaniola (according to Mörch).

*Records.* SOUTH CAROLINA. GEORGIA: St. Simon's Id. (USNM). FLORIDA: along entire east coast and on the west coast as far north as Tampa Bay and Cedar Keys. CUBA: El Terraplén, Isla de Turiguano, Camaguey; Cayo Romano, Camaguey; N. shore of Cayo Megano Grande, Camaguey; at USNM from Ensenada de Sa. Rosa, Pinar del Rio.

### Batillaria Benson

*Batillaria* Benson, 1842, Ann. Mag. Nat. Hist. **9**, p. 448. Monotypic for *Cerithium zonale* Bruguière, 1792. *Lampania* Gray, 1840, Synopsis Contents Brit. Mus., ed. 42, p. 148 (*nomem nudum*: no description, no type); 1847, Proc. Zool. Soc. London, p. 153. Monotypic for *Cerithium zonale* Bruguière, 1792.

Shell pyramidal, rarely decollate, with many flat or weakly convex whorls, moderately to strongly sculptured. Sculpture of spiral grooves and ridges, cut by very fine growth-striae; some of the ridges usually stronger and often more or less wavy or cut into transverse nodules, particularly over upper half of whorl where they may form longitudinal or oblique vertical rows. Aperture with the columellar margin short, somewhat produced outward at the squarely truncate base which is separated from the outer lip by a deep but short, horizontal, oblique or vertical, semi-tubular channel; outer lip evenly and moderately thickened throughout, not projecting beyond base of columella in side view, smooth inside. Spire very rarely with varices. Operculum corneous, subcircular, spiral, closely coiled about a central nucleus (Plate 1, fig. 3).

The only Western Atlantic species is placed in the subgenus *Lampanella* Mörch (1876, Malak. Blätt., **23**, p. 93), with *Murex minimus* Gmelin, 1790, as type (by designation of Wenz, 1940). The group is scarcely worth recognizing.

### Batillaria minima Gmelin, Plate 1, figs. 2-3; Plate 5, figs. 1-6

*Murex minimus* Gmelin, 1790, in Linné, Syst. Nat., 13th Ed., **1**, pt. 6, p. 3564 (Sea near Jamaica; based on Lister, 1770, Hist. Conchyl., Ed. Altera, pl. 1018, fig. 81).

*Cerithium clathratum* Menke, 1828, Synopsis Moll., p. 32 (*nomen nudum*: new name for “*Nassa septemstriata* Say” = *Cerithium septemstriatum* Say, which was not described until 1832). Mörch, 1876, Malak. Blätt., **23**, p. 93, first defined as a synonym of *B. minima* Gmelin.

*Cerithium nigrescens* Menke, 1828, Synopsis Moll., pp. 33 and 83 (with description; Havana, Cuba).

*Cerithium septemstriatum* Say, 1832, American Conchology, **5**, pl. 49, fig. 2, with description in letterpress (Southern coast of Florida).

*Cerithium heteroclytes* Potiez and Michaud, 1838, Gal. Moll. Douai, **1**, p. 365, pl. 31, figs. 21-22 (no locality). Not of Lamarek, 1822.

*Cerithium peloritatum* Kiener, 1841-1842, Spéc. Gén. Icon. Coq. Viv., **6**, *Cerithium*, p. 67, pl. 23, figs. 2-2a (Coast of Florida). Not of Cantraine, 1835.

*Cerithium eriense* “Valenciennes” Kiener, 1841-1842, Spéc. Gén. Icon. Coq. Viv., **6**, *Cerithium*, p. 59, pl. 24, fig. 1 (West coast of Florida and Lake Erie).

*Cerithium albovittatum* C. B. Adams, 1850, Contrib. to Conchology, No. 7, p. 122 (Jamaica).

*Cerithium albocoopertum* C. A. Davis, 1904, Nautilus, **17**, p. 129, pl. 4, figs. 32-33 (Bermuda).

*Description.* Shell small, slender or obesely pyramidal, with 9 to 11 flat whorls, only the two or three earliest whorls lost in the adult; body-whorl evenly rounded at periphery; as a rule distinctly ridged and nodulose, but without varices. Sculpture highly variable, normally of many fine spiral threads and a few much stronger spiral ridges; on last 6 or 7 whorls of spire and above periphery of body-whorl with four evenly spaced ridges, gradually decreasing from the subsutural to the peripheral one, the last partly hidden by the suture; ridges usually wavy, raised at fairly even intervals into spirally elongate tubercles or smooth crests; waving strongest on upper two ridges, often barely indicated on peripheral ridge, and, being fairly regularly spaced, it forms on the spire vertical or somewhat oblique rows of low tubercles which stop at the periphery of the

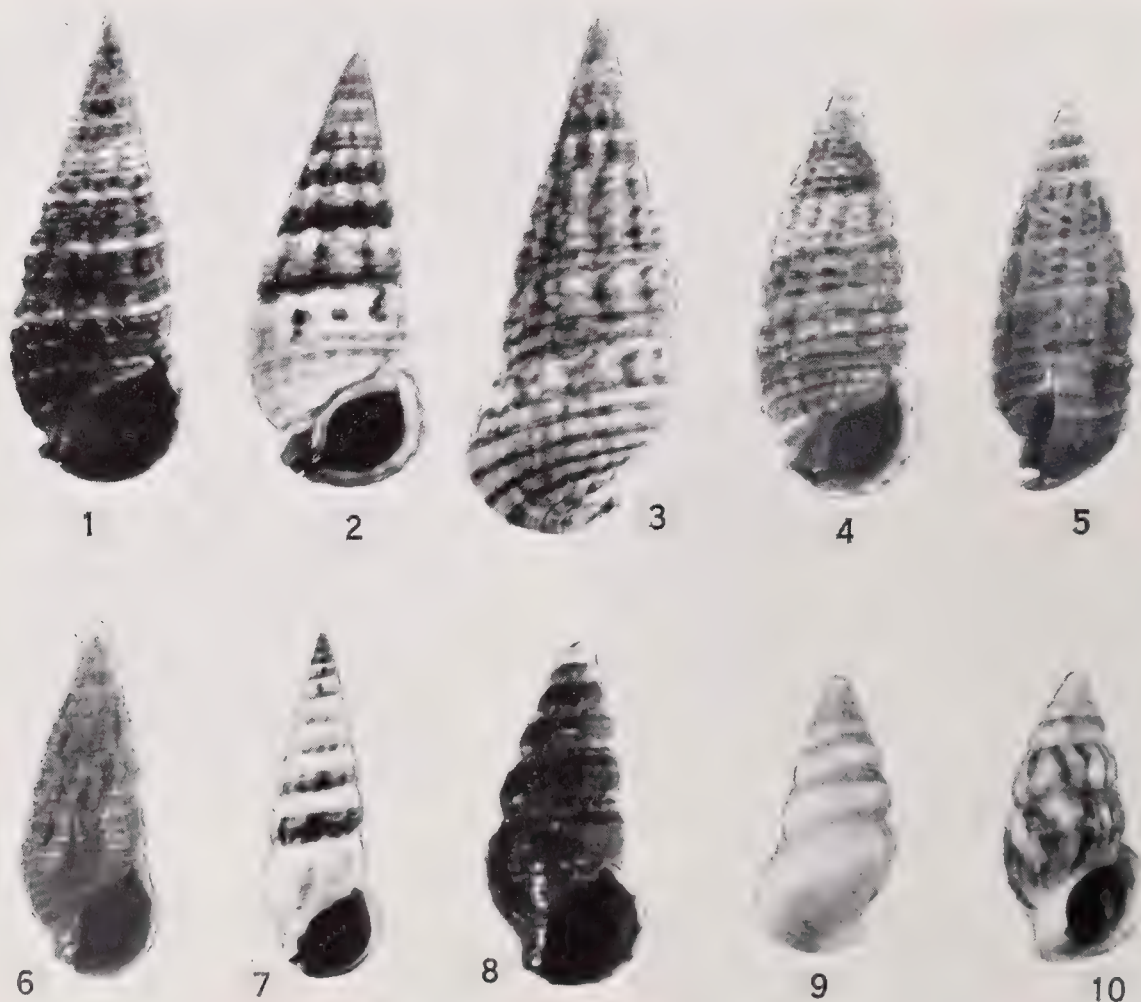


Plate 5. *Batillaria minima* Gmelin and subspecies. Enlarged

body-whorl; base, below periphery, with three or four more spiral ridges, about as strong as the peripheral one; growth-striae very fine. Aperture triangular with rounded sides; outer nearly vertical and lower nearly horizontal, sides connected by a broad, even curve; columellar margin concave; columella short and broad, vertical, abruptly truncate below, separated from base of outer lip by a deep but short, nearly horizontal channel; outer upper edge of channel projecting somewhat beyond outer lower edge and separated by a groove from lowermost spiral ridge of body-whorl; lip simple, scarcely produced basally, either thin or slightly thickened; mouth smooth inside; callus of columellar margin well marked and limited by a fine ridge which is slightly thickened at the upper corner, where it is separated by a notch and narrow groove from the outer lip. The color varies from completely black to almost white; most shells show broad or narrow, dark and light spiral lines or bands.

	length	width (at body-whorl)	
(Smallest adult)	11	3.7 mm.	Miraguana, Haiti
	12	4.1	Gulfport, Florida
	18.5	7.3	Knights Key, Florida
(Largest adult)	21.4	7.3	New Providence, Bahamas

*Types.* The type figure is that of Lister (1770) and the type locality, given by Gmelin, Jamaica.

*Remarks.* *B. minima* is often found in abundance in shallow brackish water where it lives in the mud of the intertidal zone. Variation in size, shape, sculpture and color is considerable, several forms usually occurring in one spot, so that they do not even have an ecological significance. Deformed shells are frequent. *B. minima* appears to be the main food of the American flamingo (*Phoenicopterus ruber*) in the Bahamas, this being evidently the snail mentioned as *Cerithium* by Frank M. Chapman (1908, Camps and Cruises of an Ornithologist, p. 155).

*B. minima* is often confused or mixed with *Cerithium variabile* C. B. Adams (1845) (Syn.: *Cerithium ferrugineum* Say, 1832; not of Bruguière, 1792), a snail of about the same size and general appearance and living under the same conditions. The *Cerithium* differs, however, in the more rounded or bead-like nodules and in the shape of the mouth; this is narrower, with the base of the outer lip shorter than its upper portion, the convex outer lip scarcely more curved than the concave curve of the columellar margin; the channel at the base of the columella is oblique, with the outer upper edge not or scarcely produced and not separated by a groove from the base of the body-whorl; there is a broad channel in the upper corner, where the outer lip joins the body-whorl; inside the mouth is thickened and grooved spirally or toothed some distance from the lip; operculum paucispiral with eccentric nucleus (Plate 1, figs. 4-5).

*Range.* Bermuda, Florida, West Indies, the Caribbean shores of Central and South America, as far east as Barbados. On the Gulf Coast of Mexico, as far north as Vera Cruz.

*Records.* FLORIDA: West coast from Gulfport southward; on the east coast from Lake Worth southward to Key West; BERMUDA: common. BAHAMAS: Great Bahama; Great Abaco; Bimini; New Providence; Cat Island; Mariguana; Little Abaco; Long Island; Exuma; Concepcion Island. CUBA: Cienfuegos; Bahia Honda; Caibarien; Cayo Romano; Sagua la Grande; Havana; Banes. Isle of Pines. HISPANIOLA: Monte Cristi; Miragoane; Gonave Id.; Sa. Barbara de Samana. JAMAICA: Kingston. PUERTO RICO: San

Juan; Ponce; Cabras Id.; Ensenada Honda, Culebra Id. VIRGIN IDS.: St. Croix; Virgin Gorda; Tortola; St. Thomas. MEXICO: Campeche. HONDURAS: Roatan Id. PANAMA: Aspinwall (Colon). DUTCH WEST INDIES: Curaçao. COLOMBIA: Cartagena. VENEZUELA: La Cabrera, Lake Valencia. At the A.N.S.P. there are old specimens (from Tryon and T. Say) labelled "South Carolina"; but Mazyck (1913) does not include it in his list. Published records from St. Kitts and Barbados. The reported occurrence in a living condition on the coast of Sicily needs confirmation.

### **Batillaria minima rawsoni** Mörch, Plate 5, figs. 8-10

*Cerithium rawsoni* "Krebs mss." Mörch, 1876, Malak. Blätt., **23**, p. 20 (doubtfully from Barbados).

*Cerithium (Pyrazus) rawsoni* Dall, 1894, Bull. Mus. Comp. Zoöl., **25**, p. 115, pl., fig. 12 (Great Lagoon, Watling Id., Bahamas).

*Description.* Differs from typical *B. minima* in the shorter but broader shell, particularly at the body-whorl, and in the very weak or obsolete sculpture. The whorls are often very convex, but in some lots they are flat. Transitional stages occur, however, between the typical form and *rawsoni*, both being often found living together; and this applies also to *rawsoni* and *degenerata*.

length	width (at body-whorl)	
10	5 mm.	Mörch's type
10.2	5	Watling Id., Bahamas
12	5.2	Bermuda

*Types.* The type should be at the Copenhagen Museum. The locality Barbados, given with doubt, was certainly erroneous, and the type probably came from the Bahamas where Rawson also collected. As Watling Id. is the first correct locality published, it may be taken as the type locality. Mörch regarded *rawsoni* as a variety of *Cerithium mutabile* C. B. Adams, although he noted that the outer lip was smooth inside. His two references to Sowerby's figures were not intended as synonyms, but merely to give an idea of the general appearance of *rawsoni*.

*Range.* *B. m. rawsoni* has been found with typical *minima* in Bermuda and the Bahamas. Its range is therefore restricted, perhaps a valid argument in favor of its retention as a race, even though it may be entirely due to peculiar ecological conditions.

*Records.* BERMUDA. BAHAMAS: Great Lagoon, Watling Id.; Flamingo Cay, Ragged Id. Group; Long Pt. Pond, 1½ mi. S. E. of Governor's Harbor, Eleuthera Id.; Wemyss, 7 mi. S. E. of Simms, Long Island; Alicetown, N. Bimini Id.

### **Batillaria minima degenerata** Dall, Plate 5, fig. 7

*Cerithium (Pyrazus) septemstriatum* var. *degeneratum* Dall, 1894, Bull. Mus. Comp. Zoöl., **25**, p. 115, pl., fig. 11 (Great Lagoon, Watling Id., Bahamas).

*Description.* Agreeing with *rawsoni* in the great reduction or obsolescence of the sculpture, but much more slender, being often even more elongate than typical *minima*. It passes, however, gradually into *minima* and *rawsoni*, being usually found with them. The whorls may be very convex or almost flat.

length	width (at body-whorl)	
12	3.9 mm.	Cotype, Watling Id., Bahamas, Pl. 5, fig. 7
10.3	3.5	Lago Enriquillo, Hispaniola



*Type.* The type, figured by Dall, is at U.S.N.M. There are cotypes from the original lot (one figured here) at M.C.Z.

*Range.* Known thus far with certainty only from the Bahamas and Hispaniola. Dall and Simpson (1901) report a single specimen from San Juan Harbor, Puerto Rico, but this may have been a worn shell of typical *minima*.

*Records.* BAHAMAS: Great Lagoon, Watling Id. HISPANIOLA: Lago Enriquillo, Rep. Dominicana.

### *Key to Western Atlantic Potamididae*

1. A deep, nearly horizontal channel separates the base of the columella sharply from the outer lip. Adult shell 10 to 22 mm. long *B. minima*  
A broadly open and very shallow groove scarcely separates the base of the columella from the outer lip 2.
2. Base of body-whorl without spiral threads, except for 1 or 2 where the vertical ribs stop. Outer lip not or slightly thickened. Varices rarely present. Adult shell 8.5 to 17 mm. long *C. costata*  
Base of body-whorl entirely covered with evenly spaced spiral threads 3.
3. Spire with a number of well marked varices, irregularly spaced. Concave intervals between the vertical ribs with fine spiral striation. No spiral thread in the suture. Adult shell 17 to 27 mm. long *C. pliculosa*  
Spire without varices. Intervals between the vertical ribs not spirally striate. A strong spiral thread in the suture. Adult shell 16 to 30 mm. long *C. scalariformis*

In addition to the collections of the Museum of Comparative Zoölogy (MCZ), I have been privileged to study material from the Academy of Natural Sciences of Philadelphia (ANSP) and the United States National Museum (USNM).

\* \* \* \*

Through lack of space, the generic diagnosis of *Amiantis* had to be omitted from Johnsonia no. 3, p. 7. We include it here.—W. J. CLENCH

### *Amiantis* Carpenter

*Amiantis* Cpr. 1864, Rept. British Assoc. **33**, (1863) p. 640, (genotype, *Cytherea callosa* Conr.).

Shell ovate, moderately to strongly sculptured with concentric ridges. Lunule and escutcheon defined; inner margins smooth; pallial sinus large, acute and somewhat ascending. Anterior cardinal tooth thin, anterior laterals large and rather thickened.

This genus is limited to only one species in the Western Atlantic. It is exceedingly close to *Macrocallista* in its characters. The Western Atlantic form is without the pronounced thickening of the inner radial ridges which characterizes *A. callosa* Conrad, of the Eastern Pacific (California to Mexico). *A. purpurata* is the type of the section *Eu-callista* Dall 1902.

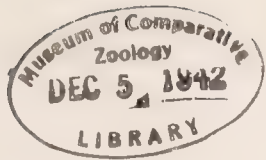
### **Santa Barbara de Samana, Santo Domingo**

Santa Barbara de Samana is a grand collecting ground for West Indian marine shells. The town proper is small, probably not over 1500 in population and is somewhat sprawled along part of the northern shore of Samana Bay. This little settlement is quaint and decidedly picturesque with its red roofs, white houses, and a background of green mountains.

The entire northern shore of Samana Bay (about twenty-five miles) consists of a series of small crescent-shaped bays created by short spurs or ridges from the main mountain mass of the peninsula. The horns of each crescent are rocky, the inner area a sandy or rubble beach. The town of Santa Barbara possesses as well two small islands which give not only additional beauty to the place but a few extra hundred feet of really fine collecting areas.

Marine shells are exceedingly abundant at this locality, both as to species and as to individuals. It is particularly advantageous in that it offers a remarkable number of habitats so that all types of collecting stations are available for the interested collector. Paths lead along the shores and over or around the small mountain spurs so that several of the bays are readily accessible from the town. We spent three weeks at this place (1937) and did not begin to exhaust the possibilities of Santa Barbara itself. Though our main object was land shell collecting, which was excellent, we did devote much time to the fine marine collecting in this delightful spot. Small boats are available, and more distant points can easily be reached by this method.

At the time of our visit Santa Barbara was completely isolated by road and had to be reached by motorboat from Sabana de la Mar, nine miles across the bay to the south. This last was accessible from Trujillo City (Santo Domingo City) by bus or private auto over a narrow but good road. Also from San Francisco de Marcoris, in the interior of Santo Domingo, a tri-weekly train runs to Sanchez at the head of Samana Bay and from there passage is made by motorboat to Santa Barbara. We made the return trip by way of Sanchez and the tri-weekly train, an experience that alone was worth the trip to Santa Barbara. Marine collecting at Sanchez was very poor owing to the amount of fresh water delivered into the bay at this point by the Yuna River. Two or three miles west of this town the collecting would very probably improve. It certainly "looked good" from the boat, a trip of about twenty miles from Santa Barbara.—W. J. CLENCH



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# JOHNSONIA

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CONIDAE

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## THE GENUS *CONUS* IN THE WESTERN ATLANTIC

BY  
WILLIAM J. CLENCH

The very valuable and extensive list of *Conus* by Tomlin (see bibliography) contains more than 2700 names that have been employed for the fossil and recent species in this genus. Many of these names are synonyms and others are new names employed to replace homonyms, but this list gives in a very graphic way the large number of forms that have been described and indicates the extensive body of literature that has been written about this genus.

Though our recent forms are well under half of this number, the list is still an imposing one. The separation of the many species is exceedingly difficult as the differential characters are few in number and most of these are variable. Color and color pattern have played a conspicuous part in their differentiation with the shape of the shell and the contour of the spire as important diagnostic characters of species groups.

*Conus* has always been a very popular genus and with *Cypraea* and *Voluta* were and still are the most sought after shells among the marine gastropods. Interest in these forms among our early workers resulted in a very large number of names being employed, based unfortunately on a belief in the fixity of color pattern and a general lack of interest in, or lack of knowledge of, their geographic origin. Most of the early descriptions are meager with few or no comparisons, many are unfigured or refer to previously published figures, mainly wood-cuts, that have but slight diagnostic value. There are, of course, many exceptions, but I think the above holds true not only for *Conus* but for other genera that were held in high favor among our early European students.



*Conus quercinus* Hwass



*Conus pulicarius* Hwass

Plate 1. Showing cross-section of shell (natural size).

It is exceedingly unfortunate that many specific names now in current use must be replaced by others less familiar. The collation of the literature by Tomlin and the greatly increased series of material now available for study have made possible a much better understanding of this genus. Errors in names as well as in determinations become apparent only when a large amount of factual evidence can be studied at one time.

The bites of all *Conus* are believed to be poisonous. There are many published records of fatal stings by members of this genus, though, so far, the known species responsible are few in number and are limited to the Indo-Pacific region. Care should be taken, however, when collecting our Western Atlantic forms alive. Certain specimens of *Conus spurius atlanticus* reach a fairly large size and a bite may prove to be very serious. We figure herewith (plate 2) an enlarged tooth of *Conus striatus* (3 fathoms, Rabbit Island, Oahu, Hawaiian Islands) to illustrate the biting apparatus used by *Conus*. This is only one of many teeth that are responsible for the bite. Our shell was a particularly large specimen, reaching 130 mm. in length. The size of the tooth as indicated is exceedingly long in comparison with the teeth on the radulae of most other mollusks.

As a defensive weapon, the bite of a cone is possibly only of secondary importance, its primary use probably being the procurement of food; the prey is bitten to paralyze it before an attempt is made to feed upon it. The purpose is strikingly parallel to that of a rattlesnake's bite.

*Conus* is essentially a tropical genus though a few species occur in the warmer portions of the temperate regions. They occur in many types of habitats, on mud flats, sand bars, exposed rocky coasts and reefs as well as in the more quiet waters of lagoons and bays. Many occur in the inter-tidal zone though most are to be found below the low water line. A very few species extend beyond the 100 fathom line, though they are not known to occur in the profound depths. The vast Indo-Pacific region is by far the richest in *Conus*. Our entire Western Atlantic province contains fewer species than could be obtained at any good collecting spot on the Barrier Reef off Queensland or in a coral-margined bay in any of the Philippine Islands.

The operculum is usually lengthened and rounded at the ends and not capable of closing the aperture. Its relative size varies with the different species. The periostracum also varies materially with the different species, ranging from a thin transparent covering with the coloration of the shell showing through, to a very heavy and non-transparent coat which may possess ridges, "hairs," or other sculptural growths.

The following comments and the translation of Bruguière's remarks are by my colleague, Dr. Joseph Bequaert.

"In his extremely valuable Catalogue of Recent and Fossil Cones, J. R. le B. Tomlin states, without further comment: 'The numerous species described in the Encyclopédie

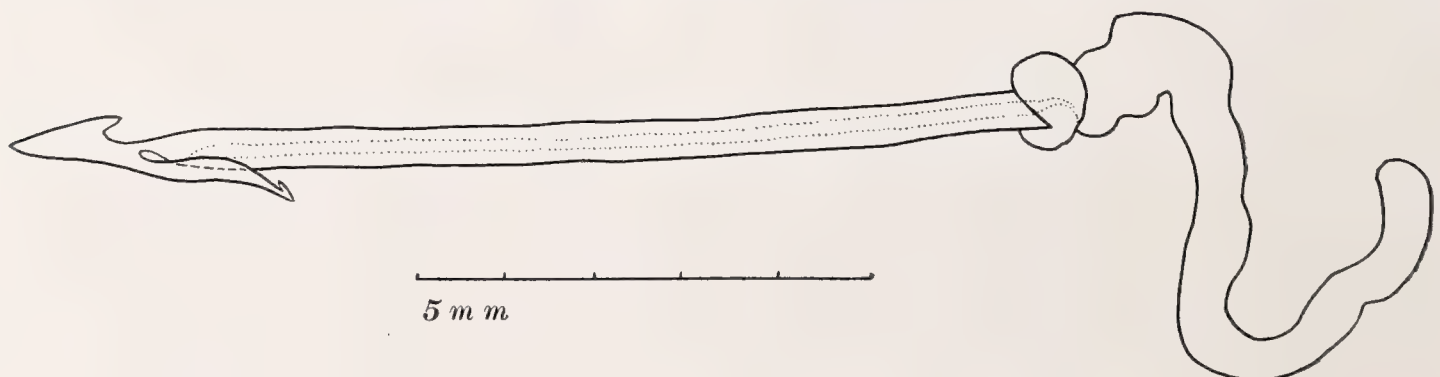


Plate 2. A single tooth from the radula of *C. striatus* Linné. Greatly enlarged.  
Copied from a drawing by Y. Kondo.

Méthodique are attributed to Bruguière and not to Hwass. This of course not only does a grave injustice to Hwass, who laid the foundation of the taxonomy of the genus, but is in direct opposition to Bruguière's statement (1792, *Encyclopédie Méthodique*, Vers, I, pt. 2, p. 598): 'The work which I present here on the cones was communicated to me by Mr. Hwass, who has consented to take it from a more extensive one, at present in the press and comprising the systematic catalogue of the precious shells in his collection . . . In order to be worthy of the trust, of which the Danish savant gives me so high a token, I must warn the reader that the definition and divisions of the genus, and the Latin diagnoses ["phrases"] of species and varieties are his work ["lui appartiennent"] and one should regard as my work only the French table of specific differences, the general observations on the genus *Conus*, the additional synonymy of the species, and finally their descriptions.' In addition, Hwass' name follows every binomial for which he was responsible, so that the authorship is never in doubt.

'E. Lamy (1930, *Journ. de Conchy.*, 74, pp. 57-59) has traced the vicissitudes of Hwass' collection. From his account it appears that the cones should be at present in the Natural History Museum at Geneva. So far as I know, these types have never been critically examined.'

I am greatly indebted to several friends for the use of their material for study and for their records. These are acknowledged by name after the records. I am indebted to Dr. Pilsbry for the many records obtained during a visit to the Academy of Natural Sciences at Philadelphia (ANSP).

### *Conus* Linné

*Conus* Linné 1758, *Syst. Nat.* ed. 10, p. 212.

Shell obconic, usually heavy and strong, generally ornamented with bright colors which are diffused, banded or spotted. Aperture generally long and narrow with a simple lip. Whorls numerous, rather tightly coiled and moderately descending. Inner whorls generally absorbed to a paper-thinness (Plate 1). Sculpture when present usually of a minor nature consisting of low riblets which may be smooth or tuberculate. Periostracum thin to heavy and often sculptured to a moderate degree. Teeth relatively few, proportionately long and equipped with a poison gland. This apparatus is capable of injecting an exceedingly powerful neurotoxin into its prey.

According to Iredale (1930, p. 79) the genotype of *Conus* is *C. litteratus* Linné, designated by Swainson (1840, *Treat. Malac.*, p. 148).

### *Conus regius* Gmelin, Plate 3, fig. 1-4

*Conus regius* Gmelin 1791, *Syst. Nat.* ed. 13, p. 3379 (No locality).

*Conus leucostictus* Gmelin 1791, *Syst. Nat.* ed. 13, p. 3388 (Oceano Americano).

*Conus insularis* Gmelin 1791, *Syst. Nat.* ed. 13, p. 3389 (No locality).

*Conus cedonulli curassaviensis* Hwass 1792, [in] Bruguière, *Ency. Meth. Vers.*, 1, p. 602 (Curaçao).

*Conus cedonulli trinitarius* Hwass 1792, [in] Bruguière, *Ency. Meth. Vers.*, 1, p. 603 (Trinidad).

*Conus cedonulli martinicanus* Hwass 1792, [in] Bruguière, *Ency. Meth. Vers.*, 1, p. 603 (Martinique).

*Conus cedonulli caracanus* Hwass 1792, [in] Bruguière, *Ency. Meth. Vers.*, 1, p. 603 (Caracas [Venezuela]).

*Conus cedonulli grenadensis* Hwass 1792, [in] Bruguière, *Ency. Meth. Vers.*, 1, p. 603 (Grenada).

*Conus nebulosus* Hwass 1792, [in] Bruguière, *Ency. Meth. Vers.*, 1, p. 606 (Santo Domingo), *non nebulosus* Gmelin 1791.

*Conus eques* Hwass 1792, [in] Bruguière, *Ency. Meth. Vers.*, 1, p. 705 (Coast of Florida).

*Cucullus coronacivica* Röding 1798, *Mus. Boltzenianum* p. 38 (No locality).

*Conus leucostictus* 'Gmelin' Green 1830, *Trans. Albany Inst.* 1, p. 123, pl. 3, fig. 4 (Florida).

*Conus armillatus* C. B. Adams 1850, *Contributions to Conchology* no. 4, p. 59, Amherst, Mass. (Jamaica). [A young specimen of *regius* similar to figure 4, pl. 3].

*Description.* Shell 50 to 70 mm. in length, solid and strong and usually colored a mottled brown and cream. The color generally appears in the form of two irregular bands, a broad one above the middle and a narrower one between the mid area and the base. However, extensive mottling may partially or wholly obscure the band formation. The color is usually a deep chocolate-brown though occasional specimens are brownish-red. Aperture oblique, deeply inset above, long and fairly wide proportionately. Whorls 6 to 8, flat sided, tuberculated on the top and occasionally offset to form a shoulder. Spire rather extended, usually strongly concave and with a rather large nuclear whorl. Outer lip finely crenulated along its inner margin. Sculpture consisting of numerous spiral threads that are usually beaded and most strongly developed towards the base. Occasional specimens smooth above the mid area. The spire possesses numerous and fine spiral threads. Fine and irregular axial growth lines cross the beaded sculpture. Periostracum very thin and usually worn away even in live shells. Operculum with a terminal nucleus, long and strongly sculptured with irregular concentric growth lines. It is between one-half and one-third the length of the aperture.

	length	width	whorls	
(large)	71	41 mm.	8	Middle Sambo Shoals, Florida
(average)	60	32.5	7½	Pelican Shoals, Florida

*Types.* Gmelin cites several references for this species and we here select his citation "b," Martini 1773, Conchy.-Cab. (1) 2, pl. 62, fig. 684, to be the type figure. We also restrict the type locality to Jaimanitas, Cuba (near Havana). We figure the neoholotype, MCZ. 127816.

*Common name.* The Crown Cone.

*Remarks.* It is unfortunate that the well-known name of *nebulosus* Hwass, must be discarded owing to an earlier name by Gmelin. In addition, it is a homonym of *nebulosus* Gmelin, a totally different species.

This is a very remarkable shell and strikingly different from most other cones. Live

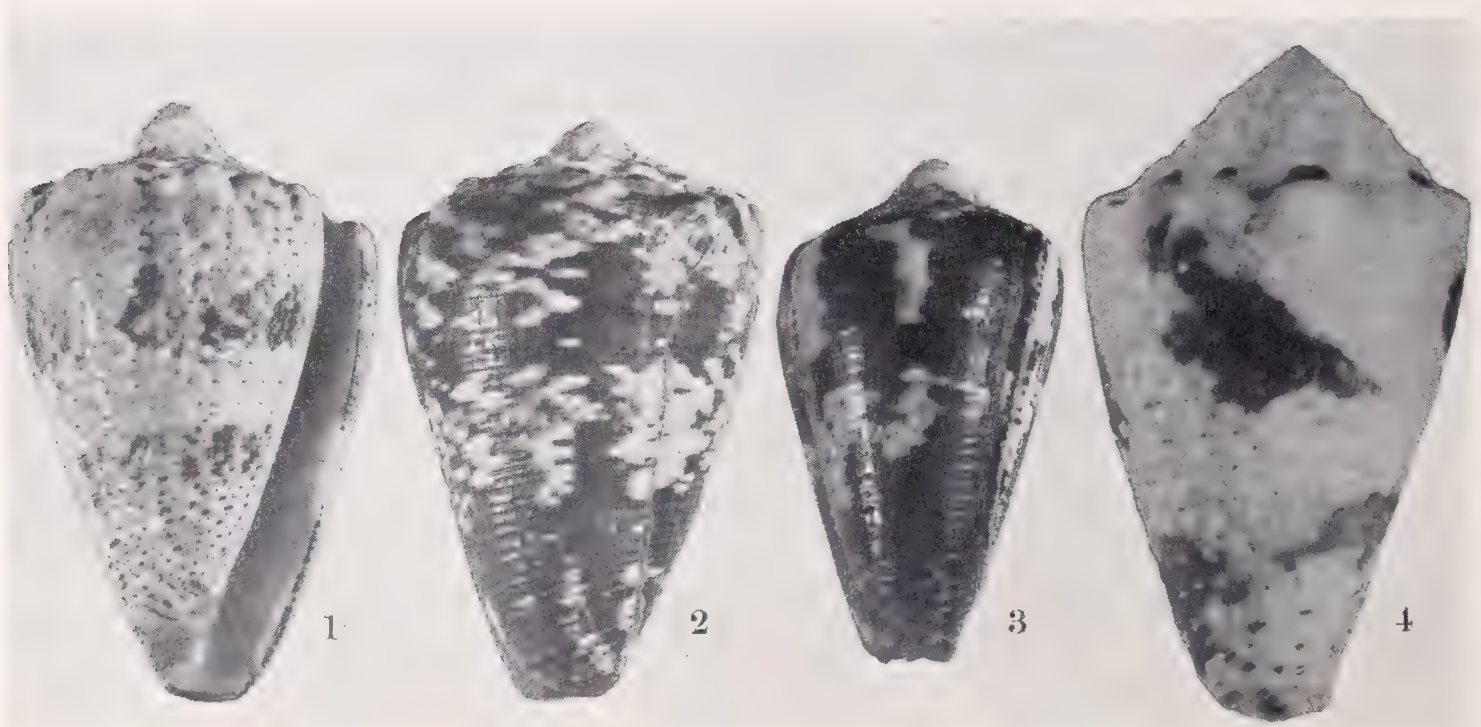


Plate 3. *Conus regius* Gmelin

Fig. 1. Nassau, Bahamas (nat. size). Fig. 2. Jaimanitas, Cuba (nat. size).  
Fig. 3. Middle Sambo Shoals (nat. size). Fig. 4. Fowey Rocks, Florida (3×).

shells are difficult to obtain as they are reef dwelling and can only be had by diving or found at times when the outer reefs are exposed during calm weather. *C. regius* is exceedingly variable in character, particularly in its color pattern and sculpture. Specimens from the same locality show remarkable differences. In a large series, these variations are almost completely linked together by intermediates which show a homogeneity which would not be suspected if only a few isolated specimens were studied. This variation was responsible for the many names employed by Hwass and Gmelin.

*C. leucostictus* 'Gmelin' Green (err. for *leucostictus*) is a young specimen. The young show axially lengthened and irregular maculations which on older shells are more or less formed in two broad, spiral bands. The young shells have also been called *maculiferus* Sowerby in error, a species occurring in the Indo-Pacific area (Red Sea).

*Range.* Southern Florida, southern Mexico, the Bahamas and south to Brasil.

*Records.* FLORIDA: Boynton (T. Bayer; T. McGinty); Deerfield Beach (T. Van Hyning); Hillsborough Reef (T. Bayer; L. A. Burry); off Fowey Rocks (A. H. Patterson); Pelican Shoals; Sand Key; Washerwoman Key (all J. Schwengel); Boca Chica Key (T. Van Hyning); Middle Sambo Shoals (T. McGinty); Tortugas (L. A. Burry; T. Van Hyning). BAHAMAS: West End, Grand Bahama; South Bimini Id.; Arthurs-town, Cat Id.; Cape Santa Maria, Long Id.; Matthewtown, Gt. Inagua (all MCZ); Nassau, New Providence (A. H. Patterson). CUBA: Jaimanitas, Havana; Cayo la Farola, Santa Clara; Castillo de Jagua, Cienfuegos; Blue Beach, Guantanamo Naval Base (all MCZ). HISPANIOLA: Puerto Plata; Monte Cristi; Jerémie (all MCZ). JAMAICA: (Holotype of *armillatus* Adams, MCZ. 154005). VIRGIN IDS.: Guana Id., Tortola; The Baths, Virgin Gorda (both M. Dewey); St. Thomas; St. Croix; (both ANSP); St. Johns (MCZ). LESSER ANTILLES: St. Kitts; St. Vincent (both ANSP). CARIBBEAN IDS.: Playa Abau, Curaçao (ANSP). NICARAGUA: (ANSP). PANAMA: Colón (MCZ). VENEZUELA: Paria Peninsula (MCZ). BRASIL: Praia do Chega Negro, Cidade da Bahia; Praia de Itapoan, Est. Bahia (both P. E. de Oliviera).

### *Conus regius cardinalis* Hwass, Plate 4, fig. 1

*Conus cardinalis* Hwass 1792, [in] Bruguière, Ency. Meth. Vers, 1, p. 632 (Indian Ocean; Santo Domingo; Martinique); *non* Röding 1798.

*Conus roseus* Lamarck 1810, Ann. Mus. Hist. Nat. Paris, 15, p. 37 (Seas of the Antilles); Kiener 1846, Icon. Coquilles Vivantes, 2, p. 22, pl. 9, fig. 3; *non* Fischer 1807; Sowerby 1834; Kiener 1847 (pl. 107, fig. 4).

*Conus ornatus* Sowerby 1833, Conch. Illust. pt. 29, fig. 22 (Locality unknown).

*Conus speciosissimus* Reeve 1848, Conch. Icon. 1, (Suppl.) pl. 2, fig. 274 (Curaçoa [Curaçao]).

*Description.* This race may possibly reach the size of *C. regius*. It agrees with the typical form in all of its general characters other than size and color. This color is generally a deep reddish-orange well diffused over the shell other than at the mid area where there is a narrow white irregular band which may even be discontinuous. Small patches of brown may also occur on this mid band. At the shoulder and again at the base there may be irregular patches of white with small brownish patches in addition. On the spire there are brown and white bars, usually axially formed with the red-orange between them. Occasional specimens are reddish-salmon throughout except for a very narrow mid band of white with the spire white and flecked with the salmon coloration.

length	width	whorls	
41.5	25 mm.	—	Kiener's figure
29	18	9	Guana Id., Tortola
25	15	8½	Bimini Ids., Bahamas

*Types.* Hwass listed Martini 1773, Conchy.-Cab. (1) 2, pl. 61, fig. 680, as one of his references and this is here selected as the type figure. As Hwass was not at all certain where his specimen came from, I select Tortola Id., Virgin Islands, as the type locality.

*Common name.* Cardinal Cone.

*Remarks.* I believe this to be a very rare form of *regius*. It agrees in all its essential characters with the typical form other than size and color. I have seen but few specimens, only one a "live shell," the remaining specimens a little beach worn. If it does reach the size of *regius*, an adult specimen with its intense reddish coloration would be an exceedingly beautiful shell.

*Range.* Possibly co-extensive with *C. regius*.

*Records.* FLORIDA: Tortugas (L. A. Burry). BAHAMAS: Bimini Ids. (W. A. Royce). VIRGIN IDS.: Guana Id., Tortola (M. Dewey).

### **Conus regius abbotti**, new subspecies, Plate 4, fig. 2-3

*Description.* Similar in its general characters to *C. regius* except for coloration and perhaps size. In color it differs by possessing a grayish green or olivaceous green with a central mid band of white flecked usually with irregular brownish patches. Occasional specimens have axially formed, brownish zig-zag bars superimposed over the green; these sometimes invade the white band at the mid area. The spiral lines of beads which form most of the sculpture may also be dotted with reddish-brown.

length	width	whorls	
42	25.3 mm.	10	Arthurstown, Cat Id.
35	22	9½	Governors Harbor, Eleuthera, Id.

*Types.* Holotype, Mus. Comp. Zoöl. no. 145274, Arthurstown, Cat Island, Bahamas. Clench, Huntington and Russell collectors, July 1935. Three paratypes from the same locality and one from Governors Harbor, Eleuthera Island, Bahamas.

*Common name.* Abbott's Cone.

*Remarks.* I have been unable to find any published figure that agrees with the present new subspecies. It differs noticeably from typical *regius* by both its color and color pattern. Our few specimens were dead when collected but possessed excellent coloration. Similarly to *regius*, it occurs along rocky reefs below low water line.

*Range and Records.* Known only from the type series.

Named for R. Tucker Abbott, assistant and colleague.

### **Conus dominicanus** Hwass, Plate 4, fig. 4

*Conus cedonulli dominicanus* Hwass 1792 [in] Bruguière, Ency. Meth. Vers, 1, p. 603 (Dominica).

*Conus cedonulli surinamensis* Hwass 1792 [in] Bruguière, Ency. Meth. Vers, 1, p. 603 (Surinam [Dutch Guiana]) *non* Gmelin 1791.

*Conus cedonulli* Lamarck 1810, Ann. Mus. Hist. Nat. Paris, 15, p. 31; Delessert 1841, Recueil Coquilles Décrites par Lamarck, pl. 40, fig. 3-4 (Paris) *non* Linné, 1758.

*Description.* Shell medium, probably reaching a length of 50 to 55 mm. It is strong and solid. Whorls 11 and flat sided. Color milky-white with two spiral bands of yellow-brown which are broken into many irregular patches. In addition there are numerous spiral bands of dots or beads of a darker brown which under a lens actually appear as strings of white beads outlined with brown and connected by a thread of brown. As these beadlike lines pass over the white areas, the thread appears as a whiter line than the back-



ground. On the lower half of the shell, the beads are built upon fine spiral ridges. Spire somewhat extended, moderately concave and produced at an angle of about  $95^\circ$ . Aperture oblique, fairly wide and moderately inset above. Sculpture of numerous threadlike ridges which occur mainly below the mid area. Shoulder of the body whorl slightly irregular and may be also somewhat nodulose. Periostracum and operculum not seen.

length	width	whorls	
46.2	23.5 mm.	11	West Indies

*Types.* Hwass refers to Chemnitz 1788, Conchy.-Cab. (1) 10, pl. 141, fig. 1306, which is here selected as the type figure. The island of Dominica, Lesser Antilles, is the type locality.

*Common name.* The Antillian Cone.

*Remarks.* We possess but a single specimen of this rare *Conus*, obtained originally by Governor Rawson (Bahamas). This general type of shell has long been confused with *C. cedonulli* Linné and *ammiralis* Linné (both from the Indo-Pacific).

In relationship it appears nearest to *C. regius*, mainly by its type of color pattern. It differs in being more slender, having a less concave spire and lacking the strong nodules which characterize *regius*.

*Range and Records.* Possibly occurring throughout the West Indies.

### *Conus citrinus* Gmelin, Plate 4, fig. 5-6

*Conus citrinus* Gmelin 1791, Sys. Nat. ed. 13, 1, pt. 6, p. 3389 (Curacas [Caracas, Venezuela]) *non* Kiener 1849.

*Conus mus* Hwass 1792, [in] Bruguière, Ency. Meth. Vers, 1, p. 630, (Guadeloupe).

*Conus barbadosis* Hwass 1792, [in] Bruguière, Ency. Meth. Vers, 1, p. 632 (Barbados, Guadeloupe and Santo Domingo).

*Conus magellanicus* Hwass 1792 [in] Bruguière, Ency. Meth. Vers, 1, p. 633. [Hwass changed the type locality given by Favanne as Martinique to the Straits of Magellan, which is certainly in error.]

*Conus jamaicensis* Hwass 1792 [in] Bruguière, Ency. Meth. Vers, 1, p. 700 (Jamaica).

*Conus lubeckianus* Bernardi 1861, Jour. de Conch. 9, p. 169, pl. 6, fig. 7-8 (Guadeloupe).

*Conus minutus* Reeve 1864, Conch. Icon. 1, pl. 47, fig. 259 (St. Vincent) *non* Röding 1798; Schröter 1803. [This is a very young specimen of *C. citrinus*.]

*Description.* Shell 30 to 35 mm. in length, rather solid but not heavy and covered with a moderately thick periostracum. Whorls 8 to 10, slightly convex above the middle and slightly concave below, each side forming a very flattened sigmoid outline. Color a pale gray to grayish-blue with two mottled brownish bands, a broad one above the mid-region and a narrower one below. Both of these bands are visible from within the aperture. Spire obtuse, short and flat sided to slightly concave, forming an angle of about  $110^\circ$ . In young shells, the spire is more concave and the nuclear whorls extend above the others disproportionately. The nuclear whorls are glass-like and smooth. Aperture oblique, long and narrow and deeply notched above. Outer lip simple, fairly thick and finely crenulated along its inner margin. Sculpture of numerous fine, spiral threads over the entire body whorl surface, coarser near the base. Shoulder of the whorl nodulose, which also characterizes each whorl of the spire. In addition, there are fine spiral threads on the whorls of the spire. Periostracum on "live" shells rather thick and sculptured with numerous ridges or threads. It is thick enough to conceal the coloration of the shell proper. In appearance, the periostracum is silken with very fine axial striations. Under a 14 power lens, this appears like netting that has been pulled very tightly parallel to the shell axis.



Plate 4. Fig. 1. *C. r. cardinalis* Hwass, Guana Id., Tortola (3×). Fig. 2. *C. r. abbotti* Clench, Arthurs-town, Cat Id., Bahamas (Holotype, nat. size). Fig. 3. *C. r. abbotti* Clench, Governors Harbor, Eleuthera, Bahamas (Paratype, nat. size). Fig. 4. *C. dominicanus* Hwass, West Indies (nat. size). Fig. 5. *C. citrinus* Gmelin, Hillsborough Inlet, Florida (nat. size). Fig. 6. *C. citrinus* Gmelin, Hillsborough Inlet, Florida (with covering of periostracum, nat. size).

	length	width	whorls	
(large)	41.5	25 mm.	10	Boynton, Florida
(average)	30	16.5	9	Puerto Sosua, Santo Domingo
(small)	21	12	8	Cienfuegos, Cuba

*Types.* Gmelin referred to Martini 1773, Conchy.-Cab. (1) 2, pl. 61, fig. 681, which is here designated as the type figure. Caracas, Venezuela is the type locality as given by Gmelin.

*Common name.* The Mouse Cone.

*Remarks.* A rather widespread and abundant species. It is found under and on rocks near low water line and in the West Indian region.

The soft parts are dull red. Among the Western Atlantic species, it appears to be nearest to *C. regius*, but it is much smaller, has a much heavier periostracum, a more sinuous outline and the spiral threads are not beaded. The color pattern also differs as can best be exhibited by the plates of these two forms.

*Range.* Bermuda and southern Florida, and from Vera Cruz, Mexico south to Trinidad.

*Records.* FLORIDA: Pelican Shoals; Sand Key; (both J. Schwengel); Tortugas: Lake Worth (both ANSP); Palm Beach (J. Schwengel); Hillsborough Inlet (L. A. Burry); Boynton Beach (T. McGinty); Soldiers Key (MCZ). BERMUDA: Warwick. BAHAMAS: Nassau, New Providence (ANSP); West End, Grand Bahama; Sweeting's Village, Gt. Abaco; Alicetown, Bimini Ids.; Governors Harbor, Eleuthera; Cape Santa Maria, Long Id.; Watlings Id.; Fortune Id.; Matthewtown, Gt. Inagua (all MCZ). CUBA: Casilda; Havana; Mota, Oriente Prov. (both ANSP); Gavilan, Cienfuegos; Cable Beach, Guantanamo Naval Base; Cayo la Farola, Santa Clara Prov.; Caibarien (all MCZ). HISPANIOLA: Yuma (ANSP); Puerto Sosua; Puerto Plata; Monte Cristi; Santa Barbara de Samana; Cape Haitien; Miragoâne; Jérémie; Gonave Id. (all MCZ). JAMAICA: Port Antonio; Montego Bay (both MCZ). VIRGIN ISLANDS: St. Thomas (ANSP); Guana Id., Tortola (M. Dewey); Virgin Gorda (MCZ). LESSER ANTILLES: St. Vincent (ANSP); Antigua;

Barbados; Tobago; Toco, Trinidad (all MCZ). CARIBBEAN IDS.: Oak Ridge, Roatan Id.; Swan Id. (both MCZ). MEXICO: Vera Cruz (MCZ); Isla Mujeres (C. G. Aguayo). BRITISH HONDURAS: Belize (MCZ). PANAMA: Colón (MCZ). COLOMBIA: Cartagena (MCZ). BRITISH GUIANA: Corentyne River (H. G. Kugler).

**Conus stearnsii** Conrad, Plate 5, fig. 1-4

*Conus stearnsii* Conrad 1869, Amer. Jour. Conch. 5, p. 104, pl. 10, fig. 1 (Pine Key, west coast of Florida).

*Description.* Shell small, seldom exceeding 20 mm. in length, rather thin but strong. Whorls 10 to 11 and nearly flat sided. Color a dirty white overlaid by irregular areas of light to dark brown blotches. Under a lens there appears a series of small, spirally lengthened white dots with a smaller brownish dot at both ends or either end of the white dots. These are most distinct above the middle. The color varies considerably in specimens contained in a single series. Spire acute, extended and produced at an angle of about 70°. The spire is carinated on each whorl and the last forms a small but pronounced shoulder on the body whorl. The carinae have brownish dots more or less evenly disposed up to the nuclear whorls above. The nuclear whorls are not papilliform but continue the contour of the spire. The spire is flat sided to moderately concave. Aperture oblique, rather narrow and deeply inset above. The outer lip is finely crenulated below the mid-area; these crenulations are the termini of the incised lines. Sculpture of 10 to 13 fine, incised lines that are found only on the lower half of the body whorl. Under a lens an occasional specimen exhibits a continuation of these lines to the top of the body whorl but they are usually only faintly discernible. Spire dull, very finely and axially striate. On the spire, the periostiacum forms fine, bladelike and crescent-shaped ridges between the whorls. Operculum unknown.

	length	width	whorls	
(large)	21	9 mm.	11	Gulfport, Florida
(average)	18	8	10	Holotype

*Types.* Holotype, Acad. Nat. Sci. Phila. no. 34158. Type locality, Pine Key, west coast of Florida. This is in the Tampa Bay area. R. E. C. Stearns collector.

*Common name.* Stearns' Cone.

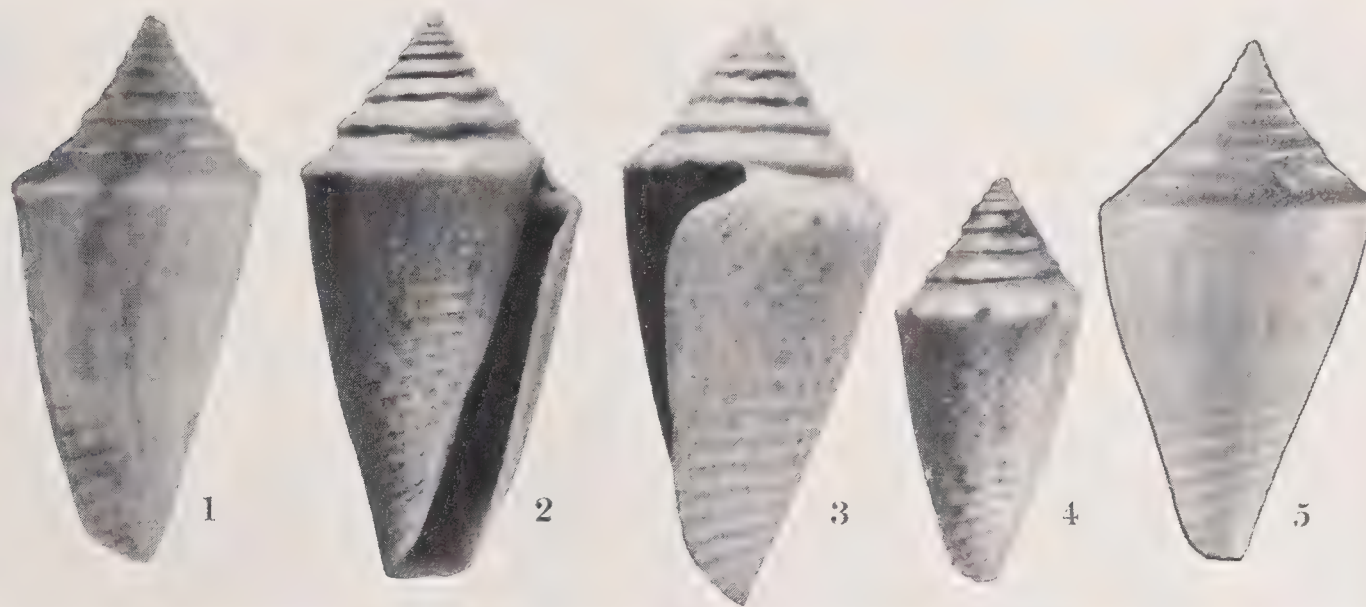


Plate 5. Fig. 1. *C. stearnsii* Conrad, Pine Key, West Florida (Holotype, 3×). Fig. 2 and 3. *C. stearnsii* Conrad, Punta Gorda, Florida (3×). Fig. 4. *C. stearnsii* Conrad, Gulfport, Florida (3×). Fig. 5. *C. stimpsoni* Dall, off Palm Beach, Florida (2×).

*Remarks.* Both Tryon (1884, p. 36) and Dall (1889, p. 68) have considered this species of Conrad to be a synonym of *C. pealii* Green (= *jaspideus* Gmelin). In my opinion both are decidedly wrong. As far as our present knowledge indicates, the present species is limited to the east and west coast of Florida, the Atlantic coast of Mexico and perhaps south along the Central American coast. It exists from low water to depths of about 20 fathoms.

It differs from *C. jaspideus* in several respects. It has proportionally a higher spire, a more slender shape, a darker and more suffused coloration and usually has the five incised lines only on the lower half of the shell.

*Range.* East and West Florida and the Atlantic Coast of Mexico.

*Records.* FLORIDA: Marco (A. Koto); Bonita Springs (L. A. Burry); Tarpon Bay, Sanibel Id. (J. Schwengel; MCZ); off Sanibel Id. in 4 to 6 fathoms (J. Schwengel); Punta Gorda (A. Koto); Key West (MCZ); Gasparilla Id.; Osprey; Bradenton; Tarpon Springs; Clearwater (all ANSP); Sarasota Bay in 3 fathoms (W. A. Royce); Englewood (A. Koto); Cortez; Venice Bay (both B. R. Bales); Pine Key, Tampa Bay; Gulfport, Lemon Bay; Cedar Keys (all MCZ); off Destin in 14 fathoms (T. McGinty); 15 to 35 miles off Ft. Walton in 13 to 19 fathoms (L. A. Burry); Jupiter Inlet (ANSP); Biscayne Bay (T. McGinty). MEXICO: Progreso and Silam, Yucatan (both ANSP).

### *Conus jaspideus* Gmelin, Plate 6, fig. 1-4

*Conus jaspideus* Gmelin 1791, Syst. Nat. ed 13, p. 3387 (Locality unknown).

*Conus pusio* Hwass 1792 [in] Ency. Meth. Vers, 1, p. 710 (Santo Domingo; Martinique and Guadeloupe).

*Conus pealii* Green 1830, Trans. Albany Inst. 1, p. 123, pl. 3, fig. 3 (Key Vache [Vaca] Florida).

*Conus duwali* Bernardi 1862, Jour. de Conch. 10, p. 404, pl. 13, fig. 3 (Guadeloupe).

*Conus acutimarginatus* Sowerby 1866, Thesaurus Conchyliorum 3, p. 328, pl. 288, fig. 640-641 (Locality unknown).

*Conus beddomei* Sowerby 1901, Jour. of Malac. 8, p. 101, pl. 9, fig. 1 (West Indies).

*Conus boubeeae* Sowerby 1903, Jour. of Malac. 10, p. 76, pl. 5, fig. 5, (Locality unknown).



Plate 6. *C. jaspideus* Gmelin

Fig. 1. Off Sanibel Id., Florida (3×). Fig. 2 and 3. Little Duck Key, Florida (3×). Fig. 4. Caibarien, Cuba (3×).

*Description.* Shell small, hardly reaching 25 mm. in length. Whorls 9 to 10, moderately convex above and slightly concave below, producing a flattened sigmoid outline. Color of irregular patches of brownish-red, usually grouped sufficiently to indicate an arrangement into two spiral bands. Occasionally the brownish-red is considerably diffused which obscures the band formation. Under a lens there are usually present very small and somewhat lengthened dots of brown which are usually spaced by small white areas. The basic color of the shell is milky white. The spire usually has a series of brownish-red spots that follow along each whorl. The spire is concave, acute and finely carinated, the carinae being the acutely shouldered margin of each whorl. The spire is produced at an angle of about  $80^\circ$ . Aperture oblique and a little wider near the base. It is deeply inset above at the notch. The aperture, deeply within, is colored a dull brownish or brownish-purple. The outer lip is thin and convexly though flatly arched in profile except for the deeply inset notch. Sculpture consisting of a series of rather regularly spaced incised spiral lines or grooves which may or may not extend from the base to the shoulders of the body whorl. The ridges between are generally quite flat. Periostracum thin, axially striated and usually persisting as very fine axially striated threads in the depressions of the incised lines or grooves. On the spire the periostracum is coarser and in strongly though finely formed concave ridges. Occasionally there are exceedingly fine spiral striae on the spire, visible only under fairly strong magnification.

	length	width	whorls	
(large)	22.5	12.2 mm.	11	Little Duck Key, Florida
(average)	19.5	10.5	10	Cape Romano, Florida

*Types.* Both Gmelin and Hwass refer to the same figure in Martini (Conchy.-Cab. (1) 2, pl. 55, fig. 612), which we here select as the type figure. The figure is almost valueless, but the description by Hwass leaves little to be desired. We here restrict the type locality to Puerto Plata, Santo Domingo, one of the three islands originally given by Hwass.

*Common name.* The Jasper Cone.

*Remarks.* A widely distributed and somewhat abundant cone occurring mainly in the West Indian region. It extends up the west coast of Florida at least as far as Santa Rosa Island. *Conus pealii* Green is unquestionably this species. Green's figure was based upon a small and half grown specimen. His description, however, adequately describes *jaspideus*. It is related to both *stearnsii* Conr. and to *verrucosus* Hwass, particularly to the latter. See remarks under both of these species.

*Range.* Florida, the West Indies and from Mexico south to Venezuela.

*Records.* FLORIDA: Jupiter Inlet (ANSP); off Palm Beach in 18 to 20 fathoms (T. McGinty; ANSP); off Miami Beach in  $8\frac{1}{2}$  fathoms (J. Schwengel); Biscayne Bay (T. Bayer); Tavernier, Key Largo (MCZ); Lower Matecumbe Key (T. McGinty); Grassy Key and Bonefish Keys (B. R. Bales); Little Duck Key (B. R. Bales; T. Bayer; A. Koto); Big Pine Key (ANSP); Bahia Honda and Missouri Keys (T. McGinty); Sombrero Key (MCZ); Key West in 5 fathoms (MCZ); off American Shoals in  $3\frac{1}{2}$  fathoms (J. Schwengel); 20 miles off Marco (J. Schwengel); Bonita Springs (ex Mrs. G. R. Fearing); 4 to 6 fathoms off Sanibel Id. (MCZ; J. Schwengel); Gasparilla Id. (ANSP); 15 miles off Sarasota in 6 fathoms (W. A. Royce); 15-35 mi. off Ft. Walton in 13 to 19 fathoms (L. A. Burry). BAHAMAS: West End, Grand Bahama; Whale Cay Channel, Gt. Abaco; James Cistern, Eleuthera; Arthurstown, Cat Id.; Little San Salvador Id.; Simms, Long Id.; Matthewtown, Gt. Inagua (all MCZ). CUBA: La Chorrera, Havana; Bahia

Guadiana (both MCZ); Caibarien (P.J. Bermudez). HISPANIOLA: Puerto Plata (MCZ). VIRGIN IDS: St. John; St. Croix (ANSP); Virgin Gorda; Guana Id., Tortola (both M. Dewey). LESSER ANTILLES: St. John's Harbor, Antigua (ANSP). CARIBBEAN IDS.: (St. Andrew). MEXICO: off Isla Mujeres, Yucatan in 12 fathoms (C. G. Aguayo). GUATEMALA: Livingston (ANSP). VENEZUELA: Maiquetia (ANSP).

**Conus jaspideus pygmaeus** *Reeve*, Plate 7, fig. 1-2

*Conus pygmaeus* Reeve 1844, Conch. Icon. 1, pl. 47, fig. 260 (Locality unknown); Proc. Zool. Soc. London 1844, p. 179.

*Description.* Shell somewhat similar to typical *jaspideus* but differs by being proportionately wider at the shoulder, possessing somewhat more convex whorls and having the spire a little more concave. In addition, the color pattern differs somewhat by having the brownish patches formed generally in long axially arranged zig-zag bars.

	length	width	whorls	
(large)	27	15.2 mm.	11½	Couva Bank, Trinidad
(average)	20	10.2	10	Colón, Panama

*Types.* The holotype is in the Stainforth collection; its present location is unknown to me. As Reeve gave no type locality we here select Colón, Panama, a place where the species is known to occur.

*Common name.* The Pigmy Cone.

*Remarks.* This is a well marked subspecies of *jaspideus*, and limited, as far as our few records would indicate, to the lower Caribbean area. The axial color bars vary in width somewhat and are not always continuous. Interrupted spiral lines are generally present.

*Range.* Panama to Trinidad.



Plate 7. Fig. 1. *C. j. pygmaeus* Reeve, Couva Bank, Trinidad (3×). Fig. 2. *C. j. pygmaeus* Reeve, Colón, Panama (3×). Fig. 3 and 4. *C. largillierti* Kiener, Colón, Panama (nat. size). Fig. 5. *C. largillierti* Kiener, Cartagena, Colombia.

*Records.* PANAMA: Colón (MCZ). LESSER ANTILLES: 3 fathoms of Point-à-Pierre; Couva Bank, Gulf of Paria, Trinidad (both H. G. Kugler). COLOMBIA: Cartagena; Santa Marta (both MCZ).

**Conus verrucosus** *Hwass*, Plate 8, fig. 1-4

*Conus verrucosus* *Hwass* 1792, [in] *Bruguière, Ency. Meth. Vers*, **1**, p. 708 (Africa).

? *Conus puncticulatus* *Hwass* 1792, [in] *Bruguière, Ency. Meth. Vers*, **1**, p. 702 (Santo Domingo, Guadeloupe and Martinique).

*Conus nodiferus* *Kiener* 1849, *Icon. Coquilles Vivantes* **2**, p. 228, pl. 100, fig. 4 (Seas of the Indies).

*Conus echinulatus* *Kiener* 1849, *Icon. Coquilles Vivantes* **2**, p. 270, pl. 105, fig. 2 (Locality unknown).

*Conus papillosus* *Kiener* 1849, *Icon. Coquilles Vivantes* **2**, p. 271, pl. 72, fig. 4 (Locality unknown); *non* *Tate* 1890.

*Conus sticticus* *A. Adams* 1854, *Proc. Zool. Soc. London for 1853*, p. 117 (Locality unknown). [According to *Tomlin* this is a smooth form of *verrucosus*. It could be as well the same for *jaspideus*. The type is in the British Museum and has never been figured.]

*Conus anaglypticus* *Crosse* 1865, *Jour. de Conch.* **13**, p. 314, pl. 11, fig. 8-8a (Antilles); *Sowerby* 1866 (as *anaglyptus*).

*Description.* Shell small to medium in size, usually not more than 25 mm. in length. It is solid and strong. Whorls 10 to 11 which are nearly flat sided. Most specimens show a slight concavity near the base. Others are faintly and flatly sigmoid. Nuclear whorls (2) slightly papillose. Color of shell generally a suffused pinkish-brown with darker brown and irregular blotches somewhat axially arranged as an overlay. The color, however, is quite variable and many specimens have a material reduction in the size and position of the darker color blotches. Periostracum thin, silken and minutely axially striated. On the spire the periostracum forms crescent shaped blades somewhat more widely spaced than is usual. Spire somewhat elevated, slightly concave and acute, produced at an angle of about 70°. Aperture oblique, somewhat wider at the base and deeply inset above. In profile, the outer lip is strongly convex with a deep recurve at the notch above. The outer lip is thin and finely crenulated. Sculpture of many spiral, incised lines producing some-



Plate 8. *Conus verrucosus* *Hwass*

Fig. 1, 2 and 4. Puerto Plata, Hispaniola (3×). Fig. 3. Tobago Id. (with covering of periostracum, 3×).

what rounded ridges between them. On each ridge there is a series of pustules or small rounded knobs that are quite regularly disposed. The spire is minutely nodulose as well as carinated, the pustules or nodules appearing on the carina. In the depressed incised lines on the body whorl there are very many fine axial threads which are strongest near the lines on the base of the shell and can be seen best under a 14 power lens.

	length	width	whorls	
(large)	24	12 mm.	11	Puerto Plata, Santo Domingo
(average)	19	10.2	10	Hillsborough Reef, Florida

*Types.* We here select pl. 55, fig. 612c in Martini, Conchy.-Cab., (1) 2, 1773, as the type figure which was referred to by Hwass. We also select Puerto Plata, Santo Domingo as the type locality.

*Common name.* The Warty Cone.

*Remarks.* An exceedingly attractive cone that does not appear to be at all common. It occurs at low water and out to a few fathoms, generally living in protected areas under stones and coral blocks. Young specimens may be without the small pustulations. It is apparently closely related to *C. jaspideus* Gmelin but can be differentiated easily from that species by the usually strong pustulations which are spirally disposed along the areas between the incised spiral lines.

*Range.* Southern Florida, Bahama Islands and south through the West Indies. It very probably occurs on the coast of both Central and northern South America but our meager records from this area are limited to Panama.

*Records.* FLORIDA: off Palm Beach in 8 to 10 fathoms (J. Schwengel; ANSP) and 50 fathoms (T. McGinty); Hillsborough Inlet (T. Bayer; L. A. Burry; A. H. Patterson); Tortugas (L. A. Burry). BAHAMAS: Sweetings Village, Gt. Abaco; Stranger Cay, Little Abaco; West End, Grand Bahama; Mangrove Cay, Andros; Savannah Sound, Eleuthera; Arthurstown, Cat. Id.; Little San Salvador Id.; Clarendetown, Long Id.; Cat Cay, Bimini Ids.; Matthewtown, Gt. Inagua (all MCZ); Nassau, New Providence (A. H. Patterson). CUBA: Cayo Frances, Caibarien (P. J. Bermudez). HISPANIOLA: Puerto Plata; Monte Cristi; Puerto Sosua (all MCZ). VIRGIN IDS.: Guana Id., Tortola (M. Dewey); St. Thomas (ANSP). LESSER ANTILLES: St. Martin (ANSP); Tobago; Trinidad (both MCZ). PANAMA: Ft. Sherman (MCZ); Colón (ANSP).

### **Conus verrucosus piraticus**, new subspecies, Plate 11, fig. 1

*Description.* Shell similar in general outline to *verrucosus* but differs in having the pustules smaller, being white to yellow-mottled, possessing papilliform nuclear whorls and having spiral threads on the whorls of the spire. The pustules are formed on a raised thread rather than on a ridge between incised lines as is generally found in *verrucosus*.

length	width	whorls	
19	10 mm.	10	Holotype
12.8	7.2	8	Paratype

*Types.* Holotype in the McGinty collection (Boynton Beach, Florida) dredged off Singer's Hotel, Palm Beach, Florida in 33 fathoms, T. McGinty collector. Paratypes in the collection of A. H. Patterson and the MCZ, from a wreck, off Carysfort Reef, Florida, in 10 fathoms, A. H. Patterson collector, April 1941.

*Common name.* The Pirate Cone.



*Remarks.* I have provisionally considered this as a subspecies of *verrucosus*. More material may indicate this to be a full species and possibly related to *flavescens* rather than to *verrucosus*.

Parallels in sculpture are more than abundant in mollusks and this character considered alone indicates a relationship which is probably only superficial. The significant differences appear to be papilliform nuclear whorls and the presence of spiral threads on the whorls of the spire, characters not present on any specimen of *verrucosus* that I have examined. Also the present form appears to have a very small notch and as a consequence the growth lines on the spire are nearly parallel with the axis rather than strongly concave as on species where the notch and subsequent growth lines are concave.

*Range and Records.* Known only from three specimens, the localities of which are cited above under *Types*.

### **Conus stimpsoni** Dall, Plate 5, fig. 5

*Conus stimpsoni* Dall 1902, Proc. United States Nat. Mus. 24, p. 503, pl. 29, fig. 7 (off Key West, Florida in 60 fathoms).

*Description.* Shell medium in size, probably reaching 40 mm. in length. It is light in structure but strong. Color yellowish-salmon, the color in three rather faint spiral bands, one at the base, a mid band and one at the top of the body whorl. The two narrow areas between the bands, a pale yellow or white. Entire spire yellowish-salmon. Whorls 12 to  $12\frac{1}{2}$ , the body whorl weakly sigmoid in outline. Spire moderately elevated and slightly concave, forming an angle of about  $87^\circ$ .<sup>1</sup> Early whorls below nuclear whorls (2) smooth or finely beaded along a small but well pronounced carina. Sculpture consisting of rather deeply incised spiral lines. On the main part of the body whorl the incised lines may disappear and fine spiral threads occur. There are several rather indistinct low ridges, axially arranged, that appear stronger on the mid area of the body whorl. The spire has a few exceedingly fine spiral threads on the top of each whorl. Periostracum yellowish, fine and silken and minutely striated axially. On the spire the periostracum is coarser, formed in concave axial ridges which, in addition, may form two rows of suberect "hairs." These hair-like processes are small and follow one another on each ridge appearing in spiral formation. Operculum exceedingly small, being 3 mm. long or one-seventh the length of the aperture in one specimen examined.

length	width	whorls	
37	19 mm.	12 <sup>2</sup>	Holotype
38	21.5	12	off Delray, Fla.
26.5	13.5	12 $\frac{1}{2}$	off Palm Beach, Fla.

*Types.* Holotype, United States Nat. Mus. no. 107371, off Key West, Florida in 60 fathoms. Collected by the *Albatross*.

*Common name.* Stimpson's Cone.

<sup>1</sup>The angle of the spire is apt to change materially as an individual increases in size. This is due to a change in the curvature, i.e., the curve of the spire may increase or decrease as the shell matures depending upon the species. In this way young specimens may possess a very acute spire while upon maturity the spire may actually become obtuse. The angle is obtained from the shoulder of the whorl to the summit and down to the shoulder again.

<sup>2</sup>Probably a loss of one or more whorls.

*Remarks.* The few specimens I have been fortunate enough to examine agree in all essential details with Dall's description. The only differences that I note are the presence of the faint axial ridges on some specimens and the occasional change of the incised lines to threads above the base. The periostracal outgrowths that form the little "hairs" on the spire are a little different in structure from anything that I have seen in the Western Atlantic species. The great rarity of this form is probably due to its occurring on or along rocky reefs in fairly deep water.

*Range.* Lower Florida between Palm Beach and Key West.

*Records.* FLORIDA: Off Key West in 60 fathoms (W. H. Dall, 1902); off Delray in 80 fathoms (F. B. Lyman, ex T. Van Hyning); off Palm Beach in 60 fathoms (T. L. McGinty); Tortugas in 4 to 5 fathoms (L. A. Burry).

### *Conus largillierti* Kiener, Plate 7, fig. 3-5

*Conus largillierti* Kiener 1848, Icon. Coquilles Vivantes 2, p. 212, pl. 98, fig. 3 and pl. 101, fig. 1-1a (Mexico).

*Conus japonicus* Sowerby 1858, Thesaurus Conchyliorum, 3, p. 14, pl. 202, fig. 376; non Hwass 1792.

*Conus largillardii* Weinkauff 1874 [err. typ.] Conchy.-Cab. (2) 4, pt. 2, p. 266, pl. 44, fig. 9. (Mexico, Atlantic side).

*Description.* Shell medium in size, probably reaching 40 mm. in length. It is fairly thin but strong. Whorls 11 to 12, nearly flat-sided to slightly sigmoid. Color consisting of a series of spiral dots of brownish-orange, not always uniform, but with occasional groups of spots that have coalesced. Occasionally several of these spots merge to form long axial bars of color. Spire generally strongly concave. The spire is produced at an angle of about 100°. Aperture oblique, narrow and moderately inset above. Sculpture consisting of numerous spiral threads which are more strongly developed towards the base. Periostracum and operculum unknown.

	length	width	whorls	
(large)	39.8	19 mm.	12	Colón, Panama
(average)	33.2	16.2	11½	Colón, Panama

*Types.* The exact location of the type specimen is unknown. Though Kiener gave "Mexico" as the type locality, I suspect that the original specimen was probably collected on the lower Central American coast, perhaps in Panama.

*Common name.* Largilliert's Cone.

*Remarks.* This species is superficially similar to young specimens of *C. spurius atlanticus*. It differs, however, in many of its basic characters such as its much smaller size, its more slender outline, its more extended and pointed apex and its color pattern. In addition, it possesses the sculpture of spiral threads which usually are found over all of the body whorl. In general appearance it is also close to *C. floridanus floridensis* Sby. which it approximates in size and somewhat in color pattern. It differs from that species by possessing rather strong spiral ridges, a character almost lacking in *floridensis* other than at the base of the shell. It seems to me, on the basis of all of its characters, to be nearest to the next species. It is rare and, as far as is now known, limited to the southern Caribbean.

*Range.* Panama and Colombia.

*Records.* PANAMA: Colón (ANSP). COLOMBIA: Cartagena (MCZ).

**Conus mazei** Deshayes, Plate 9, fig. 1-2

*Conus mazei* Deshayes 1874, Jour. de Conch. **22**, p. 64, pl. 1, fig. 1 (Martinique); W. H. Dall 1889, Bull. Mus. Comp. Zoöl. **18**, p. 67.

*Description.* Shell about 60 mm. in length, exceedingly narrow and rather thin. Whorls 11 to 12, nearly flat-sided, the nuclear whorls smooth, the remainder sculptured. Color consisting of a series of small dots or squares arranged in 8 to 10 spiral rows. Occasionally the spots are enlarged and become diffused and mottled. Spire extended, smoothly and moderately concave with a series of nodules at the base of each whorl. Body whorl long, shouldered and strongly nodulose at the shoulder margin. Aperture oblique, long and narrow and rather deeply inset at its upper margin. Sculpture of numerous flattened ribs, separated by shallow grooves which are cut at right angles (axially) by deeper grooves. The shouldered portion of each whorl has 4 to 6 raised spiral threads which continue on the shoulder of each whorl to the nuclear whorls. Operculum and periostracum unknown; the latter, however is probably thin.

length	width	whorls	
59	16 mm.	12	Holotype
48	14	11	off Cayo Coco, Cuba
54.5	15	12	off Matanzas, Cuba

*Types.* I have no information as to the present location of the holotype. The type locality is the island of Martinique.

*Common name.* Maze's Cone.

*Remarks.* Little can be added to the history of this rather remarkable species. It has been dredged in 92 to 240 fathoms, the deeper records all from the north coast of Cuba. According to Dall (reference above) the present species is closely allied to *C. orbigny* Audouin, a species believed to occur in China.

*Range.* Known from Cuba, the Virgin Islands and the Lesser Antilles, but will probably be found in many areas of the West Indian region in deep water.

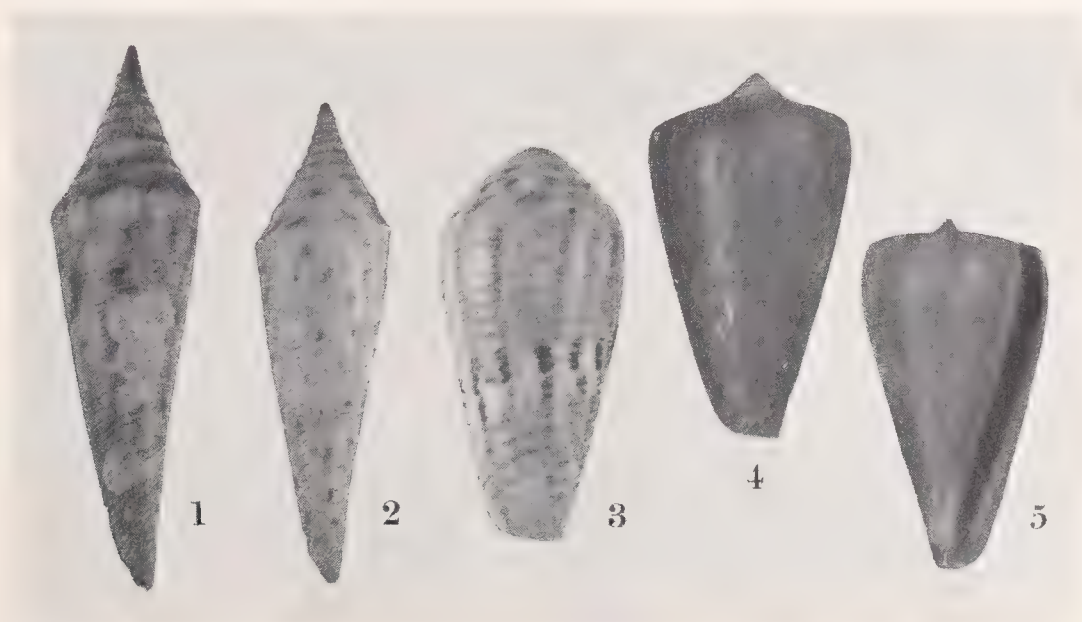


Plate 9. Fig. 1. *C. mazei* Deshayes, off Matanzas, Cuba (nat. size). Fig. 2. *C. mazei* Deshayes, off Cayo Coco, Cuba (nat. size). Fig. 3. *C. granulatus* Linné, Watlings Id., Bahamas (nat. size). Fig. 4. *C. daucus* Hwass, Nassau, Bahamas (nat. size). Fig. 5. *C. daucus* Hwass, off Palm Beach, Florida (nat. size).

*Records.* CUBA: The following Cuban records were all obtained by the *Atlantis*: Station 3460 (N. Lat. 23° 05'; W. Long. 81° 31') off Matanzas in 240 fathoms, May 1939; Station 3415 (N. Lat. 22° 51' 30"; W. Long. 78° 55' 30") off Punta Alegre, Santa Clara Prov. in 225 fathoms, March 1938; Station 3391 (N. Lat. 22° 34'; W. Long. 78° 14') off Cayo Coco, Camaguey Prov. in 220 fathoms, April 1939. VIRGIN ISLANDS: *Blake* Station 132, off St. Croix in 115 fathoms. LESSER ANTILLES: Martinique (Deshayes); *Blake* (no station number) off Barbados in 100 fathoms; *Blake* Station 262, off Grenada in 92 fathoms.

### *Conus granulatus* Linné, Plate 9, fig. 3

*Conus granulatus* Linné 1758, Sys. Nat. ed. 10, p. 716 (O. Africano); Gmelin 1791, Sys. Nat. ed. 13, 1, pt. 6, p. 3391; *non granulatus* Röding 1798; Borson 1830; Sowerby 1834.

*Conus verulosus* Hwass 1792, [in] Bruguière, Ency. Meth. Vers, 1, p. 719 (Seas of America).

*Description.* Shell medium in size, probably reaching 50 mm. in length. Whorls 8 to 10 and faintly sigmoid in outline. Color white with two rather broad irregular pinkish bands separated by a narrow white band in the mid area. Irregular brownish blotches margin the white area and occur elsewhere as spots, particularly near the base of the shell. Irregular brownish spots more or less regularly disposed on each whorl. Spire obtuse with each whorl strongly convex. Aperture oblique and not deeply inset above. Sculpture of numerous and rather deeply incised grooves, the areas between them as flattened ridges. Whorls on the spire with 3 or 4 spiral threads. Periostracum and operculum unknown.

length	width	whorls	
39	18.5 mm.	6 (remaining)	Watlings Id., Bahamas
31	15	8	West Indies

*Types.* Among the several references cited by Linné, we here select that of Gaultieri 1742, pl. 25, fig. H, for the type figure. Gmelin refers in addition to Martini 1773, Conchy.-Cab. (1), 2, pl. 52, fig. 575, which, though not so good a figure as that by Gaultieri, does certainly represent the species. Martini properly assigned it to the American Indies. The only localized West Indian specimens that we have seen came from Watlings Island, Bahama Islands and Jamaica. We here select this latter island for the type locality as it is near the center of its range.

*Common name.* The Granulated Cone.

*Remarks.* This is a very remarkable species and quite different from any other species occurring in the Western Atlantic. Nothing is known about its life history. I have seen but three specimens and upon these the above description was based. It probably occurs in water of some depth, possibly 10 or more fathoms and only a very occasional example is washed up above the tide line. It has been stated that this species has a granulated surface which originally gave Linné the suggestion for the name. The four specimens I have examined possess only the strong spiral sculpture.

*Range and Records.* Probably occurring throughout the West Indies, from the Bahamas and south to the coast of South America. Weinkauff (Conchy.-Cab. (2) 4, pt. 2) states that it occurs at Antigua (Lesser Antilles) Surinam and Brasil. We have an additional record from 2 miles off Fort Lauderdale, Florida, in 35 fathoms. This is a small, dead shell. It was dredged by W. A. Burry during August 1939. A single specimen.

**Conus spurius** Gmelin, Plate 10, fig. 4-5

*Conus spurius* Gmelin 1791, Sys. Nat. ed. 13, p. 3396 (Locality unknown).

*Conus proteus* var. B. Hwass 1792, [in] Bruguière, Ency. Meth. Vers, 1, p. 682 (Santo Domingo and Guadeloupe).

*Conus leoninus* Hwass 1792, [in] Bruguière, Ency. Meth. Vers, 1, p. 683 (Mexico to Brasil); *non leoninus* Gmelin 1791.

*Cucullus ferugineus* Röding 1798, Museum Boltenianum p. 41.

*Cucullus syriacus* Röding 1798, Museum Boltenianum p. 41.

*Cucullus quadratus* Röding 1798, Museum Boltenianum p. 41.

*Conus ochraceus* Lamarek 1810, Ann. Mus. Nat. Hist. Paris, 15, p. 275 (Locality unknown); Sowerby 1866, Thesaurus Conchyliorum 3, pl. 204, fig. 432 (West Indies). [If correctly portraying Lamarek's species which was unfigured, Sowerby's illustration shows a specimen of *spurius* in which the spiral lines of spots have coalesced to form two solid spiral bands.]

*Conus characteristicus* Dillwyn 1817, Desc. Catal. Recent Shells 1, p. 367 (St. Bartholomew).

**Description.** Shell 40 to 60 mm. in length, solid and ornamented with many spiral rows of orange or chocolate-brown spots or irregular squares. These spots usually coalesce in part, both above and below the mid area, to form two irregular and somewhat obscure spiral bands. Spire moderately elevated and strongly concave. Aperture oblique and relatively narrow. Outer lip thin. Sculpture of fine growth lines and crossed occasionally by very fine threads. Periostracum a dull straw yellow, thin with the color pattern showing through. Operculum long and narrow and crossed with fine, sinuous growth lines.

	length	width	whorls	
(large)	53.3	32 mm.	11	Tortola, Virgin Ids.
(average)	42.5	25	10½	Gt. Inagua, Bahamas

**Types.** The type figure of *spurius*, here selected, is that of Gaultieri 1742, Index Testarum Conchyliorum, pl. 21, fig. D. Reference to this plate and figure is given by both Gmelin for *spurius* and by Hwass for *leoninus*.

**Common name.** Chinese Alphabet (West Indian form).

**Remarks.** (See also under *C. spurius atlanticus*). It is exceedingly unfortunate that the well known name of *proteus* Hwass, long used for this species, must be changed to *spurius*

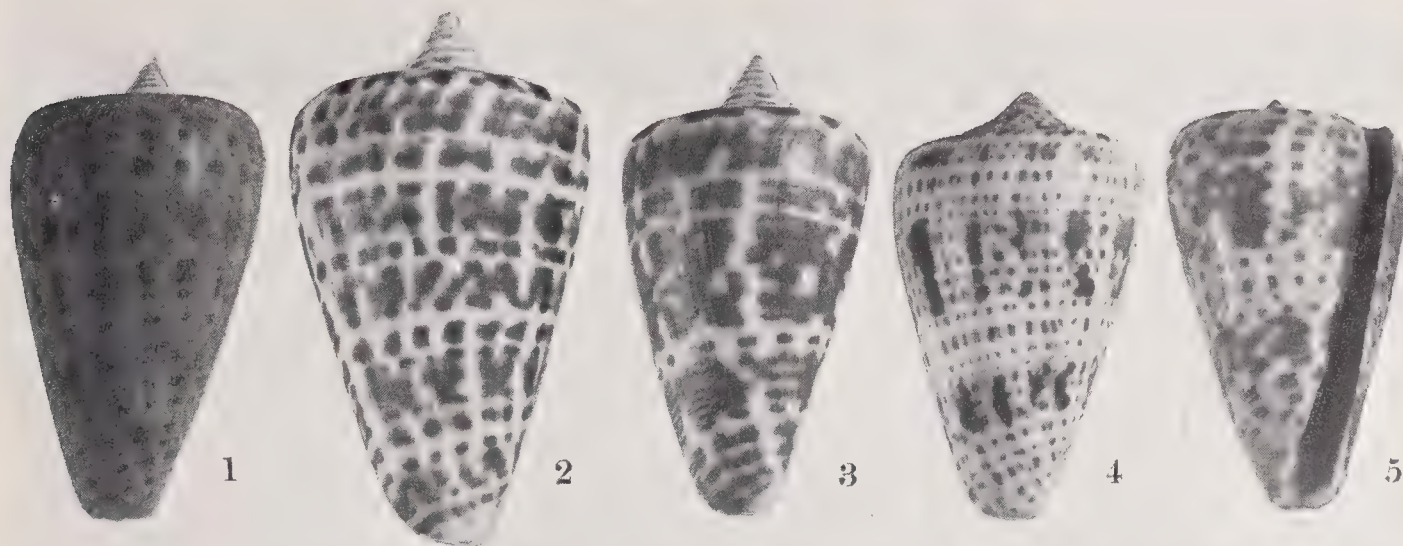


Plate 10. (All natural size). Fig. 1. *C. s. atlanticus* Clench, Bonita Springs, Florida. Fig. 2. *C. s. atlanticus* Clench, Marco Id., Florida. Fig. 3. *C. s. atlanticus* Clench, Ragged Keys, Biscayne Bay, Florida. Fig. 4. *C. spurius* Gmelin, Monte Cristi, Hispaniola. Fig. 5. *C. spurius* Gmelin, Matthewtown, Gt. Inagua, Bahamas.

Gmelin, which has one year priority. This refers to the variety "B" of Hwass. His variety "A" under *proteus* is credited to the "Asiatic Ocean" and he cites Rumphius (Thesaurus Piscium Testaceorum, 1739, pl. 34, fig. M) for his figure of variety "A," which was apparently based on an East Indian species of *Conus*. As a consequence, the name *proteus* Hwass, if eventually retained, will refer to an Indo-Pacific species.

*Conus spurius* appears to be quite rare in the West Indies to judge by the few specimens available for study. So far as our records would indicate, it is limited entirely to the islands of the West Indies and does not reach the continental coast line.

*Range.* Bahamas and south through the Greater Antilles.

*Records.* BAHAMAS: Marsh Harbor, Gt. Abaco; Matthewtown, Gt. Inagua. HISPANIOLA: Santa Barbara de Samana; Monte Cristi; Puerto Plata. VIRGIN IDS. Tortola; St. Johns; St. Thomas. (all MCZ).

### ***Conus spurius atlanticus*, new subspecies, Plate 10, fig. 1-3**

*Conus proteus* (in part of authors, not Hwass 1792).

*Description.* Shell 60 to 80 mm. in length, solid and strong. Whorls 10-12, sometimes offset to form a shoulder. Color consisting of a series of small orange dots, squares or oblongs arranged in a spiral pattern. Occasionally these markings coalesce forming bands that are more or less regularly delimited. Outer lip thin and straight though somewhat thickened within. Aperture oblique and narrow. Spire generally much depressed and deeply concave. Sculpture of fine growth lines that are crossed by exceedingly spiral lines. Periostracum a dull straw yellow, rather thin, exposing the color pattern below. Operculum narrow and nearly one-half the length of the aperture. It is crossed by fine sinuous growth lines.

	length	width	whorls	
(large)	80	47 mm.	13	Grove City, Florida
(average)	65	38	12	Lemon Bay, Florida

*Types.* Holotype. Mus. Comp. Zoöl. no. 140787, Bonita Springs, Florida, Mrs. J. F. Reahard collector, 1935. Paratypes from the same locality and from the following places in Florida: Sanibel Island; Lemon Bay; Naples; Gasparilla Sound; Grove City; Fort Myers Beach; Marco Island.

*Common name.* The Florida Chinese Alphabet.

*Remarks.* None of the names considered as synonyms of *spurius* refer to the continental form which occurs rather abundantly on the west coast of Florida. Though the relationship appears exceedingly close between *spurius* and *atlanticus*, we can readily differentiate most of the specimens examined.

The band formation on *spurius* is always present and rarely so on *atlanticus*. In formation, the bands on *spurius* consist of irregular groupings of the spots which tend to form patches of solid color, while on *atlanticus* the spots are more or less evenly grouped, even to forming solid areas that are quite regular.

*C. s. atlanticus* occurs on sand bars, grass covered flats and even the margins of mangrove swamps as long as the water is not brackish. It occurs from low water to 20 fathoms.

*Range.* Florida, southern Mexico and south to Venezuela along the coast of Central America.

*Records.* FLORIDA: Ragged Keys, Biscayne Bay (L. A. Burry); Cape Florida, Biscayne Bay; Carysfort Reef; Key West (all MCZ); Boca Chica Key; Key Vaca; Marquesas Key (all J. Schwengel); Duck Key (ANSP); Bonefish Key; Little Duck Key (both T. McGinty); Bonita Springs (L. A. Burry); Coney Id., Tampa Bay; Grove City; Punta Rassa; Sanibel Id.; Captiva Id.; Lemon Bay; Naples (all MCZ); Marco (T. McGinty); Cape Romano; Estero Bay; Hickory Pass; Little Gasparilla Id.; Boca Grande; Sarasota Bay (all ANSP); off Destin in 14 to 20 fathoms (T. McGinty). MEXICO: Vera Cruz (M. E. Bourgeois); *Blake* Station 38 (1877) Campeche Bank (N. Lat. 23° 10', W. Long. 88° 35') in 20 fathoms. PANAMA: Colón (ANSP). COLOMBIA: Cartagena (ANSP). VENEZUELA: Cumana (MCZ).

### *Conus clerii* Reeve, Plate 11, fig. 2

*Conus clerii* Reeve 1844, Conch. Icon. 1, pl. 43, fig. 229 (Cape St. Thomas, Brasil); Proc. Zool. Soc. London, 1843 [1844] p. 175.

*Description.* "Shell turbinated, sharply angled round the upper part, rather thin, very finely ridged over the entire surface; white, somewhat irregularly variegated with longitudinally waved brownish streaks; spire rather depressed, slightly canaliculated, apex raised and pointed."

length	width	
32	15 mm.	(Reeve's figure)

*Types.* The holotype is in the British Museum, originally from the Cuming collection. Type locality, Cabo de São Thomé, Brasil, in 35 fathoms. Collected by Commander Clery of the French Navy.

*Common name.* Clery's Cone.

*Remarks.* The description above is copied directly from Reeve. This species has not been obtained since the original specimen was collected off Brasil by Commander Clery. Dall's statement that *C. villepinii* "is very close to and possibly identical with *C. cleryi*" [sic] is wholly in error. The two differ not only in color pattern but also by possessing very different spires.

*Range and Records.* Known only from type locality.

### *Conus daucus* Hwass, Plate 9, fig. 4-5

*Conus daucus* Hwass 1792 [in] Bruguière, Ency. Meth. Vers, 1, p. 651, var. A (Seas of America, the Islands of Santo Domingo, Guadeloupe and Martinique).

*Conus mamillaris* Green 1830, Trans. Albany Inst. 1, p. 123, pl. 3, fig. 6 (Florida).

*Conus arausiensis* 'Chemnitz' Reeve 1843, Conch. Icon. 1, pl. 20, fig. 114 (Seas of America).

*Conus daucus luteus* Krebs 1864, The West Indian Marine Shells p. 4. [Nude name. This form is probably only a light color phase of *C. daucus*.]

*Description.* Shell 35 to 50 mm. in length, solid and colored a brownish orange. There is usually a narrow, light band across the mid area and rarely one just below the upper margin of the whorl. Whorls 10 to 11 and nearly flat sided. Outer lip thin and straight. Aperture narrow and oblique and colored within the margin with a band of pinkish brown. Spire short, depressed and smoothly concave. Sculpture consisting of very fine and irregular growth lines which may be crossed by exceedingly fine and irregular spiral threads. Near the base of the shell there are 6 to 8 stronger spiral threads visible to the unaided eye. Periostracum is very thin, patchy even in live material and usually remains as low, erect, longitudinal, blade-like ridges. Along the basal threads the periostracum produces a series of low hair-like processes.

	length	width	whorls	
(large)	51	29 mm.	11	West Indies
(average)	45	25	10	Barbados
(small)	38	20	11	Nassau, Bahamas

*Types.* Hwass referred to Chemnitz 1788, Conchy.-Cab. (1) 10, pl. 144 A, fig. L, which is here selected as type figure. Also the island of Guadeloupe is here selected for the type locality from among several given by Hwass.

*Common name.* The Carrot Cone.

*Remarks.* A rather rare species owing to its preference for fairly deep water. Occasional specimens are cast up on the beach but live material occurs, as far as we know, only below the low water line. Published records of these species occurring in the Indo-Pacific area are certainly open to question.

*Range.* Florida, Bahamas and south through the Lesser Antilles.

*Records.* FLORIDA: off St. Marks in 20 fathoms (F. M. Bayer); 100 miles off Cedar Keys in 20 fathoms (J. Schwengel); off Palm Beach in 60 fathoms (T. McGinty). BAHAMAS: Nassau, New Providence (A. H. Patterson); Bimini Ids. (W. A. Royce); Matthewtown, Gt. Inagua (MCZ). CUBA: Blue Beach, Guantanamo Naval Base (MCZ). VIRGIN Ids.: St. Croix; St. Thomas (both ANSP). JAMAICA: (MCZ). LESSER ANTILLES: Bridgetown, Barbados (ANSP); Blake Station 272, off Barbados in 76 fathoms (dead). CARIBBEAN ISLANDS.: Swan Island (MCZ).

### *Conus flavescens* Sowerby, Plate 11, fig. 3

*Conus flavescens* 'Gray' Sowerby 1834, Conchological Illustrations, pt. 55, fig. 68; Sowerby 1858, Thesaurus Conch. 3, pt. 18, pl. 200, fig. 305 (South Australia).

*Description.* Shell small, rarely exceeding 25 mm. in length. It is strong and fairly solid. Whorls 11 to 12 and flat sided to slightly convex. Color white with a suffusion of pale brownish yellow, brownish orange or yellow bands leaving but a small mid area of white. This area may be invaded irregularly by the band above or below. A few speci-



Plate 11. Fig. 1. *C. v. piraticus* Clench, off Palm Beach, Florida (Holotype, 2×). Fig. 2. *C. clerii* Reeve (after Reeve, 1½×). Fig. 3. *C. flavescens* Sowerby, off Hillsborough Light, Florida (2×). Fig. 4. *C. caribbaeus* Clench, off Palm Beach Co., Florida (Holotype, 1½). Fig. 5. *C. caribbaeus* Clench, Nassau, Bahamas (Paratype, 1½×).



mens possess this color as blotches leaving areas of white between them. Spire usually depressed, non carinated, obtuse and with the two nuclear whorls papilliform. The spire is formed at an angle of about  $105^\circ$  to  $110^\circ$ . Aperture oblique and rather uniform in width throughout its length. It is not deeply inset above. Outer lip thin and convexly arched in profile. Sculpture limited to 10 to 12 finely incised lines near the base of the cone. Axial growth lines fine and relatively inconspicuous. No spiral threads on the spire. Periostracum probably thin. Operculum unknown.

	length	width	whorls	
(large)	25	13 mm.	11	Grand Bahama Id., Bahamas
(average)	21.8	12	10	“ “ “ “

*Types.* Sowerby gave "South Australia" as the locality, which is very probably an error as stated below. I am inclined to believe that the original specimens may have come from the Bahamas, the only area where this species appears to be at all common.

*Common name.* The Bahama Cone.

*Remarks.* We have specimens that agree exactly with Sowerby's excellent colored plate. His locality of "South Australia" as published in the Thesaurus was probably a guess rather than a statement of fact. It is not listed by Verco (1935, Combing the South Seas, Adelaide) among the species occurring in South Australia.

In relationship it appears nearest to *C. daucus*, differing in its yellowish and orange coloration and its very much smaller size and possessing papilliform nuclear whorls. This latter characteristic is found only on live or very "fresh" specimens.

*Range.* Southern Florida, Bahamas and probably the Greater Antilles.

*Records.* FLORIDA:  $8\frac{1}{2}$  fathoms off Miami Beach (J. Schwengel); Key West, 3 to 4 feet below low tide; off Hillsborough Light, Broward Co., in 50 fathoms (L. A. Burry). BAHAMAS: Eight Mile Rock and West End, Grand Bahama Id. (MCZ); Nassau, New Providence (A. H. Patterson); Bimini Ids. (W. A. Royce). CUBA: Pueblo Nuevo, Matanzas Bay (P. J. Bermudez).

### **Conus caribbaeus**, new species, Plate 11, fig. 4-5

*Description.* Shell medium in size, probably reaching a length of 35 mm. Whorls 11 to 12, regularly increasing in size and flat-sided. Color a grayish white overlaid with a dull and pale yellowish periostracum. Spire rather depressed, slightly concave and finely carinated. Nuclear whorls papilliform. Aperture narrow and oblique, a little wider near the base of the shell and rather deeply inset above. Sculpture consisting of a few, usually 8 to 10, incised lines near the base, the remaining part of the body whorl smooth except for the very fine axial growth lines. Spire with exceedingly faint spiral threads, occasionally absent. Concave growth lines fairly strong on the spire. Periostracum fine and minutely axially striated. Operculum unknown.

	length	width	whorls	
(average)	31	15 mm.	$11\frac{1}{2}$	Holotype
(large)	33.5	18.5	11 (remaining)	Nassau, Bahamas
(small)	23	12.2	10	“ “ “

*Types.* Holotype, Mus. Comp. Zoöl. No. 138333, off Palm Beach Co., Florida. Frank Lyman collector (ex B. R. Bales). Paratypes from "Nassau," New Providence, Bahamas, in the collection of F. M. Bayer and A. H. Patterson.

*Range and Records.* Known only from off Palm Beach Co., Florida and New Providence, Bahamas.

**Conus centurio** *Born*, Plate 12, fig. 1

*Conus centurio* Born 1780, Testacea Musei Caesarei Vindobonensis p. 153, pl. 7, fig. 10 (Locality unknown); Dall, W. H. 1889, Bull. Mus. Comp. Zoöl. 18, p. 69.

*Description.* Shell medium in size, reaching probably about 50 mm. in length. Color white with three band areas of yellowish orange. These bands are not solid but are composed of irregular patches of color which, in addition, have a few zig-zag lines connecting them. Whorls  $9\frac{1}{2}$  to 10, regularly increasing in size and nearly flat sided. Spire depressed, obtuse and produced at an angle of about  $110^\circ$ . Each whorl on the spire is rather deeply concave. Aperture oblique and not very deeply inset above. Sculpture consisting of 12 to 15 rather strong spiral threads toward the base of the shell, usually with a fairly deep incised line or groove separating them. No spiral threads observed on the whorls of the spire. Periostracum and operculum unknown.

length	width	whorls					
43.2	24.1 mm.	$9\frac{1}{2}$ (remaining)	Puerto Plata,	Santo Domingo			
32.5	19	9	“	“	“	“	“

*Types.* The type figure is that of Born given above. According to F. Brauer, most of Born's types are still preserved in the Vienna Museum (F. Brauer, Sitzungs. Akad. Wissens. 77, pt. 1, pp. 117-192, 1878). *C. centurio* Born is listed on p. 146 in the above. As Born gave no locality, Puerto Plata, Santo Domingo, is here selected as the type locality.

*Common name.* The Centurion Cone.

*Remarks.* Very little can be added about this species. It was dredged in about 5 fathoms in the small harbor of Puerto Plata. Its relationships are not clear but it appears to be nearest to *caribbaeus* herein described. The nuclear whorls are missing but the general spire contour would indicate their possible presence in live material.

*Range and Records.* Known only from the type locality. I have not seen the specimens referred to by Dall.

**Conus brasiliensis**, new species, Plate 12, fig. 2

*Description.* Shell relatively thin and small, probably reaching a length of 25 mm. Color a mottled reddish brown formed in two bands separated by mid area of white which is as well invaded by smaller patches of brownish red. Whorls 8 (remaining) and nearly flat sided. Spire depressed, obtuse, produced at an angle of about  $125^\circ$  and possessing fine spiral threads. Aperture oblique with a thin outer lip and a shallow notch above. Sculpture of 6 to 8 small spiral threads near the base of the shell. Remaining shell surface smooth except for the very fine axial growth lines. Operculum and periostracum unknown.

length	width	whorls	
22.2	13 mm.	8 (remaining)	Holotype

*Types.* Holotype, Mus. Comp. Zoöl. no. 146894, Victoria, Brasil. Thayer Expedition, Hartt and Copeland collectors, 1865-1866. Two slightly smaller paratypes from the same locality.

*Remarks.* This new species appears to be quite different from any so far described from the Western Atlantic, mainly on the basis of its distinctive color pattern. It was collected over 80 years ago by Agassiz's party of naturalists during the Thayer Expedition.

It is to be remembered that comparatively little work has been done along the vast Brazilian coast line. Though mainly West Indian in the character of its fauna, there are many species known from this region that appear only in the southern Caribbean or to the south of it. More collecting will certainly bring to light many new species.

*Range and Records.* Known only from the type locality.

**Conus villepinii** Fischer and Bernardi, Plate 12, fig. 3; Plate 13, fig. 5

*Conus villepinii* Fisch. and Bern. 1857, Jour. de Conch. 5, p. 292, pl. 9, fig. 12 (Marie Galante); Dall 1889, Bull. Mus. Comp. Zoöl. 18, p. 69.

*Conus agassizii* Dall 1886, Bull. Mus. Comp. Zoöl. 12, pl. 9, fig. 8 (No locality). Dall 1889, *ibid.* 18, p. 68 (Santa Cruz; Barbados).

*Description.* Shell small, known only up to 32 mm. in length. It is thin but strong. Color consisting of yellowish or brownish blotches, usually in three spiral rows, the blotches being exceedingly irregular in shape and size. Whorls 10–11 and nearly flat sided. Spire rather short and generally strongly convex. Aperture oblique, long and narrow and deeply inset above. Outer lip thin and not crenulated. Sculpture consisting of ten or twelve fine incised spiral lines near the base of the shell, the main portion of the body whorl being smooth except for the exceedingly fine axial growth lines. On the spire there are four to six very fine spiral threads crossed by strong though fine concave growth lines (concave because they are the growth layers following the "notch" or apertural inset). Periostracum thin on the body whorl, much stronger and producing very fine concave and axially arranged ridges on the spire. Operculum unknown.

	length	width	whorls	
(large)	32	13 mm.	7–8 <sup>1</sup>	Marie Galante
(average)	23	10.5	10	Grenada
(small)	19.8	10	11	St. Croix

*Types.* Holotype probably in the collection of the Jour. de Conch. The type locality is Marie Galante Island near Guadeloupe Island, Lesser Antilles.

*Common name.* Villepin's Cone.

*Remarks.* This rather small species is, so far, known only from fairly deep water, ranging from 38 to 175 fathoms. For reasons unknown to me, Dall listed this species under *flavescens*, *villepinii* and *centurio* in his Blake report (Bull. Mus. Comp. Zoöl.). These specimens are now before me and they are certainly all the same species.

In relationship, our present species is related to the *floridanus* complex, being smaller, having a more obtuse spire and possessing very fine spiral threads on the whorls of the spire and having a proportionately narrower shell.

In the original citation, Fischer and Bernardi did not give any depth but it was described with others that are now known to occur only in the deeper off-shore waters.

*Range.* Known only from fairly deep water off the Virgin Islands and the Lesser Antilles. It will probably be found more widespread in the West Indies when more dredging has been done.

<sup>1</sup>This number probably did not include the nuclear whorls.



Plate 12. Fig. 1. *C. centurio* Born, Puerto Plata, Santo Domingo ( $1\frac{1}{2}\times$ ). Fig. 2. *C. brasiliensis* Clench, Victoria, Brasil (Holotype,  $2\times$ ). Fig. 3. *C. villepini* Fischer and Bernardi (after Fischer and Bernardi,  $1\frac{1}{2}\times$ ). Fig. 4. *C. juliae* Clench, off Fort Walton, Florida (Holotype, nat. size). Fig. 5. *C. fosteri* Clench and Aguayo, off Sagua la Grande, Cuba (Holotype, about nat. size).

*Records.* VIRGIN ISLANDS: St. Croix, in 38 and 115 fathoms (MCZ, the latter record based on cotypes of *C. agassizii* Dall). LESSER ANTILLES: Marie Galante (Fischer & Bernardi); Guadeloupe, in 175 fathoms; Barbados, in 73, 76 and 84 fathoms; Grenada, in 170 fathoms (MCZ).

#### **Conus juliae**, new species, Plate 12, fig. 4

*Description.* Shell probably reaching 60 mm. in length, solid and strong. Whorls 10 to 12, regularly increasing in size. Color a pale pinkish-brown with a moderate and indistinct band of white at the mid area. This is overlaid with a series of fine spiral lines which are discontinuous. Over the white band area these interrupted lines are darker and coalesce somewhat to form rather indistinct axial bars of color. On the spire there are irregular and somewhat zig-zag marks of reddish brown on each whorl which alternate with white areas. Spire somewhat extended and nearly flat sided. Aperture oblique, with a comparatively shallow notch. Sculpture of fine incised spiral lines crossed by fine irregular growth lines. Near the base the spiral lines become fairly coarse, enough to produce crenulations on the extreme lower area of the outer lip. Operculum unknown. Periostracum thin.

length	width	whorls	
54	27 mm.	10 (remaining)	Holotype

*Types.* Holotype in the collection of the Florida State Museum, Gainesville, Florida. Type locality, 9 miles off Fort Walton, Okaloosa Co., Florida in 15 fathoms. F. B. Lyman collector, August 22, 1939.

*Remarks.* This is a very beautiful shell and very different from any hitherto described from the Western Atlantic. It would appear to be related to the *floridanus* complex but not at all closely.

This is only one of the several new forms that have been dredged off the Florida coast during the past few years. There is no question but that very many new species await the student who cares to investigate the comparatively shallow waters off the west coast of Florida.

*Range and Records.* Known only from the type locality.

### **Conus floridanus** Gabb, Plate 13, fig. 1-2

*Conus floridanus* Gabb 1868, American Jour. of Conch. 4, p. 195, pl. 15, fig. 4 (Tampa Bay, Florida).

*Description.* Shell medium in size, occurring up to about 50 mm. It is generally quite solid and strong. Whorls 12 to 13 and flat sided. Color consisting of two bands of brown or yellowish-brown, more or less solid or broken into blotches. There is generally a narrow mid area of white. On the spire, color marks may be absent or consist of comma-shaped or concave bars extending between the sutures. Spire extended and usually strongly concave and generally with a strong carina. Aperture oblique, long and narrow, which is deeply inset above. Outer lip thin, non-crenulated and strongly convex in profile. Sculpture of 10 or 12 incised lines near the base of the shell which may be quite obsolete in some specimens. Main portion of body whorl smooth. Spire with numerous concave growth lines between the sutures of each whorl. Periostracum thin, occasionally heavy enough to more or less obscure the color pattern below. Under a 14 power lens it appears silken and formed in long but very fine axial ridges. On the spire it is somewhat coarser and concave, following the sculpture of the growth lines. Operculum not observed.

	length	width	whorls	
	48	24 mm.	12 remaining	Holotype
(large)	51.2	26	11	Marco Id., Florida
(average)	37	17.2	12½	Blind Pass, Sanibel Id., Florida
(small)	19	14.2	10½	Bonita Springs, Florida

*Types.* Holotype, Acad. Nat. Sci. Phila. no. 80917. Type locality, Tampa Bay, Florida.

*Common name.* Florida Cone.



Plate 13. Fig. 1. *C. floridanus* Gabb, Tampa Bay, Florida (Holotype, nat. size). Fig. 2. *C. floridanus* Gabb, off Sanibel Id., Florida ( $1\frac{1}{2}\times$ ). Fig. 3. *C. b. lymani* Clench, off Lake Worth, Florida (Holotype,  $1\frac{1}{2}\times$ ). Fig. 4. *C. bermudensis* Clench, Dyer Id., Bermuda (about nat. size). Fig. 5. *C. villepini* F. and B. (as *agassizii* Dall, after Dall, nat. size).

*Remarks.* This is a rather common species only along the west coast of Florida. Elsewhere it appears to be quite rare. It has a wide range of color pattern which does not seem to be either ecological or geographic as most phases are to be met with at any single locality. Specimens occurring off exposed beaches are somewhat heavier in structure than specimens found on protected grass-covered shallows. It occurs alive mainly just a little below low water though dead specimens are frequently found thrown up on the beaches.

It is occasionally confused with young specimens of *C. sozoni*, but this latter form has a more extended and less concave spire, possesses three color bands and generally has the spirally arranged spots coalescing in the region of the color bands. All of the few specimens of *sozoni* I have seen have a pinkish diffusion of color within the aperture, a character not found in *floridanus*.

*Range.* Hatteras, North Carolina (Dall) to Florida.

*Records.* FLORIDA: off Sanibel Id. in 4 to 6 fathoms; 20 miles off Marco in 7 fathoms (both J. Schwengel); off Bonita Springs in 3 to 4 fathoms (L. A. Burry); Tampa Bay; Little Gasparilla Id. (both ANSP); Indian Pass; Sarasota Bay; Cedar Keys; Gulfport; Lemon Bay; Captiva Id.; Naples (all MCZ).

### *Conus floridanus*, form *floridensis* Sowerby, Plate 14, fig. 1-2

*Conus floridensis* Sowerby 1870, Proc. Zool. Soc. London, p. 256, pl. 22, fig. 11 (Florida).

*Description.* Shell similar to typical *floridanus* but differing in possessing a somewhat darker basic color of reddish brown (nearer yellowish brown in *floridanus*) and having a series of numerous dark brown spiral lines superimposed on the ground color. These lines may be continuous or more or less regularly interrupted. Both types may occur on the same specimen.

	length	width	whorls	
(large)	51	26 mm.	11+	Marco Id., Florida
(average)	38.5	18.2	12½	Pass-a-Grille, Florida

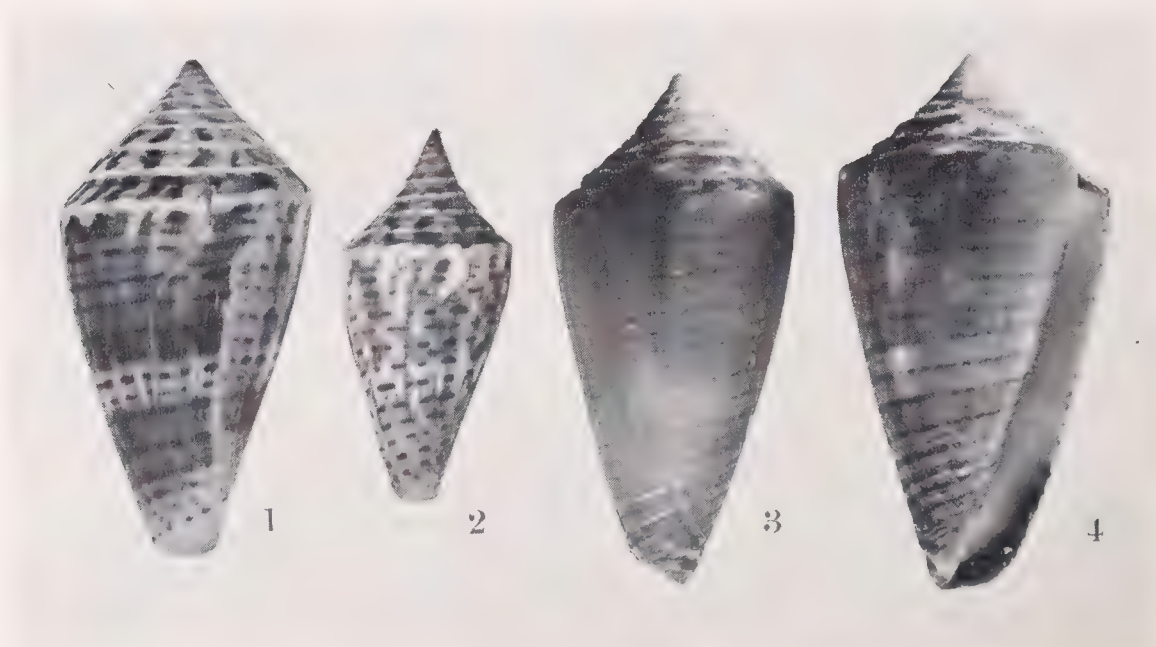


Plate 14. Fig. 1. *C. f. floridensis* Sowerby, Marco Id., Florida (nat. size). Fig. 2. *C. f. floridensis* Sowerby, Pass-a-Grille, Florida (nat. size). Fig. 3. *C. f. burryae* Clench, off Lower Matecumbe Key, Florida (Holotype, 1½×). Fig. 4. *C. f. burryae* Clench, Ragged Keys, Biscayne Bay, Florida (Paratype, 1½×).

*Types.* The type specimen is in the British Museum. We restrict the type locality to Pass-a-Grille, Florida (near St. Petersburg).

*Common name.* The Striped Florida Cone.

*Remarks.* This appears to be a rather strongly marked color form. The few specimens in our possession are distinctive but there may well be forms that will show complete intergradations with typical *floridanus*. On the other hand it shows a color pattern that closely approximates young specimens of *C. sozoni*. The spiral lines also indicate a close relationship with *C. burryae* of the Florida Keys. At the present writing our material is far too limited even to speculate on relationships other than to point out what seems to be apparent. It is unfortunate that this name was employed as it will always be confusing, but under the rules *floridanus* and *floridensis* do not constitute homonyms.

*Range.* Probably co-extensive with *C. floridanus*. We have seen specimens only from Florida.

*Records.* FLORIDA: off Ft. Walton in 13 to 19 fathoms (W. A. Burry); Marco Id.: off Palm Beach in 35 fathoms; Grassy Key; off Boca Raton in 33 fathoms (all T. McGinty); Sarasota Bay in 3 fathoms (W. A. Royce); off Miami Beach in 8½ fathoms (J. Schwengel); Hickory Pass, Bonita Springs (ANSP); Pass-a-Grille; Sanibel Id.; Terracia Bay; Pirates Cove, Sugar Loaf Key (all MCZ).

### ***Conus floridanus burryae*, new species, Plate 14, fig. 3-4**

*Description.* A smaller and narrower form than *floridanus* to which it appears closely related. The color is generally reddish brown to dark brown, usually in blotches and sometimes obscuring the mid band of white. The tip of the base is usually very dark brown to a deep brownish black. The secondary spiral and lengthened spots are present on the specimens so far examined. The whorls also are slightly convex, differing noticeably from the flat sided whorls of typical *floridanus*. Periostracum thin and silken and on young shells forming a few fine spiral threads over the main portion of the body whorl. Sculpture of the shell proper similar to *floridanus* with a few fine incised lines near the base. Operculum long and narrow.

length	width	whorls	
34.5	16 mm.	11½	Holotype
34	15.6	11	Paratype

*Types.* Holotype, Mus. Comp. Zoöl. no. 145296, off Lower Matecumbe Key, Lower Florida Keys, Mrs. L. A. Burry collector. A paratype from this locality is in the collection of Mrs. George R. Fearing from whom both specimens were received. Other paratypes from Grassy Key and the Florida Reefs.

*Common name.* Burry's Cone.

*Remarks.* This appears to be a well marked subspecies which is readily differentiated from *C. floridanus* Gabb and *C. f. floridensis* Sby. by its darker color, its more slender outline and by the slightly convex sides.

*Range.* Limited to the Lower Florida Keys as far as is now known.

*Records.* FLORIDA: off Lower Matecumbe Key (L. A. Burry); Florida Reefs (MCZ, collected by L. F. Pourtales in 1869). All these localities are in the Lower Florida Keys. Ragged Key, Biscayne Bay (L. A. Burry).

Named for Mrs. L. A. Burry of Pompano, Florida, who has done much collecting, particularly for the deeper water forms off the Florida Coast.

### **Conus amphiurgus** Dall

*Conus amphiurgus* Dall 1889, Bull. Mus. Comp. Zoöl. **18**, p. 70 (off Yucatan in 27 fathoms).

I am unable to figure this species as the type collection in the United States National Museum is unavailable during the period of the war.

Dall, along with certain others, had an exceedingly unfortunate and vexatious habit of mentioning a few characteristics possessed by a specimen and then associating these notes with a name. These notes were generally given as added remarks under another species and as a consequence were many times overlooked. Tomlin (p. 211) has listed *amphiurgus* as a nude name, based upon Dall's reference to this name in his list of the mollusks of the southeastern coast (see bibliography). It appeared, however, as a note in his Blake report as cited above.

The following is the original citation by Dall:

"A beautiful species with very much the color of *roseo-tinctus* Sowerby, but with the form and size of *subcarinatus* Sowerby (see Thes. Conch. *Conus*, pl. XXV. figs. 604 and 615), the dark streaks longer and darker than in *roseo-tinctus* and always followed by an equivalent pale area, a thickish epidermis, and the top of the whorls excavated and striated, was dredged in 27 fms., near the coast of Yucatan, by the Fish Commission, and has been named by me *Conus amphiurgus*."

### **Conus sozoni** Bartsch, Plate 15, fig. 1-4

*Conus delessertii* of authors (not of Récluz 1843, Mag. de Zool. text and pl. 42 (Red Sea)).

*Conus sozoni* Bartsch 1939, Smithsonian Misc. Collections **98**, no. 1, p. 1, fig. 1-3 (reef off Tarpon Springs, Florida).

*Description.* Shell 70 to 100 mm. in length, heavy and strong. Color consisting of three distinct pinkish brown bands, one at the shoulder, a mid band and one at the base. There are numerous lengthened spots in spiral arrangement which frequently coalesce irregularly where they are superimposed upon the pinkish brown bands. These lengthened spots are a dark mahogany brown in color. On the spire, they are strongly developed and appear to be lengthened axially. In young specimens the color is visible from within the aperture. Aperture long, narrow and oblique and deeply inset above. In profile, the outer lip is strongly convex in outline and deeply concave at the shoulder where the inset or notch is located. Spire generally extended, sometimes with flattened sides; usually, however, moderately concave. The curvature of the spire usually increases towards the earlier whorls. Whorls 12 to 13 (probably 15 would be the exact number as the small nuclear whorls do not persist in the adult specimens). Nuclear whorls glass-like and smooth. The body whorl is flat sided to slightly sigmoid and develops a strong shoulder which appears as an encircling ridge at the base of each whorl on the spire. Sculpture consisting of 10 to 12 spiral ridges at the base of the shell. These encircle the shell and disappear within the aperture. The outer lip of the aperture is crenulated at the termination of these ridges. The main portion of the body whorl is smooth, except for the very fine, incised lines crossed by rather prominent concavely arched growth lines. Operculum thin, less than one-third the aperture length and possessing a marginal nucleus. Periostracum thin on the body whorl, rather coarse on the spire. On the body whorl the color shows through the periostracum. On the spire, the periostracum indicates the pat-



tern of growth and consists of fine blade-like ridges, inwardly concavely arched and these arched ridges appear as if slightly jammed together.

	length	width	whorls	
(large)	100	47.5 mm.	13	off Tarpon Springs, Florida
(average)	71.5	42	13	off Cedar Keys, Florida
(small)	44	21.5	12	off Ft. Walton, Florida

*Types.* Holotype, United States Nat. Mus. no. 472849. Type locality, reef off Tarpon Springs, Florida. Collected by a sponge fisherman, Mr. Sozon Vatikiotis of Tarpon Springs.

*Common name.* Sozon's Cone.

*Remarks.* Since the publication of this species by Bartsch, there has been considerable collecting done by many competent and enthusiastic Florida collectors. More material has been accumulated and, though still somewhat limited, would certainly indicate that Dall's reference to this form as *delessertii* from the Red Sea is in error. Young specimens of *sozoni* do look like the excellent figure of Delessert but the adults indicate, through a series of color gradations, a rather different shell. It is to be borne in mind that many cones exhibit a rather wide range of color changes from young to adult and unless a large series of specimens from many localities is at hand for study, such changes, without the transitions, appear to indicate different species. The enormous number of synonyms that now exist for most of our species is ample testimony to these differences, the result of selected specimens rather than an extensive series of material for comparison. The young specimens of *sozoni* exhibit a strong relationship to *floridanus*.

*Range.* Florida from Palm Beach south to Tortugas and north along the Gulf coast to Santa Rosa Island.

*Records.* FLORIDA: 100 miles off Cedar Keys in 20 fathoms (J. Schwengel); off Destin in 18-20 fathoms, sandy marl bottom (T. McGinty); 40 miles south of Fort Walton in 23 fathoms (Mrs. G. Fearing); on beach (dead) north of Nigger's Head, near Schooner Rocks, Singer Island, Palm Beach Co.; off Palm Beach in 75 fathoms (both Ted Bayer); off Lantana in 100 fathoms (T. McGinty); off town of Gulfstream, Palm Beach Co. in 10 fathoms (F. Lyman); "Blake" Station 11, off Tortugas, Florida (N. Lat. 24° 43'; W. Long. 83° 25') in 37 fathoms (MCZ).

### *Conus perryae*, new species, Plate 15, fig. 5

*Conus melvilli* Perry 1939, Nautilus 53, p. 40, pl. 8, fig. 1 (3 miles off Little Carlos Pass, Lee Co., Florida); Perry 1940, Marine Shells of the Southwest Coast of Florida, p. 162, pl. 37, fig. 258a-b; *non Conus melvilli* Sby. 1878.

*Description.* Shell small, rather thin but strong. Color a pale bluish-gray with fine pale brown, axially arranged zig-zag threads of color. These threads are more abundant near the base of the shell which gives a decided brownish tinge to this portion. Whorls 6, channeled at the suture and edged along the upper margin of each whorl by a narrow band of brown. Spire only moderately elevated and forming an angle of about 90°. Aperture oblique. Outer lip thin, hardly inset above and not crenulated. Sculpture of numerous, fine, thread-like, spiral ridges strongly developed near the base of the shell, becoming much less strong on the main portion of the body whorl. Growth lines exceedingly fine and numerous. Spire with a single spiral thread and above this a flattened ridge. The

sutural channel is narrow, shallow and rather inconspicuous. Periostracum very thin. Operculum thin and small for the relative size of the aperture.

length	width	whorls	
12.5	7 mm.	6	Sanibel, Florida

*Types.* Holotype no. 1934, collection of Jeanne S. Schwengel (Scarsdale, New York). Type locality, 6 miles off Sanibel Island (3 miles off Little Carlos Pass, Lee Co.) Florida in 6 fathoms. J. S. Schwengel collector, winter 1938-1939.

*Common name.* Perry's Cone.

*Remarks.* This appears to be a very distinctive species, differing quite sharply from all other Western Atlantic *Conus*. It is a young shell and probably would be 4 or 5 mm. larger when adult. Its confusion with *C. melvilli* Sby. is difficult to understand as Sowerby's original figure presents a totally different shell. *Conus perryae* has a definite sigmoid outline, i.e., the upper portion of the body whorl is convex, while the basal portion is concave, both forming a flattened "S" outline to each side. On the other hand, Sowerby's figure of *C. melvilli* indicates the upper portion of the whorl to be slightly convex and the lower portion to be strongly convex. The color pattern differs as well, *melvilli* possessing strong dark color blotches axially arranged, while in *perryae*, the color is faint and thread-like, forming axially arranged zig-zag marks. In *perryae*, the notch or inset at the upper part of the aperture is exceedingly shallow.

*Range and Records.* Known only from the type locality off Sanibel Island, Florida.

Melvill, in the citation given below, states that Sowerby was in error in giving Key West, Florida as the locality for *C. melvilli*. The specimen in question had been purchased with much other material, mainly *Conus*, at the sale of the Norris collection and had subsequently been mixed in with the shells he had collected at Key West. The locality of *C. melvilli* still remains unknown, though Melvill states that it is related to *C. adansonii* Lam. from Senegal. Below are given the citations for this species.

*Conus melvilli* Sowerby 1878, Proc. Zool. Soc. London, p. 795, pl. 48, fig. 1 (Key West, Florida), Sowerby 1887, Thesaurus Conchyliorum, 5, pl. 507, fig. 653; Melvill 1917, Jour. of Conch., 15, p. 222 (Locality unknown).

### ***Conus ranunculus* Hwass, Plate 15, fig. 6-7**

*Conus ranunculus* Hwass 1792, [in] Bruguière, Ency. Meth. Vers, 1, p. 671 (American Ocean).

*Conus testudinarius* Hwass 1792, [in] Bruguière, Ency. Meth. Vers, 1, p. 694 (Surinam [Dutch Guiana]).

*Conus informis* Hwass 1792, [in] Bruguière, Ency. Meth. Vers, 1, p. 699 (American Ocean); *non informis* Reeve 1843.

*Conus portoricanus* Hwass 1792, [in] Bruguière, Ency. Meth. Vers, 1, p. 714 (Puerto Rico); as *puertoricanus* Krebs 1864.

*Cucullus barathrum* Röding 1798, Museum Boltenianum p. 43.

*Cucullus flammeus* Röding 1798, Museum Boltenianum p. 44; *non* Lamarek 1810.

*Conus narcissus* Lamarek 1810, Ann. Mus. Hist. Nat. Paris, 15, p. 281 (American Ocean).

*Conus coeruleus* Dillwyn 1817, Desc. Catal. Recent Shells 1, p. 368 (St. Thomas); *non* Schröter 1803.

*Conus caeruleus* Küster 1838, Conchy.-Cab. (2) 4, p. 85, pl. 14, fig. 3-4 (St. Thomas).

*Description.* Shell large, reaching 70 mm. in length, solid and strong. Whorls  $9\frac{1}{2}$  to 10, moderately convex and rounded over the shoulder. Nuclear whorls somewhat papiliform. Color a grayish white with two very irregular spiral bands of chocolate brown, one above and one below the mid area. This color varies from dark to light mahogany



Plate 15. *C. sozoni* Bartsch, 15 miles off Destin, Florida (nat. size). Fig. 2. *C. sozoni* Bartsch, off Fort Walton, Florida (nat. size). Fig. 3. *C. sozoni* Bartsch, off Destin, Florida (nat. size). Fig. 4. *C. sozoni* Bartsch, off Destin, Florida (nat. size, showing periostracum). Fig. 5. *C. perryae* Clench, off Sanibel Id., Florida (Holotype, 3×). Fig. 6. *C. ranunculus* Hwass, "Puerto Rico" (nat. size). Fig. 7. *C. ranunculus* Hwass, West Indies (nat. size).

brown. A secondary color is sometimes present in the form of fine and interrupted spiral lines which may be lengthened or may be a series of dots. This secondary type of color may be absent. Spire obtuse, forming a flattened cone of about  $117^\circ$ . Aperture oblique, fairly wide and broadening slightly below. It is moderately inset above. Edge of outer lip thin but somewhat thicker below. Sculpture of numerous and fine, somewhat wavy threads that are a little stronger in development toward the base. Spire with four or five spiral threads on each whorl which are crossed by fine growth lines. Periostracum not observed but probably quite thin. Operculum not seen.

	length	width	whorls	
(large)	69	39.5 mm.	10	Saline Bay, Trinidad
(average)	49	27.6	10	Cape St. John, Spanish Guinea

*Types.* Hwass refers to A. Seba, 3, pl. 43, fig. 36, 1761, which I here select as the type figure. I limit the type locality to Dutch Guiana, where specimens have been described under the name of *testudinarius* Hwass, one of the many synonyms of this species.

*Common name.* The Turtle or Little Frog Cone.

*Range.* Possibly from Puerto Rico south through the Lesser Antilles to northern South America and along the west coast of Africa.

*Records.* LESSER ANTILLES: Anguilla Id. (MCZ); Saline Bay; Toco; Magueripe Bay, Trinidad (H. G. Kugler); Balata Bay, Trinidad (MCZ); Tobago Id. (ANSP).

VENEZUELA: Paria Peninsula (MCZ); Porlamar, Margarita Id. (ANSP). We also possess two lots, one from Cape St. John and one from Adjé, 20 miles south of Benito, Spanish Guinea, on the west coast of Africa.

**Conus fosteri** *Clench and Aguayo*,<sup>1</sup> new species, Plate 12, fig. 5

*Description.* Shell narrowly obconic, strong and rather thin for a *Conus*. Whorls 10, very regularly increasing in size. Color a milky white with two bands composed of irregular reddish brown blotches which are more or less axially lengthened. The holotype possesses two spiral rows of dots of the same color between the bands. The shell has, however, a thin transparent periostracum which gives it a dull straw yellow cast. Aperture long and recurved backwards at its upper end to form a fairly deep sinus. Below it flares out slightly. The outer lip is very thin. Spire moderately extended and rather strongly concave. The sides of the body whorl are also slightly concave. Sculpture of very fine axial growth lines which are crossed in the lower one-third of the shell by five spiral threads or riblets. These growth lines are strongly sinuous as they pass over the whorl shoulder.

length	width	whorls	
61.5	27 mm.	11½	Holotype
61	31	10	Paratype

*Types.* Holotype, Mus. Comp. Zoöl. No. 146003, *Atlantis* station 3434 (N. Lat. 23° 10'; W. Long. 79° 35') off Sagua la Grande, Santa Clara Prov., Cuba, May 1, 1939, in 260 fathoms. Paratype (Mus. Poey) from *Atlantis* station 2981B (N. Lat. 22° 47'; W. Long. 78° 49' off Punta Alegre, Camaguey Prov., Cuba, March 10, 1938, in 195–225 fathoms. Additional paratypes from *Atlantis* station 3415 (N. Lat. 22° 51' 30"; W. Long. 78° 55' 30") off Punta Alegre, Camaguey Prov., Cuba, April 29, 1939, in 210 fathoms; *Atlantis* station 3480 (N. Lat. 23° 10'; W. Long. 81° 28') off Matanzas, Matanzas Prov., Cuba, May 11, 1939, in 200 fathoms; *Atlantis* station 2963 (N. Lat. 22° 07'; W. Long. 81° 08') Bahia Cochinos, Santa Clara Prov., Cuba, Feb. 1938, in 180–190 fathoms; *Atlantis* station 3333 (N. Lat. 22° 13'; W. Long. 81° 11') Bahia Cochinos, April 1939, in 190–200 fathoms.

*Remarks.* The relationships of this species are not at all clearly defined. It is, perhaps, best compared with *Conus furvoides* Gabb (? Miocene) of Santo Domingo from which it differs in its stronger concave profile.

*Range.* Both north and south coasts of Cuba in fairly deep water.

*Records.* See under *Types*.

Named for R. W. Foster, assistant and colleague, who has done much to increase our knowledge of West Indian mollusks.

**Conus bermudensis**, new species, Plate 13, fig. 4

*Conus agassizii* Dall 1889, (in part) Bull. Mus. Comp. Zoöl. 18, p. 68 (Bermuda) [part of text, not the reference to the plate. See also under *C. villepini* F. and B.].

*Description.* Shell about 50 mm. in length, heavy and nearly smooth. Color porcellaneous white or with faint pinkish irregular blotches or spiral bands. Interior of aperture

<sup>1</sup>The "Atlantis" material was collected by members of Harvard University and the University of Havana. All new forms are described jointly by W. J. Clench and C. G. Aguayo.

tinged with dull pink. Occasional specimens have many spiral lines of very fine, reddish brown dots that are just visible to the unaided eye. Whorls 9 to 10, regularly increasing in size and with slightly convex sides. The whorls composing the spire are generally channeled or grooved at their union. Spire short, straight sided and producing an angle of  $90^\circ$ . Aperture oblique, with nearly parallel sides, the upper end rather deeply recessed. Outer lip simple. Sculpture consisting of numerous incised lines which are most abundant near the base of the shell though faintly seen over the rest of the body whorl. Periostracum rather thin but opaque and of a rusty brown color, concealing the coloration beneath. Operculum not seen.

	length	width	whorls	
(large)	48	26.8 mm.	10	Bermuda
(average)	43	22.5	10	Dyer Id., Bermuda

*Types.* Holotype, Mus. Comp. Zoöl. no. 141965, Dyer Island, Bermuda. W.J. Crozier collector, August 1918. Paratypes from the same locality.

*Common name.* The Bermuda Cone.

*Remarks.* This species has long been known under the name of *agassizii* Dall. In 1881, Dall (Bull. Mus. Comp. Zoöl. 12, pl. 9) figured two specimens, 8 and 8a under this name. Later (*ibid.* 1889, p. 68) he listed the localities for the figured specimens as *Blake* station, no. 132, off Santa Cruz [St. Croix] in 115 fathoms and *Blake* station, no. 272, off Barbados in 76 fathoms. His figure 8 (here selected as the type of *agassizii*) is a synonym of *C. villepinnii* F. and B. His figure 8a is based upon a specimen which may be a very young example of *C. mazei* Deshayes. In his discussion and description (1889) he also included a third species from Bermuda. This resulted in a curious mixture in which three species were involved.

*Range.* Probably limited to Bermuda.

*Records.* BERMUDA: (L. L. Mowbray; Dyer Island (MCZ)).

### ***Conus bermudensis lymani*, new subspecies, Plate 13, fig. 3**

*Description.* Shell solid, medium in size, probably reaching 35 mm. in length. Color a mottled reddish brown with a faint indication of a mid area of white. Under a lens there appears a series of white spiral lines (pale reddish over the patches of reddish brown) with dots of brown. These dots are more or less evenly disposed along these lines with fairly wide gaps between them. Whorls 10 and nearly flat sided. Spire subdepressed and produced at an angle of about  $90^\circ$ . The whorls of the spire are rather deeply concave. Aperture oblique, fairly wide, having a thin outer lip and a rather deeply inset notch above. Sculpture of 8 to 10 rather deeply incised spiral lines near the base of the shell. Operculum and periostracum unknown.

length	width	whorls	
34	17.2 mm.	10	Holotype

*Types.* Holotype, Florida State Museum. Dredged off Nellies Point, South Lake Worth, Palm Beach Co., Florida. Mrs. F. B. Lyman collector.

*Remarks.* This subspecies is fairly close in its relationship to *C. bermudensis* from Bermuda. Both have a similar outline. *C. b. lymani*, however, is much smaller and possesses

a very distinctive color pattern, a characteristic only moderately developed in *bermudensis*.

*Range and Records.* Known only from the type locality.

Named for Frank Lyman, who has added much to our knowledge of Florida marine shells.

\* \* \* \* \*

The above report on the *Conus* in the Western Atlantic is far from being complete. Additional records must be obtained before the limits of distribution can be assigned to many of these species.

There is still much confusion regarding the various subgenera in *Conus*. The entire family of Conidae must be studied as a whole before any stability can be reached and the complex relationships worked out. For this reason I have made no attempt to group the various species under subgeneric headings.

A common name has been added where such was known or when such could be derived from the scientific name.

The "notch," "inset," or more properly the "subsutural flexure" is figured on Plate 5, fig. 3; Plate 6, fig. 3; Plate 8, fig. 4; Plate 15, fig. 1.

I neglected to state in the description of *C. mazei* that the little circular areas that appear on Plate 9, fig. 1 are the attachment plates of barnacles, not a sculptural or color character of the shell itself.

\* \* \* \* \*

### Key to Western Atlantic *Conus* (Adult specimens).<sup>1</sup>

The following key is based upon adult or nearly adult specimens. The adult in *Conus* is a specimen possessing about eight or more whorls. Most of the characters in *Conus* are relative and variable. Extreme variation may well cause any one specimen to fall outside the characters assigned to it in the key. I have attempted to give rather full descriptions and these, with the plates, should be considered in detail after a specimen has been "run down" in the key.

The key is not infallible, but is designed for use only as an aid to determination.

- |  |                           |
|--|---------------------------|
| 1. Shell smooth or with spiral threads or ridges   | 5                         |
| 2. Shell with small pustules or warts in spiral rows   | 3 <sup>2</sup>            |
| 3. No spiral threads on the spire  | <i>verrucosus</i> , p. 13 |
| 4. Two to four threads on the whorls of the spire  | <i>piraticus</i> , p. 14  |
| 5. Shell smooth or possessing only moderate spiral threads near the base                               | 19 <sup>2</sup>           |
| 6. Shell with rather strong spiral threads over the entire body whorl or from the mid area to the base | 7                         |

<sup>1</sup> *Conus clerii* and *C. villepini* are not included in the key as I did not have adequate material for study.

<sup>2</sup> Young specimens of *regius* are finely pustulose and many of the adults have fine spiral ridges or threads over the entire surface of the body whorl. At this point, reference should be made to both description and figures of *regius* and *cardinalis*.

7. Shell less than 30 mm. in length 13
8. Shell greater than 30 mm. in length 9
9. Whorls on spire without beads or nodules 11
10. Whorls on spire with a series of fine beads or nodules *mazei*, p. 17
11. Color pink, with axial bars of brown usually in three bands *granulatus*, p. 18
12. Color yellowish or with spiral rows of brownish yellow as dots or bars 13
13. Whorls on spire usually convex, color in lines of spiral dots or interrupted lines, sometimes grouped to form axial bars of color *largillierti*, p. 16
14. Whorls on spire flat to slightly concave, color usually salmon yellow forming three spiral bands *stimpsoni*, p. 15
15. Spiral threads generally over the entire body whorl *jaspideus*, p. 10
16. Spiral ridges occurring from the mid area to the base 17
17. With axial color bars of brown or dark red *pygmaeus*, p. 12
18. Generally uniformly dark colored *stearnsii*, p. 9
19. Shell irregular or nodulose at the whorl shoulder 21
20. Shell smooth along the whorl shoulder 29
21. Shell colored red and usually with a central mid area of white *cardinalis*, p. 5
22. Shell with irregular patches of black, brown, cream or green 23
23. Shell with black, blackish brown or brown patches, generally in two more or less defined bands 25
24. Shell with two spiral bands of green and occasionally with axial bars of brownish *abbotti*, p. 6
25. Shell with two more or less solid, spiral bands of dull black or purplish black; usually less than 40 mm. in length *citrinus*, p. 7
26. Shell with patches of color, usually formed in two spiral bands; usually greater than 40 mm. in length 27
27. Color patches small, light brown or yellowish brown; spire somewhat extended; early whorls rather small *dominicanus*, p. 6
28. Color patches large, brown to blackish brown; spire depressed; early whorls large *regius*, p. 3
29. Body whorl rather sharply rounded over at the shoulder of the whorl 33
30. Body whorl broadly rounded over the shoulder of the whorl 31
31. Shell greater than 30 mm. in length; brownish or blackish brown color patches forming two irregular spiral bands *ranunculus*, p. 32
32. Shell less than 30 mm. in length; axial zig-zag lines near the base of the shell *perryae*, p. 31
33. Each whorl on the spire rather deeply concave 35
34. Each whorl on the spire flat or nearly so 41
35. Shell white or with two bands of pink or brownish pink 39
36. Shell with three bands of color 37
37. Spire extended; color consisting of three spiral bands of brownish orange with a series of brownish dots arranged in a spiral pattern *sozoni*, p. 30
38. Spire rather depressed; color consisting of three bands of orange with a series of zig-zag axial lines crossing the white areas *centurio*, p. 24
39. Shell white or with two pale pinkish bands *bermudensis*, p. 34
40. Shell with two irregular brownish pink bands *lymani*, p. 35

41. Sides of body whorl flat or slightly convex	43
42. Sides of body whorl moderately concave	<i>fosteri</i> , p. 34
43. Spire with rather deeply concave sides	47
44. Spire with flat sides	45
45. Shell less than 25 mm. in length; spire with three or four incised spiral lines	<i>brasiliensis</i> , p. 24
46. Shell more than 30 mm. in length; spire without the incised lines	<i>juliae</i> , p. 26
47. Spire extended, occasionally carinated	53
48. Spire well depressed, rarely carinated	49
49. Shell with numerous spots of orange or orange brown in spiral formation	51
50. Shell generally a solid brownish orange or brownish salmon with a narrow pale mid area	<i>daucus</i> , p. 21
51. Lines of spiral dots usually separated, seldom forming solid patches by coalescing	<i>atlanticus</i> , p. 20
52. Lines of spiral dots generally coalescing in patches to form two irregular banded areas	<i>spurius</i> , p. 19
53. Nuclear whorls papilliform	55
54. Nuclear whorls acute but not papilliform	58
55. Shell white or very pale flesh colored	<i>caribbaeus</i> , p. 23
56. Shell maculated with bright yellow or brownish orange	<i>flavescens</i> , p. 22
57. Color consisting of irregular areas of yellow, brown or brownish orange	<i>floridanus</i> , p. 27
58. Color as in 57 but in addition with a series of interrupted spiral lines	<i>floridensis</i> , p. 28
59. Color consisting of a warm brown with fine spiral lines that are nearly continuous. Base of shell usually tipped with chocolate brown	<i>burryae</i> , p. 29

\* \* \* \* \*

Most of the following citations refer to species that at one time or another have been credited to the Western Atlantic. Many of these are now known to occur elsewhere or are known as synonyms of species found in other regions.

*Conus ammiralis* Linné 1758, Syst. Nat. ed. 10, p. 713 (Locality unknown).

Linné refers to G. E. Rumphius 1739, Thesaurus Piscium Testaceorum, pl. 34, fig. B, which is here selected as the type figure. This species is East Indian and not Western Atlantic.

*Cucullus antillarum* Röding 1798, Museum Boltenianum p. 47.

This is a synonym of *Conus pertusus* Hwass according to Tomlin (p. 213). It is not a Western Atlantic species.

*Conus archetypus* Crosse 1865, Jour. de Conchy. 13, p. 313, pl. 10, fig. 7 (Locality unknown).

This is certainly not a synonym of *C. daucus* as stated by Tomlin (p. 214). It appears to be a young specimen of *regius* or perhaps *C. r. cardinalis*. I have seen reddish brown specimens of *regius* that agree very closely with the specimen figured by Crosse. The type is in the British Museum.

*Conus breviculus* Sowerby 1833, Conch. Illust. pt. 37, fig. 55 (Locality unknown).

This is apparently a young specimen of *C. papilionaceus* Hwass from West Africa.



*Conus candidus* Kiener 1848, Icon. Coquilles Vivantes 2, p. 214, pl. 97, fig. 1 (Locality unknown).

This species has frequently been referred to as an earlier name for both *floridanus* Gabb and *pealii* Green. It may well be related but is certainly not either of these species.

*Conus castus* Reeve 1844, Conch. Icon. 1, pl. 47, fig. 267 (Locality unknown).

This species does not appear to be a synonym of *C. daucus* as stated by Tomlin (p. 226). The character of the spire and the general shape of the shell are very different from our West Indian species.

*Conus cedonulli* Linné 1767, Syst. Nat. ed. 12, p. 1167 (O. Americae meridionalis). Linné refers to A. Saba 1761, Rerum Naturalium Thesauri 3, pl. 48, fig. 8; *non cedonulli* Lamarck 1810.

I know of nothing in the Western Atlantic that approaches the excellent figure in Saba. This figure is the type.

*Conus cidaris* Kiener 1846, Icon. Coquilles Vivantes, 2, p. 57, pl. 63, fig. 1-1a (Indian Ocean).

This species is close to *citrinus* Gmelin but does not appear to be the same. It probably does not occur in the Western Atlantic.

*Conus columba* Hwass 1792, [in] Bruguière, Ency. Meth. Vers, 1, p. 709 (Asiatic Ocean and Mauritius).

Hwass refers to Gaultieri 1742, pl. 25, fig. G, which is here designated as the type figure. There appears to be nothing in the Western Atlantic that agrees with this species.

*Conus croceus* Sowerby 1833, Conch. Illustrations, p. 29, fig. 27 (Locality unknown); *non croceus* Smith 1877.

This is not a synonym of *C. daucus* as stated by Tomlin (p. 236) nor does it even appear closely allied to it. I have seen nothing in the Western Atlantic that even approaches the excellent figure of Sowerby.

*Conus gracilis* Sowerby 1823, Gen. Rec. Foss. Shells, pt. 16, pl. 267, fig. 4; *non* Wood 1828; Sowerby 1875.

This is a synonym of *australis* Lam. according to Sowerby himself.

*Conus maculiferus* Sowerby 1833, Conch. Illustrations, pt. 29, fig. 23 (Locality unknown).

Western Atlantic specimens appearing under this name are generally young specimens of *C. regius* Gmelin. True *maculiferus* differs in having the maculations definitely in an axial arrangement and not irregular or patchy as in young *regius*. A larger series may indicate this species to be a synonym of *regius*.

*Conus praefectus* Hwass 1792, [in] Bruguière, Ency. Meth. Vers, 1, p. 734 (Seas of America).

This is not a Western Atlantic species.

*Conus rattus* Hwass 1792, [in] Bruguière, Ency. Meth. Vers, 1, p. 700 (Seas of America).

This is an Indo-Pacific species though occasional specimens of *citrinus* approximate it in general character, especially by the broadening of the white bands.

*Conus sanguinolentus* Reeve 1849, Conch. Icon. 1, (Suppl.) pl. 8, fig. 274 (Locality unknown).

This is not *daucus* as stated by Tomlin (p. 305). It is not known to me as a Western Atlantic species.

*Conus venulatus* Hwass 1792, [in] Bruguière, Ency. Meth. Vers, 1, p. 695 (America or Manila).

This is not a Western Atlantic species.

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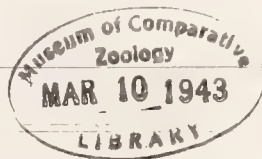
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LITTORINIDAE



NUMBER 7

## THE GENUS LITTORINA IN THE WESTERN ATLANTIC

BY  
JOSEPH C. BEQUAERT

The Littorines, or periwinkles, are littoral snails, chiefly herbivorous and normally living near or between the high and low tide marks. Where several species occur in one locality each usually prefers certain types of marine algae, on which it feeds mainly. The intertidal zonation of the northern species has been a favorite topic of study, but does not seem to follow definite rules (J. Colman 1933, Jr. Marine Biol. Assoc. Un. Kingdom, **18**, pt. 2, pp. 435-476). When the tide goes out the animal withdraws in the shell and may remain dry and exposed to the sun for many hours. Some species, which live out of water for weeks or months, breathe atmospheric air (P. H. Fischer, M. Duval and A. Raffy 1933, Arch. Zool. Exp. Gén., **74**, fasc. 31, p. 629). Many species adhere to rocks, stones or pile-work; a few occur on mud-flats, particularly where there is good drainage, being sometimes common in salt-marshes; and some of the tropical ones live in mangrove swamps, preferably on the roots, branches and leaves of the trees. Periwinkles are a favorite food of many shore birds, particularly ducks.

### *Littorina* Férussac

*Paludina* subgenus *Littorina* Férussac 1822, Tabl. Syst. Gén. Moll., p. xxxiv (no description or species; defined on p. xi, where the French vernacular "Littorine" only is used, as containing the marine *Paludinae* placed by Adanson in *Trochus*; on p. ix, four such species are listed, without combining them with *Littorina*, the specific names being those of Gmelin: *obtusatus*, *neritoides*, *littoreus* and *muricatus*). Genotype by designation of de Blainville (1828, Dict. Sci. Nat., **56**, p. 98; only French vernacular "Littorine" used here): *Turbo littoreus* Linné, 1758, one of the species originally included (see Winckworth 1922, Proc. Mal. Soc. London, **15**, p. 95).

*Turbo* subgenus *Littorina* "Férussac" de Blainville 1825, Faune Française, Malacozoaires, p. 297 (with definition and species). Genotype by designation of de Blainville (1828): *Turbo littoreus* Linné, 1758, one of the species originally included.

*Littorina* "Férussac" Menke 1828, Synopsis Meth. Moll., pp. 24 and 25 (emendation of *Littorina*). Type by designation of H. Suter (1913, Man. New Zealand Moll., p. 186): *Turbo littoreus* Linné, 1758, one of the species originally included.

*Bacalia* "Gray" H. and A. Adams 1854, Gen. Rec. Moll., **1**, p. 312 (as a synonym of *Littorina*). Type by designation of Winckworth (1922): *Turbo littoreus* Linné, 1758, one of the species originally included. [Gray 1840, Contents Brit. Mus., 42d Ed., p. 147; *nomen nudum*].

*Isonema* "Hall" Provancher 1891, Faune Canadienne, Moll. Québec, p. 91 (as a synonym of *Littorina*; type by present designation: *Turbo littoreus* Linné, 1758). Not *Isonema* Meek and Worthen, 1865.

*Littorina* section *Algaroda* Dall 1918, Proc. Biol. Soc. Washington, **31**, p. 137. Type by monotypy: *Turbo littoreus* Linné, 1758.

Opinion 46 of the International Commission on Nomenclature seems to cover the case of *Littorina* Férussac. If, however, it were ruled on some technicality that Férussac (1822) cannot be credited with the name, it will date from de Blainville (1825), which will in no way affect its proper use, the genotype remaining the same. A. S. Kennard (1942, Proc. Mal. Soc. London, **25**, pt. 3, p. 116) considers that Férussac did not define *Littorina*, but this is open to argument. He regards B. C. Payraudeau's generic definition (1826, Cat. Descr. Ann.

Moll. Corse, p. 114) as the first in date, unaware of de Blainville's earlier definition of 1825. As Payraudeau did not designate his *Littorina basterotii* as the genotype, but merely described it as a new species in the genus, de Blainville's type designation of *Turbo littoreus* in 1828 seems to be the first valid one.

*Lithorina* Hartmann (1840), *Litormia* Mörch (1849), *Littorrina* Gabb (1861), *Litorinna* Dall (1884), and *Littornia* Jenkins and Grocock (1891) are misspellings of *Littorina*.

Shell elongate or rounded turbinate, subglobose, conical, or conico-turriculate, usually rather thick. Spire of few whorls. A deciduous periostracum in some species. Surface either smooth or with spiral engraved lines or grooves, rarely more strongly ribbed or wavy, but never tuberculate; axial sculpture restricted to growth-striae. Aperture entire, ovate or subcircular; outer edge of columellar area continuous with basal lip; outer lip very oblique in profile, simple, sharp-edged, often thickened within. Umbilical slit present in the adult of a few species, more often present in the young and closed later, sometimes absent at all stages. Operculum horny, with a laterally placed, paucispiral (2 or 3 coils, as a rule) nucleus and a low process attaching it to the foot. Animal with one pair only of slender, tapering tentacles; eyes unstalked or on globular expansions at outer bases of tentacles; foot obtuse behind, divided lengthwise, each side progressing alternately; operculigerous lobe without filamentary processes. Radula very long; in *L. littorea* 50 mm. long (twice the length of the animal's body), with some 500 cross-rows of teeth. Oviparous or ovoviviparous. Sexual dimorphism more or less pronounced in the shell.

The 9 species recognized from the western Atlantic may be placed in 5 groups, here given subgeneric rank for convenience, although they do not seem to be of fundamental or phylogenetic importance. The mode of reproduction being known for few species, it is impossible to judge to what extent it is correlated with shell characters.

*Littorina*, proper, includes snails with a thick, turbinate shell, slightly convex or flattened whorls, a moderately high, pointed spire, and a short, curved inner columellar edge. The type, *L. littorea*, is oviparous (see under that species). *L. irrorata* Say also is placed here.

The subgenus *Littorivaga* Dall (1918, Proc. Biol. Soc. Washington, **31**, p. 137) comprises snails with a thick, turbinate shell, decidedly convex whorls, a moderately high, pointed spire, and a short, curved inner columellar edge. The type is *Littorina sitkana* Philippi, 1846 (= *Littorina sitchana* Philippi, 1847, author's emendation). Of our species, only *L. saxatilis* Linné, an ovoviviparous snail, belongs here.

The subgenus *Melarhappe* Menke (1828, Synopsis Meth. Moll., p. 23; monotypic for *Melarhappe glabrata* Menke = *Turbo neritoides* Linné, 1758) comprises snails with a moderately thick, ovate-conical to ovate-turriculate shell, flattened or convex whorls, a high pointed spire, and a long, straightened columellar inner edge. The type species, at first believed to be ovoviviparous, has now been shown to be oviparous, with a pelagic stage similar to that of *L. littorea* (O. Linke 1935, Zool. Anz., **112**, pp. 57-62. M. V. Lebour 1935, Jr. Mar. Biol. Assoc. Un. Kingdom, **20**, pp. 373-378). *Melarapha* Cristofori and Jan (1832), *Melaraphis* Philippi (1836), *Melarhaphis* Agassiz (1845), *Melaraphe* H. and A. Adams (1854), *Melarhophe* Hall (1867), *Melarpha* Paetel (1875), *Melanorhappe* O. Boettger (1885) and *Melarrhappe* v. Martens (1897) are emendations or misspellings of *Melarhappe*. Two western Atlantic species belong here: *L. nebulosa* Lamarck and *L. ziczac* Gmelin.

The subgenus *Neritrema* Récluz (1869, Actes Soc. Linn. Bordeaux, ser. 3, **7**, pp. 43 and 46; for six species, including *Turbo obtusatus* Linné, 1758, designated as type by W. H. Dall 1909, U.S. Geol. Surv., Prof. Pap. **59**, p. 79) contains subglobular or low-conical snails, with slightly raised spire, a more or less distinct periostracum, a short, concave inner columellar edge, and at least traces of a columellar slit either in the young or in the adult. The type species is oviparous. *Neritotrema* Wenz (1939, Handb. Paläozoologie, **6**, Gastropoda, pt. 4, p. 518) is an emendation. *Neritoides* T. Brown (1827, Illustr. Conch. Great Britain Ireland, Pl. 43, figs. 14-22, with letterpress; name also on p. iv of Index; monotypic for *Neritoides littoralis* T. Brown, 1827 = *Turbo obtusatus* Linné, 1758) is a synonym, the name being antedated by *Neritoides* Meuschen (1779, Der Naturforscher, **13**, p. 85; based on a naticid).<sup>1</sup> I refer to this group the western Atlantic *L. meleagris* Potiez and

<sup>1</sup> Rang (1829, Manuel Hist. Nat. Moll., p. 185) designated as type of *Littorina*, *Nerita littoralis* Linné, 1758 = *Turbo obtusatus* Linné, 1758; but he had been anticipated by de Blainville (1828), a fact overlooked by Dall and others.

Michaud and *L. mespillum* v. Mühlfeld, which have at least in the adult an umbilical slit, often as pronounced as in *Lacuna*. The thick shell and type of markings are, however, as in *Littorina*, where their nearest relative seems to be *L. obtusata*. The latter has an umbilical slit in the young, but not in the adult.

The subgenus *Littoraria* J. E. Gray (in Griffith and Pidgeon 1834, Cuvier's Anim. Kingdom, **12**, p. 598 and pl. 1, fig. 3; monotypic for *Littoraria pulchra* Gray = *Littorina pulchra* Sowerby, 1824) comprises rather thin, fair-sized snails, with a high, conical, pointed spire, and a long, excavated columellar area, straightened at the inner edge. They are peculiar to tropical and subtropical brackish water. *Littorinopsis* Mörch (1876, Malak. Blätt., **23**, p. 135; type by original designation, *Phasianella angulifera* Lamarck, 1822, misspelled "*subangulata*" by Mörch) is a synonym. The only western Atlantic species, *L. angulifera*, is closely related to the Indo-Pacific *L. scabra* Linné, which is known to be ovoviviparous.

*Aquilonaria turneri* Dall, 1886, placed by Tryon in a section of *Littorina*, is now considered one of the Lacunidae. *Littorina adamsii* Reeve, 1857 (= *L. pulchella* "C. B. Adams" Reeve, 1857; not of Dunker, 1845) belongs in Trochidae. *Littorina ziczac litterata* "Phil.," of some Florida lists, is a fictitious name. *Littorina aspera* was listed from Mariguana Id., Bahamas, by oversight (W. J. Clench 1937, Proc. New England Zool. Club, **16**, p. 61).

### *Littorina littorea* Linné, Plate 1, figs. 1-11

*Turbo littoreus* Linné 1758, Syst. Nat., 10th Ed., **1**, p. 761 ("in the European Ocean, common on the coasts of Norway"). Hanley 1855, Ipsa Linnaei Conchylia, p. 326 (type).

*Littorina litorea* Menke 1828, Synopsis Meth. Moll., p. 25 (emendation of *littorea*).

*Synonymy.* This is fully given by P. Dautzenberg and H. Fischer 1912, Rés. Camp. Scientif. Prince de Monaco, **37**, pp. 181-187. *Littorina communis* W. Thompson (1856; not of T. Brown, 1843) is an additional synonym not mentioned by them.

*Description.* Shell regularly turbinate, higher than wide, thick, opaque, dull, of 7 to 8 gradually increasing and rather flattened whorls: upper part of whorls somewhat concave below the coarsely crenulate, but weak suture; on the body-whorl of adult shells this may become a shallow groove near the mouth: body-whorl about  $\frac{2}{3}$  of total height. A light yellowish-brown periostracum, usually lost in the adult: sculpture, when preserved, of many low, irregularly spaced spiral ridges, with finer wavy wrinkles in the intervals, and cut by extremely fine, axial growth-striae. Spire high, more or less pointed, often corroded or destroyed by a worm (*Polydora concharum* Verrill). Aperture subcircular: outer lip slightly flaring, sharp-edged, smooth within, its upper edge ascending and ap-

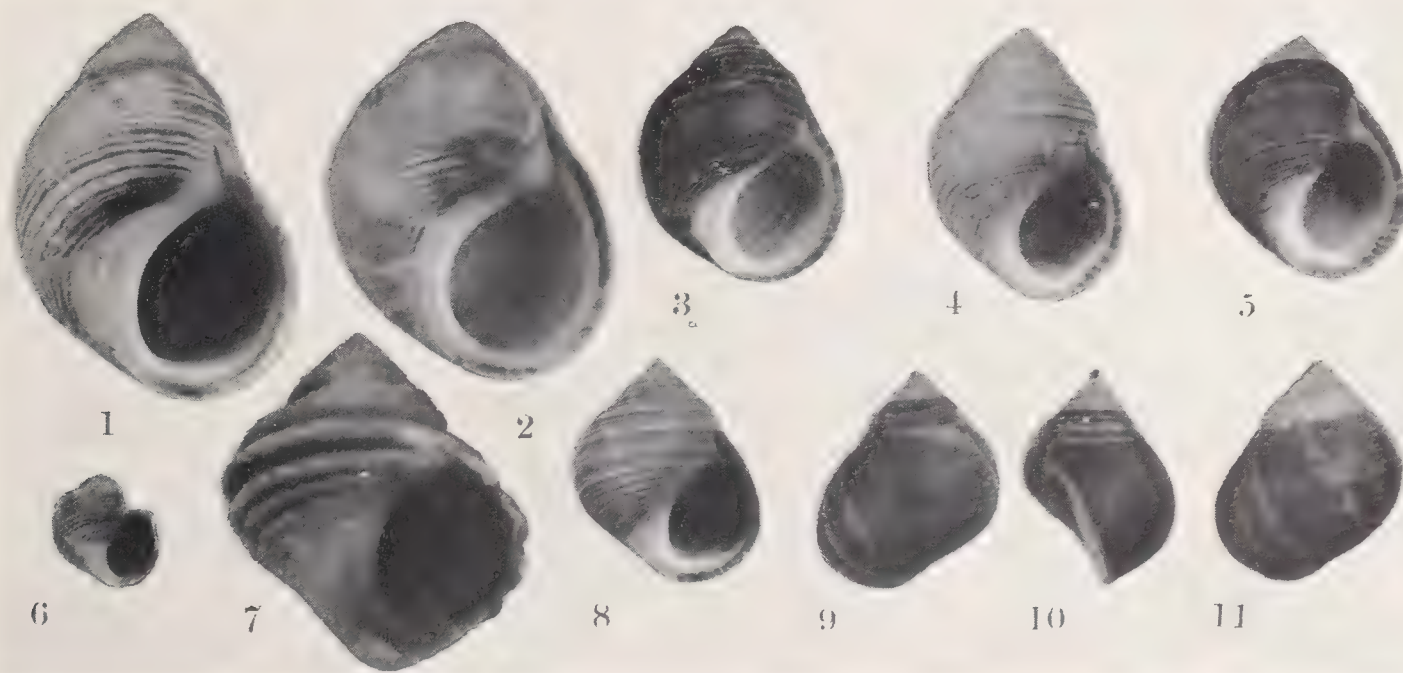


Plate 1. *Littorina littorea* Linné: 1 and 2, Grand Manan, New Brunswick; 3, Stonington, Connecticut; 4, Salmon Bay, Labrador; 5, Neptune City, New Jersey; 6, Woods Hole, Massachusetts (abnormal); 7, Isle-au-Haut, Maine (young, 8×); 8 to 11, Falmouth, Massachusetts. All, except 7, nat. size.

pressed against the body-whorl, forming a shallow groove within; columellar area broad, thick, slanting inward, smooth, rapidly narrowed at the base, margined outwardly by a sharp but low ridge which merges with the bow-like or rounded-angular basal lip; young shells more angular at the base of the columella; no trace of umbilical depression or pit at any stage. Color fairly constant in America, usually a bistre-gray, the ridges often pale brownish or the shell with dark brown bands; in Europe sometimes entirely reddish-orange; mouth within pale chocolate-brown, with whitish outer and basal edge, which is more or less spotted with reddish-brown; columella whitish; operculum yellowish-brown or dark mahogany. Oviparous, as first recognized by W. Clark (1850, *Ann. Mag. Nat. Hist.*, ser. 2, 5, p. 362): from 1 to 9 (usually 2 or 3) eggs enclosed in a chitinous, transparent capsule, which floats away; a first stage ciliate larva (trochosphere) is followed by a second swimming stage (veliger), which produces the shell-bearing, crawling young (M. Tattersall 1908, *Irish Naturalist*, 17, p. 238; 1920, *Fisheries, Ireland, Scientif. Invest.*, No. 1, pp. 1-11, 1 pl. Caullery and Pelseneer 1910, *Bull. Scient. France Belg.*, 44, pp. 357-360, pl. 9, figs. 1, 2, 5, 6, 9-11). Whorls more convex and aperture relatively larger in female than in male.

length	width	aperture	
32.4	24.5	22×15.8 mm.	Conception Bay, Newfoundland
42	28.6	26×20.4	Eastport, Maine
41.5	28	21.4×17	Salem, Massachusetts
24.2	19	17.4×12.5	Branford, Connecticut
22.7	19	16.5×13.8	Neptune City, New Jersey

The largest European shell seen (Clyde, Scotland) is 38 mm. long.

*Type.* Linné's type is at the Linnaean Society of London. The type locality is Norway.

*Range.* Coast of western Europe (including the British Isles and the Baltic Sea) from the White Sea (Russia) to the Straits of Gibraltar. Spitzbergen. Not alive in the Mediterranean, specimens reported from there being from ship's ballast. Not positively known to live in Iceland and Greenland, O. Fabricius' (1780) supposed *littorea* being *saxatilis*. The few specimens found in Iceland may be subfossil (G. Thorson 1941, *Zoology of Iceland*, 4, pt. 60, p. 34) or more probably were dumped with ship's ballast.

Introduced by the agency of man on the North American coast of the Atlantic about a century ago and now well established from southern Labrador to southern New Jersey (W. F. Ganong 1886, *Amer. Natural.*, 20, pp. 931-940). It is not known whether the introduction was accidental or intentional. It has not been found fossil nor in Indian shell-heaps. It was unknown to the early American malacologists, not being listed by A. A. Gould (1841, *Invertebrates of Massachusetts*), J. W. Mighels (1843, for Maine) and J. H. Linsley (1845, for Connecticut). J. W. Dawson stated that he found it at Pictou, Nova Scotia, as early as 1840 (W. F. Ganong 1887, *Amer. Natural.*, 21, p. 287) and E. S. Morse received it in 1855 from Bathurst, Bay of Chaleur, in the Gulf of St. Lawrence (1881, *Bull. Essex Inst. for 1880*, p. 176). About 1857, however, it was first reported in print by John Willis from Nova Scotia (1860, *Proc. Ac. Nat. Sci. Phila.*, p. 148; 1890, *Proc. Trans. Nova Scotian Inst. Nat. Sci.*, 7, p. 417). From Nova Scotia it spread rapidly southward, its pelagic early stages being carried in the plankton by the Labrador Current. In 1861 or 1862 it occurred in the Bay of Fundy near St. John, New Brunswick (W. F. Ganong 1890, *Bull. Nat. Hist. Soc. New Brunswick*, 9, p. 47). By 1879 it had reached Connecticut (A. F. Gray 1879, *Science News*, 1, p. 111; a reprint,

dated April 15, 1879, has added information). Prime found it at Lloyd's Neck, Long Island, in 1881, and Hollick at the Narrows of Staten Island in 1888 (S. Smith 1888, Proc. Nat. Sci. Assoc. Staten Id., 1, part for Jan. 14, p. 61; empty shell; first alive in 1893, see W. T. Davis 1893, *op. cit.*, 3, part for Sept. 9, p. 50). W. A. Stearns collected it in southern Labrador in 1882 (K. Bush 1883, Proc. U.S. Nat. Mus., 6, p. 240). J. Ford reported it in 1892 (Nautilus, 6, p. 27) from Atlantic City. Jeffreys' (1869, Brit. Conch., 5, p. 206) record from "Mexico," after a specimen in the British Museum, was either due to an error in labelling or based on a shell picked up from ship's ballast.

As recognized by Dautzenberg and Fischer (1912), *Littorina squalida* Broderip and Sowerby (1829, Zool. Journ., 4, p. 370; "boreal Ocean." Gray 1839, Zool. Beechey's Voyage "Blossom," Moll., p. 139, pl. 34, fig. 12; "Icy Cape," Alaska) is the representative, or perhaps subspecies, of *L. littorea* on the Arctic coast of Alaska, in the Behring Sea, Kamchatka and northern Japan.

*Records.* LABRADOR: Salmon Bay. NEWFOUNDLAND: Conception Bay; Cape Norman; etc. QUEBEC: Percé Rock; Bonaventure Id. NEW BRUNSWICK: Grand Manan. PRINCE EDWARD ID. NOVA SCOTIA: South Joggins. CAPE BRETON ID. MAINE. RHODE ISLAND: Westerly. CONNECTICUT: Stonington; Branford. NEW YORK: Pelham Bay; Oyster Bay, Long Island; Oakwood Beach, Staten Island (W. T. Davis). NEW JERSEY: Neptune City, Monmouth Co.; Atlantic City; Cape May (N. J. State Mus.).

*Remarks.* *L. littorea* varies little, particularly in North America, where it is as large as in Europe. Dautzenberg and Fischer (1912) thought that Newfoundland specimens were unusually large, but some British shells are about the same size. H. C. Bumpus (1898, Zool. Bull., 1, pp. 247-259, 14 charts) attempted to show that the species had become more variable in America, being more elongated, lighter, more bulky, and with less pronounced color markings. These differences are slight and not apparent. Moreover, Bumpus' measurements were probably vitiated by the corrosion of the shells (R. P. Bigelow and E. P. Rathbun 1903, Amer. Natural., 37, pp. 171-184).

This periwinkle is a favorite food in Europe and sometimes eaten also in New Brunswick, Nova Scotia and New England (C. W. Johnson 1904, Nautilus, 18, p. 47. W. F. Ganong 1889, Bull. Nat. Hist. Soc. New Brunswick, 8, p. 45). In England pearls have been found in it a few times.

*L. littorea* prefers rocks and pilings of the lower intertidal zone, near mean sea level, where it thrives in sea-water and is only partially exposed at extreme low tides; but in New England it also occurs on shallow muddy bottoms and among the roots and blades of *Zostera*, even in water that is only moderately salty (W. J. Clench 1930, Nautilus, 43, p. 105). The habits were studied in New Brunswick by J. N. Gowanloch and F. R. Hayes (1926, Contrib. Canad. Biol. Fish., New Ser., 3, pp. 133-166; 1929, *ibid.*, 4, pp. 413-430). C. H. Batchelder noted that it migrates in early winter 25 to 30 ft. from its summer habitat, to shallower but ice-free basins (1915, Nautilus, 29, p. 45). In parts of Europe it is popularly believed to anticipate changes in weather, moving to higher levels (above high tide mark) before a storm. Its herbivorous habits are sometimes made use of to keep parked oysters free of algal growth. W. T. Davis kept a *L. littorea* alive from Nov. 23, 1930, to April 1, 1932, in a corked bottle of sea-water with a piece of *Ulva lactuca* on which it fed (1931, Proc. Staten Id. Inst. Arts Sci., 6, pp. 41, 48 and, 1932, p. 185).

## *Littorina irrorata* Say, Plate 2, figs. 1-7

*Turbo irroratus* Say 1822 (July?), Jr. Ac. Nat. Sci. Phila., **2**, pt. 2, p. 239 (eastern shore of Maryland; coast of Carolina, Georgia, Florida and New Jersey).

*Phasianella sulcata* Lamarck 1822 (August), Hist. Nat. An. Sans Vert., **7**, p. 54 ("coasts of Carolina"). Delessert 1841, Recueil Coq. Lamarck, pl. 37, figs. 13a-b, with letterpress (type).

*Littorina lunata* H.C. Lea 1845 (March), Proc. Boston Soc. Nat. Hist., **1**, p. 205 (Cape May, New Jersey); 1845, Boston Jr. Nat. Hist., **5**, pt. 2, p. 287, pl. 24, fig. 3 (type).

*Littorina sayi* Reeve 1858, Conchol. Iconica, **10**, *Littorina*, pl. 17, figs. 96a-b, with letterpress (Florida). Not *L. sayi* Philippi, 1846.

*Littorina carolinensis* Conrad 1863, Proc. Ac. Nat. Sci. Phila. for 1862, p. 567 (Pliocene of North Carolina); 1875, Geol. Rept. North Carolina, **1**, Appendix, p. 23, pl. 4, figs. 10-11 (types).

*Littorina irrorata* var. *carolinensis* M. Smith 1936, Nautilus, **49**, p. 136, pl. 9, fig. 1.

*Synonymy.* *T. irroratus* and *P. sulcata* were published about the same time. Lamarck's book is dated "August 1822"; while pt. 2 of vol. 2 of Jr. Ac. Nat. Sci. Phila. was for June 1822 (according to the heading on p. 193). Mörch (1876) believed this to be the actual date of publication; but p. 251 (of this part 2) starts a paper "read July 26, 1822." It seems advisable to adhere to established custom and use Say's name for the species. There is no difficulty about recognizing a young *irrorata* in Lea's *L. lunata*.

*Description.* Shell elongate conical, much higher than wide, thick, opaque, dull, of 8 to 10 gradually increasing, flat whorls; early whorls lost in adult; suture weak, smooth, except behind outer lip of adult, where it is coarsely crenulate. Body-whorl about  $\frac{1}{2}$  of total height, rounded at periphery. Surface without periostracum, even in the smallest shell seen (4.5 mm. high); first 3 whorls (lost in adult) apparently smooth; on the 4th traces of spiral engraved lines appear, which become stronger on the succeeding whorls; body-whorl of adult with regularly spaced shallow grooves, separating narrow, low, spiral ridges; uppermost ridge, at suture, wider than the others and slightly ascending; growth-striae very fine, usually obsolete. Spire high, pointed. Aperture pear-shaped; outer lip meeting the body-whorl at a narrowly acute angle, slightly flaring, the edge sharp but slightly wavy or grooved within; farther back the inside is smooth and more or less thickened; inner lip with a strong smooth callus over the body-whorl. Columellar area rather narrow, thick, slanting inward, smooth, even, rapidly narrowed to the basal lip, margined outwardly by a blunt ridge which is somewhat folded back over the much narrowed base of the body-whorl and merges evenly with the bow-like basal lip; no trace of umbilicus at any stage. Color slightly variable, grayish-white, with a bluish tinge in the young, usually with blotches or short streaks of dark purple or reddish-brown on the spiral ridges, rather irregular in young shells, evenly spaced in older shells, often lacking or barely visible. Mouth white or yellowish-white within; outer lip inside with short, hor-

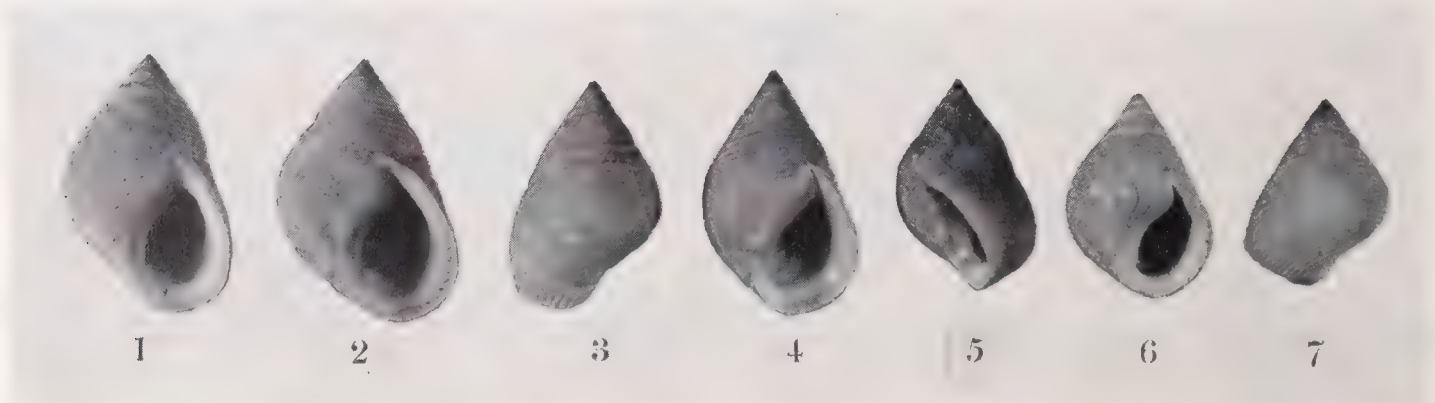


Plate 2. *Littorina irrorata* Say: 1 and 2, Boca Ciega Bay, Florida; 3 and 4, Pass-a-Grille, Florida; 5, Galveston, Texas; 6, Taunton River, Massachusetts (from Indian shell-heap); 7, Anglesea, New Jersey. All nat. size.



izontal, dark purple streaks, which disappear in very old shells; callus of inner lip and columella pale reddish-brown, fading toward the base; operculum dark mahogany-brown. Reproduction unknown.

length	width	aperture	
29.4	21.3	16.6×12 mm.	Boca Ciega Bay, St. Petersburg, Florida
26	17	15.5×11.5	Little Choptank River, Maryland
24	16.8	15.8×11.9	Cape May, New Jersey
22	16.2	14×11	Galveston, Texas

*Types.* Say's types of *irroratus* could not be traced; the type locality is here defined as Little Choptank River, Maryland. The type of *P. sulcata* is at the Geneva Museum and that of *L. lunata* should be at USNM, where it is not available at present.

*Range.* Southeastern United States, from Long Island, New York, to Florida (as far south as Indian River in the East and Charlotte Harbor in the west); on the Gulf of Mexico as far west as Point Isabel, Cameron Co., Texas (north of mouth of Rio Grande; H. B. Stenzel 1940, *Nautilus*, 54, p. 20). Not taken in Mexico, Central and South America. Very few records from the Antilles, perhaps all based on dead shells, from ballast. Known fossil from the Upper Miocene and Pliocene of North Carolina, South Carolina and Florida, and from the Pleistocene of Louisiana and Texas.

There is no reliable evidence that *L. irrorata* lives nowadays in New England, all published records from there being before 1880: Stratford, Connecticut ("on high sedge"; J. H. Linsley 1845, *Amer. Jr. Sci.*, 48, p. 284); New Haven ("not at all common"; G. W. Perkins 1869, *Proc. Boston Soc. Nat. Hist.*, 13, p. 125); Vineyard Sound and Long Island Sound near New Haven (A. E. Verrill, S. I. Smith and O. Harger 1873, *Rept. U.S. Comm. Fish. for 1871-1872*, p. 651). H. F. Carpenter saw no specimen in Rhode Island, although he included it in his Catalogue (1885, *Random Notes Nat. Hist.*, 2, p. 46; 1889, *Cat. Shell-Bearing Moll. Rhode Id.*, p. 2). Some of these records may have been based on living snails; others refer to fossils washed up by the waves from old deposits or shell-heaps; and Verrill suggested that in some cases *L. irrorata* had been brought in with southern oysters. A. Gould (1841) never saw it alive from Massachusetts. It is certain, however, that it was fairly abundant within historic times as far north as Cape Cod. It was reported from an Indian rock-shelter at New Haven (MacCurdy 1914, *Amer. Jr. Sci.*, ser. 4, 38, p. 517). J. B. Knight (1933 *Amer. Jr. Sci.*, ser. 5, 26, pp. 130-133) found it in post-Pliocene deposits underlying a salt-marsh near Branford, Connecticut (one at MCZ received from H. G. Richards), and in Indian shell-heaps nearby. A specimen at the MCZ (Fig. 6) was taken by Mr. R. C. Athearn from an Indian shell-midden at Barnaby's Cove on the Taunton River, Freetown, Massachusetts. Near New York City it was first reported by J. E. DeKay (1843, *Zool. New York*, 5, *Moll.*, p. 106, pl. 6, figs. 112a-b; "at Harlem, clinging to the stems of salt grass"); later also from Long Island by S. Smith and T. Prime (1870, *Ann. Lyc. Nat. Hist. New York*, 9, p. 393; "Huntington and Rockaway; a few dead shells were found in the grass above high water mark"), and from Staten Island by S. Smith (1886, *Proc. Nat. Sci. Assoc. Staten Id.*, 1, for June 12, p. 35; 1887, 1, Extra No. 5, p. 50). Mr. Roy Latham informs me that he found a few living specimens near the eastern end of Long Island as late as 1933, but that the species is very rare there. The dying out of *L. irrorata* at the northern edge of its range may be due to a change in climate for the colder, for which there is a certain amount of evidence (H. M. Raup 1937, *Jr. Arnold Arboretum*, 18, pp. 79-117).

*L. irrorata* does not occur in the Pacific. Reeve's *irrorata* (1857, Conchol. Iconica, 10, *Littorina*, pl. 11, figs. 56a-b), supposedly from Sitka, Alaska, was *L. aspera* Philippi, of the Pacific coast of Central America.

*Records.* NEW YORK: Orient, Long Island (R. Latham). NEW JERSEY: Cold Spring Harbor near Wildwood; Anglesea; Cape May. MARYLAND: Bishop's Head, Dorchester Co.; Little Choptank River. VIRGINIA: Norfolk; etc. NORTH CAROLINA: Roanoke Id. SOUTH CAROLINA: Charleston. GEORGIA: St. Simon's Id. FLORIDA: common, as far south as Indian River in the east and Charlotte Harbor in the west. ALABAMA: Mobile. MISSISSIPPI: Cat Id., off Pass Christian; Biloxi. LOUISIANA: Bayou du Lac; Empire. TEXAS: Port Aransas; Swan Lake, Galveston. CUBA: Matanzas (3 shells coll. by Sprague; possibly brought in ballast). HISPANIOLA: Monte Cristi (1 shell collected by Clench, Russell and McLean, 1937; possibly brought in ballast).

*Remarks.* *L. irrorata* lives in the brackish water of salt marshes, on grass-stems and around their roots, near and above the high tide mark, often climbing the grass. It is remarkably uniform throughout its range, in shape as well as in color. It could only be confused with *L. nebulosa tessellata*, which has a different columella and a very convex body-whorl, shouldered at the periphery.

I agree with W. H. Dall (1892, Trans. Wagner Free Inst. Sci., 3, pt. 2, p. 321) that the fossil specimens from the Carolinas and Florida are not separable from Recent ones. Some snails collected alive at Beaufort, North Carolina, are as slender as the fossil figured by M. Smith.

### *Littorina saxatilis* Olivi, Plate 3, figs. 1-10

*Turbo saxatilis* Olivi 1792, Zool. Adriatica, p. 172, pl. 5, figs. 3a-d (Gulf of Venice, Italy).

*Turbo rudis* Maton 1797, Observations Nat. Hist. Antiq. Western Counties, 1, p. 277 (Devon, England) [reference checked by H. G. Richards]. Donovan 1800, British Shells, 1, pl. 33, fig. 3.

*Turbo davidis* "Bolten" Röding 1798, Mus. Bolten., 2, p. 88 (defined by reference to Chemnitz 1781, Syst. Conchy. Cab., 5, pl. 185, figs. 1855a-b, from the Faroë Ids.).

*Turbo jugosus* Montagu 1803, Test. Brit., 2, p. 586; 1808, Supplement, pl. 20, fig. 2 (Dorsetshire and St. Ives in Cornwall, England).

*Turbo tenebrosus* Montagu 1803, Test. Brit., 2, p. 303; 1808, Supplement, pl. 20, fig. 4 (Devonshire and Kent, England).

*Turbo obligatus* Say 1822, Jr. Ac. Nat. Sci. Phila., 2, pt. 2, p. 241 (Portland, Maine).

*Turbo vestita* Say 1822, Jr. Ac. Nat. Sci. Phila., 2, pt. 2, p. 241 (Maine).

*Littorina groenlandica* Menke 1830, Synopsis Meth. Moll., 2d Ed., p. 45 (defined by the reference to Chemnitz 1781, Syst. Conchy. Cab., 5, pl. 185, figs. 1855a-b, from the Faroë Ids.).

*Littorina nigrolineata* J. E. Gray 1839, Zool. Beechey's Voyage "Blossom," Moll., p. 140 (no locality; with description and reference to Chemnitz 1781, Syst. Conchy. Cab., 5, pl. 185, figs. 1854 and; doubtfully, figs. 1855. Dautzenberg and H. Fischer restricted the name to figs. 1854a-b, from the coasts of Europe).

*Littorina castanea* Deshayes 1843, in Lamarek, Hist. Nat. An. Sans Vert., 2d Ed., 9, p. 206 ("northern seas").

*Littorina incarnata* "Lovén" Philippi 1846, Abb. Beschr. Conch., 2, p. 103 (Greenland; as a synonym of the red variety of *L. groenlandica* Menke).

*Littorina tenebrosa* var. *costulata* Middendorff 1849, Mém. Ac. Imp. Sci. St. Pétersbourg, ser. 6, Sci. Nat., 6, pts. 5-6, p. 389, pl. 8, figs. 6-8; [1849, Beiträge Malac. Rossica, 2, p. 61, pl. 8, figs. 6-8] (no locality, but evidently from the Arctic coast of Russia; with *Turbo obligatus* Say and *Littorina groenlandica* Menke as synonyms).

*Synonymy.* Only names used for North American shells are listed. For the many Old World synonyms, see P. Dautzenberg and H. Fischer 1912, Rés. Camp. Scientif. Prince de Monaco, 37, pp. 187-201. The following should be added to their list: *Littorina macerwinii* "Thompson" Philippi (1846), *Littorina simplex* Reeve (1857), *Littorina danieli* Locard (1886) and *Littorina rudis* var. *alticola* Dacie (1917).

*Description.* Shell turbinate to conical, variable in shape, usually much higher than wide, moderately thick, opaque, dull, of 6 to 8 gradually increasing and convex whorls; suture deep, even or rugulose; body-whorl nearly  $\frac{1}{2}$  to  $\frac{2}{3}$  of total height. Surface of young with a thin yellowish-brown, minutely wrinkled periostracum, usually lost in the adult, often corroded; sculpture very weak or almost lacking in young and small shells; in larger ones low and broad, rather regularly spaced spiral ridges, which are wider below the periphery; in adult shells they tend to disappear behind the outer lip; the intervals with minute spiral striation; growth-striae very weak; sometimes some of the ridges much stronger, forming widely spaced, sharp ribs. Spire high, pointed. Aperture sub-circular; outer lip not flaring, sharp-edged, smooth within and a little thickened some distance from the edge, horizontal or somewhat descending at the body-whorl; columellar area broad, thick, slanting inward, smooth, gradually narrowed to the basal lip, margined outwardly by a sharp ridge, much produced below the base of the body-whorl; in the male, obtusely angular where it meets the bow-like basal lip; a weak umbilical groove outside the edge of the columella in young but no trace of this in adult. Color variable; adult usually a uniform yellowish or brownish-gray, sometimes more reddish or orange-gray, occasionally with one or more spiral white bands, or gray with one or more black or dark purple bands; sometimes the pale bands irregularly interrupted, producing blotching or tessellation; mouth within usually bright reddish-brown, gradually paler toward the edge; columella whitish, pale brown, or dark purple; operculum pale or dark brown. Ovoviviparous; eggs producing shell-bearing, crawling embryos in a brood sac at the lower end of the oviduct. Male smaller than female, with a longer spire in proportion to the body-whorl, and a narrower aperture, somewhat angular at the basal edge.

The largest European shell seen (Brest, France) is 24.3 mm. long and 17.5 mm. wide.

length	width	aperture	
18.3	15.5	13×11.6 mm.	St. Andrews, New Brunswick
18	12	9.5×9.5	Stonington, Connecticut

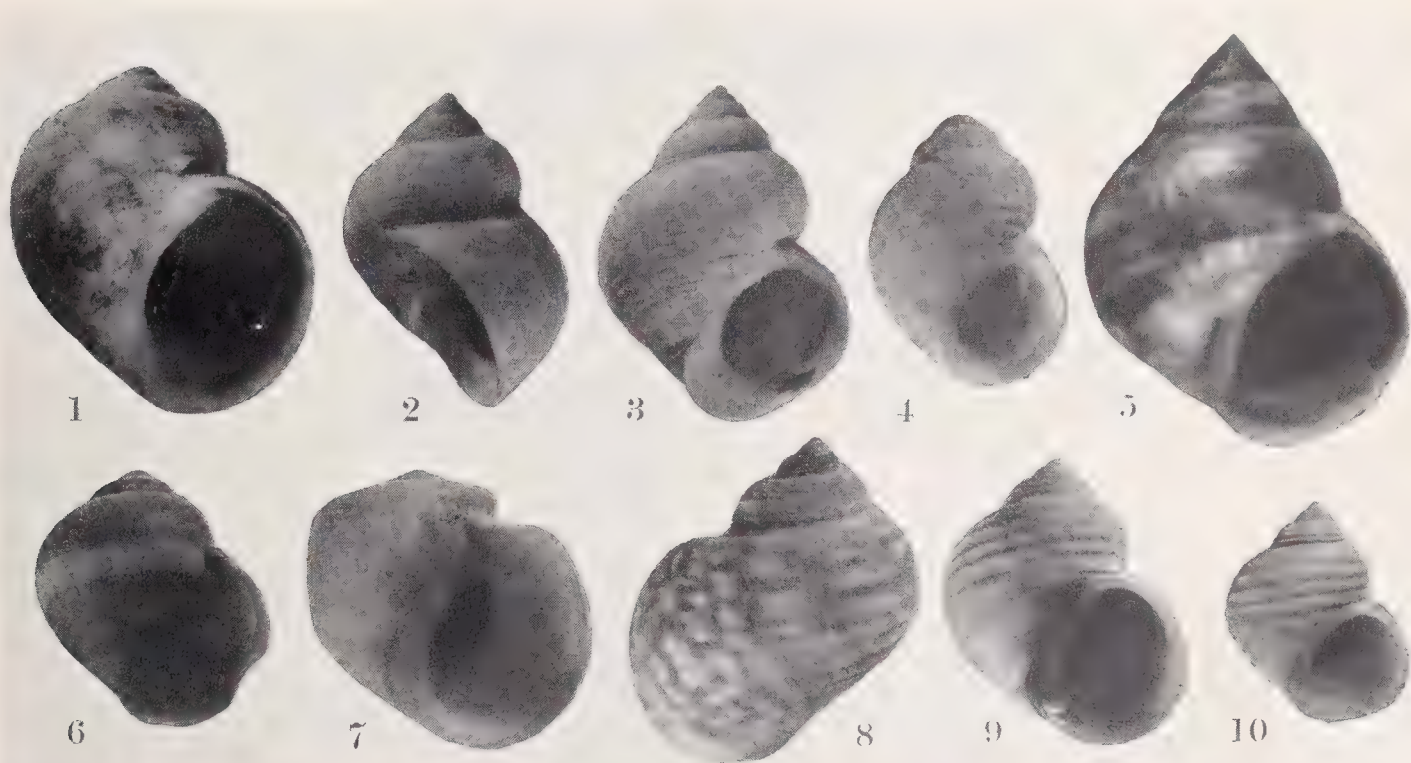


Plate 3. *Littorina saxatilis* Olivi: 1 and 2, Stonington, Connecticut; 3, St. Andrews, New Brunswick; 4 and 9, Perry, Maine; 5, Isleboro, Maine (young, 8×); 6 to 8, Grand Manan, New Brunswick (7, abnormal); 10, Kennebunk, Maine. All, except 5, nat. size.

*Types.* Types of *saxatilis* and *rudis* probably lost. That of *castanea* may be at the British Museum, as well as those of Montagu's *tenebrosus* and *jugosus*. Say's types of *obligatus* are at the Ac. Nat. Sci. Phila. (No. 18387); those of *vestita* could not be traced.

*Range.* Mainly boreal and arctic. In Europe from Nova Zembla (probably even farther east on the coast of Siberia) and Spitzbergen to the Azores, in the British Isles, the Baltic, the western Mediterranean (Adriatic, Tunisia, etc.) and the Black Sea. Faroë Ids. Iceland. Greenland. Autochthonous in North America from Cape Barrow in Coronation Gulf, 68° 4' N., 111° W. (W.H. Dall 1919, Rept. Canad. Arctic Exp. 1913-18, 8, pt. A, p. 16), Southampton Id., Hudson Bay, southern Baffin Land (at the Arctic Circle; J. Oughton 1940, Nautilus, 54, pp. 1-6) to southern New Jersey. It is known from Pleistocene deposits in Quebec (J. W. Dawson 1893, Canadian Ice Age, p. 249) and from post-Pliocene deposits underlying a salt-marsh near Branford, Connecticut (J. B. Knight 1934, Amer. Jr. Sci., ser. 5, 28, p. 172). G. F. Matthew (1892, Bull. Nat. Hist. Soc. New Brunswick, 10, p. 23) reports it from Indian shell-heaps at Bocabec, New Brunswick. Published records from the Pacific coast of America, Alaska and Japan were probably all based on forms of *L. sitchana* Philippi, the Pacific representative, or perhaps subspecies, of *L. saxatilis*. Jeffreys' British Museum specimen (1869, Brit. Conch., 5, p. 206) from Mexico was either wrongly labelled or a shell from ship's ballast.

*Records.* GREENLAND: Proven; Frederikshaab; Evigtut. ONTARIO: Hudson Bay. LABRADOR: Indian Harbor; Main. NEWFOUNDLAND: Port Saunders; etc. QUEBEC: Bonaventure Id.; Gaspé; etc. NOVA SCOTIA: South Joggins; etc. ST. PIERRE-ET-MIQUELON. MAINE: common. NEW HAMPSHIRE: common. MASSACHUSETTS: common. RHODE ISLAND: common. CONNECTICUT: common. NEW YORK: common. NEW JERSEY: Sea Isle City; Cape May (N.J. State Mus.).

*Remarks.* Some of the variations in size, shape, sculpture and color of the proteiform *L. saxatilis* pass into one another and may be found together under the same conditions; others seem to be due to the direct action of the environment. This was first recognized in England by W. Clark (1850, Ann. Mag. Nat. Hist., ser. 2, 5, pp. 362-364). There appear to be no true geographical races or subspecies. I am unable to distinguish consistently series from Greenland and Labrador (so-called var. *groenlandica*) from more southern lots. If desired, collectors may sort their specimens into named forms by means of the exquisite figures in Dautzenberg and Fischer's work (1912). Sexual differences are sometimes mistaken for racial ones and monstrosities are not uncommon. The oldest name for our most striking variant, with few, but very strong or sharp ridges, is var. *jugosa* Montagu. Say's *vestita* and *obligatus* were based upon similar shells, but with weaker ridges. More elongate, usually smoother and thinner shells, often found on the mud of brackish creeks or in salt marshes, may be called var. *tenebrosa* Montagu. Typical *saxatilis* and var. *jugosa* prefer rocks or small stones, near high tide mark, where they are exposed for the greater part of every day. According to C. H. Batchelder (1915, Nautilus, 29, p. 46), in northern localities *L. saxatilis* migrates in early winter to deeper water, in order to escape the ground ice. N. R. Bouchard-Chantereaux (1836, Mém. Soc. Agric. Boulogne-sur-Mer for 1835, p. 154; erroneously called by him *littorea*) first noted that the eggs remain in the oviduct until they hatch, producing at once young, crawling snails. These are released one at the time, at intervals of several hours. The lack of a free-swimming stage is correlated with this species living habitually out of the water part of the day, and occasionally remaining dry for several days in succession. It then secretes a

sticky slime, which dries up and cements the outer lip to the rock. Being ovoviviparous renders this periwinkle unfit to eat, as noted by W. Clark (1850).

### *Littorina nebulosa* Lamarck, Plate 4, figs. 1-4

*Phasianella nebulosa* Lamarck 1822, Hist. Nat. An. Sans Vert., 7, p. 54 (Santo Domingo). Delessert 1841, Recueil Coq. Lamarck, pl. 37, figs. 12a-b, with letterpress (type).

*Littorina columellaris* d'Orbigny 1840, Voy. Amér. Mérid., 5, pt. 3, Moll., p. 392 (Pernambuco; Antilles); 1842, in de la Sagra, Hist. Phys. Pol. Nat. Cuba, Moll., Atlas, pl. 15, figs. 18-20 (binomial on plate); Text, 1, (1842), p. 213 (Martinique; Pernambuco).

*Littorina tigrina* d'Orbigny 1842, in de la Sagra, Hist. Phys. Pol. Nat. Cuba, Moll., Atlas, pl. 15, figs. 9-11 (binomial on plate); Text, 1, (1842), p. 211 (Havana; Guadeloupe).

*Littorina sayi* Philippi 1846, Proc. Zool. Soc. London for 1845, p. 140 ("Florida"); 1847, Abb. Besch. Conch., 3, p. 12, pl. 6 (*Litorina*), fig. 11 (type).

*Litorina exarata* Philippi 1848, Abb. Besch. Conch., 3, p. 63, pl. 7 (*Litorina*), fig. 8 (no locality).

*Litorina angulifera* var. *minor* Weinkauff 1878, Syst. Conchy. Cab., 2, Abt. 9, p. 39 (with *nebulosa* Lamarck as synonym).

*Synonymy.* Tryon regarded Lamarck's *nebulosa* as a variety of *L. scabra*; but Delessert's figure of the type is certainly *L. columellaris*. I agree with Weinkauff that Philippi's *sayi* was this species, not *irrorata*; the type locality was probably erroneous, as *nebulosa* is not definitely known from Florida. Tryon supposed that *L. tigrina* might have been *tessellata* (here regarded as a form of *nebulosa*); but, as d'Orbigny's figure does not show the shouldering at the periphery of the body-whorl nor the spotting of the outer lip characteristic of *tessellata*, I refer it to typical *nebulosa*.

*Description.* Shell elongate conical, higher than wide, moderately thick, dull, of 7 to 9 gradually increasing, convex whorls; early whorls lost in adult; suture well marked, smooth or very slightly crenulate behind the outer lip. Body-whorl of adult about  $\frac{2}{3}$  of

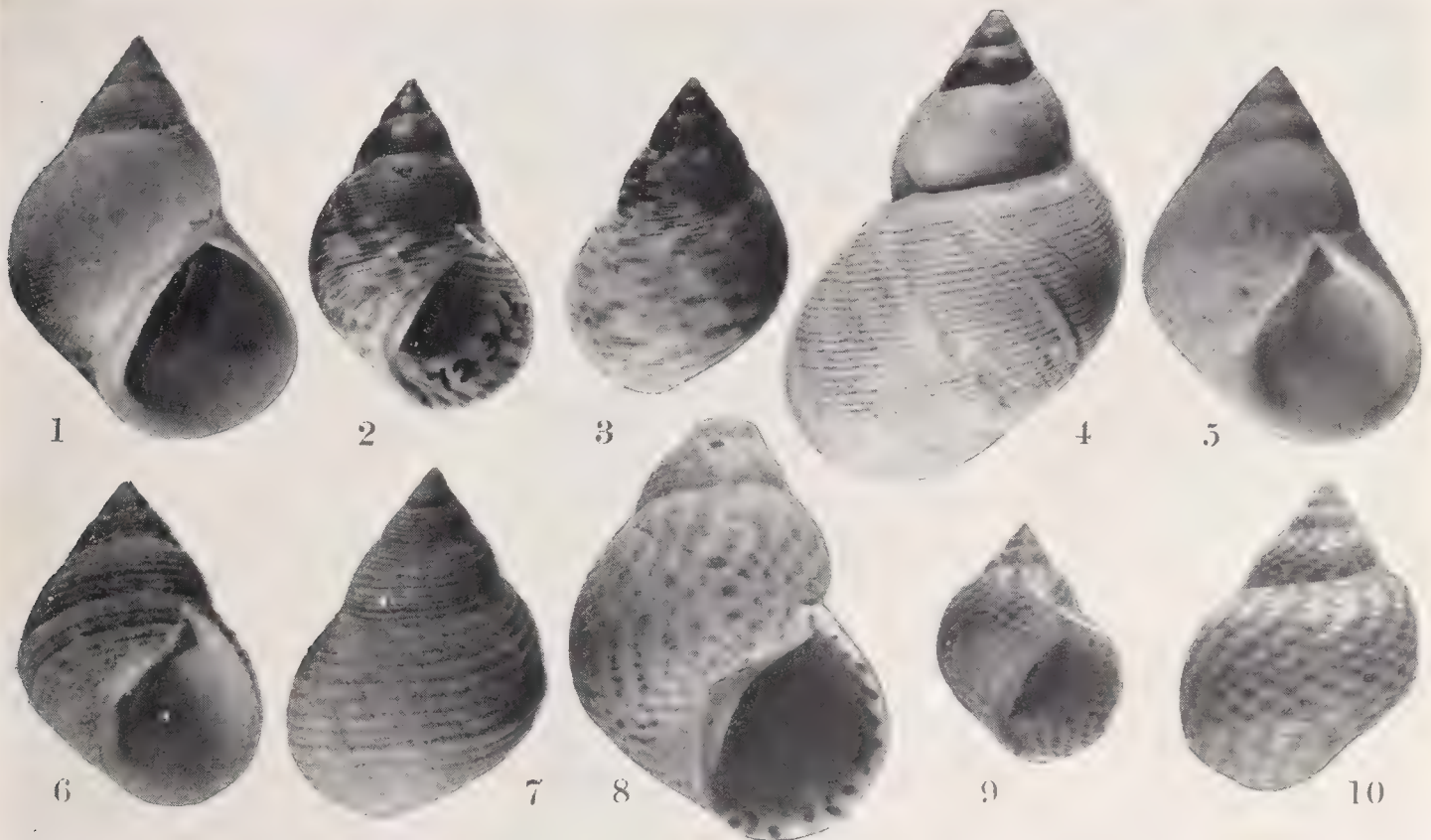


Plate 4. 1 to 4, *Littorina nebulosa* Lamarck: 1 to 3, Punta de los Colorados, Cienfuegos, Cuba; 4, Chagres River, Panama. 5 to 7, *L. n. flava* King and Broderip: 5, Proto de Iguapé, Sao Paulo; 6 and 7, La Milpa, Cienfuegos, Cuba. 8 to 10, *L. n. tessellata* Philippi: 8, West End, Grand Bahama Id.; 9 and 10, Jeremie, Haiti. All  $2\times$ .

total height, more convex than earlier whorls. No periostracum. First 2 or 3 whorls worn smooth; traces of spiral engraved lines on the 4th, becoming stronger on the next; on the body-whorl they are numerous, close together, rather regularly spaced, and somewhat wavy, the raised intervals much wider and flat; subsutural area somewhat depressed, with 2 or 3 deeper, more regular grooves; growth-striae strong, more or less decussating the spiral sculpture. Aperture subcircular; outer lip not flaring, the edge sharp, thin, smooth and not thickened within, meeting the body-whorl at a sharp angle; inner lip forming a very slight callus over the body-whorl. Columellar area very long and wide, slanting inward, smooth; the narrow inner edge much thickened, long and nearly straight, ending rather abruptly below, separated by a broad and shallow depression from the sharp outer edge which limits the base of the body-whorl and merges evenly with the bow-like basal lip. Depression of the columella in the position of the umbilicus and more pronounced in young shells; but even in the smallest (5.5 mm.) there is no umbilical slit. Color rather variable in youth, more uniform later; in shells up to 10 mm. long the earliest 2 or 3 whorls are fairly unicolor, pale dirty-yellow; soon white and reddish-brown speckling appears, eventually producing streaks or spots, irregularly scattered or checkered or forming jagged zigzag stripes; in the same lot some young shells may show very few spots or be uniformly dirty- or bone-yellow; spotting usually stops rather abruptly on the 6th or 7th whorl, the remainder being uniformly bone-yellow or white, often with a bluish tinge; occasionally an adult, 21 mm. long, may be blotched over part of the body-whorl. Mouth uniformly yellowish-brown to pale-purplish within; outer lip whitish; columellar area with the swollen inner edge white, the depression pale purplish-brown; operculum pale mahogany-brown. Reproduction unknown.

length	width	aperture	
24	16.2	13.8×12.6 mm.	Cienfuegos, Cuba
23	14.2	14×11.1	Colón, Panama
21	13.2	12.8× 9.8	Sta. Barbara de Samana, Hispaniola
24	16.1	14×11.8	Fullerton Bay, Trinidad
21.6	14	13×10.4	Tampico, Mexico

*Types.* The type of *nebulosa* is in Lamarek's collection at the Geneva Museum. The types of d'Orbigny's *columellaris* and *tigrina*, and of Philippi's *sayi* and *exarata* may all be at the British Museum. The type locality of *columellaris* is herewith designated as Pernambuco and that of *tigrina* as Havana.

*Range.* Greater and Lesser Antilles, Gulf of Mexico (from Tampico southward) and Caribbean coast of Central and South America to Trinidad and the Guianas.

*Records.* CUBA: Matanzas; Cienfuegos; Havana; Manzanillo, Oriente; etc. JAMAICA: Bowden; Kingston Harbor. HISPANIOLA: Sanchez; Sta. Barbara de Samana. PUERTO RICO: San Juan Harbor. TRINIDAD: Mayaro; Moruga; Pointe-à-Pierre; Otaheite Bay; Fullerton Bay. MEXICO: Tampico; Vera Cruz. GUATEMALA: Livingston; Puerto Barrios. NICARAGUA: Waunta Haulover. PANAMA: Porto Bello; Chagres River; Colón (Aspinwall). Specimens at MCZ labelled "Charlotte Harbor" (west coast of Florida), probably an erroneous locality. Reported from Yucatan, Honduras, Costa Rica, Venezuela, French Guiana (Cayenne), Guadeloupe and Martinique. Dall's records from Brasil (1891, *Nautilus*, 5, p. 44; Sta. Catharina, 1901, *Proc. Wash. Ac. Sci.*, 3, p. 144; Parahyba) were, I believe, based on *L. n. flava*.

*Remarks.* *L. nebulosa* is most commonly found attached to logs, jetties or wreckage; it seems to avoid rocks exposed to heavy surf.

Throughout most of the range of typical *nebulosa* and farther south some specimens differ rather markedly, yet agree in so many characters that they clearly belong to the same stock. I recognize two such forms by name, giving them subspecific rank, though they are perhaps not geographically segregated.

### ***Littorina nebulosa tessellata* Philippi, Plate 4, figs. 8-10**

*Littorina tessellata* Philippi 1847, Abb. Besch. Conch., **2**, p. 226, pl. 5 (*Littorina*), fig. 26 (Martinique; new name for *L. undulata* d'Orbigny, 1842).

*Littorina undulata* d'Orbigny 1842, in de la Sagra, Hist. Phys. Pol. Nat. Cuba, Moll., Atlas, pl. 15, figs. 12-14 (binomial on plate); Text, **1**, (1842), p. 212 (Martinique). Not *Littorina undulata* Gray, 1839.

*Phasianella lineata* Lamarck 1822, Hist. Nat. An. Sans Vert., **7**, p. 54 (no locality). Delessert 1841, Recueil Coq. Lamarck, pl. 37, figs. 11a-b, with letterpress (type). Not *Buccinum lineatum* Gmelin, 1790, which is also a *Littorina*.

*Synonymy.* Lamarck's *P. lineata* has often been regarded as a variant of *L. ziczac*; but Delessert's figure of the type agrees with d'Orbigny's *L. undulata*, there being no trace of the inner basal band of the mouth characteristic of *L. ziczac*. As both Lamarck's and d'Orbigny's names conflict with earlier ones in the genus, Philippi's *tessellata* is the valid name.

*Description.* Differs from typical *nebulosa* in the slightly more swollen body-whorl, often obtusely shouldered or subangular below the suture and at the periphery, but without prominent peripheral rib. Spiral linear grooves more spaced, with broad and flat intervals. Brownish-red spots on a grayish-white background in a fairly regular checker pattern, tending to form oblique axial lines. White inner margin of the sharp outer lip with a series of brownish-red spots.

length	width	aperture	
22.8	16.5	12.8×9.8 mm.	Grand Bahama, Bahamas
18.3	13.6	12.5×9.9	Jeremie, Haiti

*Types.* The type of *undulata* may be at the British Museum; that of Lamarck's *lineata* is at the Geneva Museum.

*Range.* Bahamas, Antilles and the Caribbean coast of South America. Not known from Bermuda, Florida or east of Venezuela.

*Records.* BAHAMAS: Grand Bahama; Mariguana; Great Inagua; Long Island; Eleuthera; New Providence. CUBA: Cienfuegos; Caibarien; Baracoa; Sagua; Gibara; Puerto Padre, Oriente. HISPANIOLA: Gonave Island; Cape Haitien; Jeremie; Miragoane; Santa Barbara de Samana; Monte Cristi; Puerto Sosua. JAMAICA: Port Antonio; St. Ann; Kingston Harbor. VIRGIN ISLANDS: St. John. PANAMA: Colón. VENEZUELA: Guanta; Cumana. Reported from Guadeloupe and Puerto Rico.

*Remarks.* In color *tessellata* is sometimes much like *L. irrorata*, with which it has been confused; it differs in the shape of the columella and the very convex body-whorl.

### ***Littorina nebulosa flava* King and Broderip, Plate 4, figs. 5-7**

*Littorina flava* King and Broderip 1832, Zool. Journ., **5**, (1831) p. 345 (Rio de Janeiro). d'Orbigny 1840, Voy. Amér. Mérid., **5**, pt. 3, Moll., p. 391, pl. 53, figs. 1-3.

*Description.* Agreeing essentially with *nebulosa*. Shell on the average smaller, usually broader, often little higher than wide, with the body-whorl relatively longer. Engraved

spiral lines much more spaced, their intervals often raised and more or less rib-like, particularly one at the periphery and another below this; some specimens in the same lot have the ribs very weak; but they may be pronounced even in very young shells. Outer lip with a sharp edge, but often much thickened within. Color markings, if present, of very faint, small spots; most shells uniformly dirty-yellowish or whitish, sometimes slightly orange. Columellar area extensively reddish-brown, paler at the inner edge, white over the outer edge; outer lip white and unspotted over the thickened area; mouth within pale reddish-brown.

length	width	aperture	
19.6	13.8	11.2×9.7 mm.	Cienfuegos Bay, Cuba
16.2	11	9.5×8.4	Trinidad
19.8	14.8	12×9.3	Proto de Iguapé, Brasil

*Types.* Probably at the British Museum, at least in part.

*Range.* Chiefly on the coast of eastern South America, from the Gulf of Paria to São Paulo; but by no means rare near Cienfuegos, Cuba (first recorded by C. G. Aguayo 1935, Mem. Soc. Cubana Hist. Nat., 9, p. 111). One lot from Guadeloupe in the C. B. Adams Collection (now at MCZ). Perhaps these Antillean records are due to relatively recent introductions by man.

*Records.* CUBA: Cienfuegos, fairly common at several localities in the bay. GUADELOUPE. VENEZUELA: Soldado Rock, Gulf of Paria. TRINIDAD: common. TOBAGO. BRASIL: Maranhão; Pernambuco; Bahia; Ilha de Itaparica, Bahia; Praia de Itapoan, Bahia; Rio de Janeiro; Proto de Iguapé, São Paulo; Ilha do Cardoso, Cananéa, São Paulo.

*Remarks.* The original description was very brief: "L. testa longitudinaliter striata, sub-flava; spira brevi; anfractu basali ventricosos; columellae purpurascens margine et apertura subflava; operculo nigricante; long. 5/8 paulo plus; lat. 7/10; poll.—In young shells there are a few obscure reddish-brown streaks crossing the striae." This was apparently based on specimens with rather weak spiral ridges, but none of the types have ever been figured. The later figures by d'Orbigny and Philippi (1847, Abb. Besch. Conch., 2, p. 201, pl. 4 (*Littorina*), figs. 17) show specimens with some sharp ridges. All transitions occur between these two types, in the same lot. Pilsbry (1907, Nautilus, 21, p. 71) writes: "*L. flava* is very thick inside the lip, exactly like *irrorata*. It resembles *nebulosa* in color, but is evidently a distinct species close to *irrorata*. I have never seen *L. flava* from north or west of Trinidad." The thickening inside the lip is well-marked in most full-grown shells only; but in the same lot some large shells hardly show it at all. Our Cuban and Guadeloupan specimens do not differ from those of Trinidad and Brasil; but I suggest that *flava* may be a recent introduction in the Antilles by man. It is now well established in the Bay of Cienfuegos. Sometimes called *irrorata* in collections, but that species has a different columella and flattened whorls.

### *Littorina ziczac* Gmelin, Plate 5, figs. 1-10

*Trochus ziczac* Gmelin 1790, in Linné, Syst. Nat., 13th Ed., 1, pt. 6, p. 3587 (no locality; based on Chemnitz 1781, Syst. Conchy. Cab., 5, pl. 166, figs. 1599a-b, from the "Zuckerinseln" in the West Indies).

*Littorina zic-zak* "Chemnitz" Mörch 1876, Malak. Blätt., 23, p. 137 (emendation of *ziczac*).

*Littorina zigzag* d'Orbigny 1842, in de la Sagra, Hist. Phys. Pol. Nat. Cuba, Moll., Atlas, pl. 15, figs. 5-8 (binomial on plate); Text, 1, (1842), p. 210 (Havana; Martinique; emendation of *ziczac*).

*Littorina zigzag* Arango 1880, Contrib. Fauna Malac. Cubana, p. 160 (misspelling of *ziczac*).



*Turbo dispar* Montagu 1815, Trans. Linn. Soc. London, **11**, p. 195, pl. 13, fig. 4 (supposedly from Poole, England; recognized by E. Forbes and S. Hanley 1853, Hist. Brit. Moll., **3**, p. 54, as not British, but probably West Indian).

*Littorina lineata* d'Orbigny 1842, in de la Sagra, Hist. Phys. Pol. Nat. Cuba, Moll., Atlas, pl. 14, figs 24-27 (binomial on plate); Text, **1**, (1842), p. 208 (Havana; Martinique; Rio de Janeiro). Not *Buccinum lineatum* Gmelin, 1790, or *Phasianella lineata* Lamarek, 1822.

*Littorina lineolata* d'Orbigny 1840, Voy. Amér. Mérid., **5**, pt. 3, Moll., p. 392 (Rio de Janeiro; with description and reference to Chemnitz 1781, Syst. Conchy. Cab., **5**, p. 69, pl. 166, figs. 1600a-b, from the "Zuckerinseln" in the West Indies).

*Littorina carinata* d'Orbigny 1842, in de la Sagra, Hist. Phys. Pol. Nat. Cuba, Moll., Atlas, pl. 15, figs. 1-4 (binomial on plate); Text, **1**, (1842), p. 209 (Havana; Martinique). Not *Turbo carinatus* Sowerby 1819, which is also a *Littorina*.

*Littorina debilis* Philippi 1846, Proc. Zool. Soc. London for 1845, p. 140 (no locality); 1847, Abb. Besch. Conch., **3**, p. 11, pl. 6 (*Litorina*), fig. 7 (type).

*Litorina d'orbignyana* Philippi 1847, Abb. Besch. Conch., **2**, p. 162, pl. 3 (*Litorina*), fig. 12 (Cuba; Jamaica; Mte. Christi in western Colombia [probably Hispaniola]).

*Littorina orbignyana* "Philippi" G. Nevill 1885, Hand List Moll. Ind. Mus., **2**, (1884), p. 139 (as a synonym of *L. ziczac*; emendation of *d'orbignyana*).

*Littorina pusilla* Philippi 1847, Abb. Besch. Conch., **2**, p. 164, pl. 3 (*Litorina*), fig. 23 (Brasil or Sandwich Ids.). Not *Littorina pusilla* F. M'Coy, 1844.

*Littorina mauritiana* var. *crassior* Philippi 1847, Abb. Besch. Conch., **2**, p. 165, pl. 3 (*Litorina*), fig. 15, only (Cuba).

*Littorina columna* "Jonas" Philippi 1847, Abb. Besch. Conch., **3**, p. 14, pl. 6 (*Litorina*), fig. 15 (no locality).

*Littorina cingulata* ["Pfeiffer" C.B. Adams 1847, Cat. Rec. Shells Coll. C.B. Adams, p. 19 (Jamaica; *nomen nudum*)] Mörch 1876, Malak. Blätt., **23**, p. 138 (as a doubtful synonym of *L. floccosa*). Not *Littorina cingulata* Philippi, 1846.

*Littorina jamaicensis* C.B. Adams 1850, Contrib. to Conchology, No. 5, p. 71 (Jamaica).

*Littorina lineata* var. *interrupta* "Adams" Philippi 1856, Syst. Conchy. Cab., **2**, Abt. 9, p. 24, pl. 3, figs. 14-15 (Jamaica).

*Littorina angustior* Mörch 1876, Malak. Blätt., **23**, p. 139 (Havana; St. Croix; St. Thomas).

*Littorina floccosa* "Beck" Mörch 1876, Malak. Blätt., **23**, p. 138 (St. Thomas).

*Littorina glaucocincta* "Beck" Mörch 1876, Malak. Blätt., **23**, p. 138 (St. John; listed as a variety of *L. floccosa*).

*Littorina riisei* Mörch 1876, Malak. Blätt., **23**, p. 140 (Havana).

*Littorina cubana* Weinkauff 1882, Syst. Conchy. Cab., **2**, Abt. 9, p. 68, pl. 9, figs. 2-3 (Cuba).

*Synonymy.* *L. ziczac*, of the Antilles, has sometimes been confused with *L. mauritiana* Lamarek, a closely related or representative species of the Indo-Pacific. Gmelin had no specimen and gave no locality; but he referred to a figure of a West Indian shell, the "Sugar Islands" being an old name for the Windward Islands. The extensive variation in size (for the same number of whorls), shape and color, as well as the pronounced sexual dimorphism, led to a multiplicity of names. Without the types, it is not easy to recognize either *L. ziczac* or *L. nebulosa* in the published figures and descriptions. Each case was carefully studied, sometimes with results disagreeing with those of earlier authors. Male shells are often labelled *L. ziczac* var. *lineata*, but I regard Lamarek's *P. lineata* as *L. nebulosa tessellata* and Gmelin's *B. lineatum* as a form of *L. scabra*. Montagu's *T. dispar* was a small, unicolor *ziczac*; he mentions the inner pale band near the base of the mouth.

*Description.* Shell with marked sexual dimorphism, elongate-conical to short-turriculate and much higher than wide in the female, broadly-conical and nearly as wide as high in the male; moderately thick, dull, of 6 to 8 gradually increasing, convex or moderately flattened whorls; summit as a rule little or not corroded, exceptionally decollate (Philippi's *pusilla*); suture well-marked, smooth. Body-whorl of adult slightly over  $\frac{1}{2}$  of total height, much more convex than earlier whorls (particularly in male), as a rule shouldered or obtusely carinate at the periphery and, near the outer lip, somewhat depressed below the suture. In some senile shells the body-whorl uncoils partly, producing a subsutural carina below a sutural groove or channel (pl. 5, fig. 1). No periostracum. First 2 whorls

worn smooth; sculpture of remainder variable and differing in both sexes: female usually with moderately deep, engraved spiral lines, either few (10 or less) and far apart or many and close, when they may be wavy or irregular, sometimes obsolete; male more strongly sculptured, often with broad and deep spiral grooves, the intervals flat or obtusely ribbed; sculpture sometimes weaker below the periphery; peripheral shoulder either smooth, narrow or barely set off, or forming (particularly in the male) a strong and broad, blunt ridge, sharply delimited above and below; growth-striae very weak or lacking. Aperture broadly pear-shaped; outer lip not flaring, the edge sharp, thin, not thickened within, usually smooth but sometimes wavy in more strongly sculptured (male) shells, meeting the body-whorl at a sharp angle which is often somewhat channelled inside; inner lip forming a very slight callus over the body-whorl. Columellar area moderately long and wide, slanting inward, smooth, even or barely concave; inner edge bluntly rounded, nearly straight, gradually curving at the base; outer edge weak above where it touches the body-whorl directly or with an intervening very narrow, crescent-shaped, dull lunule; farther down the outer edge is stronger, somewhat produced beyond the base of the body-whorl, either very bluntly angular or evenly rounded into the bow-like basal lip; no trace of umbilical depression or slit even in the smallest shell seen (2 mm.). Color very variable, even in the same lot; typical pattern of fine, oblique, wavy or zigzag, chestnut-brown or purplish-brown, axial lines or stripes on a white or bluish-white background; earliest whorls uniformly pale reddish-brown; the stripes vary in number and width; they may fuse over part or most of the surface, but usually leave prominent whitish spots or streaks below the suture and on the peripheral shoulder; the network pattern of Philippi's *pusilla* is a modification of this; finally some shells are almost unicolor chestnut or mahogany-brown, faintly paler below the suture and at the periphery, while at the other extreme the

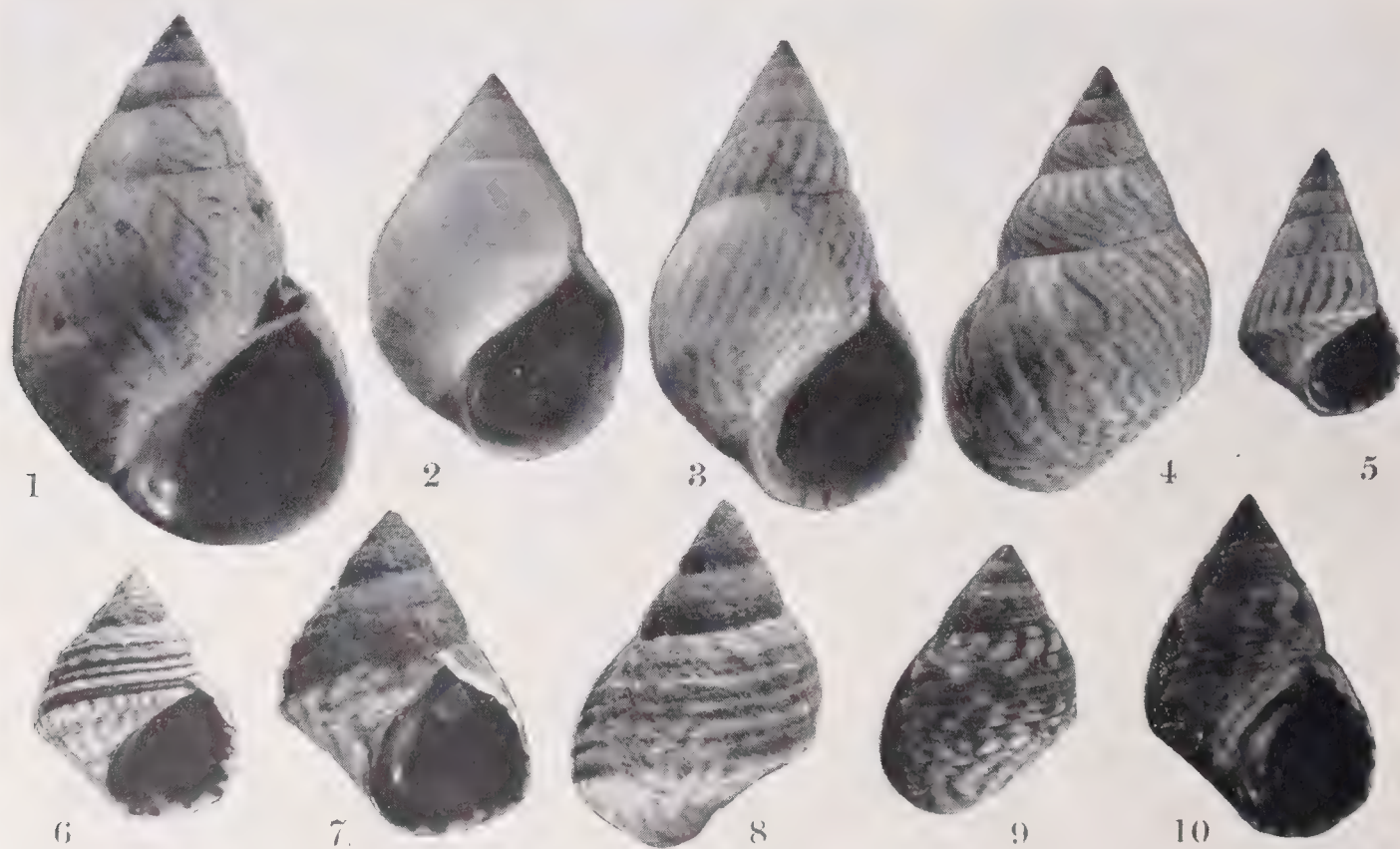


Plate 5. *Littorina ziczac* Gmelin: 1, Bermuda; 2 to 5, 9 and 10, Bimini Ids. (female shells); 6 to 8, Governor's Harbor, Eleuthera Id. (male shells). All 2 $\times$ .

brown stripes may be lacking or barely visible on the nearly white or pale bluish shell. In addition, 2 or 3 pale bluish spiral bands may be discerned, particularly when the axial pattern is faded. Mouth within somewhat purplish, dark mahogany-brown, with 1 or 2 whitish spiral bands; one, close to the base, always present in larger shells and at least indicated in the young; the other, between the periphery and the suture, sometimes lacking or obliterated; outer lip white, more or less blotched with reddish-brown; columellar area either entirely mahogany or blackish-brown or with the outer edge paler; operculum dark mahogany-brown. Reproduction unknown.

	length	width	aperture	
Female	25.3	15.6	13.3×9 mm.	Bermuda
Male	15.8	11	9.8×7.8	New Providence, Bahamas
Female	21.4	12.2	9.6×7.2	Cienfuegos Bay, Cuba

*Types.* Barbados, one of the two so-called "Sugar Islands" cited in Chemnitz's references to Lister and Favanne, is here selected as the type locality of *T. ziczac* and *L. lineolata*; but Chemnitz's types are probably lost. The British Museum may have the types of Montagu's *T. dispar*, Philippi's *debilis*, *d'orbignyana*, *pusilla* and *mauritiana* var. *crassior*, and d'Orbigny's *carinata*. Mörch's types of *angustior*, *floccosa*, *glaucocincta* and *riisei* should be at the Copenhagen Museum. *L. columna* Philippi was described from the Jonas collection, which I have not traced.

*Range.* Florida (south of Jupiter Inlet on the east and as far north as Cedar Keys on the west coast). Bermuda and the Antilles to Trinidad, Atlantic coast of southern Texas, Central and South America to Uruguay. Established on the Pacific coast near Panama City, which it reached by means of the Canal.

*Records.* FLORIDA: common in the south; northernmost locality on the east coast, Giebert's Bar, Martin Co., just above Jupiter Inlet (P. P. McGinty), and on the west coast, Cedar Keys. TEXAS: Galveston. BERMUDA. BAHAMAS: New Providence; Long Island; Grand Bahama; Cat Id.; Little San Salvador; Great Inagua; N. Bimini Id.; Great Abaco; Eleuthera; Mariguana. CUBA: Havana; Cienfuegos; Caibarien; Guantánamo. HISPANIOLA: Puerto Plata; Santa Barbara de Samana; Beata Id.; Puerto Sosua; Miragoane; Cape Haitien; El Canal, Cabo Macoris; Gonave Id. PUERTO RICO: Borinquen; Guanica Harbor; San Juan; Aricibo; San Geronimo; Veja Baja; Ponce. JAMAICA: Montego Bay; Southwest Cay, Pedro; mouth of Dunn's River; St. Ann; Port Antonio. VIRGIN IDS.: Guana Id.; Tortola; Virgin Gorda; St. Croix; St. John; St. Thomas. LESSER ANTILLES: Guadeloupe; Antigua; Martinique; Grenada; Barbados. TRINIDAD: Pointe-a-Pierre; Mayaro; Toco; Pelican Id. CARIBBEAN ISLANDS: Swan Id.; Navassa Id.; Cayman Brac, Cayman Ids. MEXICO: Tampico; Vera Cruz. GUATEMALA: near Cavech; Puerto Barrios. HONDURAS: Roatan Id.; Utila Id. COSTA RICA: Limon. PANAMA: Porto Bello; Chagres River; Colón (Aspinwall); Panama City (J. Zetek, 1933); Naos Id., Bay of Panama (T. Hallinan, 1914). VENEZUELA: Soldado Rock, Bay of Paria. BRASIL: Manguinhos, Ilha de Itaparica, State Bahia; Pedra Furada, Bahia; Rio de Janeiro; São Paulo. URUGUAY: Cabo Polonio; Puerto Paloma, Rocha. Recorded from Nicaragua, St. Kitts, St. Martin, Curaçao and Colombia (Cartagena).

*Remarks.* *L. ziczac* is the most common West Indian species, living in the intertidal zone on rocks, jetties or pilings, sometimes in large colonies in crevices. When few specimens are compared, it is relatively easy to distinguish varieties corresponding to some of the names listed in the synonymy; but a study of a large lot from one spot shows the

fallacy of such attempts, particularly if proper allowance be made for sexual dimorphism. The same lot contains large and small female snails, apparently for the same number of whorls, the smaller snails usually gaudily marked.

### *Littorina obtusata* Linné, Plate 6, figs. 1-6

*Turbo obtusatus* Linné 1758, Syst. Nat., 10th Ed., 1, p. 761 ("in the northern Ocean"). Hanley 1855, Ipsa Linnaei Conchylia, p. 325, pl. 3, fig. 6 (type).

*Nerita littoralis* Linné 1758, Syst. Nat., 10th Ed., 1, p. 777 ("on the coasts and in the estuaries of the European sea"). Hanley 1855, Ipsa Linnaei Conchylia, p. 399 (type).

*Turbo palliatus* Say 1822, Jr. Ac. Nat. Sci. Phila., 2, pt. 2, p. 240 (New England States).

*Littorina arctica* H.P.C.Möller 1842, Index Moll. Groenlandiae, p. 9 (Greenland; without description, but defined by the reference to *Nerita littoralis* O. Fabricius 1780, Fauna Groenlandica, p. 402).

*Littorina neritoides* J.E.DeKay 1843, Zool. New York, 5, Moll., p. 105, pl. 6, figs. 109-111. Not of Linné 1758.

*Littorina peconica* S. Smith 1860, Ann. Lyc. Nat. Hist. New York, 7, p. 156 (Peconic Bay, Long Island, New York).

*Synonymy.* For European synonyms, see P. Dautzenberg and H. Fischer 1915, Jour. de Conchy., 62, (1914), pt. 2, pp. 87-128. *Turbo neritoides* Pulteney (1813) is an additional synonym not mentioned by them.

*Description.* Shell subglobular or slightly wider than high, thick, opaque, dull, of 4 to 5 rapidly increasing whorls; sutures little or not impressed; body-whorl over  $\frac{3}{4}$  of total height. Surface with many minute, wavy, spiral raised lines of the thin periostracum, usually worn off in older specimens, which are either smooth or very finely spirally striate. Spire low, either flattened or obtusely raised in adult shells, sometimes pointed in the young. Aperture subcircular, slightly expanded; outer lip sharp-edged, thickened but smooth within; columellar area broad, thick, smooth, flat or slightly concave, margined outwardly (at the base of the body-whorl) by a low but sharp ridge which merges with the bow-like basal lip; newly hatched snails have a narrow umbilicus, more or less preserved as a pit in older shells; below this pit a roughened lunule often separates the edge of the columella from the body-whorl, but this is not constant even in the same locality. Young shells have the base of the columellar area somewhat rounded-angular. Color variable, usually a uniform yellowish-fulvous or dirty-yellow, rarely more chestnut-brown; young, unworn shells may have the early whorls whitish or bluish; sometimes 2 broad pale chestnut spiral bands, one above and the other below the periphery; more rarely black with spiral lines of obscure whitish or bluish spots, or chestnut-brown with a white band. Mouth within colored like the outside; edge of outer lip unspotted; columella white or dirty-white. Operculum bright yellow to orange-brown. Oviparous: 90 to 180 eggs agglomerated within a gelatinous mass, attached to sea-weed; upon hatching the veliger larva is completely developed and remains in the spawn, emerging in the crawling stage (Caullery and Pelseneer 1910, Bull. Scient. France Belg., 44, p. 357). Male smaller than female, with a more produced spire and narrower body-whorl, the aperture smaller and less expanded.

length	width	aperture	
12	12	10×7.5 mm.	Port Clyde, Maine
10.8	10	7×6	Gaspé Peninsula, Quebec
11.5	13	10×7.5	Rockport, Massachusetts
12.3	11	9×7.2	Rye, New York

The largest European shell seen (Plymouth, England) was 15.5 mm. long and 15.2 mm. wide.

*Types.* Linné's types of *T. obtusatus* and *N. littoralis* are at the Linnaean Society of London. They bear no localities, but *obtusatus* came probably from the coast of Lapland (Norway), which may be taken as the type locality. One of Linné's *obtusatus* was figured by Hanley. The type of Say's *palliatus* is at Ac. Nat. Sci. Phila. (No. 18420). Where the type of *L. peconica* went is unknown.

*Range.* Coast of western Europe (including the British Isles) from Nova Zembla (72° 30' N.) and Spitzbergen to the Straits of Gibraltar; also in the Baltic Sea. Records from the western Mediterranean (Malaga; Corsica) and the Azores are open to question. Faroë Ids. Jan Mayen Id. Iceland. Greenland. Autochthonous in America, from Newfoundland and southern Labrador to southern New Jersey. It was found in Indian shell-heaps in Casco Bay, Maine (J. Wyman 1868, Amer. Natural., 1, p. 565), in the Back Bay area of Boston below a layer of pit in silt deposited several centuries before Colonial times (W. J. Clench 1942, in F. Johnson, The Boylston Street Fishweir, p. 46), and in post-Pliocene deposits underlying a salt-marsh near Branford, Connecticut (J. B. Knight 1934, Amer. Jr. Sci., ser. 5, 28, p. 172). W. H. Dall reported it as a Pliocene fossil from Nome, Alaska (1920, U. S. Geol. Surv., Prof. Pap. 125C, p. 29, pl. 5, fig. 12).

*Records.* LABRADOR. NEWFOUNDLAND: Ferryland. QUEBEC: Trois Pistoles, Gaspé Peninsula. NEW BRUNSWICK: Grand Manan. NOVA SCOTIA: Bird Id. MAINE: common. NEW HAMPSHIRE: Newcastle. MASSACHUSETTS: common. RHODE ISLAND: Westerly; Newport. CONNECTICUT: Stonington; Pine Orchard. NEW YORK: Rye; Fort Hamilton, Brooklyn. NEW JERSEY: Cape May (N. J. State Mus.).

*Remarks.* Jeffreys and Tryon believed that *L. obtusata* of the British Isles and western Europe was specifically distinct from the more boreal and North American shells which they called *L. littoralis* (with *L. palliata* Say as a synonym). Tryon even placed them in different sections of the genus. Others restricted the name *palliata* to North American specimens. The problem has been thoroughly studied by J. Colman (1932, Biol. Bull., 62, pp. 223-243), who concluded that it is impossible to differentiate between European and North American shells. The species is not very variable and none of its forms appear to merit subspecific rank. They are discussed and figured by Dautzenberg and Fischer (1915).

*L. obtusata* is usually found on seaweeds attached to intertidal rocks, where its color often blends with that of the surroundings. In New England it may occur sometimes among the low coarse grass of salt marshes. C. H. Batchelder (1915, Nautilus, 29, p. 46) states that it migrates to deeper water in early winter, so as to escape the ground ice of the shore, returning to higher levels in the spring.

### ***Littorina meleagris* Potiez and Michaud, Plate 6, figs. 17-19**

*Phasianella meleagris* "Beck" Potiez and Michaud 1838, Gal. Moll. Douai, 1, p. 311 (no locality).

*Littorina meleagus* "Beck" Rush 1891, Nautilus, 5, p. 67 (St. Thomas; misspelling of *meleagris*).

*Phasianella* (or *Littorina*) *punctata* Pfeiffer 1840, Arch. f. Naturg., 6, pt. 1, p. 255 (Cuba). Not *Turbo punctatus* Gmelin, 1790, which is also a *Littorina*.

*Litorina guttata* Philippi 1847, Abb. Besch. Conch., 2, p. 197, pl. 4 (*Litorina*), fig. 7 (Antilles; Cuba; new name for *Phasianella punctata* Pfeiffer, 1840).

*Littorina hidalgoi* Arango 1880, Contrib. Fauna Malac. Cubana, p. 159 (Havana and La Chorrera, Cuba; with brief description). Azpeitia Moros 1925, Rev. R. Ac. Cienc. Ex. Fis. Nat. Madrid, 22, p. 165, pl. 1, fig. 5 (cotype).

*Synonymy.* The foregoing synonymy, first suggested by Azpeitia Moros (1925), was definitely proposed by C. G. Aguayo (1934, Mem. Soc. Cubana Hist. Nat., 8, p. 88). I had reached the same conclusion indepen-

dently. Potiez and Michaud mention expressly the rimation of the columella and describe the characteristic color pattern. Some confusion has arisen from Reeve's figuring the American *meleagris* as "*L. punctata*" (1857, Conch. Icon., 10, *Littorina*, pl. 13, figs. 66a-b) and the true West African *L. punctata* Gmelin as "*L. guttata*" (*op. cit.*, pl. 14, fig. 76).

*Description.* Shell ovate-turriculate, much higher than wide, moderately thick, dull, of 5 or 6 rapidly increasing convex whorls; early whorls little or not eroded; suture well marked, smooth. Body-whorl about  $\frac{2}{3}$  of total height, much more convex than the earlier whorls, rounded at the periphery. Periostracum very thin, often worn. Surface either smooth or with faint traces of spiral striation at the periphery; growth-striae very weak, irregular. Aperture pear-shaped; outer lip not flaring, the edge sharp and thin, smooth and slightly thickened within, meeting the body-whorl at a sharp angle; inner lip forming a very slight callus over the body-whorl. Columellar area very long and moderately wide, slanting inward, smooth, flat or slightly convex; the inner edge not thickened, long and nearly straight, but not ending abruptly below; a very sharp outer ridge, blunter at the base where it merges evenly with the bow-like basal lip. A crescent-shaped, slightly concave, dull, microscopically striate columellar lunule, of variable width, separates the outer ridge of the inner lip from the base of the body-whorl and extends as a slit or perforation into the axis; the umbilical slit is often scarcely developed in very young shells

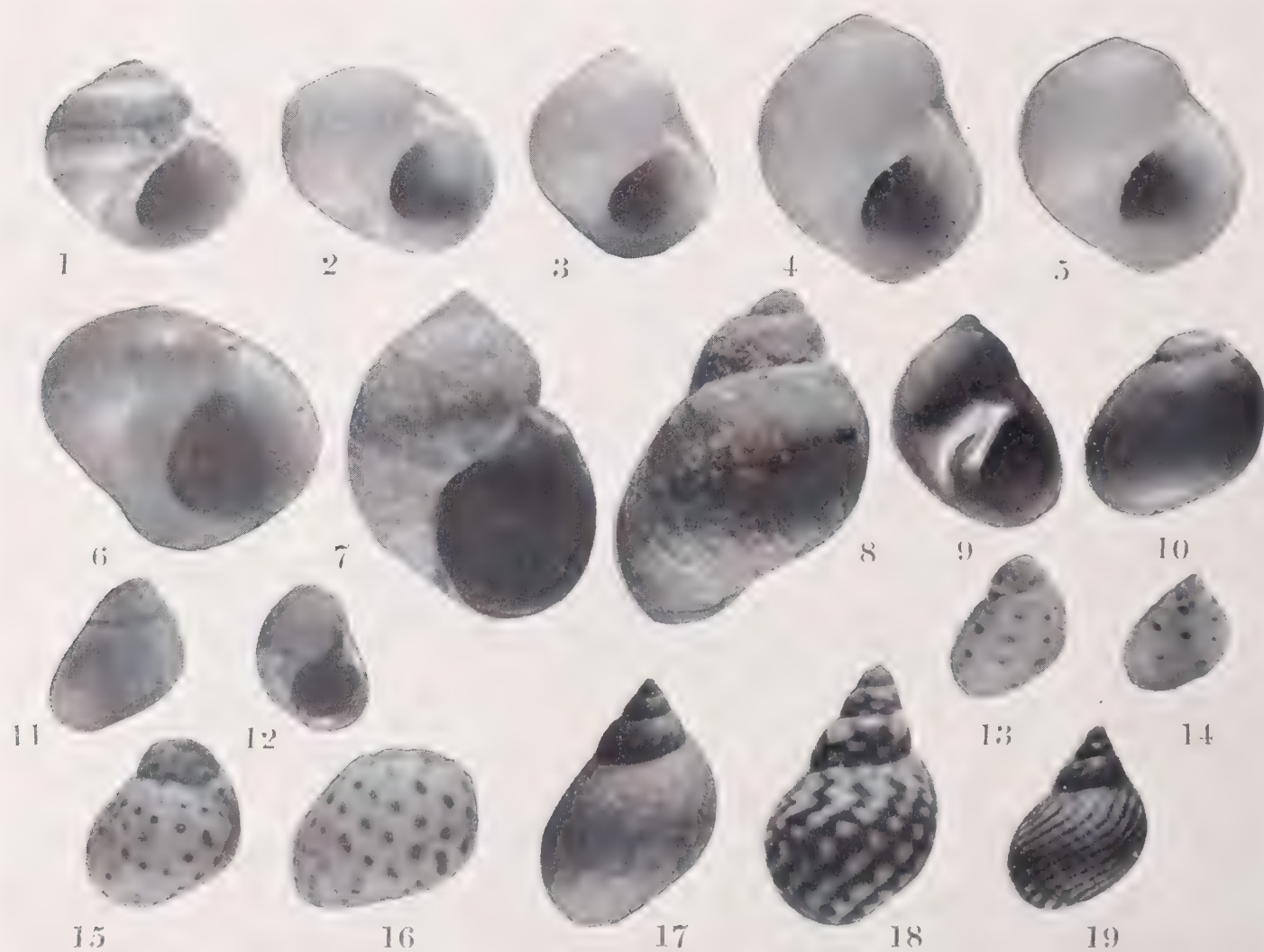


Plate 6. 1 to 6, *Littorina obtusata* Linné: 1, Rye, New York (2×); 2 and 3, Gloucester, Massachusetts (2×); 4 and 5, Port Clyde, Knox Co., Maine (2×); 6, Westerly Rhode Island (young, 8×). 7 to 16, *Littorina mespillum* Megerlé v. Mühlfeld: 7 and 8, South Cat Cay, Bimini Ids. (4×); 9 and 10, Cayo Frances, Cuba (4×); 11 to 14, Punta Chiva, Samana Peninsula, Hispaniola (2×); 15 and 16, Spanish Water, Curaçao (4×). 17 to 19, *Littorina meleagris* Potiez and Michaud: 17, Mariel, Cuba (4×); 18, St. Croix (4×); 19, East Sister Key, Florida (4×).

(3 mm. and less high). Color pattern typically a checkering of large white spots separated by much narrower mahogany or lighter brown intervals, the spots more or less in spiral rows, larger below the sutures: spots sometimes confluent into crenulate spiral bands, or much faded, particularly on the body-whorl. Mouth reddish-brown within: outer lip whitish or reddish-brown, spotted or blotched with white: inner lip whitish or more or less tinged with pale brown: operculum dark mahogany-brown. Reproduction unknown.

length	width	aperture	
7.6	4.7	4.6×3 mm.	Playa del Chivo, Mariel, Cuba
8.9	5.4	5×3.8	Havana, Cuba
7.2	4.2	4×2.8	St. Croix

*Types.* The present location of the types of *P. meleagris* and *L. guttata* (= *punctata*) is not known. Cotypes of *hidalgoi* are in Azpeitia Moros' collection, presumably in Madrid. One of the types of *meleagris* was larger (10 mm.) than any specimen seen.

*Range.* Southern Florida, Bahamas, Greater and Lesser Antilles, and Caribbean coast of South America.

*Records.* FLORIDA: Boynton Beach, Palm Beach Co. (P. McGinty). BAHAMAS: near Matthew Town, Great Inagua; Alicetown, North Bimini. CUBA: Vedado, Havana; Cojimar, Havana Prov.; Playa del Chivo, near Mariel; La Playa, Matanzas; Peñas Altas, Matanzas Prov.; Marianao. HISPANIOLA: El Canal, Cabo Macoris. JAMAICA: (C. B. Adams). VIRGIN ISLANDS: St. Croix; Guana Id., Tortola; Virgin Gorda; St. Thomas. LESSER ANTILLES: Guadeloupe; St. Vincent. Recorded from the Tortugas (Florida), Puerto Rico, Vieques Id., Republic of Honduras (Utilla) and Colombia (Cartagena).

*Remarks.* *L. meleagris* lives on rocks or pilings in the intertidal zone, in rather quiet water.

### ***Littorina mespillum* Megerlé v. Mühlfeld, Plate 6, figs. 7-16**

*Helix mespillum* Megerlé von Mühlfeld 1824, Verh. Ges. Naturf. Fr. Berlin, **1**, pt. 4, p. 219, pl. 8, fig. 8 (Antilles) [reference checked by Miss Hazel Gay].

*Littorina mespillum* Philippi 1847, Abb. Besch. Conch., **3**, p. 16, pl. 6 (*Littorina*), fig. 20 (Cuba; emendation of *mespillum*).

*Turbo minimus* "Gray" Wood 1828, Index Testac., Suppl., pl. 6, fig. 29; with name on p. 19 of letter-press (no description; no locality).

*Littorina minima* Gray 1839, Zool. Beechey's Voyage "Blossom," Moll., p. 139 (description; no locality).

*Littorina fusca* Pfeiffer 1840, Arch. f. Naturg., **6**, pt. 1, p. 254 (Cuba).

*Littorina naticoides* d'Orbigny 1842, in de la Sagra, Hist. Phys. Pol. Nat. Cuba, Moll., Atlas, pl. 15, figs. 21-23 (binomial on plate); Text, **1**, (1842), p. 214 (Havana).

*Littorina gundlachi* Philippi 1849 (March), Zeitschr. f. Malak., **5**, (1848), p. 150 (Cuba).

*Synonymy.* I am unable to draw the line between spotted *minima* and unspotted *mespillum*. Philippi synonymized *fusca* and *naticoides* correctly with *mespillum*. *L. gundlachi* has not been figured; but the size and "umbilicate-perforate" columella make it either *mespillum* or *meleagris*. I have never seen *meleagris* colored as described for *gundlachi*, whereas the description agrees well with some unspotted *mespillum*.

*Description.* Shell ovate-conical, slightly higher than wide, thick, opaque, dull, of 4 to 7 rapidly increasing whorls; the apex much corroded in older shells; sutures moderately impressed, even, that of the body-whorl deeper; body-whorl over  $\frac{2}{3}$  of total height, rounded or weakly shouldered at the periphery. A thin, brownish periostracum, often lost, with microscopic spiral striation in very young shells, later without definite sculpture; beneath this the shell is smooth. Spire low, obtusely pointed. Aperture pear-shaped; outer lip sharp-edged, thickened but smooth within; columellar area narrow,

flat, thick, smooth, slanting inward, with concave inner edge and a thick outer edge, which becomes sharper at the base where it merges with the bow-like basal lip; adults with a distinct, usually narrow, sometimes broader umbilical slit, often continued upward as a distinct perforation of the axis and downward as a narrow, roughened lunule between the outer edge of the columella and the body-whorl; umbilical slit obsolete or absent in very young shells (5 mm. or less long). Color reducible to two types, connected by passages. Some shells (form *minima*) are pale orange-yellow, straw-yellow or light brown, more rarely almost white, with 5 to 8 rather irregular spiral rows of roundish or drop-shaped purplish-brown to blackish spots, very variable in size, and either boldly or weakly marked; sometimes the spots of a row alternate with faint whitish blotches; in the same lot some shells have many spots in distinct rows, others have very few, irregularly scattered or hardly any. Thus we pass to the second type (form *mespillum*), which is uniformly darker or lighter mahogany-brown, often with a lighter base or paler below the suture, though not distinctly banded, and without spots; in the same lot some shells are unspotted, while others show at least traces of the roundish spots characteristic of the first type. Mouth mahogany-brown within, with spots if these are present outside; outer lip of the same color or paler, in spotted shells often with a few purplish-brown spots; columella uniformly dirty-white or brownish-white; operculum dark mahogany-brown. Reproduction unknown.

	length	width	aperture	(summit corroded in all)
(spotted)	8	6.5	5.6×4.5 mm.	Sta. Barbara de Samana, Hispaniola
(unspotted)	10.2	7	6.6×4.8	South Cat Cay, Bimini Ids.

*Types.* The location of the types of *minima*, *mespillum*, *fusca* and *gundlachi* is not known; that of *naticoides* may be at the Paris Museum. As *minima* was described without locality and *mespillum* merely from the Antilles, Havana, Cuba, is herewith selected as the type locality for both the spotted and unspotted forms, which are found there together.

*Range.* Southern Florida Keys, southern Bahamas, and Greater and Lesser Antilles as far as Barbados. Also in Curaçao, Dutch West Indies. Not known definitely from Trinidad, nor the coast of Central and South America. The reported occurrence in Texas (W. H. Dall 1889, Bull. U. S. N. Mus., No. 37, p. 146) and near Sanibel, Florida (L. M. Perry 1940?, Checklist Mar. Moll. Sanibel-Captiva, p. 14), is doubtful.

*Records.* FLORIDA: Key West (very young shells; Palmer); East Sister Key near Key Vaca (T. L. McGinty). BAHAMAS: Andros; Bimini Ids.; Eleuthera; Mariguana; New Providence; Long Island; Great Inagua; Grand Bahama; Cat Id. CUBA: Playa del Chivo and Vedado, Havana; Claude and Peñas Altas, Matanzas Prov.; Nuevitas, Camaguey Prov.; Cienfuegos; Guantanamo Naval Base; Cayo Frances, Caibarien; Gibara. HISPANIOLA: El Canal, Cabo Macoris; Punta Chiva, 7 miles E. of Santa Barbara de Samana; Puerto Sosua. PUERTO RICO: Luquillo Beach. JAMAICA: a few specimens without definite locality (C. B. Adams coll.). GUADELOUPE. CARIBBEAN IDS.: West side, entrance to Spanish Water, Curaçao (G. J. H. Molengraaff, 1923). Recorded from St. Martin and St. Croix.

*Remarks.* W. J. Clench (1938, Nautilus, 51, p. 113) found *L. mespillum* in Hispaniola in great abundance in the "splash-pools" on limestone rocks, from the high tide line to 6 or 7 feet above. He comments upon the evident kinship of the spotted *minima* and the unspotted *mespillum*, which I am unable to distinguish by names. In nearly everyone of the MCZ localities from Cuba, Hispaniola and the Bahamas both occur together, as well as intergrades.



**Littorina angulifera** Lamarek, Plate 7, figs 1-7

*Turbo striatus* Schumacher 1817, Essai Syst. Vers Test., p. 198 (based on "Helix scabra Linnaei" of Chemnitz 1795, Syst. Conchy. Cab., **11**, p. 283, pl. 210, figs. 2074-2075; fig. 2075 being a shell from Guinea). Not of Vallot, 1801, nor of Brocchi, 1814.

*Phasianella angulifera* Lamarek 1822, Hist. Nat. An. Sans Vert., **7**, p. 54 (Antilles).

*Littorina augulifera* Maury 1922, Bull. Amer. Paleont., **9**, No. 38, p. 106 (misspelling of *angulifera*).

*Littorina subangulata* "Lamarek" Mörch 1876, Malak. Blätt., **23**, p. 135 (error for *angulifera*).

*Littorina ahenea* Reeve 1857, Conch. Iconica, **10**, *Littorina*, pl. 3, figs. 15*b-c* (Senegal; Reeve's text makes it clear that his name *ahenea* referred to these only, not to his fig. 15*a*).

*Littorina angulifera* var. *lineata* Philippi 1847, Abb. Besch. Conch., **2**, p. 224, pl. 5 (*Littorina*), fig. 15 (Loanda, West Africa). Not *Buccinum lineatum* Gmelin 1790, which is a form of *L. scabra* Linné.

*Littorina angulifera* var. *flavescens* Philippi 1847, Abb. Besch. Conch., **2**, p. 224 (no locality).

*Littorina angulifera* var. *punctata* Philippi 1847, Abb. Besch. Conch., **2**, p. 224, pl. 5 (*Littorina*), fig. 13 (Antilles; Honduras). Not *Turbo punctatus* Gmelin 1790, which is a *Littorina*.

*Littorina angulifera* var. *rubra* Philippi 1847, Abb. Besch. Conch., **2**, p. 224, pl. 5 (*Littorina*), fig. 12 (Senegal; Honduras). Not *Littorina rubra* Anton, 1839.

*Littorina angulifera* var. *strigata* Philippi 1847, Abb. Besch. Conch., **2**, p. 224, pl. 5 (*Littorina*), fig. 14 (Senegambia; Antilles). Not *Littorina intermedia* var. *strigata* Philippi, 1846.

*Littorina aurea* Bonnet 1864, Rev. Mag. Zool., ser. 2. **16**, p. 281, pl. 22, figs. 4-4*a* (no locality).

*Littorina scabra* d'Orbigny 1842, in de la Sagra, Hist. Phys. Pol. Nat. Cuba, Moll., Atlas, pl. 15, figs. 15-17; Text, **1**, (1842), p. 212 (Cuba; Martinique; Guadeloupe; Jamaica). Not *Helix scabra* Linné, 1758.

*Synonymy.* Except for *L. aurea*, from an unknown locality, names listed here were of Atlantic shells, hence referable to variations of one species. *Buccinum lineatum* Gmelin (1790, in Linné, Syst. Nat., 13th Ed., **1**, pt. 6, p. 3493) was based, not on a specimen, but on Knorr's pl. 14\*\*, fig. 4 (1768, Vergnügen der Augen, **3**), from an unknown locality. This figure can be matched either amongst Atlantic *angulifera* or Indo-Pacific *L. scabra* Linné, 1758. In order to avoid further ambiguity, I suggest referring Knorr's figure definitely to *L. scabra*, thus making Gmelin's *lineatum* a synonym or variety of Linné's earlier name.

*Description.* Shell broadly conico-turriculate, much higher than wide, thin but solid, more or less translucent, slightly shiny, of 6 to 8 gradually increasing, moderately convex whorls; early whorls usually preserved; suture moderately deep, smooth. Body-whorl about  $\frac{1}{2}$  or slightly less of total height, slightly descending at the aperture in large shells, rounded or obtusely carinate at the periphery (in the same lot). No periostracum. Rarely corroded; first 2 whorls smooth; remainder with many fine spiral grooves separated by low, flat ribs, much wider than the grooves; one of the ribs stronger at the periphery in carinate shells; grooves sometimes with much finer spiral striation; growth-striae very fine, decussating the ribs. Spire high, pointed. Aperture short oval; outer lip not flaring,

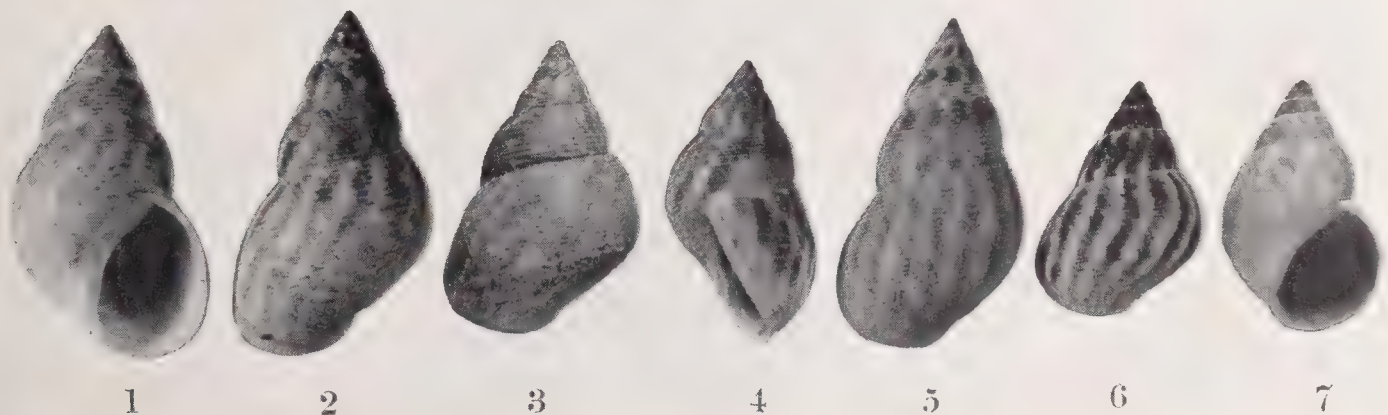


Plate 7. *Littorina angulifera* Lamarek: 1 and 2, Cape Sable, Florida; 3, Florida City, Florida; 4, Pigeon Point, Tobago Id.; 5, Hungary Bay, Bermuda; 6, Key West, Florida; 7, Ilha de Itaparica, Bahia. All nat. size.

the edge smooth, sharp and not thickened within, nearly horizontal at the body-whorl; inner lip with a very thin deposit over the body-whorl. Columellar area moderately wide, slightly thickened, slanting inward, smooth, slightly depressed or shallowly grooved between the nearly straight inner edge and the much swollen or somewhat reflexed, thick outer edge (at the base of the body-whorl); the outer edge merges evenly with the bowl-like basal lip. Smallest shell seen (7 mm. long) without a trace of an umbilical slit. Ground color white (often with a bluish tinge), dirty-yellow, orange-yellow, reddish-brown or grayish-brown; darker markings of elongate spots spaced on the ribs, the spots usually grouped or fused into a more or less distinct pattern of narrow or broad, oblique stripes, either straight or more or less wavy, often best marked on the body-whorl; the early whorls often with a series of vertical white spots, regularly spaced below the suture. Mouth within of the outside color, often with a series of darker blotches at the edge; columellar area whitish at inner and outer edges, pale purplish medially; operculum pale mahogany-brown. Reproduction unknown.

length	width	aperture	
41	23	20.8×16.1	Cape Sable, Florida
33.1	18.2	17×14	Paget, Bermuda
34.5	22.3	18.2×15.2	Caibarien, Cuba
31.6	19.2	17×14	Natal, Brasil

*Type.* The type of Lamarck's *angulifera* was apparently not in Delessert's collection and may be at the Paris Museum. Lamarck also referred to his species, correctly, shells figured by Lister (1770, Hist. Conchy., pl. 583, figs. 37-38) from Jamaica and Barbados, Jamaica being here selected as the type locality.

*Range.* In America on the coast of southern Florida (northward to St. Augustine in the east and at least to Cedar Keys in the west; Dall's record from Texas needs confirmation), Central and South America (from Mexico to São Paulo), Bermuda and Antilles. On the coast of West Africa from Senegal and Cape Verde Ids. to Angola (Lobito Bay). It has reached the Pacific Coast of Panama through the Canal in recent years; C. B. Adams did not find it there in 1850. Other published Indo-Pacific records of *angulifera* were based on *L. scabra*.

*Records.* FLORIDA: common from Jupiter, Palm Beach Co., and Cedar Keys southward; C. W. Johnson found it at St. Augustine about 1883 (1890, Nautilus, 3, p. 115; and 1919, 33, p. 6; possibly no longer living there). BERMUDA: common. BAHAMAS: Long Island; Eleuthera; Cat Island; Bimini Islands; Grand Bahama; Great Inagua; Great Abaco; Little Abaco; New Providence; Mariguana. CUBA: common. HISPANIOLA: common. JAMAICA: common. PUERTO RICO: Ponce; San Juan; Guanica. VIRGIN IDS.: St. Croix; Virgin Gorda; St. John; St. Thomas. LESSER ANTILLES: Guadeloupe; Tobago. HONDURAS: Roatan Id. NICARAGUA: Waunta Haulover. PANAMA: Porto Bello; Piriatupo Id., San Blas; Panama City (J. Zetek, 1933); A. P. Brown and H. A. Pilsbry (1913, Proc. Ac. Nat. Sci. Phila., p. 495) report it from Pleistocene deposits at Mt. Hope near Colón. BRASIL: Bahia; Ilha de Itaparica, Bahia; Natal; Pernambuco; Maranhão; Rio de Janeiro; São Paulo; Praia de Camocim, Ceará; Fernando Noronha Id. Reported from Curaçao and Colombia. Also seen from Senegal, Liberia, Spanish Guinea and Gaboon.

*Remarks.* *L. angulifera* is the common mangrove periwinkle of the tropical and subtropical coasts, where it prefers the quiet brackish water inlets margined with the thickets

of *Rhizophora Mangle*, not far from the sea. Here it is attached to the roots, trunks or leaves, sometimes climbing 25 feet above high tide level and spending much of the day out of the water. It may occasionally be found on wharves and pilings. J. S. Gibbons (1878, Quart. Jr. Conch., 1, pt. 15, p. 339) claims that it is more solid where the water is fresher and thinner where it is more saltish. The anatomy was described by J. Leidy, who emphasized the peculiar structure of the branchial chamber (1846, Boston Jr. Nat. Hist., 5, pp. 344-347, pl. 20, figs. 1-3).

The differences between the Atlantic *angulifera* and the Indo-Pacific *Littorina scabra* (Linné) are very slight and probably of at most subspecific value, although their ranges nowhere touch. None of the supposedly specific characters hold when many specimens from different localities are compared. *L. scabra* is, however, more variable, in color as well as in sculpture. It has produced forms with several strong spiral ridges (var. *carinifera* Menke) or boldly marked with spots at the periphery (var. *flammea* Philippi), not found in the Atlantic *angulifera*. West African specimens show no consistent difference from those of tropical America.

R. B. S. Sewell (1924, Rec. Indian Mus., 26, pt. 6, pp. 535-540) found *L. scabra* ovoviviparous, the developing ova filling partially the branchial chamber. No doubt this is also true of *L. angulifera*, although its mode of reproduction has not yet been observed.

### Key to Western Atlantic Littorina

1. Adult with a more or less distinct umbilical slit or perforation. Small (10 mm. or less) 2  
Adult without trace of umbilical slit 3
2. Ovate-conical, little higher than wide, unspotted or with roundish dark spots *L. mespillum*  
Ovate-turriculate, much higher than wide, usually with checkered spots, which may fuse more or less  
*L. meleagris*
3. Subglobular, not or little higher than wide, nearly smooth; apex flattened or obtusely pointed; sutures flattened; uniformly colored or with spiral bands. Small (15 mm. or less) *L. obtusata*  
Ovate-conical, turbinate or broadly turriculate, higher than wide; apex sharply pointed; sculpture usually distinct. Often over 15 mm. 4
4. Broadly turriculate, thin and light; spire very high, conical; columellar area hollowed out, with long, straightened inner edge. Up to 41 mm., the mouth about half the height *L. angulifera*  
Thicker and often heavy, ovate-conical, turbinate, or conico-turriculate 5
5. Conico-turriculate, usually much higher than wide; mouth often much less than half the height; columellar inner edge long and straightened 6  
Turbinate or short conical, moderately or not higher than wide; mouth about half the height or more; columellar inner edge short and strongly curved (concave) 7
6. Columellar area nearly flat; usually with zigzag lines or stripes; mouth inside with a pale basal spiral band and sometimes with a second band above the periphery *L. ziczac*  
Columellar area hollowed out or grooved; unicolor or checkered or blotched with dark; mouth inside without spiral bands *L. nebulosa*
7. Broadly ovate-conical, with very convex whorls and deeply impressed sutures; mouth subelliptical, the upper angle nearly square on the body-whorl. Up to 24 mm. *L. saxatilis*  
More turbinate, with flattened or slightly convex whorls and scarcely or not impressed sutures; mouth subovate, the upper angle acute on the body-whorl 8
8. Body-whorl not depressed below the suture; whorls flattened; mouth more elongate; edge of outer lip wavy within. Up to 30 mm. *L. irrorata*  
Body-whorl somewhat depressed below the suture; whorls slightly convex; mouth wider; edge of outer lip smooth within. Up to 42 mm. *L. littorea*

Although the nine species here accepted as valid are very distinct and readily recognized when placed side by side, they show few prominent characters which may be used in a concise key. It may be useful to remember that only three of them (*obtusata*, *saxatilis* and *littorea*) live nowadays on the coast of eastern Canada and New England. Five others (*irrorata*, *ziczac*, *mespillum*, *meleagris* and *angulifera*) are found in the southeastern United States, but two of these (*mespillum* and *meleagris*) are very rare and restricted to southern Florida. The Caribbean area has also five species (*nebulosa*, *ziczac*, *mespillum*, *meleagris* and *angulifera*), but only three of them (*nebulosa*, *ziczac* and *angulifera*) extend beyond Trinidad along the east coast of South America.

The present study lays great stress on the distribution of the several forms, in conformity with the general policy of JOHNSONIA. The available literature has been carefully combed for information. All records, however, whether based on actual specimens or on published data, were critically examined and only those that appeared fully trustworthy were incorporated. Periwinkles being common shore snails are usually collected in abundance, hence represented in most large collections by a wealth of material. They are an ideal group for students of variation and distribution. Owing to limitations of space, it seemed unwarranted to list all our records of the more common species, so that the main part of their range is given only by states and islands, with the occasional mention of a few selected localities. At the limits of the range, however, all known records are mentioned. It is believed that this method gives a reliable picture, while bringing out the many gaps to be filled by future research.

In areas like the east coast of North America and the Caribbean, where traffic by ships has been intense for several centuries, the student of the geography of marine mollusks should be fully aware of two main sources of error.

There is first the problem presented by the introduction of certain species into new areas through the agency of man. The well-authenticated case of *L. littorea* is very instructive in this connection. If this snail had been brought to the Western Hemisphere one or two centuries earlier, it might have been extremely difficult or perhaps impossible to prove that it was a foreign element in the American fauna. For this reason I have discussed the history of the spread of *L. littorea* rather fully. I have likewise indicated the evidence from which we may safely conclude that our other two northern species (*L. obtusata* and *L. saxatilis*) are autochthonous in North America at least since the Pliocene or Pleistocene; so that their present occurrence on both sides of the Atlantic is due to natural means of dispersal. The tropical and subtropical *L. angulifera*, which occurs both in the western and the eastern Atlantic, is believed to be autochthonous in both areas. It is known from the Pleistocene of Panama, but has not as yet been found in the fossil state in West Africa. I suggest in this paper that the unusual occurrence of *L. nebulosa flava* at Cienfuegos, Cuba, and possibly in Guadeloupe, may be due to accidental introductions by man.

The frequent dumping of foreign shells with ship's ballast is also likely to lead the student astray. The description of the common West Indian *L. ziczac* as a new British mollusk (*Turbo dispar*) was probably due to this cause. I have pointed out several other aberrant records probably based on material of this type, and which therefore should be disregarded until they can be supported by more positive proof. When a species is found outside the normal range or habitat, the collector should not fail to note whether the specimens were dead or alive.

Some conclusions of more general interest may be drawn from the distribution of the

several species, as known at present. Apart from the introduced *L. littorea*, the western and eastern Atlantic have three species in common, two of them in the northern seas (*L. obtusata* and *L. saxatilis*) and one in tropical waters (*L. angulifera*). All three are variable along much the same lines over their entire range and there is no evidence that they have become differentiated into western and eastern geographical races. This is probably due to the similarity of ecological conditions, with the same local differences occurring on both sides of the ocean. It is also worth noting that, except for *L. angulifera*, the Caribbean and South American species are lacking on the African coast of the Atlantic. Most of them have no very close relatives there, as shown by a careful comparative study of the West African species. One possible exception is the West African *Littorina cingulifera* Dunker (1845), which appears to be related to *L. nebulosa*.

On the other hand, it is a remarkable fact that several of the autochthonous Western Atlantic species of *Littorina* are very closely related to forms of the Indo-Pacific area, being sometimes scarcely more than subspecifically distinct. I have called attention to three such cases: *L. saxatilis* and *L. sitchana*; *L. ziczac* and *L. mauritiana*; *L. angulifera* and *L. scabra*. Others may come to light when the Indo-Pacific species are better understood.

It is hoped that the present revision of *Littorina* will be an incentive to further study by the amateur as well as the professional malacologist. Some matters may be investigated by any keen observer, needing no particular training nor laboratory facilities. The distribution of several species should be worked out more carefully at the limits of their ranges, and especially in Central America and the Lesser Antilles. We have as yet little information on the ecology of the tropical species, the habitats they prefer, their daily and seasonal habits, their mode of reproduction, the changes brought about by age, the sexual differences in the shells, etc.

I greatly regret that present disturbed world conditions prevented me from studying the types or from obtaining reliable information about them. This notable defect will have to be corrected when stable conditions return. The location of the types is given after the most reliable published information, except in the case of Say's species, which were looked up for me by Dr. H. G. Richards. As no types were seen, all synonymies are based on a study of the original descriptions and figures.

### Acknowledgments

This study of *Littorina* is based almost entirely upon the very extensive collection of the Museum of Comparative Zoölogy. The unusual circumstances of the times made it impractical to visit other American museums or to draw more information from them. Some unusual specimens were obtained through the kindness of the following private collectors: R. C. Athearn, B. R. Bales, W. T. Davis, Roy Latham, T. L. McGinty, James Miller, Paulo E. de Oliveira and H. G. Richards. I am particularly indebted to Miss Hazel Gay (of the American Museum of Natural History) and to Dr. H. G. Richards (of the Academy of Natural Sciences of Philadelphia), who checked up the references to two books not available to me in the originals.

## Cienfuegos, Cuba

Cienfuegos is one of Cuba's finest cities. It is built on the eastern shores of Cienfuegos Bay in the Province of Santa Clara on the south coast of the island. The city proper is about ten miles from the harbor entrance.

As a locality name, "Cienfuegos" can be misleading, as it is applied to the general region about the bay. The marine zoölogist would find exceedingly poor collecting in the immediate vicinity of the city, as its situation is far from the open sea and the bay waters are materially freshened by the many small rivers and streams that enter it.

However, excellent marine collecting is to be found near the narrow harbor entrance and along the outer coast nearby. Just above the harbor entrance is situated the little village of Castillo de Jagua where accommodations are to be had at its little hotel and small boats can be obtained for all local trips. On the "Castle" side of the bay (west) a path leads to Punta de la Sabanilla at the harbor entrance. Along the two mile stretch of coast several marine habitats are to be found, mainly however, ledge rock and "diente de perro" the badly weathered dog-tooth limestone. This rock not only extends to this Point, but around it and west for many miles. We followed the shore for over three miles and found this type of rock collecting to be most excellent. The country behind is somewhat level with a low scrub forest with good though limited land shell collecting. *Liguus fasciatus goodrichi* Cl. and *Cerion iostomum* Pfr. are found in fair numbers.

The opposite shore from the "Castle" (east) is by far the better for the shell collector. This can be reached by the little wood-burning boat that makes frequent trips from Cienfuegos and stops at several places about the Bay. La Milpa and Pasacaballos, two very small settlements, are on this side and from the latter, a walk of two miles south along the shore margined with the dog-tooth limestone brings one to the lighthouse at Punta de los Colorados. Backing the coast for a short distance and above the dog-tooth limestone are low red-rocked cliffs which give this Point its name. Less than half a mile east the limestone gives way to a region of flat broken stones and is shallow for many feet seaward. This area offers exceedingly fine collecting. Every flat slab of rock is a home for marine animals, particularly mollusks. We have counted as many as twenty specimens of *Livona pica* Linné under a single rock slab and *Fissurella*, *Columbella*, *Conus*, *Cypraea* and a multitude of other genera are to be had for the picking up. Another half mile to the east are short sandy beaches and mangrove areas, both productive for many species not found along the rocky stretches.

North of Castillo de Jagua there are a few small bays which are easily reached by boat. Our method was to hire a man to take us to one of these bays by motor boat, leaving with us a row boat and calling again late in the afternoon. We could then explore at our leisure the entire bay as well as the forest-covered shores about the bay. These bays have a fauna somewhat different from the harbor entrance and the open coast. Near the mouth of small streams several brackish water species were found and elsewhere about the bays we found species that have a tolerance for slightly brackish water. —W. J. CLENCH

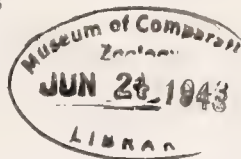
# JOHNSONIA

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XENOPHORIDAE



NUMBER 8

## THE GENERA XENOPHORA AND TUGURIUM IN THE WESTERN ATLANTIC

BY

W. J. CLENCH AND C. G. AGUAYO

The family Xenophoridae is mainly tropical in its distribution. It is remarkable for its habit of attaching foreign objects to its shell, particularly the shells and shell fragments of other mollusks, along with coal, pebbles and coral. The variation in this habit among the several species, however, ranges from its entire absence in *Tugurium exutum* Reeve of China and Japan to nearly complete coverage in *Xenophora trochiformis* of our own Western Atlantic, where the entire surface, other than the base of the shell, is covered with foreign objects. This latter condition is developed in the species that occur in the shallower waters. Deeper water species are but moderately adorned. Other species, such as *Haliphobus solaris* Linné of the Indo-Pacific area, have modified the "cape" into a series of rather long and blunt marginal spines or folds which would appear to serve a similar purpose of adornment and protection.

It has been suggested that this habit of fixing foreign objects to the outer surface of the shell is protective and that it simulates a small mound of dead shells. This may certainly be true but the protection afforded by the attached shells is probably quite real. These objects produce a spinose condition on many species which would render them more or less immune from many types of predators. The production of the "cape" or palatal extension is developed to the greatest degree in the deep-water species. This may be a cause of their preference for a soft bottom as this larger surface area, coupled with the light structure of the shell, would enable them to exist on a softer substratum than would be possible for a proportionately heavier shell.

About 20 recent species are known to occur in this family. Though mainly tropical, a few extend well into the warmer portions of the temperate zones. With few exceptions, they exist below low water line and may extend to depths of about 450 fathoms.

### Key to the Western Atlantic Xenophoridae

- |   |                     |
|---|---------------------|
| 1. Possessing a "cape" or broad extension of the palatal area | 3                   |
| 2. No palatal extension or "cape"                             | <i>trochiformis</i> |
| 3. Lower whorls shingled, no submarginal depression           | <i>longleyi</i>     |
| 4. Lower whorls not shingled, a strong submarginal depression | <i>caribaeum</i>    |

### *Xenophora* Fischer von Waldheim

*Xenophora* F. v. W. 1807, Muséum-Demidoff, Moscou 3, p. 213<sup>1</sup> (genotype, *Trochus conchyliphorus* Born = *X. trochiformis* Born). *Phorus* Montfort 1810 and *Onustus* Gray 1847, are synonyms.

<sup>1</sup>We have not seen this paper, but the part on *Xenophora* has been published by P. Fischer in the Journ. de Conchy. 5, p. 251, 1857.

Species in the genus *Xenophora*, as now restricted, are without a cape or palatal extension, possess a strongly angled whorl, and are usually moderately to completely covered with other shells, shell fragments, coral, small stones and even small pieces of coal. All are imperforate in the adult stage.

### *Xenophora trochiformis* Born, Plate 1, fig. 1-2

*Turbo trochiformis* Born 1778, Index Musei Caesarei Vindobonensis p. 355 (locality unknown).

*Trochus conchyliophorus* Born 1780, Testacea Musei Caesarei Vindobonensis p. 333, pl. 12, fig. 21-22 (Oceano Americano).

*Trochus lithophorus* Blumenback 1803, Manuel Hist. Nat. Metz, **2**, p. 64 (Indes occidentales) [Trans. from the German by S. Artaud]. Reference made to Chemnitz 1781, Conchy.-Cab. (1) **5**, pl. 172, fig. 1688-1689.

*Xenophora laevigata* Fischer von Waldheim 1807, Muséum-Demidoff **3**, p. 213 (locality not given).

*Phorus agglutinans* Denys de Montfort 1810, Conchyliologie Systematique, Paris, **2**, p. 159 (non *Trochus agglutinans* Lamarek 1804, Ann. Mus. Hist. Nat. **4**, p. 51 [fossil, Paris Basin]).

*Phorus onustus* Reeve 1843, Proc. Zool. Soc. London p. 161 (West Indies); Conch. Icon. **I**, *Phorus*, pl. 1, fig. 3a-b; Conch. Syst. **2**, pl. 214, fig. 3 and pl. 215, fig. 8.

*Xenophora conchyliophora* Born, Dall 1889, Bull. Mus. Comp. Zoöl. **18**, p. 290.

**Description.** Shell 50 to 60 mm. in width not including foreign attachments, not umbilicated in the adults and heavy in structure. Whorls 7 to 8, regularly increasing in size. No cape developed at all. Color a brownish cream which is usually somewhat irregular in intensity. Spire extended, forming an angle of about  $85^\circ$ . Aperture subquadrate, the basal margin deeply concave in outline. Sculpture on the base finely but unevenly reticulated, the concentric ridges being somewhat the stronger, remaining sculpture on outer surface irregular and more or less malleated in appearance. No subsutural depression on the base. Operculum higher than wide, subtriangular in outline, thin, with a series of numerous, flattened, concentric growth lines. Periostracum apparently wanting. Attachments of foreign objects abundant and use made of shells, shell fragments, coal, small stones, usually to the extent that the outer surface other than the base of the shell is completely concealed.

	height	width	whorls	
(large)	42	72 mm.	8	Bermuda
(average)	42	60	$7\frac{1}{2}$	Simms, Long Id., Bahamas

**Types.** The type figure is that of Born given above. Born's specimens are in the Vienna Museum. According to Brauer, however, the specimens do not exactly agree with the figure. (See reference, JOHNSONIA, No. 6 (*Conus*) p. 24, under types. We restrict the type locality to Nassau, New Providence, Bahama Islands.

**Common name.** The Atlantic Carrier-Shell.

**Remarks.** This species is rather remarkable for the number of shells, shell fragments and other detritus that it will attach to the outer portion of its whorls. From above it appears to represent a small heap of shells and shell fragments. *X. trochiformis* is readily differentiated from both *T. longleyi* and *T. caribaeum* by being imperforate and not possessing any cape or palatal extension.

**Range.** Off Hatteras, North Carolina (Dall 1889) south to Brasil.

**Records.** FLORIDA: Daytona; off St. Augustine, *Atlantis*, N. Lat.  $30^\circ 21'$ ; W. Long.  $79^\circ 55'$  (230-250 fathoms); Miami; Sugar Loaf Key (all MCZ); off Fort Walton in



13-19 fathoms (L. A. Burry); off Tortugas, station 10, N. Lat.  $24^{\circ} 44'$ ; W. Long.  $83^{\circ} 26'$  (37 fathoms); station 12, N. Lat.  $24^{\circ} 34'$ ; W. Long.  $83^{\circ} 16'$  (36 fathoms); off Key West, station 5, N. Lat.  $24^{\circ} 15'$ ; W. Long.  $82^{\circ} 13'$  (152-229 fathoms); these last three records are from the *Blake* voyage (MCZ). BERMUDA: (MCZ). BAHAMAS: Nassau, New Providence; Governors Harbour and James Cistern, Eleuthera Id.; Simms, Long Id.; Arthurstown, Cat. Id.; Matthewtown, Great Inagua (all MCZ). CUBA: Cayo Guajabe, Camagüey Prov. (P. J. Bermúdez). HISPANIOLA: Monte Cristi (MCZ). JAMAICA: (MCZ). VIRGIN IDS.: St. Thomas (MCZ). BRASIL: off Bahia, *Hassler*, station 9, S. Lat.  $11^{\circ} 49'$ ; W. Long.  $37^{\circ} 27'$  (15 fathoms) (MCZ).

### *Tugurium P. Fischer*

*Tugurium* Fischer 1876, [in] Kiener, *Icon. Coquilles Vivantes* **11**, p. 450; Wenz 1940 [in] Schindewolf, *Handb. d. Paläozoologie* **6**, pt. 1, p. 906.

Genotype, *Phorus exutus* Reeve

Species in the genus *Tugurium* are umbilicated, possess a well developed cape or palatal extension with the margin generally scalloped. They may or may not have a sub-marginal depression on the base of the body whorl. This latter may be marginal with two or three fine thread-like ridges as in *T. exutum* Reeve, or without this character as in *T. longleyi* Bartsch. Only a few foreign objects are cemented to the outer shell surface.

### *Tugurium (Tugurium) caribaeum* Petit de la Saussaye, Plate 1, fig. 3-4

*Xenophora caribaea* Petit 1856, *Journ. de Conchy.* **5**, p. 248, pl. 10, fig. 1-2 (Marie Galante Id). [Lesser Antilles].

*Xenophora caribaea* Petit, Dall 1889, *Bull. Mus. Comp. Zoöl.* **18**, p. 291.

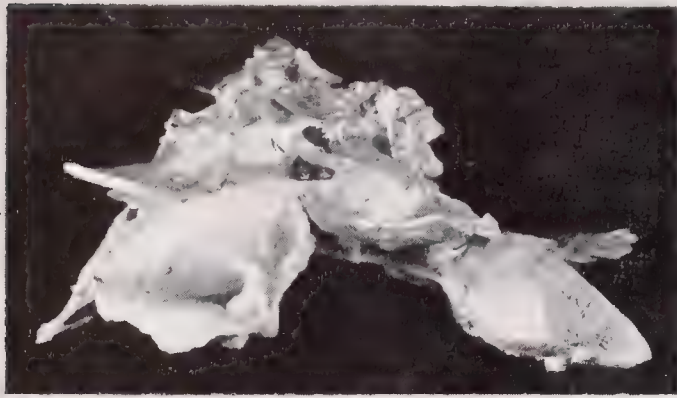
*Description.* Shell about 90 to 100 mm. in width (not including foreign attachments), umbilicated and light in structure. Whorls 8 to  $8\frac{1}{2}$  regularly increasing in size. Cape extending well below the body whorl and irregularly scalloped along its margin. Color a milk or glass-white, the base of body-whorl creamy. Spire extended, forming an angle of about  $85^{\circ}$ . Aperture subquadrate, the basal margin strongly sinuous in outline. Sculpture on the base of very fine concentric growth lines which develop into fine ridges within the umbilicus. Remaining sculpture on outer surface of shell of fine obliquely set ripple-like marks. Base of shell with a strongly marked depression which margins the suture. Periostracum apparently wanting. Attachment of foreign objects limited in number and includes small shells and shell fragments or other small objects.

	height	width	whorls	
(large)	50	90 mm.	8	Bahía de Cochinos, Cuba
(average)	25-40	65-70	7	Marie Galante (types)

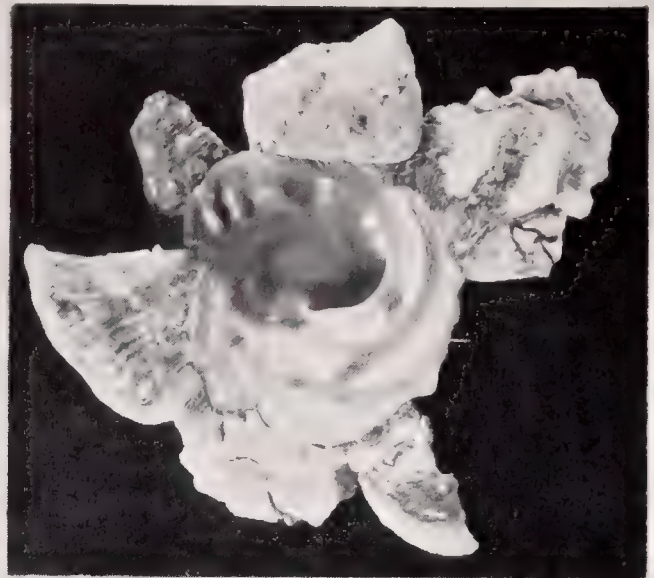
*Types.* It is probable that the types are in the collection maintained by the Journal de Conchyliologie. The type locality is the Island of Marie Galante near Guadeloupe, Lesser Antilles in 20-75 fathoms.

*Common name.* The Caribbean Carrier-Shell.

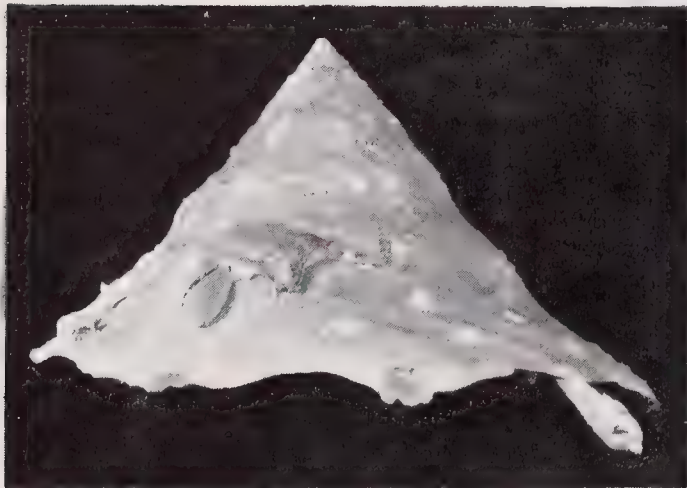
*Remarks.* (See also under *longleyi*). This species, similarly to *longleyi*, limits materially the number and size of the shells that it cements to the outer surface of its shell. As Dall originally pointed out (l.c. p. 291), care seems to be shown in the selection of ma-



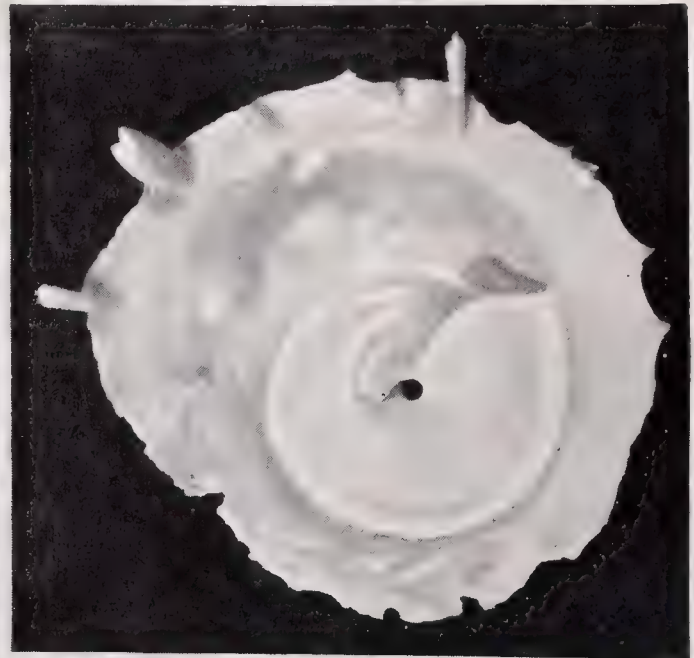
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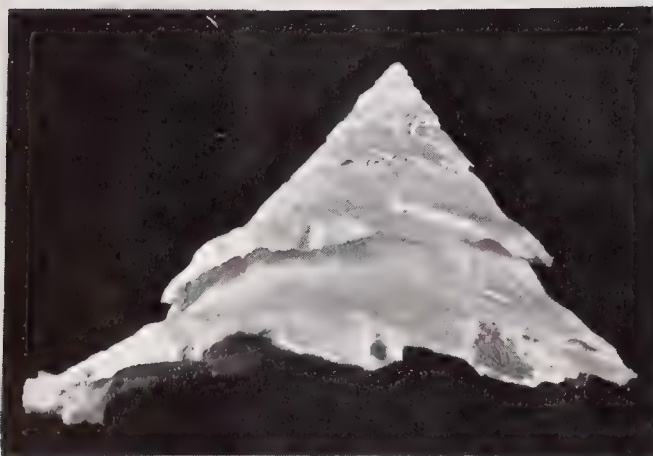
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3



4



5



6

Plate 1. Figs. 1-2. *Xenophora trochiformis* Born, Lake Worth, Florida. Reduced one-third. Figs. 3-4. *Tugurium caribaeum* Petit, Bahía de Cochinos, Cuba. Reduced one-sixth. Fig. 5. *Tugurium longleyi* Bartsch, off Barbados. Reduced about one-half. Fig. 6. *Tugurium longleyi* Bartsch, off St. Kitts. Reduced about one-third.

terial and the orientation of the shells that are used. Generally, the convex surface of the cemented objects is the bottom. In addition, our specimens of both *caribaeum* and *longleyi* that have used attenuated gastropods, have these disposed radially and almost always have them attached by their spires.

*Range.* Deep water, off Cuba and south to the Lesser Antilles<sup>1</sup>.

*Records.* BAHAMAS: off Anguilla Id., Cay Sal Group, *Atlantis*, station 2985 (250 fathoms) (MCZ). CUBA: all of the following Cuban records were obtained by the *Atlantis* during 1938 and 1939.<sup>2</sup> Off Puerto Tánamo, station 3372 (300 fathoms); off Cayo Romano, station 3387, (245 fathoms); off Cayo Coco, station 3401 (235 fathoms); off Punta Alegre, station 3411 (260 fathoms); off Caibarién, station 3435 (255 fathoms); off Sagua la Grande, station 3438 (265 fathoms); off Matanzas Bay, station 3483, (285 fathoms); off Río Jaruco, station 3490 (250 fathoms); Bahía de Cochinos, station 3335 (200 fathoms) (all MCZ and Museo Poey); off Santiago, *Blake*, station 5 (288 fathoms) (MCZ). JAMAICA: off Port Royal, *Blake* (100 fathoms) (MCZ). VIRGIN ISLANDS: off St. Thomas, *Blake*, station 118 (238 fathoms) (MCZ). LESSER ANTILLES: off Montserrat, *Blake*, station 157 (120 fathoms); off Sandy Bay, Barbados, *Hassler Voyage* (75-100 fathoms) (both MCZ). MEXICO: off Yucatan, *Blake*, station 36 (84 fathoms) N. Lat. 23° 13'; W. Long. 89° 10' (MCZ).

### Subgenus *Trochotugurium* Sacco

*Trochotugurium* Sacco 1896, Moll. Terreni Terziarii Piemonte Liguria, pt. 20, p. 27.

Subgenotype, *Phorus borsoni* "Bellardi" Sismonda<sup>3</sup>

Species of this subgenus are umbilicated, possess a well developed cape or palatal extension, are without the submarginal depression and so far as known, have strongly curved riblets on the base of the shell. These riblets extend from the umbilical area to the margin of the shell base at the cape. This forms a finely crenulated suture. They differ from *Tugurium* s.s. in lacking the submarginal depression and in the possession of the curved riblets.

### *Tugurium* (*Trochotugurium*) *longleyi* Bartsch, Plate 1, fig. 5-6

*Xenophora longleyi* Bartsch 1931, Proc. United States Nat. Mus. 80, Art. 17, pp. 1-2, pl. 1 (off Loggerhead Key, Dry Tortugas, Florida).

*Description.* Shell reaching 140-150 mm. in width not including foreign attachments, umbilicated and light in structure. Whorls 8 to 8½ regularly increasing in size. Cape extending well below the body whorl and somewhat irregularly scalloped along its margin. Color milk or glass-white, base of body whorl a uniform creamy-brown. Spire usually

<sup>1</sup> Dall in 1889 considered North Carolina as the northern range of this species. However, he had included apparently specimens of *longleyi* in his series of *caribaeum*. For this reason, we limit its range from Cuba and south until positive identification has been made of the original material.

<sup>2</sup> We select a single station from each locality. This species occurred at many more stations.

<sup>3</sup> The earliest reference that we can find is that of E. Sismonda 1847, Synopsis Methodica Animalium Invert. Pedemontii Fossilium, Turin, p. 50. It would appear that Bellardi did not describe this species but was credited with having done so by Sismonda who actually was the first to give the name and reference to a figure.

extended, forming an angle of about  $85^\circ$ . Aperture subquadrate, the basal margin deeply concave in outline. Sculpture on the base of fine but strong concentric growth lines which are fixed upon the cape, producing a finely crenulated suture. Remaining sculpture on outer surface of fine and obliquely set ripple-like marks. No subsutural depression on the base. Operculum wider than high, subquadrate in outline, thin and with a series of fine and numerous irregularly concentric growth lines. Nucleus marginal with a thin longitudinal plate or pad extending from it, ending before the margin is reached. The plate is outlined mainly by its right angled striation. Periostracum apparently wanting. Attachment of foreign material limited to a few small shells, shell fragments or other small objects.

	height	width	whorls	
(large)	85	144 mm.	8	Holotype
(average)	50	90-100	$7\frac{1}{2}$	Off Morro Light, Habana, Cuba

*Types.* Holotype, United States Nat. Mus. no. 382689, off and south of Loggerhead Key, Dry Tortugas, Florida in 98 to 125 fathoms, W.H. Longley collector, 1931. Paratype from the same locality and station.

*Common name.* Longley's Carrier-Shell.

*Remarks.* This is one of the largest species in the genus. Similar to *T. caribaeum*, it cements but few shells or other foreign matter to its own shell and generally selects small shells, shell fragments or small stones. Both this species and *caribaeum* are superficially alike but they differ in many of their characteristics. *T. longleyi* differs from *caribaeum* in possessing strongly shingled or overlapping whorls, having a wider umbilicus, lacking the submarginal depression, having a concave basal margin to the aperture and possessing fine blade-like ridges which buttress the cape. The two species are similar in their general shape, their light structure and in possessing a fine irregular ripple-like sculpture.

In depth, *longleyi* has been found in 98 to 450 fathoms, extending 150 fathoms deeper than any record that we have for *caribaeum*. It appears to be a much rarer shell than *caribaeum* as it occurred at far fewer stations during the *Atlantis* Expeditions.

*Range.* Off Cape Fear, North Carolina, south to Barbados.

*Records.* NORTH CAROLINA: 75 miles off Cape Fear in 247 fathoms (Bartsch, l.c. p. 2). FLORIDA: off Loggerhead Key, Florida in 98 to 125 fathoms (Bartsch, l.c. p. 1). CUBA: The following are all from the *Atlantis* dredgings. Off Matanzas Bay, station 3468, (375 fathoms); 3469 (425 fathoms); 3485 (385 fathoms); off Sagua la Grande, station 2978 (280-300 fathoms); 2987A (285-300 fathoms); off Cayo Coco, station 3393 (220 fathoms); 2397 (180 fathoms); off Puerto Tánamo, station 3370 (450 fathoms); Bahía de Cochinos, station 2962B (180-190 fathoms) (all MCZ and Museo Poey); off Morro Light, Habana, *Blake*, station 100 (250-400 fathoms) (MCZ). VIRGIN ISLANDS: off St. Thomas, *Blake*, station 118 (238 fathoms). LESSER ANTILLES: off St. Kitts, *Blake*, station 146 (245 fathoms); *Blake*, station 147 (250 fathoms); *Blake*, station 145 (270 fathoms); off Barbados, *Blake*, station 274 (209 fathoms); *Blake*, station 300 (82 fathoms) (all MCZ).

## The Voyage of the H.M.S. "Challenger"

One of the greatest of all scientific voyages was that of the *Challenger*. The object of this voyage was to make a study of the deep-sea in many parts of the world, both of its physical characteristics and of its natural history. The *Challenger* left England in December, 1872 and returned in May, 1876, a voyage of three and one-half years, and covered a distance of 69,000 miles, mainly in the Atlantic and Pacific Oceans.

The *Challenger* was a corvette of 2306 tons displacement. In addition to her sails, she was powered by an auxiliary steam-engine. She was especially fitted with sounding and dredging apparatus and carried a large scientific staff which was under the direction of Sir Charles Wyville Thomson.

In all, 362 stations were made during her cruise, many of them being dredging stations and certain of these were made in profound depths. Both R. B. Watson who worked up the *Scaphopoda* and *Gastropoda* and E. A. Smith who had written the report of the *Pelecypoda*, were disappointed in the total number of species obtained. The loss of much material was believed due to the extreme length of time necessary to haul up the dredge from the deeper drags, coupled with the movement of the boat in the rough seas. This occasioned the loss of mud and the small shells imbedded in it. However, an astonishingly large number of new species were encountered. Approximately 1300 species all told of *Scaphopoda* and *Gastropoda* were reported upon by Watson and 500 species of *Pelecypoda* were reported upon by Smith. The former lists 2650 fathoms as the deepest haul containing *Gastropoda* and the latter, 2900 fathoms, the deepest haul containing *Pelecypoda*. Since the voyage of the *Challenger*, however, material has been obtained from much greater depths.

Shallow water collecting was attempted only at a few localities, as limitations, both as to time and storage space on the *Challenger*, made such a course necessary. Land collecting was also limited, as time at sea was the more important and the direct object of the voyage, but attempts were made to add as much data as possible during the short stays on the more remote islands visited.

It is of interest to note that one of the four richest hauls of the entire voyage was made off the island of Sombrero, one of the northernmost islands in the Lesser Antilles. At a depth of 450 to 490 fathoms, a large number of animals were encountered, many of which were new to science. Many of these species were later obtained by the *Blake* which investigated the West Indies shortly after the *Challenger* voyage and more recently by the *Atlantis*, off the northern coast of Cuba.

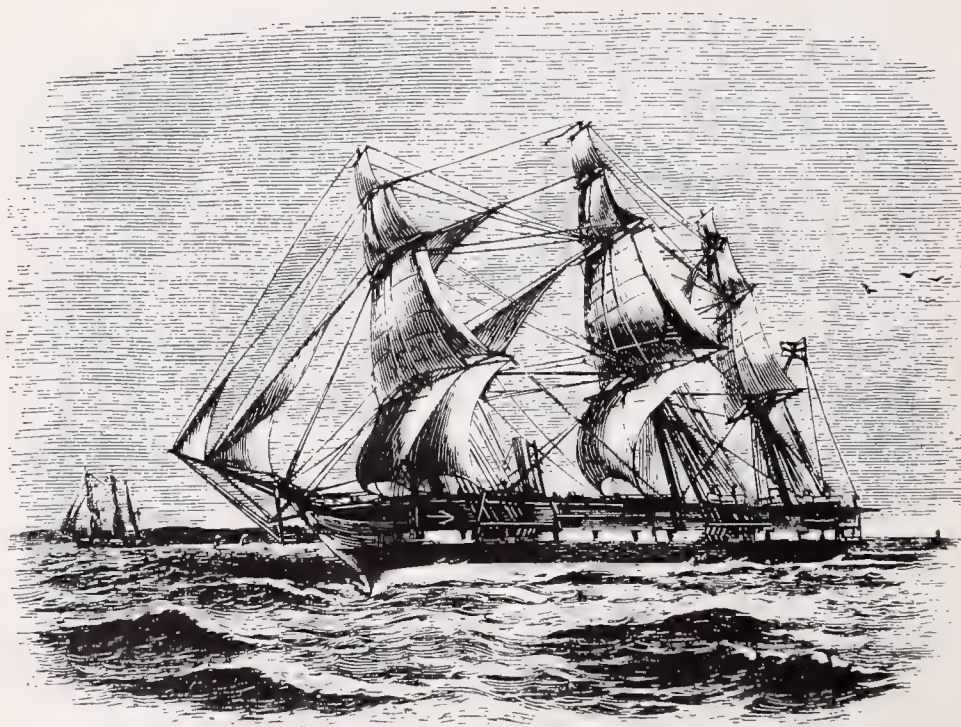
The *Challenger* made many stations in the Western Atlantic. We list below the points between which she sailed, that fall in whole or in part, within the boundaries of our area. An elaborate series of reports have appeared that were based upon the animals collected as well as upon other results obtained by this investigation. The few references that we append will lead to most of the data that have been published on and about this remarkable voyage.

Tenerife, Canary Islands to St. Thomas, Virgin Islands  
St. Thomas to Bermuda  
Bermuda to Halifax, Nova Scotia  
Halifax to Bermuda  
Bermuda to the Azores

Cape Verde Islands to Bahia, Brasil  
 Bahia to Tristan da Cunha  
 Falkland Islands to Montevideo, Uruguay  
 Montevideo to Ascension Island

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- Moseley, H.N. 1892, Notes by a Naturalist Made During the Voyage of H.M.S. "Challenger," London, pp. 241-540, map of voyage and text figures.



H. M. S. Challenger

Copied from the *Challenger Reports*, **1**, pt. 1, p. 1, 1885.

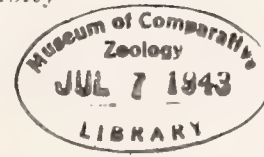
# JOHNSONIA

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CASSIDIDAE



NUMBER 9

## THE GENERA *CYPRÆCASSIS*, *MORUM*, *SCONSIA* AND *DALIUM* IN THE WESTERN ATLANTIC

BY

W. J. CLENCH AND R. T. ABBOTT

The following genera are all small in number of species. *Cypræcassis* and *Morum* have a few species, mainly in the Indo-Pacific region, while *Sconsia* and *Dalium* possess but a single species each, both limited to the West Indian area in the Western Atlantic region.

*Cypræcassis testiculus* is a fairly common shell throughout its range; *Morum oniscus* is fairly common as a beach shell in the West Indies, though quite rare in southern Florida. The remaining species are all very rare and *Dalium solidum* is known only from two or three specimens obtained by the *Blake* in deep water off Grenada Island, Lesser Antilles.

### *Cypræcassis Stutchbury*

*Cypræcassis* Stutchbury 1837, Mag. Nat. Hist. (n.s.) 1, p. 214; *ibid.* p. 470; Sowerby, *ibid.* p. 366; Lewis, *ibid.* p. 387.

Genotype, *Cassis rufa* Linné

Shell subcylindrical to oval with a depressed spire. Aperture rather narrow with the parietal wall plicate its entire length. Outer or palatal lip reflected, thickened and supporting along its inner margin a few to many single or paired teeth or short plicae. The shells are generally mottled with red, reddish brown or brown. They rarely produce more than one lip during life though occasional specimens do possess at least one varix. This is in sharp contrast to the many varices that are found on several species in the genus *Cassis*.

### *Cypræcassis testiculus* Linné, Plate 1 and Plate 3, fig. 1-3

*Buccinum testiculus* Linné 1758, Syst. Nat. ed. 10, p. 736 (Jamaica).

*Description.* Adult shells varying from 25 to 75 mm. (1 to 3 inches) in length, solid, and with a reticulated sculpture. Whorls 7 to 8. Color an orange brown with white and purplish brown blotches unevenly disposed over the body whorl. Blotches often crescent shaped. Tip of spire often tinged with pink or dull orange. Parietal wall an orange-cream glaze with two or three wide streaks of bright orange. Inner side of parietal wall wrinkled with irregular white teeth or plicae. Outer lip thick, slightly recurved and bearing about 20 prominent white teeth on its inner margin. Lip an orange-cream glaze with a dozen or more dull orange streaks running from the teeth across to the outer edge of the lip where they are terminated by a series of roughly square blackish brown dots. Interior of aperture a light orange-brown. Suture slightly indented. Nuclear whorls smooth, remaining whorls of spire sculptured by numerous, fine, spiral threads. Body whorl closely sculptured by small longitudinal ridges which are crossed by a dozen or more spiral grooves, thus producing a reticulated surface. Sometimes the shoulder of the body whorl bears ridges which are slightly longer and larger than others. Animal of moderate size

with foot slightly longer than the shell. Entire animal colored a light brownish orange, with the underside of the foot smeared with a darker shade of orange. No periostracum. Operculum not found in the live material so far studied.

	length	width	
(large)	75	48 mm.	Jamaica
(average)	56	37	Lake Worth, Boynton, Florida
(small)	20	13	Boca de Cangrejos, San Juan, Puerto Rico

*Types.* We select the illustration of Gaultieri, referred to by Linné, (1742, Index Testarum Conchyliorum, plate 39, fig. C) as the type figure. Linné's type locality is Jamaica.

*Common name.* Reticulated Helmet Shell.



Plate 1. *Cypraeacassis testiculus* Linné

Line drawing to show position of soft parts in the shell. (Cable Beach, Guantánamo Bay, Cuba). R.T. Abbott, del.

*Remarks.* This species has a wide distribution but is never found in large numbers, though it is inclined to favor certain localities. It is found usually around reef water where it can migrate from the deeper water to lay its eggs in the warmer and shallower regions. The eggs are the size of swollen grains of rice and are laid under small rocks or under large broken shells in greenish brown clusters of a hundred or so capsules. The size of adults varies considerably in the same locality, some shells reaching maturity when an inch long, others reaching a length of three inches. The smaller are generally the males.

*Range.* Bermuda, southern Florida, the West Indies, southern Mexico and south to Brasil. Hatteras, North Carolina (Dall 1889). Also the tropical coast of West Africa.

*Records.* FLORIDA: Boynton Beach; Lake Worth; Tortugas (all T. McGinty); Pelican Shoals, Key West (J. Schwengel). BERMUDA: (A. J. Peile 1926). BAHAMAS: Walter Cay, Little Abaco Id.; Cherokee Sound, Great Abaco Id.; Smith Point, Grand Bahama Id.; Cat Cay, Bimini Ids.; Governors Harbour, Eleuthera Id.; Orange Creek, Cat Id.; Little San Salvador Id.; Clarendon, Long Id.; Watlings Id.; Abrahams Bay, Mariguana Id.; Matthewtown, Great Inagua Id. (all MCZ). CUBA: Veradero; Mota, Oriente Prov. (both ANSP); Cayo Francés, Caibarién (P. J. Bermúdez); Habana: Cayo la Farola, Sagua la Grande; Castillo de Jagua, Cienfuegos; Guantánamo Naval Base (all MCZ). HISPANIOLA: Jacmel (ANSP); Cap Haitien; Gonave Id.; Monte Cristi; Puerto Plata; Puerto Sosúa; Santa Bárbara de Samaná (all MCZ); Port Blanco (H. Hurst). PUERTO RICO: Aricibo (MCZ); Boca de Cangrejos (H. Vander Schalie). VIRGIN ISLANDS: St. John; St. Thomas (both MCZ); Guana Id., Tortola (M. Dewey); St. Croix (ANSP). JAMAICA: Montego Bay (MCZ); Port Antonio (ANSP). LESSER ANTILLES: Antigua; St. Kitts; Tobago (all MCZ); Bridgetown, Barbados (ANSP); Toco, Trinidad (H. G. Kugler). CARIBBEAN ISLANDS: Swan Id.; Oak Ridge, Roatan Id.; Bay Islands (MCZ). CENTRAL AMERICA: Veracruz, Mexico (M. Bourgeois); Belize, British Honduras (MCZ); Colón, Panama (ANSP). SOUTH AMERICA: Corentyne River, British Guiana (H. G. Kugler); La Guaira, Venezuela (ANSP); Manguinhos, Ilha de Itaparica, Est. Bahía; Cidade da Bahía, Brasil (both P. de Oliveira). EASTERN ATLANTIC: Cape St. John, Spanish Guinea, Africa (Carnegie Museum).



**Cypraecassis testiculus**, form **crumena** Bruguière, Plate 2, fig. 4

*Cassidea crumena* Bruguière 1789, Encyclopédie Méthodique, Vers, 1, pt. 2, p. 428 (Ascension Id. [South Atlantic] ).

*Buccinum plicatum* Dillwyn 1817, Desc. Catalogue of Recent Shells, London, p. 588, (*non* Linné 1758).

*Cassis testiculus* Linné, var. Kiener 1835, Icon. Coquilles Vivantes 8, p. 20, pl. 4, fig. 7.

*Cassis testiculus* Linné, variety  $\beta$ . Reeve 1848, Conch. Icon. 5, *Cassis*, pl. 4, fig. 10a.

*Cassis testiculus bicincta* Bayer 1935, Zool. Mededeelingen 18, p. 97, text fig. 1 (Indian Ocean?).

In our opinion this is only a form of the typical species, and though rare, appears only as a sporadic example at any one locality.

It differs from typical *testiculus* by having a single or double row of short plications or ridges over the shoulder of the body whorl. All intermediates exist, however, between the finely reticulated specimens and those with fairly large plications. Bayer (l.c. above) possessed only a small specimen, but we have one that measures 75 mm. in length, which is as large as that reached by the typical form.

*Range.* Probably co-extensive with *C. testiculus* Linné.

*Records.* FLORIDA: Boynton Beach (T. McGinty). BAHAMAS: Eight Mile Rock, Grand Bahama Id.; Arthurstown, Cat Id.; Matthewtown, Gt. Inagua Id. (all MCZ). EASTERN ATLANTIC: Santiago, Cape Verde Ids. (MCZ).

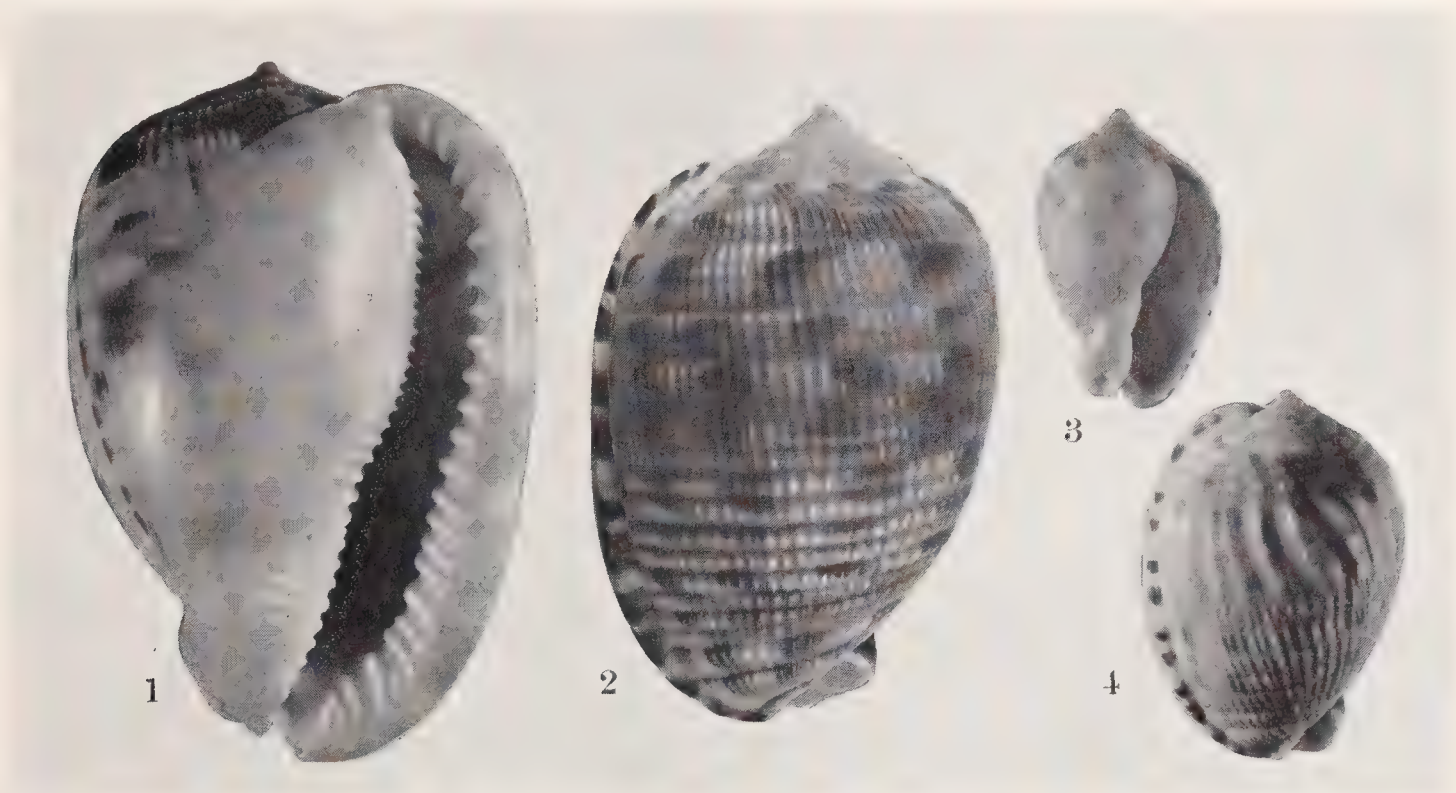


Plate 2. Fig. 1. *Cypraecassis testiculus* Linné, Veracruz, Mexico. Fig. 2. Berry Cay, Northeast Point, Cat Island, Bahamas. Fig. 3. Monte Cristi, Hispaniola (young). Fig. 4. *Cypraecassis testiculus*, form *crumena* Brug., Simms, Long Island, Bahamas. (All natural size.)

**Morum** Röding

*Morum* Röding 1798, Museum Boltenianum, p. 53 [*Lambidium* Link 1807; *Oniscia* Sowerby 1824; *Oniscidia* Swainson 1840; *Ersina* Gray 1847; *Plesioniscia* Fischer 1884; are synonyms].

Genotype, *Morum purpureum* Röding (= *Strombus oniscus* Linné)

This genus is composed of but few species, mainly tropical to subtropical, and found, with few exceptions, in the Indo-Pacific area. Two species occur in the tropical portion of the Western Atlantic. The shells are generally medium to small in size, with a short papilliform spire and usually a strongly nodulose sculpture. They occupy rocky or coral reefs below the low water line and are not particularly abundant.

*Oniscidia* Swainson (1840, Treatise on Malacology, London, p. 298, fig. 66c) was a lapsus for *Oniscis* Sowerby 1824.

**Morum oniscus** Linné, Plate 3, fig. 1-5

*Strombus oniscus* Linné 1767, Syst. Nat. ed. 12, p. 1210, No. 502 (locality unknown).

*Cypraea conoidea* Scopoli 1786, Deliciae Florae et Faunae Insubricae pt. 2, p. 78, pl. 24, fig. 3 (no locality).

*Morum purpureum* Röding 1798, Museum Boltenianum, p. 53, no. 672 [no locality; refers directly to *S. oniscus* Linné].

*Oniscis triseriata* Menke 1830, Synopsis Methodica Molluscorum, 2nd ed. p. 64 [no locality; refers directly to *S. oniscus* Linné].

**Description.** Shell reaching about 25 mm. in length, subcylindrical and roughly sculptured with blunt tubercles. Whorls 7; the first two or three nuclear whorls are papilliform, forming a sharp point at the top of the low spire. Color varying from a white background with fine brown or gray specklings to a graying background with large mottlings of black-brown. Dead, wave-worn specimens are mottled with a light chestnut-brown. Tip of spire usually white, rarely tinged with deep rose. Columella and lip white, the latter often flecked on its outer edge with brown. Parietal wall thickened with a translucent glaze which is often ingrained with numerous white dots. Sometimes these dots are developed into minutely raised pustules. Interior of aperture white. Outer lip is thickened and bears a row of about 15 small teeth on the inner side. Suture slightly indented and wavy, somewhat overlapped by the whorl below. Three bands of rounded blunt nodules usually 7 to 8 to the row, run spirally on the body whorl. A series of coarse small spiral threads run in between these rows. In live specimens the growth lines in the periostracum cross these threads to form a minute lace-like network.

Animal of medium size with the expanded foot slightly longer than the shell. The foot is spreading with wavy edges. Underside of foot whitish. Propodium slightly triangular in shape and colored a light gray. Siphon short and an even light gray. Upperside of foot a grayish white with concentrated fine gray-black specklings. The two rather slender eye-stalks are light yellow and terminated by a small black eye and a short white feeler with

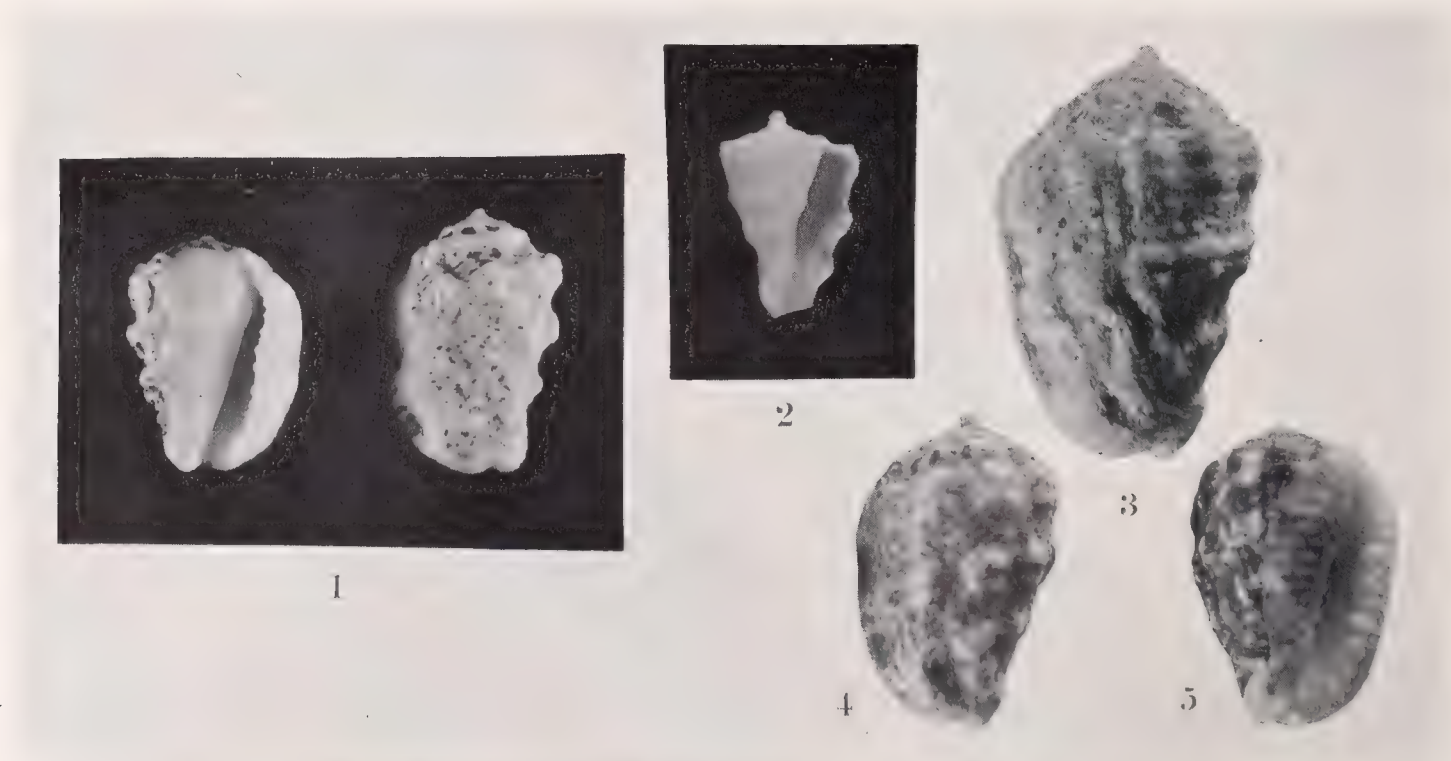


Plate 3. *Morum oniscus* Linné

Fig. 1. Eight Mile Rock, Grand Bahama Id., Bahamas. Fig. 2. Bermuda (young). Figs. 3-4. St. Thomas, Virgin Islands. Fig. 5. Antigua, Lesser Antilles. (All  $1\frac{1}{2}\times$ .)

gray circular stripes. Operculum exceedingly small, possessing a marginal nucleus and having rather strong concentric growth lines. Periostracum a thin, grayish velvet.

	length	width	
(large)	27	19 mm.	St. Thomas, Virgin Islands
(average)	21	14	Antigua Id., Lesser Antilles
(small)	14	11	Alicetown, North Bimini Id., Bahamas

*Types.* Linné refers to A. Seba 1761 (Locuplet, Rerum. Nat. 3, pl. 55, fig. 23a-g), which are here selected as type figures. As Linné gave no locality, we designate St. Thomas Island, Virgin Islands, as the type locality.

*Common name.* Atlantic Wood-louse.

*Remarks.* This handsome little shell is frequently encountered on the West Indian beaches where it is washed up from the reefs. It prefers to live in the sheltered waters of reefs where there is a continuous supply of pure ocean water. During the day it seeks shelter under slabs of coral rock, usually in water from three to ten feet in depth. It is a fairly active creature, and not at all shy like most night travellers.

The variety *lamarekii* Deshayes is, in our opinion, an absolute synonym of *Morum tuberosum* Reeve of the Eastern Pacific area (Western Panama). Its size, coloration and shape agree in all details with specimens that we possess from the western Panamic area.<sup>1</sup>

Tryon (1885, Man. of Conch. (1) 7, p. 282) has listed *O. strombiformis* Reeve as occurring in the West Indies, though unknown to him. The locality was unknown to Reeve (1842, Proc. Zool. Soc. London, p. 91; 1842, Conch. Syst. 2, pl. 253, fig. 1). It was described from the Cuming collection and may have been a species he had obtained from the Philippines.

*Range.* Lower Florida Keys, Bahamas, throughout the West Indies and south to Brasil.

*Records.* FLORIDA: Boynton Beach; Middle Sambo Shoals, Key West (both T. McGinty). BAHAMAS: West End, Grand Bahama Id.; Alicetown, North Bimini Ids.; Harbour Island, Eleuthera; Simms, Long Id.; Arthurstown, Cat Id.; Little San Salvador; Watling Id.; Matthewtown, Great Inagua (all MCZ). CUBA: Cayo Francés, Caibarién; Castillo de Jagua, Cienfuegos; Blue Beach, Guantánamo Naval Base (all MCZ); Cayo la Farola, Sagua la Grande (J. P. Bermúdez). HISPANIOLA: Cap Haitien; Miragoane (both W.J. Eyerdam); Monte Cristi (MCZ). PUERTO RICO: San Juan (MCZ). VIRGIN ISLANDS: St. Thomas; St. John (both MCZ); Guana Id., Tortola; The Baths, Virgin Gorda (both M. Dewey). LESSER ANTILLES: Antigua (MCZ). CARRIBBEAN ISLANDS: Swan Id. (MCZ). BRASIL: Ilha de Itaparica, Est. da Bahía; Farol da Barra, Cidade da Bahía (both P. de Oliveira).

### *Morum dennisoni* Reeve, Plate 4, fig. 5

*Oniscia dennisoni* Reeve 1842, Conch. System. 2, p. 211, pl. 53, fig. 5-6 [no locality]; *ibid.* 1842 [1843] Proc. Zool. Soc. London, 10, p. 91 [locality unknown]; Beau 1857 [1858] Catalogue des Coquilles Recueillies á la Guadeloupe et ses Dépendances, Revue Coloniale, p. 8 (Guadeloupe).

<sup>1</sup>A review of this species has resulted in the following synonymy:

*Oniscia tuberosa* Sowerby 1824, Genera of Shells, *Oniscia*, p. 2 [nomen nudum].

*Morum tuberosum* Reeve 1842, Conchologia Systematica 2, p. 211, pl. 253, fig. 2-4.

*Oniscis lamarekii* Deshayes 1844, [in] Lamarek, Anim. s. Vert. 10, p. 12, no. 1; (*non lamarekii* Lesson 1840).

*Morum xanthostoma* Adams 1853, Proc. Zool. Soc. London, p. 174. [This refers to a yellow-lipped form which appears sporadically in any large series of this species.]

*Description.* Shell reaching a length of 42 mm.; it is imperforate, solid and strong. Whorls 7, shouldered, and formed below the shoulder angle. General color a grayish white, with irregular patches of brown appearing most abundantly on the spire and along the outer margin of the lip. Smaller patches and dots of color over the body whorl in a faint spiral arrangement. Spire somewhat depressed and produced at an angle of  $95^\circ$ . Aperture oblique and rather narrow. Outer lip reflected, thickened and possessing a series of "teeth" along its entire inner margin. Inner lip or parietal wall with a rather thick pad or callus which is covered with a series of small and somewhat raised whitish dots. The callus is more or less evenly colored a light reddish brown. Sculpture consisting of a series of axial, blade-like ridges along which are developed a number of small knobs. On the shoulder of each whorl these knobs are larger and more pointed. All of these knobs are disposed in a spiral pattern as well. Between these nodulose ridges there are a series of very fine axially arranged threads. Operculum not observed.

height	width	whorls	
41.6	25.3 mm.	7	off Sandy Bay, Barbados

*Types.* Probably in the British Museum. As the locality was unknown to Reeve, we select that of Guadeloupe Id., Lesser Antilles, to be the type locality. This is based upon Beau's record of its occurrence on this island.

*Remarks.* Little can be added to what is known regarding this species. The three records would indicate a wide distribution in the West Indies in fairly deep water. Beau cited this species in a list with no additional information.

*Range.* The West Indies in general, in fairly deep water.

*Records.* LESSER ANTILLES: Guadeloupe (Beau 1858); off Sandy Bay, Barbados in 75-100 fathoms, *Hassler Voyage*, 1871 (MCZ). MEXICO: Arrowsmith Bank, Yucatán in 130 fathoms (Dall 1889).

### **Sconsia Gray**

*Sconsia* Gray 1847, Proc. Zool. Soc. London, **15**, p. 137.

Genotype, *Cassidaria striata* Lamarck

Shell oval to fusiform and sculptured with fine spiral, incised lines. Color pattern generally in the form of spiral rows of rather large yellowish brown squares; occasionally, however, these may form bar or flame-like markings. One or more varices may occur.

For a review of the fossil American species see Pilsbry 1921, Proc. Acad. Nat. Sci. Philadelphia, pp. 361-362.

### **Sconsia striata Lamarck, Plate 4, fig. 1-4**

*Cassidaria striata* Lamarck 1816, Encyclopédie Méthodique, Vers, **3**, p. 3, [plate reference], pl. 405, fig. 2a-b (no locality).

*Sconsia grayi* A. Adams 1854 [1855] Proc. Zool. Soc. London, **22**, p. 136, pl. 28, fig. 6 (locality unknown).

*Sconsia barbudensis* Higgins and Murrat 1877, Proc. Liter. Phil. Soc. Liverpool, **31**, p. 411, pl. 1, fig. 1 (15 fathoms, off Barbuda [Lesser Antilles]).

*Description.* Shell rather solid, imperforate, rather shining and reaching a length of about 60 mm. Whorls 8, regularly increasing in size. Nuclear whorls smooth and glass-like. Color a china-white to irregularly pale buff, overlaid with spots or axial lines of brown. The spots may be fairly regular and arranged somewhat in spiral order, while other specimens have these brownish spots coalescing to form irregular axial bars of color, sometimes complete as bars of color on the body whorl or complete above the mid-area

and continued as spots below the mid-area. Periostracum not apparent on the specimens at hand. Spire acute, somewhat produced, usually flat-sided, though occasional specimens show a fair convexity of the whorls. The spire is cast at an angle of  $75^\circ$ . Aperture oblique, somewhat spindle-shaped and rather narrow. Outer lip slightly reflexed, expanding upwardly on the penultimate whorl, thickened and possessing a series of regular palatal teeth. These may be developed only along the lower and inner margin of the outer lip, though most of the young specimens show these teeth developed along the entire margin. Parietal wall or inner lip glazed without an apparent callus. As in the outer lip, the columellar teeth or plicae are limited in the older specimens to the lower portion or to the columella itself; young specimens, however, have these short plications extending along the entire inner lip to the juncture with the outer lip. Sculpture of numerous spiral grooves crossed by very fine growth lines. The sculptural pattern, however, is distinctly spiral and not reticulated. Varices generally limited to two and then not overly conspicuous. Canal short and oblique, giving a moderate truncation to the thickened columella. Suture slightly indented and slightly inset.

	length	width	whorls	
(large)	58	30 mm.	8	off Punta Alegre, Camagüey, Cuba
(average)	52	29	$7\frac{3}{4}$	off Matanzas Bay, Cuba

*Types.* The type figures are those of Lamarck as given in the first reference above under this species. As figures, they are poor, but they do represent this species and genus

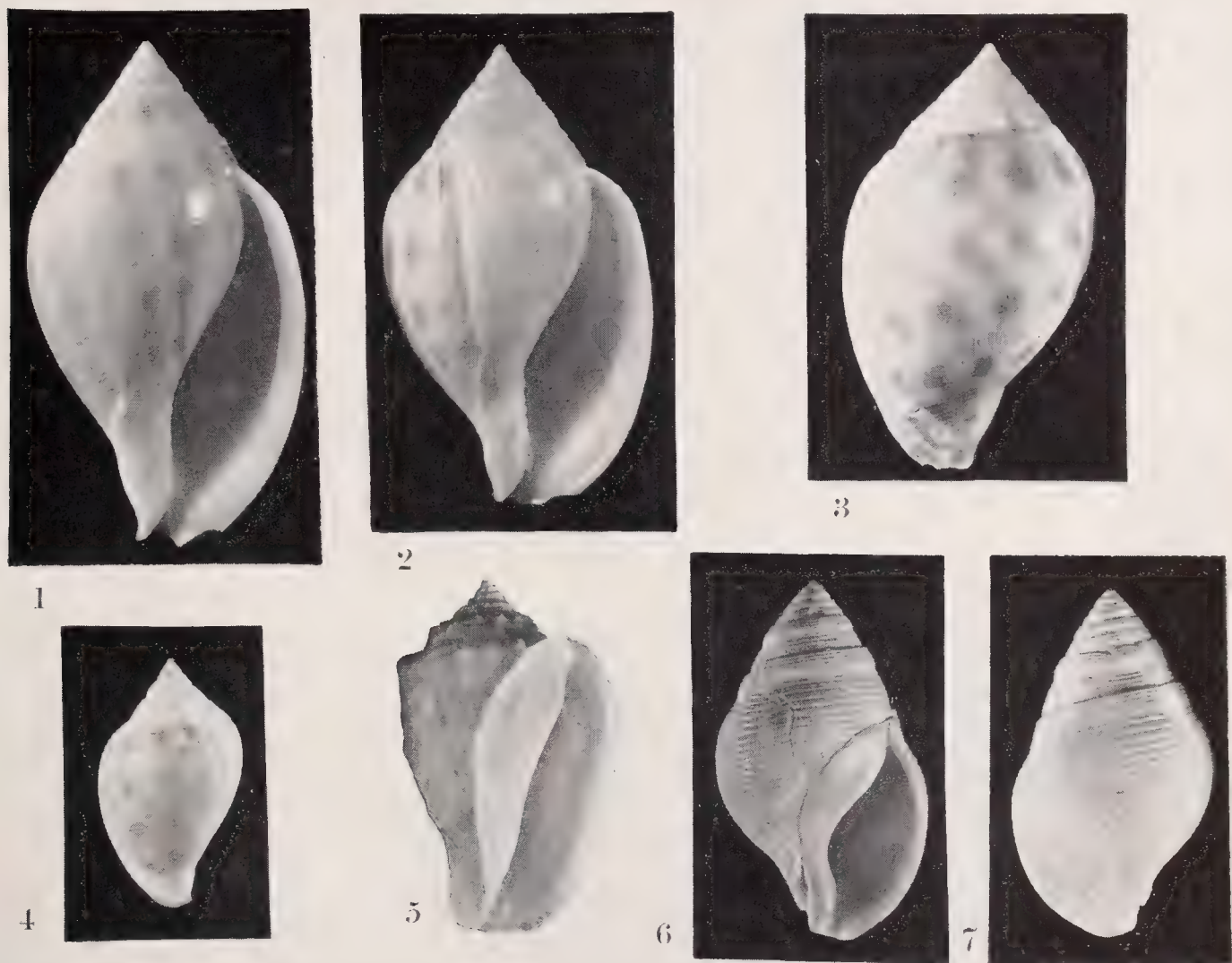


Plate 4. Figs. 1, 3 and 4. *Sconsia striata* Lam., off Punta Alegre, Camagüey Prov., Cuba. Fig. 2. *Sconsia striata* Lam., off Cayo Coco, Camagüey Prov., Cuba. Fig. 5. *Morum dennisoni* Reeve, Sandy Bay, Barbados, Lesser Antilles. Figs. 6-7. *Dalium solidum* Dall, off Grenada, Lesser Antilles. (All natural size.)

which is not at all close to any other in its relationships. The type may still be in existence though so far we have been unable to trace it. As no locality was given by Lamarck, we select *Atlantis* station 2981A off Punta Alegre, Cuba, as the type locality.

*Remarks.* This is a remarkably beautiful shell. Its occurrence in fairly deep water has made it difficult to obtain, and as a consequence it is still very rare in collections. We have been fortunate in that the *Atlantis* dredged several specimens and we have had a very fair series to study.

*Range.* Deep water off Gt. Isaac Id., Bahamas, Cuba and south to Barbados (Dall 1889).

*Records.* All records are from the *Atlantis* dredgings. BAHAMAS: station 2951, off Gt. Isaac Id., N.W. Providence Channel (N. Lat.  $26^{\circ}08'$ ; W. Long.  $79^{\circ}02'$ ) in 155 fathoms. CUBA: station 3417, off Caibarién (N. Lat.  $22^{\circ}50'$ ; W. Long.  $78^{\circ}56'$ ) in 200 fathoms; station 2981A, off Punta Alegre (N. Lat.  $22^{\circ}50'$ ; W. Long.  $78^{\circ}50'$ ) in 220-230 fathoms; station 3388, off Cayo Coco (N. Lat.  $22^{\circ}32'$ ; W. Long.  $79^{\circ}09'$ ) in 255 fathoms; station 2963, Bahía de Cochinos, in 180-190 fathoms.

### Daliium Dall

*Daliium* Dall 1889, Bull. Mus. Comp. Zoöl. **18**, p. 230.

Genotype, *Daliium solidum* Dall

As only one species is known, the generic characters are those of this species. Its position in the family Cassididae is still open to question. Live material and examination of the soft parts will be necessary before its exact position is at all certain.

### Daliium solidum Dall, Plate 4, fig. 6-7

*Daliium solidum* Dall 1889, Bull. Mus. Comp. Zoöl. **18**, p. 230, pl. 19, fig. 10d (*Blake*, station 265, off Grenada [Lesser Antilles] in 576 fathoms [dead]; Thiele 1929, Hand. Syst. Weichtierkunde **1**, pt. 1, p. 279.

*Description.* Shell fusiform, imperforate, solid, strong and reaching a length of 41.50 mm. Whorls  $6\frac{1}{4}$ , slightly convex and shingled or appressed upon the whorl above. This is indicated by a slightly wider groove in the otherwise uniform incised lines in the sculpture. Color a flat white [dead specimen] though possibly faintly yellowish brown in live material. Spire somewhat extended and acute, forming an angle of  $68^{\circ}$ .<sup>1</sup> Aperture oblique and elliptical. Outer lip simple; parietal wall with a strong callus. Columella strong and moderately recurved, with no plicae. Canal short but fairly deep. Sculpture of numerous deeply incised spiral lines crossed by weak growth lines. No periostracum apparent. Operculum unknown.

length	width	whorls	
41.5	23.5 mm.	$6\frac{1}{4}$	Holotype

*Types.* Holotype, M.C.Z. no. 7656, off Grenada Island, Lesser Antilles in 576 fathoms. *Blake* voyage, 1877-1878.

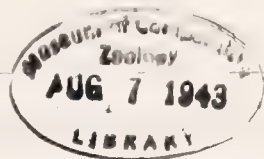
*Remarks.* Nothing can be added to Dall's description or remarks. It has not been reported since its original discovery.

*Range and records.* Known only from the original locality (see under types).

<sup>1</sup> Dall, who originally described this specimen, called it "rather obtusely pointed." However, an obtuse spire is always greater than  $90^{\circ}$ .

# JOHNSONIA

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FISSURELLIDAE

NUMBER 10

## THE GENERA *FISSURELLA*, *LUCAPINA* AND *LUCAPINELLA* IN THE WESTERN ATLANTIC

BY

ISABEL PÉREZ FARFANTE

Guggenheim Fellow, Cuba 1942-43

The genera *Fissurella* and *Lucapinella* are widely distributed in tropical and temperate seas; *Lucapina* is mainly tropical. Most species in this family live attached to rocks both in exposed situations and under stones and coral where they are protected. Several species are to be found in the inter-tidal zone; many however live well below the low water line and a few species occupy fairly deep water. Deshayes (1832, Ency. Meth. Vers, 2, p. 131) has pointed out that *Fissurella* move about at night, but usually return to their original position on the rocks. Wilcox (1905, Science (n.s.), 22, p. 90) has made the same observation on *F. barbadensis* in Bermuda. This is also well known in other allied families. Several species in this genus are rather difficult to find, even when they occur on the inter-tidal area, as they are frequently covered with marine algae and other marine organisms which render them relatively inconspicuous. Common names for individual species have not been generally applied, although the people are well acquainted with them. The various species, however, are usually known as key-hole limpets or volcano shells. In Cuba they are referred to as "sombbrero chino," the Chinese hat.

I am deeply indebted to many friends and colleagues for the loan of much valuable and critical material. Their names appear after the records. In addition to the use of private collections, I have been privileged to study certain of the larger museum collections. For the use of this material I am indebted to Dr. H. E. Vokes of the American Museum of Natural History (AMNH) and to Dr. S. C. Ball of the Peabody Museum, Yale University (Yale). I am deeply grateful to all members of the Department of Mollusks of the Museum of Comparative Zoölogy for their aid and kindness. I am particularly indebted to Mr. W. J. Clench under whose direction the present study was made, to Dr. J. Bequaert for his many helpful suggestions, and to Dr. M. Champion and Miss D. Slater for their constant help with the manuscript and aid in reading proof.

### *Fissurella* Lamarck

*Fissurella* Lamarck 1799, Mémoires de la Société D'Histoire Naturelle de Paris, 1, p. 78.

*Fissurellus* Denys de Montfort 1810, Conch. Syst., 2, p. 102.

Genotype (monotypic), *Fissurella nimbose* Linné 1758

Shell conical, elevated, depressed and even flattened, variable in size, with the apex subcentral. Orifice at the summit or anterior to it, variable in shape. Surface in a few species smooth, in others with shallow grooves, but generally with numerous radiating ribs which frequently possess small or large nodules or erect scales. Concentric growth

lines are always more or less visible. Margin simple, crenulated or notched. Muscle impression continuous but formed as two parts, the larger horse-shoe shaped with the extremities enlarged and connected by a smaller and narrower band or scar. The orifice is bounded inside by a callus which is not truncated or excavated. Shell wholly external, capable of containing the soft parts. Animal with one pair of sub-cylindrical tentacles with the eyes placed on slightly elevated tubercles at its outer side and near the base. These tubercles are on the tentacles. Foot large and oval. Central teeth of the radula narrow and feeble; lateral teeth strong; marginal teeth numerous. The animal and anatomy of the Western Atlantic *Fissurella* have been very little studied. Pilsbry (1890, *Man. of Conch.* (1), **12**, p. 143) states that "in *F.* (*Cremides*) *barbadensis* the edge of the mantle is not at all fleshy, but is very narrow. It is not a simple edge, however, having short papillose scallops on the upper and lower edges as if pinked." P. Fischer (1857, *Journ. de Conchy.*, **6**, p. 119) says about *Fissurella* (*Cremides*) *nodosa*: "foot very large, with thin margins; borders of the mantle short, but thick, forming two very narrow and deeply crenulated laminae. Lateral tentacles of the foot rudimentary. Anal opening as in *F. barbadensis*. Whitish; black spots on the head."

The genus *Fissurella* has been credited to Bruguière (1789, *Ency. Meth.*, Vers, **1**, pt. 1, p. xlv) but, however, Bruguière mentioned no species whatsoever, but only gave the name *Fissurella* with a short diagnosis in his outline of classification. This diagnosis is not at all applicable to *Fissurella* alone, but would characterize many of the several genera in the family. Later Lamarck characterized this genus by the selection of a single species, *F. nimbosa*. As a consequence the genus *Fissurella* will date from Lamarck and not from Bruguière.

The nine species recognized from the Western Atlantic are distributed in 3 subgenera.

### Subgenus **Fissurella**

Shell fairly large, reaching a length of from 45 to 60 mm., conical, elevated and heavy. Orifice large and located about in the middle. Outer surface sculptured with numerous radiating riblets. Margin of the shell entirely in one plane and finely crenulated. Internal callus of the orifice very broad and flat.<sup>1</sup>

### **Fissurella (Fissurella) nimbosa** Linné, Plate 1, fig. 1-2

*Patella nimbosa* Linné 1758, *Syst. Nat.* ed. 10, **1**, p. 785 (M. Europae australis, Americae). [Based on figures of Lister, Gaultieri and d'Argenville].

*Fissurella nimbosa* Lamarck 1822, *An. s. Vert.*, **6**, pt. 2, p. 10 (Mers de l'Europe australe, de l'Afrique occidentale, etc.).

*Fissurella balanoides* Reeve 1850, *Conchologia Iconica*, **6**, *Fissurella*, pl. 10, fig. 66 (locality unknown).

*Description.* This is the largest and heaviest species of the genus in the Western Atlantic, reaching a length of 50 mm. It is elevated, conical and narrower anteriorly. Slopes straight or slightly convex. Base ovate. Summit slightly inclined towards the anterior

<sup>1</sup> Some authors have erroneously considered *F. picta* Gmelin as the genotype of *Fissurella*. However, Lamarck who first characterized the genus, named a single type, *Patella* [= *Fissurella*] *nimbosa* Linné. I propose the subgenus *Balboaina* for the species characterized by *F. picta* that occur along the Pacific coast of the Americas.

### **Balboaina**, new subgenus

Shell generally large, certain species reaching a length of 100 mm., heavy and broadly conical. Orifice a little in front of the middle. Outer surface smooth, with numerous radiating striae or ribs more or less nodulose. Margin of the shell entirely in one plane, simple not crenulated and with a dark and generally broad, interior border. Internal callus of the orifice usually broad.

Subgenotype, *Fissurella picta* Gmelin



extremity, pierced by a large, oblong orifice from one-seventh to one-ninth the length of the shell, its sides produced upward in little points on either side, as can be seen in the figure. Sculpture consisting of numerous irregularly spaced radiating shallow grooves, separating narrow, low ribs. These are crossed by fine and very close growth lines. Ground color buff to pinkish, with eleven or twelve rays of purplish-red to dark brown. Sometimes all the grooves are tinged with this dark coloration. Margin slightly crenulated. Inside pale green, darker around the central callus which in addition is oval, broad and also green. Muscle impression distinct and rather far from the edge.

	length	width	height	orifice length	
(large)	50	35	19	7 mm.	Trinidad
(average)	45	30	16	5	Toco, Trinidad

*Types.* Linné's original description refers to figures of Lister, Gaultieri, and d'Argenville, which represent more than one species. I here select the figure of Gaultieri (1742, Testarum Conchyliorum Index, pl. 9, fig. S) as the type figure of this species. This will restrict Linné's name *nimbosa* to the West Indian species. The figures in Lister (1770, Hist. Conch. Tab. Anat., Editio Altera, Huddersford, Oxoni, 4, s. 1., c. 1, t. 1, 2 [= Book 4, pl. 527, fig. 1-2] ) to which Linné also refers are not the West Indian species.<sup>1</sup> Later Lamarck (l.c.) made reference to Lister's pl. 528, fig. 4, not cited by Linné, which is the West Indian *nimbosa* and similar to the figure in Gaultieri also cited originally by Linné. As no specific locality was given by Gaultieri, I propose Toco, Trinidad, West Indies as the type locality (Neoholotype, M.C.Z. No. 124731,).

*Remarks.* This species is very different from the others found in our Atlantic waters and its characteristics on the whole are constant. *F. nimbosa* has not been obtained in Cuba or in the Bahamas where much marine collecting has been done. *F. balanoides* Reeve is only a young specimen of this species.

*Range.* Puerto Rico and south through the Lesser Antilles to the northern coast of South America. (Fernando Noronha, Ihering 1927, p. 101).

*Records.* PUERTO RICO: Humacao Beach (H. Vander Schalie); Escambrón Beach (AMNH). LESSER ANTILLES: Charlestown, Nevis (B. Baker); Antigua; Guadeloupe; Toco, Trinidad (all MCZ). COLOMBIA: Cartagena; Santa Marta (both MCZ). BRITISH GUIANA: (H. G. Kugler). BRASIL: Ilha de Itaparica and Reconcavo, Estado da Bahía (P. de Oliveira).

### Subgenus **Cremides**

*Cremides* H. and A. Adams 1854, Genera of Recent Mollusca, p. 446.

Subgenotype, *Fissurella barbadensis* Gmelin

Shells small or moderately large, generally not exceeding 40 mm., elevated or depressed, conical or lighter in structure than the two previous subgenera. Orifice generally a little in front of the middle. Outer surface sculptured with numerous radiating ribs usually nodulose or with small scales. Margin of the shell entirely in one plane and strongly crenulated. Internal callus of the orifice narrow or moderately broad.

### **Fissurella (Cremides) nodosa** Born, Plate 1, fig. 3-4

*Patella nodosa* Born 1780, Testacea Musei Caesarei Vindobonensis, p. 429 (Barbados). [Based on figures of Lister, Petiver and Martini].

<sup>1</sup> I have not seen the first edition of this work. The second edition, however, is supposed to be the same as the first.

*Patella jamaicensis* Gmelin 1789, Syst. Nat. ed. 13, 1, pt. 6, p. 3730 (Jamaica and Barbados). [Based also on the figures of Lister and Martini].

*Patella spinosa* Gmelin 1789, Syst. Nat. ed. 13, 1, pt. 6, p. 3731 (locality unknown). [Based on Schroeter's figure].

*Description.* Shell fairly heavy and strong, reaching a length of 30 to 35 mm., considerably elevated and dome-shaped. Base broadly oval. Summit slightly in front of the

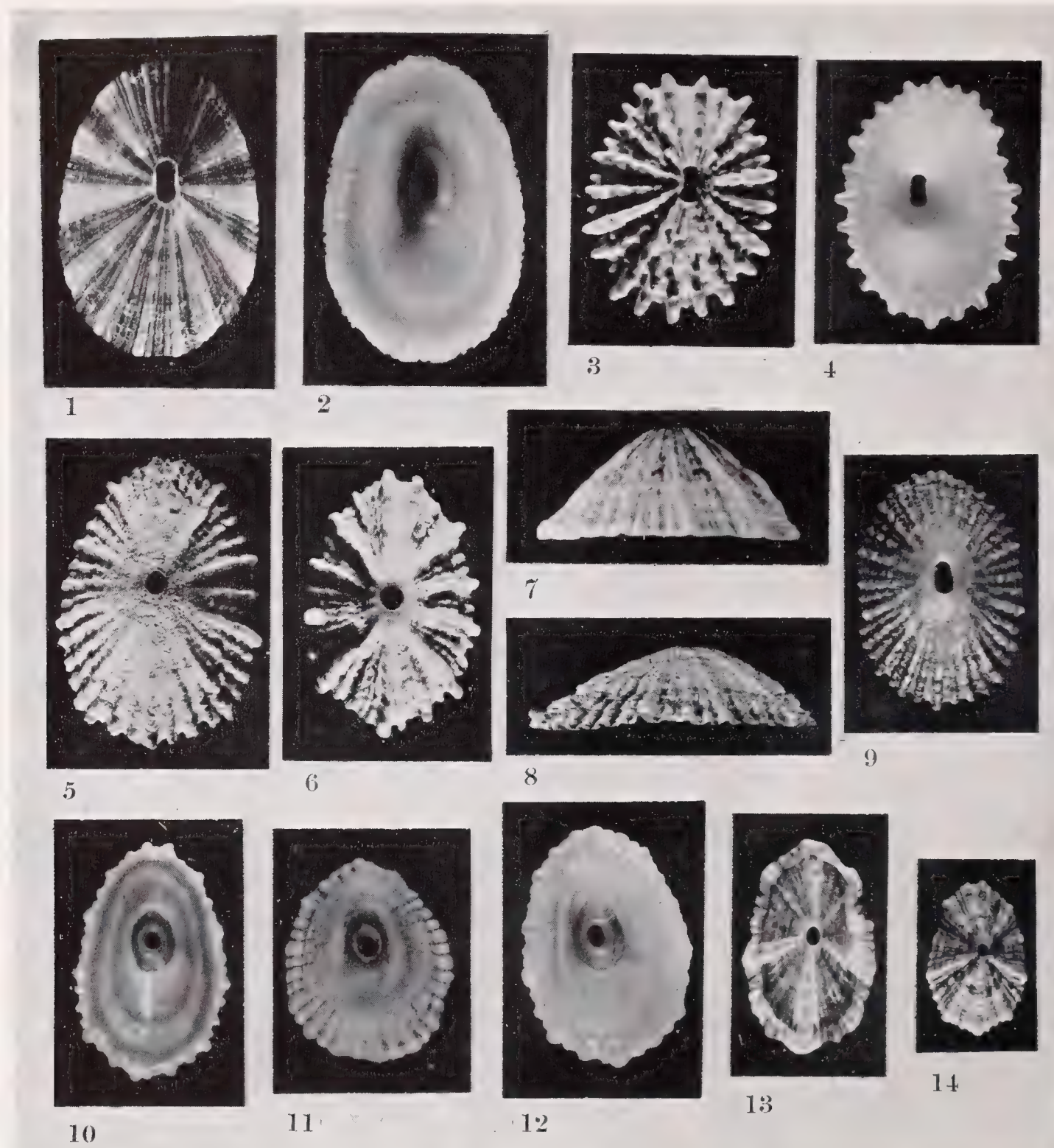


Plate 1. Fig. 1 and 2. *Fissurella nimbosa* Linné, Trinidad, Lesser Antilles. Fig. 3. *Fissurella nodosa* Born, Key Largo, Florida. Fig. 4. *Fissurella nodosa* Born, Navassa Island, West Indies. Fig. 5 and 8. *Fissurella barbadensis* Gmelin, St. George's, Bermuda. Fig. 6. *Fissurella barbadensis* Gmelin, Barbados, Fig. 7. *Fissurella barbadensis* Gmelin, Governor's Harbour, Eleuthera, Bahamas. Fig. 9. *Fissurella nodosa crusoe* P. Farfante (Holotype), Magueripe Bay, Trinidad. Fig. 10. *Fissurella barbadensis* Gmelin, Bermuda. Fig. 11 and 12. *Fissurella barbadensis* Gmelin [as *bermudensis* Pilsbry, Types] Bermuda (2×). Fig. 13 and 14. *Fissurella barbadensis* Gmelin, St. Thomas, Virgin Islands (fig. 13, 2×). All natural size except fig. 11, 12 and 13.

middle, which is partially occupied by the anteriorly placed orifice. The orifice is nearly twice as long as wide, contracted in the middle, the contracted areas being directed upward. Sculpture consists of from 20 to 22 strongly nodulated radiating ribs, between which are often riblets. The nodules are arranged concentrically and connected by fine laminae. The color varies from white to cream, a pale brown and even a faint pink. Margin strongly and sharply crenulated. The interior color a pure white with the outer ribs showing through in the form of fine radiating grooves. Internal callus of the orifice broad and white, outlined by a marked indenture. Muscle scar slightly impressed in most of the specimens, broad with its two anterior extremities very much enlarged and connected by a narrow scar, lying at some distance from the border.

	length	width	height	orifice length	
(large)	40	37	28	6 mm.	Jamaica
(average)	31	25	16	5	Habana, Cuba

*Types.* The type figure of *F. nodosa*, here selected, is that of Lister 1770, Hist. Conch. Tab. Anat. (Editio Altera, Huddersford, Oxoni), pl. 528, fig. 6 (see foot note p. 3). Barbados is the type locality as given by both Lister and Born. The actual specimens of Born are probably still in the Vienna Museum, under the same number 3369. (See reference Johnsonia No. 6 (*Conus*) p. 24, under types).

*Remarks.* *F. nodosa* varies but little, exhibiting always the same characteristic sculpture. This species, although distributed from the lower Florida Keys to Barbados, is exceedingly rare in both Florida and the Bahamas. However, it is quite abundant in Cuba and Navassa Island. It lives attached to the rocks, generally where there is surf and frequently covered by growths of calcareous algae. Characteristics of the animal are given by P. Fischer (1857, Journal de Conchy., 6, p. 119).

*Range.* Lower Florida Keys, West Indies, southern Mexico and south to Venezuela.

*Records.* FLORIDA: Key Largo (T. Van Hyning). BAHAMAS: Clarendetown; Cape St. Maria; Millerton; Long Id. (all MCZ). CUBA: Vedado (M. L. Jaume); Playa del Chivo; Pesquero Ramajo, W. of Matanzas; Varadero; Caibarién (all P. J. Bermúdez); Guantánamo Naval Base; Castillo de Jagua, Cienfuegos (both MCZ). HISPANIOLA: Santa Bárbara de Samaná; Puerto Plata; El Canal, Cabo Macorís; Gonave Id. (all MCZ). NAVASSA ID.: (MCZ). JAMAICA: Runaway Bay, St. Ann (MCZ). PUERTO RICO: Arecibo (MCZ); San Juan (D. Thomas); Boca de Cangrejos; Humacao (both H. Vander Schalie). VIRGIN ISLANDS: St. Thomas (MCZ); Guana Id., Tortola (M. W. Dewey); St. Croix (AMNH). LESSER ANTILLES: Antigua; Guadeloupe; Barbados (all MCZ); Tobago (T. McGinty). CARIBBEAN IDS.: Utilia Id.; Swan Id. (both MCZ). MEXICO: Isla Mujeres (AMNH). VENEZUELA: La Guaira (MCZ).

### ***Fissurella nodosa crusoe*, new subspecies, Plate 1, fig. 9**

*Description.* Shell similar in general outline to *nodosa* but differs by being lighter and having the primary ribs much less prominent so that all the ribs appear to be about equal. This new species is hardly nodulose and in this aspect differs quite sharply from the strongly nodulose typical form. In the orifice, the lateral projections tend to disappear and the resulting outline is oblong or almost rectangular, as shown in the figure. The color varies from white to brown.

	length	width	height	orifice length	
(large)	34	24	11	5 mm.	Magueripe Bay, Trinidad
(average)	32	21	13	5	Balata Bay, Trinidad

*Types.* Holotype, Mus. Comp. Zoöl. No. 62827, Magueripe Bay, Trinidad, E. Deichman collector, 1937. Paratypes from Toco Bay and Balata Bay, Trinidad.

*Range.* Known only from the north coast of Trinidad.

*Records.* TRINIDAD: Toco Bay (H. G. Kugler); Balata Bay and Magueripe Bay (both MCZ).

**Fissurella (Cremides) barbadensis Gmelin, Plate 1, fig. 5-8, 10-14**

*Patella barbadensis* Gmelin 1789, Syst. Nat. ed. 13, 1, pt. 6, p. 3729 (Barbados). [Based on figures of Lister and Martini].

*Patella porphyrozonias* Gmelin 1789, Syst. Nat. ed. 13, 1, pt. 6, p. 3730 (America Septentrionali). [Based on figures of Martini].

*Fissurella edititia* Reeve 1849, Conch. Icon., 6, *Fissurella*, pl. 7, fig. 47 (locality unknown).

*Fissurella antillarum* d'Orbigny 1850-1853, [in] R. de la Sagra, Hist. Phy. Pol. Nat. Cuba, Moll., 2, p. 198, pl. 24, fig. 40-42 (Florida and Antilles, particularly Cuba).

*Fissurella barbadensis* var. *intensa* Pilsbry 1890, Man. of Conch. (1), 12, p. 165, pl. 60, fig. 86. (No locality).

*Fissurella barbadensis* var. *bermudensis* Pilsbry 1890, Man. of Conch. (1), 12, p. 165, pl. 60, fig. 70-72 (St. Thomas; Bermuda).

*Description.* Shell fairly heavy, 20 to 40 mm. in length, conical and more or less elevated. Base oval or subovate. Front and posterior slopes straight or slightly convex. Apex subcentral and pierced by a small orifice almost circular in shape; its length one-eighth to one-tenth that of the shell. Sculpture consisting of numerous radiating, irregular ribs, eleven of which are generally stronger and extend from the orifice to the margin. Two of these eleven are placed very close to the sides of the anterior median line and the rest equally spaced on the shell. The ribs are either serrated or bear numerous little erect scales. These latter are usually developed on the large ribs. Color grayish white to pinkish buff, generally with purplish lines between the small ribs and, in most cases, blotched with dark reddish brown or purple in the area between the larger ribs. Margin strongly crenulated. Inside the color is alternately green and white and formed in concentric bands. Inner callus of the orifice green, generally bounded by a reddish brown line. The muscle impression is distinct and lies rather far from the edge.

	length	width	height	orifice length	
(large)	41	30	12	4 mm.	Bermuda
(average)	32	26	12	4	Cape St. Maria, Long Id., Bahamas

*Types.* Gmelin cites two references for this species and I here select that of Martini 1769, Conch.-Cab. (1), 1, pl. 11, fig. 93, to be the type figure, Barbados, Lesser Antilles, being the type locality.

*Remarks.* *F. barbadensis* is the most common West Indian species and it is exceedingly variable. As stated before it is generally rather elevated but may be fairly depressed. The ribs may have short scales. In some cases the smaller and the larger ribs become equalized so that the difference between them cannot easily be distinguished. The two varieties *intensa* Pilsbry (Pl. 1, fig. 13-14) and *bermudensis* Pilsbry (Pl. 1, fig. 11-12) are only individual variations, which appear in any large series of specimens. The animals of this species live attached to the rocks, principally where the waves can reach them and they are generally covered with marine growths, so that it is rather difficult to recognize the specimens in their natural environment.

*Range.* St. Augustine, Florida, Bermuda, the West Indies and from Mexico south to British Guiana.

*Records.* FLORIDA: St. Augustine; Melbourne; Miami; Sand Key, Key West (all T. Van Hyning). BERMUDA: Shelly Bay; Gibbet Id.; Agar's Id. (all MCZ). BAHAMAS: Eight Mile Rock, Grand Bahama; Marsh Harbour, Great Abaco; Alicetown, Bimini Ids.; Mangrove Cay, Andros Id.; Nassau, New Providence; Savannah Sound, Eleuthera; Little San Salvador Id.; Arthurstown, Great Inagua (all MCZ). CUBA: Playa de Baracoa; Vedado (M. L. Jaume); Playa de Jibacoa (J. L. Mayor); Matanzas (H. Sarasúa); Varadero; Cayo la Farola, Sagua la Grande (P.J. Bermúdez); Cayo Francés; Guantánamo Naval Base; Punta de los Colorados, Cienfuegos (all MCZ). HISPANIOLA: Puerto Plata (H. Hurst); Santa Bárbara de Samaná; Puerto Sosúa; Monte Cristi (all MCZ); Gonave Id.; Miragoane (both W. J. Eyerdam). JAMAICA: Port Antonio; Dunn's River Falls, St. Ann's Bay (both MCZ). PUERTO RICO: San Juan (D. Thomas); Boca de Cangrejos (H. Vander Schalie); Mayagüez (MCZ). VIRGIN ISLANDS: St. Thomas; Guana Id., Tortola; Virgin Gorda (all M. W. Dewey); Fredericksted, St. Croix (AMNH). LESSER ANTILLES: Ft. James Beach, Antigua; Guadeloupe (both MCZ); Barbados; Carriacou Id.; Grenadines; N. Coast Trinidad (all H. G. Kugler). CARIBBEAN IDS.: Utilia Id.; Bay Ids. (both MCZ). MEXICO: Isla Mujeres, Yucatán (C.G. Aguayo). PANAMA: Colón (Yale). BRITISH GUIANA: Corentyne River (H. G. Kugler).

### ***Fissurella (Cremides) angusta* Gmelin, Plate 2, fig. 1-2, 6**

*Fissurella angusta* Gmelin 1789, Syst. Nat. ed. 13, **1**, pt. 6, p. 3732 (no locality). [Based on Schroeter's description and figure].

*Fissurella schrammii* Fischer 1857, Journ. de Conchy., **6**, p. 383, pl. 11, fig. 5-6 (Guadeloupe).

*Fissurella barbadensis* Gmelin var. *schrammii* Fischer, Pilsbry 1890, Man. of Conch. (1), **12**, p. 165, pl. 60, fig. 77-79, (Guadeloupe; St. Thomas).

*Description.* Shell medium in size, reaching a length of 15 to 30 mm., moderately solid, depressed and sharply attenuated anteriorly. Base ovate. Summit a little in front of shell center. Orifice immediately before the summit, generally very small and oval or oblong, its length one-twelfth to one-thirteenth the length of the shell. Sculpture of nine, infrequently ten, irregular ribs, radiating from the orifice and projecting a little beyond the basal margin; a single rib is always situated on the median anterior line. Between the ribs there are riblets, varying from one to six in number. All the ribs possess small closely placed nodules. Generally the color is dark reddish brown in fresh specimens, but when the shell becomes worn, the stronger ribs are buff or even white, while the ground color fades to pinkish tan and in extreme cases to light pink. Crenulations strong, but widely and irregularly spaced. The internal callus of the orifice is rather broad and varies from light brown to dark reddish brown. The inside color is variable, frequently arranged in concentric rings: around the hole-callus is a white band beyond which is one of green, terminating in a buff margin. Sometimes it is pale green or buff all over. Muscle impression in adult specimens rather broad and distinct about 4 mm. from the edge.

	length	width	height	orifice length	
(large)	31	18	6	2 mm.	Pelican Shoals, Florida
(average)	24	15	5	2	Little San Salvador Id., Bahamas

*Types.* The figure of Schroeter (1784, Einleitung Conchylienkenntniss, **2**, p. 516, pl. 6, fig. 14) is selected as the type figure. As the specimen upon which the figure was based is not known to exist, I propose the type specimen of *schrammii* to be the type of *angusta* as well. The type locality is Guadeloupe Id., Lesser Antilles, the original locality of *schrammii*.

*Remarks.* The description and figure of Schroeter upon which Gmelin based this species are excellent and exactly describe this West Indian form. *F. angusta* (as *schrammii*) was considered a variety of *F. barbadensis* Gmelin, but it is sufficiently distinct to be a good species. *F. angusta* is lighter in structure, quite depressed and typically narrower in front. The sculpture, though similar, consists of fewer and less pronounced primary ribs. It is reddish brown without overtones. The aperture is much smaller and narrower. The internal callus of the orifice also is a different shade of brown and never surrounded by a reddish line as in *F. barbadensis*. *F. angusta* prefers rocks in the lower inter-tidal zone and frequently it is covered with marine growth, principally calcareous algae.

*Range.* Lower Florida Keys, Bahamas and south to British Guiana.

*Records.* FLORIDA: Pelican Shoals (J.S.Schwengel); Garden Key, Dry Tortugas (T. Van Hyning). BAHAMAS: New Providence (P. D. Ford); Little San Salvador Id.; Simms, Long Island; Matthewtown, Great Inagua (all MCZ). CUBA: Playa de Jibacoa (J. L. Mayor); Matanzas (H. Sarasúa); Caibarién (P. J. Bermúdez); Guantánamo Naval Base; Punta de los Colorados, Cienfuegos; Vedado (all MCZ). HISPANIOLA: Puerto Sosúa; El Canal, Cabo Macorís; Monte Cristi (all MCZ). JAMAICA: Dunn's River Falls, St. Ann's Bay (MCZ). PUERTO RICO: Boca de Cangrejos (H. Vander Schalie). VIRGIN ISLANDS: Guana Id.; Marina Cay, Virgin Gorda (MCZ). LESSER ANTILLES: Antigua (MCZ); Tobago (T. McGinty); Balata Bay (MCZ) and Toco, Trinidad (H.G. Kugler). BRITISH GUIANA: Corentyne River (H. G. Kugler).

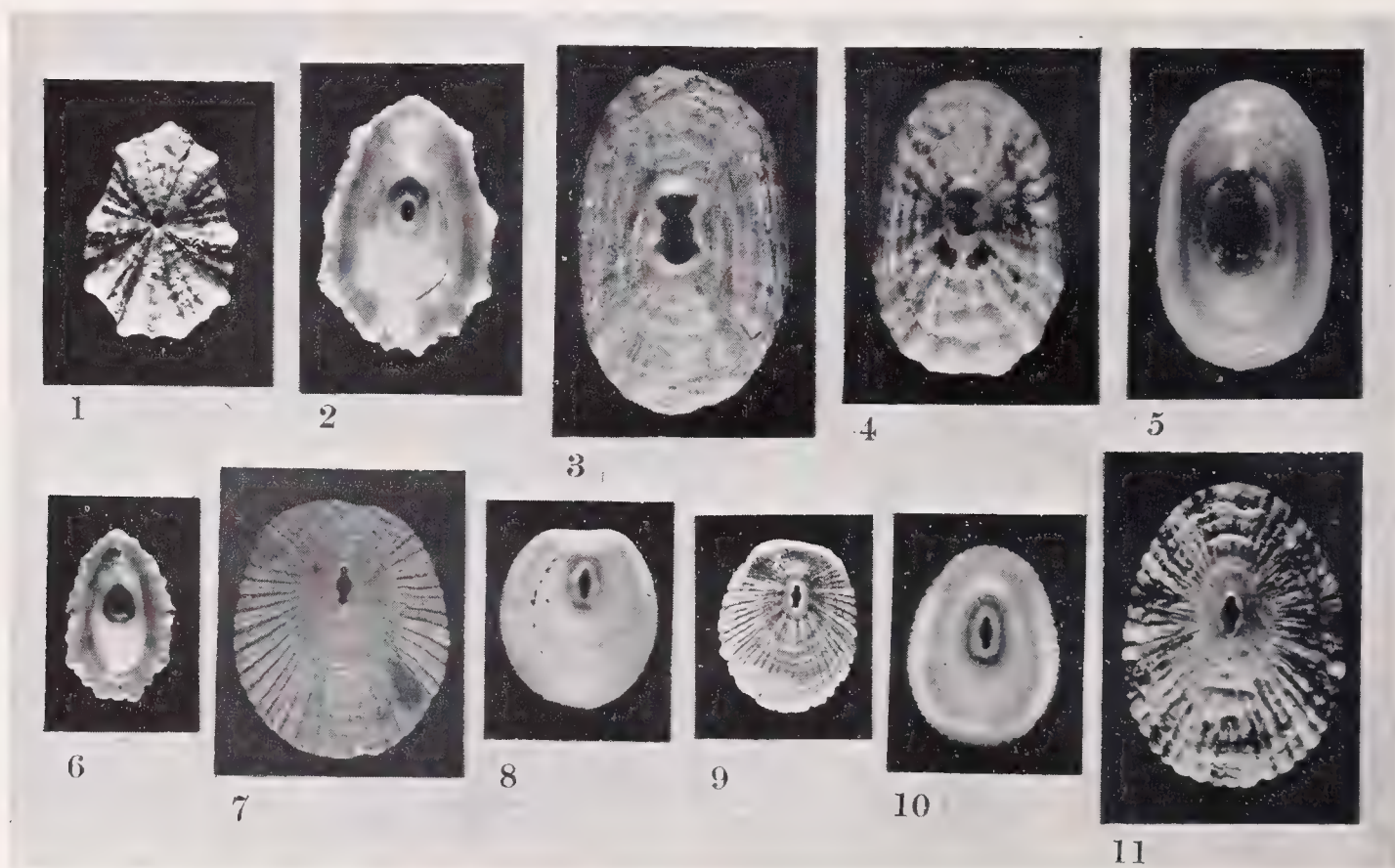


Plate 2. Fig. 1. *Fissurella angusta* Gmelin, Jamaica. Fig. 2. *Fissurella angusta* Gmelin, Punta de los Colorados, Cienfuegos, Cuba. Fig. 3. *Fissurella barbouri* P. Farfante (Holotype), Punta de los Colorados, Cienfuegos, Cuba (2×). Fig. 4. *Fissurella barbouri* P. Farfante, Matthewtown, Great Inagua, Bahamas (2×). Fig. 5. *Fissurella barbouri* P. Farfante, Nassau, New Providence, Bahamas (2×). Fig. 6. *Fissurella angusta* Gmelin, Punta de los Colorados, Cienfuegos, Cuba. Fig. 7. *Fissurella punctata* Fischer, West Indies. Fig. 8 and 9. *Fissurella punctata* Fischer, Governor's Harbour, Eleuthera, Bahamas. Fig. 10. *Fissurella fascicularis* Lamarek, Arecibo, Puerto Rico. Fig. 11. *Fissurella fascicularis* Lamarek, Orange Creek, Cat Id., Bahamas. All nat. size except fig. 3, 4 and 5.

**Fissurella (Cremides) barbouri**, new species, Plate 2, fig. 3-5

*Description.* Shell small, about 15 mm. in length, conical, rather solid, and depressed to elevated. Base long oval, the margin sometimes raised so that the shell rests upon the two ends alone. Anterior and posterior slopes slightly convex, the lateral slopes straight. Apex almost at the center. Orifice coincident with the apex and anteriorly directed. It is long and narrow; its shape as shown in the figure. Sculpture consisting of 15 to 20 rounded primary ribs which are separated by one or more interstitial riblets. Ground color white with red or purplish rays between the ribs; the rays may be solid in color or as fine radiating lines. Margin slightly crenulated. Interior highly polished, grayish green with overtones of buff. Internal callus of the orifice broad, buff or brown. In the latter case the aperture is also stained exteriorly with brown. Muscle impression wide with its anterior extremities enlarged, lying near the border.

	length	width	height	orifice length	
(large)	19	11	7	4 mm.	Punta de los Colorados, Cienfuegos, Cuba
(average)	15	8	7	3	Brown's Point, New Providence, Bahamas

*Types.* Holotype, Mus. Comp. Zoöl. No. 124729, Punta de los Colorados, Cienfuegos, Cuba. W.J.Clench collector, January, 1929. Paratypes from the same locality and from Brown's Point, New Providence, Bahamas.

*Remarks.* This species superficially resembles *F. angusta* Gmelin because of its coloring. However *F. barbouri* has more numerous primary ribs, its basal margin is long oval and not ovate, and it is more elevated. In *F. barbouri* the margin is only slightly crenulated while *F. angusta* possesses strong and deep crenulations. The orifices in these species are quite different (see illustrations). *F. barbouri* lives in cracks in the rocks of the lower inter-tidal zone. It varies but little and that principally in its sculpture which may be more or less pronounced. Its shape and raised margin may be due to its position on the rocks.

*Range.* Bahama Islands and south through the Greater and Lesser Antilles.

*Records.* BAHAMAS: Eight Mile Rock, Grand Bahama Id.; Matthewtown, Great Inagua (both MCZ); Brown's Point and Nassau, New Providence (P.D.Ford). CUBA: Vedado; Punta de los Colorados, Cienfuegos (both MCZ). HISPANIOLA: El Canal, Cabo Macoris (MCZ). JAMAICA: (T. McGinty). VIRGIN ISLANDS: Marina Cay, Tortola; Virgin Gorda (both M. W. Dewey). LESSER ANTILLES: Tobago (T. McGinty).

Named for Dr. Thomas Barbour, Director of the Museum of Comparative Zoölogy.

**Fissurella (Cremides) rosea** Gmelin, Plate 3, fig. 1-7

*Patella rosea* Gmelin 1789, Syst. Nat. ed. 13, 1, pt. 6, p. 3730 (locality unknown). [Based on figures of Lister, Martini and Schroeter].

*Fissurella radiata* Lamarck 1822, An. s. Vert., 6, pt. 2, p. 13 (l'Océan des Antilles).

*Fissurella barbadensis* d'Orbigny 1850-1853? (in part; non Gmelin), [in] R. de la Sagra, Hist. Phys. Pol. Nat. Cuba, Moll., 2, p. 196 (Florida, Antilles, principally Cuba, St. Lucia and Martinique).

*Fissurella rosea* var. *sculpta* Pilsbry 1890, Man. of Conch. (1), 12, p. 166, pl. 60, fig. 80, 81.

*Lucapina itapema* Ihering 1927, Archiv für Molluskenkunde, 59, p. 102, pl. 6, fig. 5-8 (Itapema).

*Description.* Shell rather thin, reaching a length of 20 to 30 mm., conical, more or less depressed and attenuated anteriorly. Base ovate. Slopes straight or slightly convex. Apex a little anterior to the center of the shell. The orifice is oval or oblong and forms the apex. It is rather small and its length is one-sixth to one-ninth that of the shell. Sculpture consisting of numerous and very close radiating rounded ribs, unequal in size

and with or without minute scales. When present, these are closely set and somewhat overlapping. Color consists of a series of alternating rays, the first whitish to pale straw, the others from a deep pink to purple and 11 or 12 in number. Base bordered by shallow crenulations which are sometimes edged with the dark color. Interior smoothly polished, colored a pale green at the margin which shades above into white. This extends to the green callus which is bounded by a narrow pinkish line. The rather broad muscle impression is situated about 3 mm. from the margin in adult specimens.

	length	width	height	orifice length	
(large)	30	20	9	4 mm.	Varadero, Cuba
(average)	24	15	7	4	Boca de Cangrejos, Puerto Rico

*Types.* The type figure of *F. rosea*, here selected, is that of Martini (1769, Conchy.-Cab. (1) 1, pl. 12, fig. 105). Martini states that Sloane found it in Jamaica, which can be accepted as the type locality. Of the other references cited by Gmelin, Lister's figure

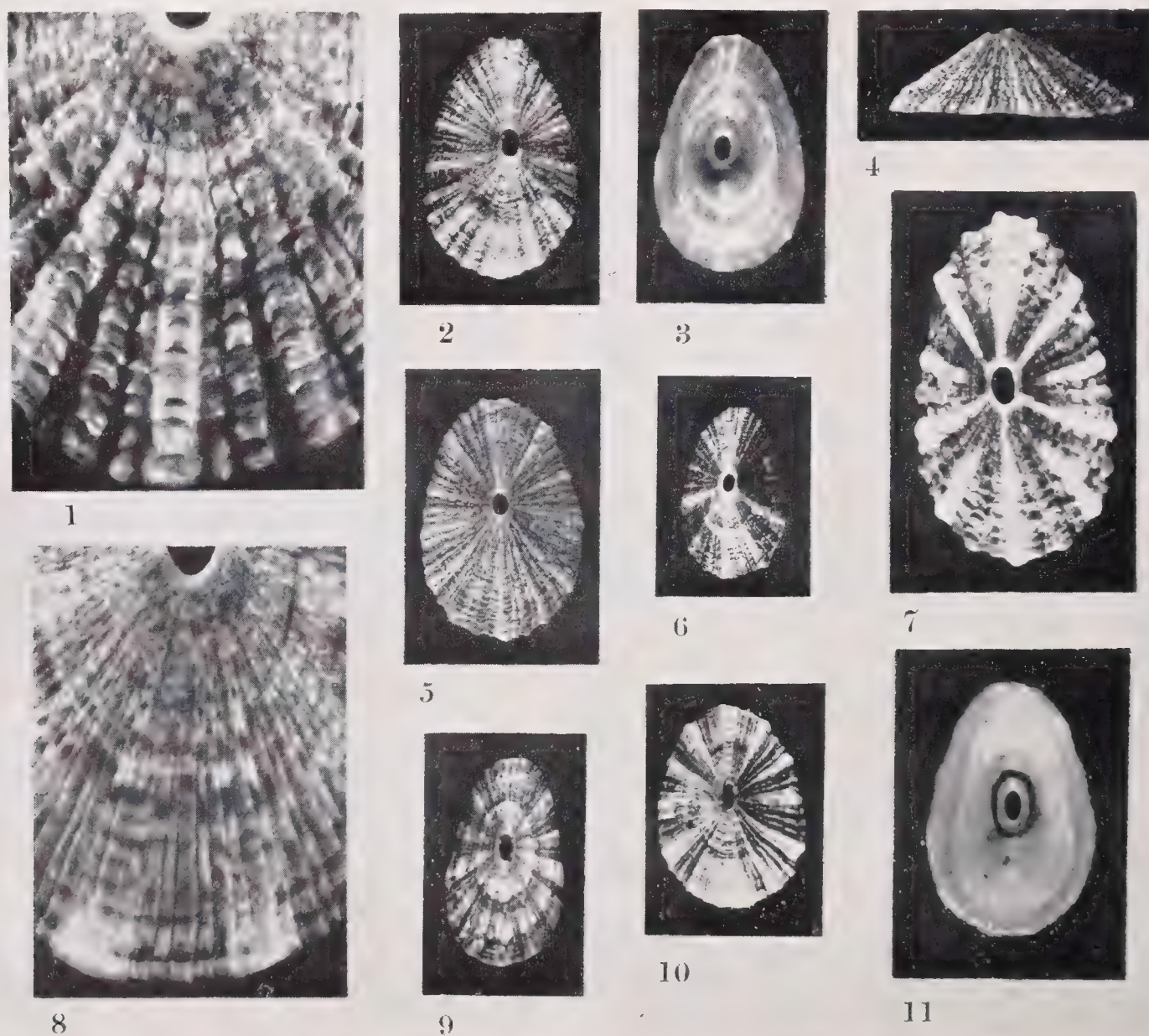


Plate 3. Fig. 1. *Fissurella rosea* Gmelin, Boca de Cangrejos, Puerto Rico (5 $\times$ ). Fig. 2, 3 and 4. *Fissurella rosea* Gmelin, Varadero, Cuba (nat. size). Fig. 5. *Fissurella rosea* Gmelin, Jamaica (nat. size). Fig. 6. *Fissurella rosea* Gmelin, Varadero, Cuba (nat. size). Fig. 7. *Fissurella rosea* Gmelin, El Canal, Cabo Macoris, Hispaniola (2 $\times$ ). Fig. 8 and 9. *Fissurella clenchi* P. Farfante, Praia das Conchas, Itanhaen, Sao Paulo, Brasil (fig. 8, 5 $\times$ ; fig. 9, 2 $\times$ ). Fig. 10. *Fissurella clenchi* P. Farfante (Holotype), Nova Almeida, Espirito Santo, Brasil (nat. size). Fig. 11. *Fissurella clenchi* P. Farfante, Praia das Conchas, Itanhaen, Sao Paulo, Brasil (2 $\times$ ).



refers to *rosea*, but only No. 316, Schroeter's description (1786, Neue Litt. Beitr. Conch. Foss., 3, p. 166) is possibly true *rosea*.

*Remarks.* This is one of our more colorful and delicate species. It is found dead on sand beaches in fair numbers and probably exists below the low water line on rocks. It is an exceedingly variable species both as to its sculpture and its color. *F. rosea sculpta* Pilsbry is only an extreme variation in sculpture in which the main ribs are a little more prominent. Occasionally specimens are found in which the entire outer surface of the shell is colored brown or dark reddish brown, though usually the solid color is broken by one or more of the radial ribs being lighter in coloration. From Lamarek's description of *F. radiata* it is obvious that what he had in his hand was *F. rosea*.

*Range.* Southeastern Florida, Bahamas, and south to Brasil.

*Records.* FLORIDA: St. Augustine; Garden Key, Dry Tortugas (both T. Van Hyning); Biscayne Bay; Key West (L. A. Burry). BAHAMAS: Millerton, Long Id. (MCZ). CUBA: Playa de Baracoa; Playa de Varadero (both MCZ); Caibarién (P. J. Bermúdez); Guantánamo Naval Base (MCZ). HISPANIOLA: Puerto Plata; Puerto Sosúa; El Canal, Cabo Macoris (all MCZ). JAMAICA: (MCZ). PUERTO RICO: Mayagüez (MCZ); Boca de Cangrejos (H. Vander Schalie); Arecibo (MCZ); Escambrón Beach (AMNH). VIRGIN ISLANDS: St. Thomas (MCZ); Little Camanoe Id., Tortola; Devils Bay, Virgin Gorda (all M. E. Dewey). LESSER ANTILLES: Guadeloupe; Barbados (both MCZ); Tobago (T. McGinty); Saline Bay, Trinidad (H. G. Kugler). MEXICO: Veracruz (M. E. Bourgeois). BRITISH GUIANA: Corentyne River (H. G. Kugler). BRASIL: Maranhão; Río de Janeiro (both MCZ); Santo Antonio, Ilha de Itaparica; Farol da Barra, Bahía, Victoria (all P. de Oliveira).

### **Fissurella (Cremides) clenchi**, new species, Plate 3, fig. 8-11

*Description.* Shell medium in size, usually not more than 25 mm. in length, rather solid, depressed, conical and narrower anteriorly. Basal outline ovate. Slopes straight or slightly convex. Summit a little in front of the middle, pierced by a long oblong orifice directed toward the anterior extremity. Orifice sides flare upward producing two very small teeth on each side; length of the orifice is about one-sixth that of the shell. Sculpture consisting of numerous low radiating ribs one of which, in the middle of the lighter rays, is generally larger. The shell is crossed by shallow growth lines which in some individuals are fairly strong. Color buff, sometimes tinged with rose, and with eleven or twelve rays of dark brown or black. Frequently these rays appear stippled; in this case the buff ground color is also stippled, but in a light rose. The orifice generally is stained outside with dark gray. Margin slightly crenulated. Inside, the shell is pale green and smoothly polished. The internal callus of the orifice is green, bounded by a black line. Muscle scar deeply impressed, lying rather far from the edge.

	length	width	height	orifice length	
(large)	25	19	7	4 mm.	Nova Almeida, Espirito Santo, Brasil
(average)	23	16	6	3.5	Praia das Conchas, Sao Paulo, Brasil

*Types.* Holotype, Mus. Comp. Zoöl. No. 124730, Nova Almeida, Espirito Santo, Brasil, Thayer Expedition, 1865-1866. Paratypes from the same locality and from Praia das Conchas, Estado de Sao Paulo, Brasil.

*Remarks.* This species is related to *F. rosea* but differs from it by its trilobate orifice, by its less pronounced sculpture, its dark brown or black rays which are generally stippled, and by the black-bounded orifice.

*Range.* Along the Northeast and East coast of South America.

*Records.* FRENCH GUIANA: Cayenne (MCZ). BRASIL: Ilha de Itaparica; Farol da Barra, Bahía; Pituba, Bahía (all P. de Oliveira); Nova Almeida, Espirito Santo; Victoria (both MCZ); Praia de Copacabana, Distrito Federal; Praia das Conchas, Itanhaen, São Paulo (both P. de Oliveira).

Named for William J. Clench, Curator of Mollusks of the Museum of Comparative Zoölogy.

### Subgenus *Clypidella* Swainson

*Clypidella* Swainson 1840, Treat. on Malacology, p. 356.

Subgenotype, (monotypic) *Fissurella pustula* Gmelin [= *Fissurella punctata* Fischer]

Shell medium in size, depressed, with its two extremities raised so that when placed on a plane it rests on its sides. Outline oval to ovate. Orifice situated well anterior to the center. It is long and narrow and widens in the middle so that a modified cross is formed. Sculpture consists of numerous rounded radiating ribs. Border crenulated. The internal callus of the orifice oval and white.

Fischer (1857, Journ. de Conch., 6, p. 115, pl. 7, fig. 5-7) gives a very detailed description of the external anatomy of *F. punctata* and its relationships.

### *Fissurella* (*Clypidella*) *punctata* Fischer, Plate 2, fig. 7-9

*Patella pustula* Gmelin 1789, Syst. Nat. ed. 13, 1, pt. 6, p. 3728 (in mari mediterraneo, atlantico, indico). [Based on figures of Lister, Petiver, da Costa, Chemnitz and Schroeter] (*non P. pustula* Linné 1758).

*Fissurella pustula* Gmelin, Lamarek 1822, An. s. Vert. 6, pt. 2, p. 14 (l'Océan indien).

*Clypidella pustula* Gmelin, Swainson 1840, Treat. on Malacology, p. 356.

*Fissurella punctata* Fischer 1857, Journ. de Conchy., 6, p. 115, pl. 7, fig. 5-7 (Guadeloupe).

*Fissurellidea pustula* Gmelin, Dall 1889, Bull. United States Nat. Mus., No. 37, p. 172 [*non P. pustula* Linné, as given by Dall].

*Fissurella* (*Clypidella*) *pustulata* Wenz 1938 [in] Schindewolf, Handbuch der Paläozoologie, 6, lfg. 1, p. 186, fig. 316 [err. typ. for *pustula* "Lamarek" Gmelin].

*Description.* Shell medium size, seldom exceeding 25 mm. in length, truncated anteriorly. The outline is broadly oval, with both ends of the shell raised, the anterior more so. When placed upon a plane it rests only upon the middle of each side. Lateral slopes slightly convex, the posterior and the short anterior straight or somewhat concave. Orifice decidedly anterior, a portion of it on the first third; it is long, narrow and with a mid-horizontal widening, so that a modified cross is formed, and it is usually banded by a narrow red line. Its length is about one-sixth that of the shell. Sculpture consists of about 55 radiating, rounded ribs widening toward the margin and separated by grooves wider and deeper at the border. The shell ribs are crossed by numerous fine growth lines which are sometimes thickened into scales. The color is pale straw, although white specimens are not rare. There is a series of red rays around the aperture which usually terminate close to it. Margin distinctly crenulated. Interior of shell pure white, including the inner callus of the orifice which is generally circumscribed by a red line. Muscle impression wide and lying about 3 mm. from the margin in full grown specimens. The enlarged anterior extremities are connected by a very narrow scar.

	length	width	height	orifice length	
(large)	27	23	6	4 mm.	West Indies
(average)	19	17	5	3	Antigua, Lesser Antilles

*Types.* The figure to which Gmelin refers in Chemnitz (1788, Conchy.-Cab. (1), 10, pl. 168, fig. 632-633) are chosen as the type figures. The type locality here selected is Governor's Harbour, Eleuthera Island, Bahamas. I figure the neoholotype, MCZ No. 124232.

*Remarks.* Linné's *Patella pustula* refers to an Eastern Atlantic species, probably *Didora gracca*. Gmelin, using the same name, *Patella pustula*, gave a totally different set of references which all pertain apparently to our Western Atlantic species. As this is a homonym, the next available name is that of *punctata* Fischer, which curiously enough was a lapsus for *pustula*. Linné never described a *Patella punctata*. The name, however, is available and will date from Fischer 1857.

This notable species is easily recognized by its peculiar form, its truncated anterior extremity and its anteriorly located and cross-shaped orifice. It probably lives on rocks fairly well below low water line. Very frequently *F. punctata* appears to have red spots which are in reality foraminifera which cement themselves to this *Fissurella*.

*Range.* Bahamas and Antilles. Cape Lookout, North Carolina (Dall 1889, p. 172).

*Records.* BAHAMAS: Governor's Harbour, Eleuthera. VIRGIN ISLANDS: St. John. LESSER ANTILLES: Antigua (all MCZ).

### ***Fissurella (Clypidella) fascicularis* Lamarck, Plate 2, fig. 10-11**

*Fissurella fascicularis* Lamarck 1822, An. s. Vert., 6, pt. 2, p. 14 (locality unknown).

*Clypidella fascicularis* Lamarck, Sowerby 1862, Thesaurus Conchyliorum, 3, p. 204, fig. 212-214 (West Indies).

*Fissurella (Clypidella) fascicularis* Lamarck, Arango 1880, Fauna Malacológica Cubana, Habana, p. 228.

*Description.* Shell 20 to 30 mm. in length, moderately solid, attenuated anteriorly and very depressed. Both extremities decidedly raised, principally the anterior, so that the shell rests upon its sides when standing upon a plane. Outline ovate. Slopes straight or slightly convex. Orifice situated on the anterior portion of the second third and shaped as is shown in the figure, its length being about one-sixth the length of the shell. Sculpture consists of 46 or 47 radiating ribs, much wider and more separated toward the margin. Many concentric growth lines cross the shell, frequently forming thickened marginal scales. Color superficially a faded magenta, but closer inspection shows that the grooves between the ribs are usually a paler shade of magenta or white. Frequently for a short distance around the orifice, there are darker colored rays which may sometimes extend to the margin. Border broadly crenulated. Interior of the shell white, tinged with pale green or pink. Inner callus of the orifice white, circumscribed by a narrow red line. Muscle impression deeply grooved, so that the central portion of the shell sometimes appears raised; its enlarged anterior extremities are connected by a narrow scar.

	length	width	height	orifice length	
(large)	32	24	7	5 mm.	Orange Creek, Cat Id., Bahamas
(average)	22	14	5	4	Caibarién, Cuba

*Types.* I select as type figures those of B. Delessert (1841, Recueil Coquilles Décrites par Lamarck, Paris, pl. 24, fig. 4a-d). As Lamarck gave no locality, I select Caibarién, Cuba, as the type locality.

*Range.* Southeastern Florida, the Bahamas and south through the Lesser Antilles. Probably also along the Central American coast.

*Records.* FLORIDA: Boynton Beach (T. McGinty). BAHAMAS: Great Abaco Id.: New

Providence (both P.D. Ford); Bimini Ids.; Governor's Harbour, Eleuthera; Little San Salvador Id.; Orange Creek, Cat Id.; Simms, Long Id.; Matthewtown, Great Inagua (all MCZ). CUBA: Vedado (M. L. Jaume); Varadero (H. Sarasúa); Caibarién (P. J. Bermúdez); Cayo Francés; Guantánamo Naval Base (both MCZ). HISPANIOLA: Puerto Sosúa (MCZ); Puerto Plata (T. McGinty); El Canal, Cabo Macorís; Jérémie (both MCZ). JAMAICA: (MCZ). PUERTO RICO: Boca de Cangrejos (H. Vander Schalie); Arecibo (MCZ); Escambrón Beach (AMNH). LESSER ANTILLES: Guadeloupe (MCZ); Barbados (AMNH). CARIBBEAN ISLANDS: Swan Id. (MCZ). MEXICO: Isla Mujeres (C. G. Aguayo).

### Lucapina Sowerby

*Lucapina* "Gray" Sowerby 1835, Conchological Illustrations, *Fissurella*, p. 4 of Catalogue of Species, fig. 29 (in the synonymy of *Fissurella cancellata* Sowerby).

Genotype, *Lucapina elegans* "Gray" Sowerby [= *Lucapina sowerbii* Sowerby]

The synonymy is given in full by Dall 1915, Proc. United States Nat. Mus., 48, p. 437.

Shell thin, small, of medium size, conical and rather depressed. Basal margin oblong or ovate, resting on a plane, not raised at the ends. Apex in front of the middle, the orifice large, oval and situated immediately before the apex. Outer surface of the shell decussated by numerous radiating ribs and concentric threads. Margin strongly and finely crenulated. Internal callus of the orifice roundly truncated posteriorly. Muscle impression of a uniform width. Body of the animal much thickened behind. The mantle is smooth and extends up and over the shell covering about one-third of it. It also extends below and shields the head, sides and back of the foot. Its border is simple and non-papillose. Tentacles long with large eyes situated on stout tubercles at their outer bases. Four species are known from the Western Atlantic.

### *Lucapina sowerbii* Sowerby, Plate 4, fig. 1-3

*Fissurella cancellata* "Solander" Sowerby [1825, Cat. Tankerville, p. 32; *nomen nudum*] 1835, (*non* Gray 1825) Conch. Illust., *Fissurella*, pt. 72, fig. 29, with name in explanation of plates (no locality); Reeve 1849, Conch. Icon., 6, *Fissurella*, pl. 7, fig. 51 [figure and description in part] (St. Vincent's and Honduras).

*Foraminella sowerbii* "Guilding" Sowerby 1835, Conch. Illust., *Fissurella*, p. 4 of Catalogue of Species [as a synonym of *Fissurella cancellata* Sowerby] (no locality).

*Lucapina elegans* "Gray" Sowerby 1835, Conch. Illust., *Fissurella*, p. 4 of Catalogue of Species [as a synonym of *Fissurella cancellata* Sowerby] (St. Vincents).

*Lucapina adspersa* Philippi 1845, Abbildungen Neuer Conchylien, 2, p. 34, pl. 1, fig. 3 (locality unknown).

*Fissurella lentiginosa* Reeve 1850, Conch. Icon., 6, *Fissurella*, pl. 13, fig. 97 (locality unknown).

*Lucapina* ? *fasciata* "Pfeiffer" Dall 1884, Proc. United States Nat. Mus. for 1883, 6, No. 22, p. 336 (Key West).

*Description.* Shell about 22 mm. in length, depressed conical and somewhat attenuated in front. Base oblong or oblong-ovate. Anterior slope straight or slightly concave toward the basal margin, a little more than half the length of the convex posterior slope. Orifice large, oblong, the rear wall frequently excavated obliquely, and placed mostly in the second third; its length about one-sixth the length of the shell. Sculpture consists of about 60 alternately larger and smaller ribs, radiating from the orifice. There are some shorter interstitial riblets posteriorly which start some distance from the orifice. All the ribs are separated by rather shallow grooves. The shell is encircled by from 9 to 13 concentric, close, raised threads which form small sublunated nodules where they intercept the radial ribs. Color varying from white to buff, usually with 7 to 9 irregularly placed broken or dotted rays of brown or flesh. Some specimens may be found with whole unbroken rays or dotted all over. Border very finely crenulated, the denticulations in pairs. Inside pol-

ished, color oyster white, the darker color pattern of the outside showing through. Riblets of the outer surface visible as white radiating lines from within. Internal callus of the orifice narrow, round, truncated behind, of the same color as the interior and sometimes bounded by an olive-green streak, which is ordinarily interrupted at the truncated end. Muscle scar close to the margin, lightly impressed and continuous.

	length	width	height	orifice length	
(large)	24	12	6	4 mm.	Varadero, Cuba
(average)	20	11	4	3	Biscayne Bay, Florida

*Types.* The type figure of this species is that of Sowerby (1835, Conchological Illustrations, *Fissurella*, pt. 72, fig. 29). The type specimen is probably in the British Museum. The type locality is St. Vincent Id., Lesser Antilles, as quoted by Sowerby under the synonym, *L. elegans*.

*Remarks.* This species was known for many years as *F. adspersa* due to Reeve's error. This author apparently had two species, *L. suffusa* and *L. sozcerbii*, which he described as a single species under the name of *cancellata*. His figure refers to *L. sozcerbii*, his description is a composite of the two. *L. sozcerbii* is exceedingly variable in color, particularly in its color pattern. The dark color usually, as stated before, forms dotted or broken rays but specimens with continuous rays occur together with the above, as well as with those having short marginal rays or dotted all over. It lives on rocks. In a letter to us Dr. B. R. Bales states: "My experience with this species has been that it usually is found in pairs." Characteristics of the animal were given by Dall (1884, p. 336).

*Range.* Lower Florida and the West Indies south to Brasil.

*Records.* FLORIDA: Biscayne Bay (T. McGinty); Indian Key; Sugarloaf Key and Boca Chica Key, Pine Ids.; Pelican Shoal; Stock Id.; Key West (all B. R. Bales); Boca Grande (J.S. Schwengel); Marquesas Key (T. Van Hyning); Fort Jefferson, Dry Tortugas (B. R. Bales). BAHAMAS: Settlement Point, Grand Bahamas; Nassau, New Providence; Arthurstown, Cat Id.; Matthewtown, Great Inagua (all MCZ). CUBA: Blake, station 65, off Habana (127 fathoms, dead specimens); Varadero (both MCZ); Habana (C.G. Aguayo). HISPANIOLA: Monte Cristi (MCZ). JAMAICA: (MCZ). LESSER ANTILLES: Pigeon Point, Tobago Id. (MCZ). BRASIL: Santo Antonio, Ilha de Itaparica (P. de Oliveira).

### *Lucapina aegis* Reeve, Plate 4, fig. 4-6

*Fissurella aegis* Reeve 1850, Conch. Icon., 6, *Fissurella*, pl. 11, fig. 72 (locality unknown).

*Description.* Shell thin, reaching about 35 mm. in length, conical and depressed. Basal outline oblong. Anterior slope straight or slightly concave, posterior slope convex. Summit in front of the middle, the orifice situated before it. The orifice is narrow, oblong, contracted in the central portion, its sides produced upward in little points on either margin, its length being from one-sixth to one-seventh that of the shell. Sculpture consists of about 40 radiating ribs separated by wide and rather deep grooves which generally bear an intermediate riblet. Strong and elevated concentric laminae are formed which produce scales at their junction with the radiating ribs. Between the concentric laminae there are two or three fine threads. Color varying from light brown to olive-green with 8 darker broken rays. Margin finely crenulated. Inside, a polished grayish-white, the sculpture of the outside showing through in the form of radial and concentric white lines. Internal callus of the orifice narrow, with the same color as the interior and almost triangular in shape. Muscle impression distinct and of a uniform width.

	length	width	height	orifice length	
(large)	31	17	12	4.5 mm.	Habana, Cuba
(average)	22	13	5	3.5	Athol Id., Bahamas

*Types.* The type figure is that of Reeve given above. The type specimen is probably in the British Museum. As no locality was given by Reeve, Habana, Cuba, is here selected to be the type locality.

*Remarks.* This species is closely related to *L. sowerbii* Sowerby. It differs from the latter by possessing a denticulated orifice and having concentric laminae. In addition, the ribs are more pronounced, the shell is of a darker coloration and has a more sharply truncated inner callus. According to Mr. P. D. Ford, the mantle of this species is wine-colored.

*Range.* Florida, Bahamas and Greater Antilles.

*Records.* FLORIDA: off Lantana, 10 fathoms (T. Van Hyning). BAHAMAS: Athol Id., New Providence (P. D. Ford). CUBA: Habana (M. L. Jaume).

### *Lucapina philippiana* Finlay, Plate 4, fig. 10-12

*Fissurella elongata* Philippi 1845, *Abbildungen Neuer Conchylien*, 2, p. 33, *Fissurella*, pl. 1, fig. 2 (locality unknown). Non M'Coy 1844.

*Lucapina elongata* Philippi, Pilsbry 1891, *Man. of Conch.* 12, p. 199, pl. 62, fig. 1, 2; pl. 36, fig. 31 (St. Thomas, West Indies).

*Diodora philippiana* Finlay 1930, *Trans. Proc. New Zealand Institute*, 61, p. 39.

*Description.* Shell thin, small, about 15 mm. in length, conical, very depressed and exceedingly narrow. Base oblong with its sides subparallel. Front slope straight, about half the length of the convex posterior slope. Orifice anterior, located in the first third. It is large and oblong. The shell is finely sculptured with about 38 close, radiating and alternately larger and smaller ribs which start at the orifice. On the posterior slope there are a few shorter ribs which originate below the orifice. The ribs are beaded by raised concentric threads which number 8 or 9 on each side of the orifice. Color cream or white, irregularly and slightly speckled with rusty brown. Margin blunt with shallow crenulations obscurely arranged in pairs. Interior of shell polished white, showing the ribs in the form of white radiating lines. Internal callus of the orifice narrow, white and truncated behind. Muscle impression distinct, narrow and close to the margin.

	length	width	height	orifice length	
(large)	16	9	3	3 mm.	Arthurstown, Cat Id., Bahamas
(average)	14	7	3	3	El Canal, Cabo Macorís, Hispaniola

*Types.* The type figure of *L. elongata* Philippi is that given above. The type specimens are probably in the British Museum. As the original locality was unknown, I here select El Canal, Cabo Macorís, Hispaniola to be the type locality.

*Remarks.* This species has been listed as coming from Queensland by Hedley (1910 *Australasian Association for the Advancement of Science*, 12, p. 352). Philippi's description and excellent figure certainly apply to this West Indian species. The Queensland species may be exceedingly close in its characteristics but will probably prove to be different when material from the two regions can be compared. Finlay (l.c.) only renamed this species. If, however, the Australian species proves to be different, a new name will have to be supplied. *Lucapina philippiana* is closely related to *L. sowerbii*. It differs, however, in many of its basic characteristics, such as its smaller size, its narrower shape,

the position of the orifice, its color pattern and its sculpture. This latter consists of more closely set and less prominent ribs.

*Range.* Bahamas (rare) south to the Virgin Islands.

*Records.* FLORIDA: off Hollywood, 35-60 fathoms (L. A. Burry). BAHAMAS: Arthurstown, Cat Id. (MCZ); Adelaide, New Providence (P. D. Ford). HISPANIOLA: El Canal, Cabo Macoris (MCZ). LESSER ANTILLES: St. Thomas (Pilsbry 1891, p. 199).

### *Lucapina suffusa* Reeve, Plate 4, fig. 7-9

*Fissurella hondurasensis* Reeve 1850 (*non* Reeve 1849), *Conch. Icon.*, 6, *Fissurella*, pl. 10, fig. 70 (Honduras).

*Fissurella suffusa* Reeve 1850, *Conch. Icon.*, 6, *Fissurella*, p. ii of Index (new name for *F. hondurasensis* Reeve, 1850).

*Fissurella cancellata* Reeve 1849 (*non* Sowerby, 1835), *Conch. Icon.*, 6, *Fissurella* [part of description, not the figure].

*Fissurella cancellata* Sowerby 1862 (*non* Sowerby, 1835), *Thes. Conchy.*, 3, p. 200, *Fissurellidae*, pl. 8, fig. 187, 189 (figures and description; part only of synonymy and localities; "California" certainly erroneous).

*Description.* Shell rather heavy and large, reaching a greater size than that of the other species of *Lucapina* in the Western Atlantic; conical, slightly elevated and narrower in front. Base ovate. Slopes variable but frequently the anterior straight and the posterior convex, the former being less than one-half the latter and sometimes one-third. Orifice large, from one-seventh to one-eighth the length of the shell; it is broad, oval or ovate and generally stained with bluish-black. The sculpture of the shell consists of numerous rounded ribs, alternately larger and smaller, the larger beginning at the orifice, while many

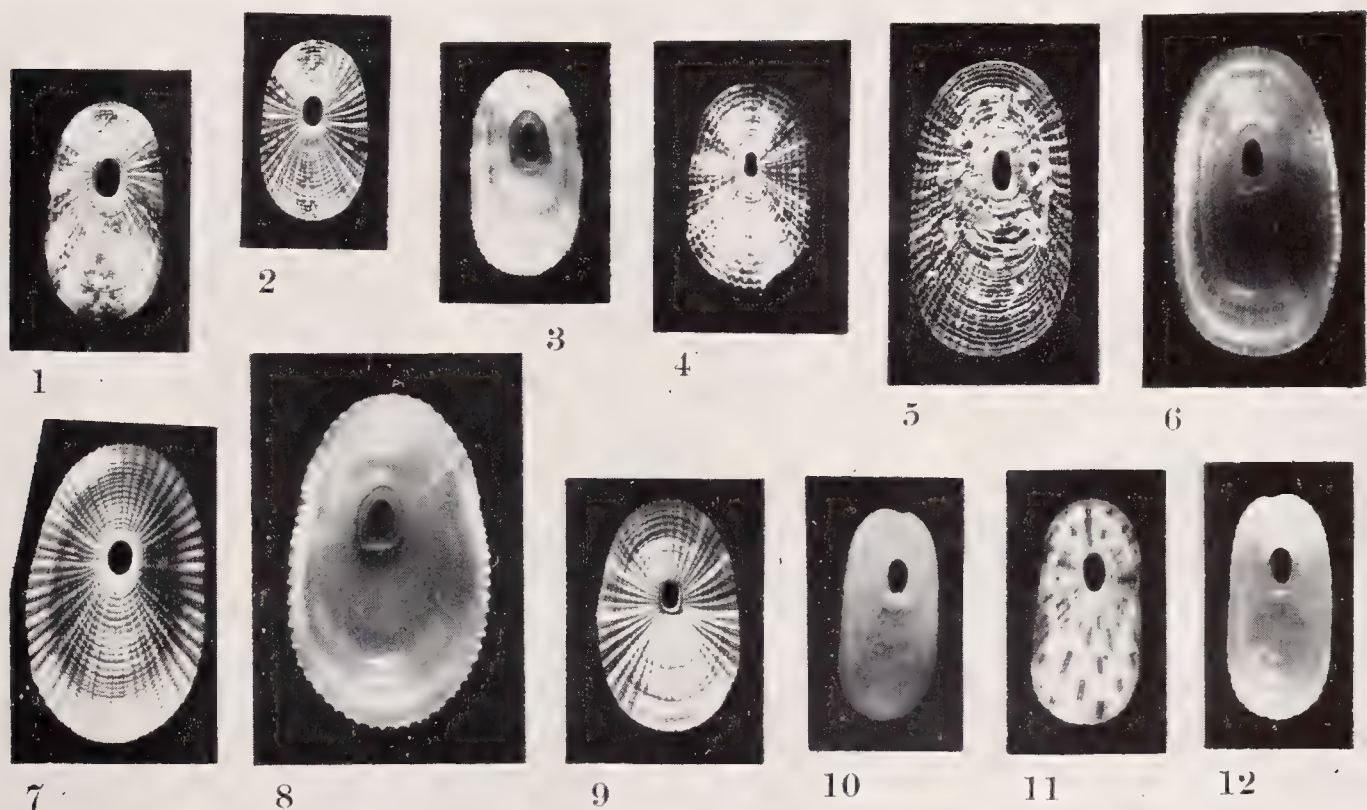


Plate 4. Fig. 1. *Lucapina sowerbii* Sowerby, Biscayne Bay, Florida. Fig. 2. *Lucapina sowerbii* Sowerby, Stock Id., Florida. Fig. 3. *Lucapina sowerbii* Sowerby, Key West, Florida. Fig. 4. *Lucapina aegis* Reeve, Athol Id., Bahamas. Fig. 5 and 6. *Lucapina aegis* Reeve (specimen partially covered with calcareous algae), Habana City, Cuba. Fig. 7 and 8. *Lucapina suffusa* Reeve, Biscayne Bay, Florida. Fig. 9. *Lucapina suffusa* Reeve, Bird Key, Dry Tortugas, Florida. Fig. 10. *Lucapina philippiana* Finlay, Arthurstown, Cat Id., Bahamas (2×). Fig. 11 and 12. *Lucapina philippiana* Finlay, El Canal, Cabo Macoris, Hispaniola (2×). All natural size except fig. 10, 11 and 12.

of the smaller start some distance below it. The ribs begin as very fine threads and increasingly broaden and separate toward the margin. Concentric raised threads cross the shell forming rounded nodules at the points of intersection with the radiating ribs. Besides these concentric threads there are innumerable growth lines. Color mauve, becoming a delicate pink when the specimens are worn. Occasionally broad rays of a darker tone may be noticed. Margin strongly crenulated with fine, paired and sharply pointed denticles. Inside of shell is gray fading to white in worn specimens. Rib sculpture of the outside is indicated on the interior as fine radiating white lines. Internal callus of the orifice thin, narrow and truncated, though not sharply so. Muscle impression distinct, uniform in width and lying very near the border. Periostracum present in this species. It is thin and covers the upper two-thirds of the shell.

	length	width	height	orifice length	
(large)	36	21	10	5 mm.	West Indies
(average)	30	18	8	4	Biscayne Bay, Miami, Florida

*Types.* The type figure is that of Reeve, Conch. Icon., 6, *Fissurella* pl. 10, fig. 70. The type specimen is probably in the British Museum. The type locality is Honduras.

*Remarks.* This species is most commonly found attached to rocks. Its bluish-black orifice readily distinguishes this species which, on the other hand, has also a very conspicuous orange body.

*Range.* Lower Florida, Bahama Islands and south along the Antilles and the eastern coast of Central America, probably as far as northern South America.

*Records.* FLORIDA: Fernandina; off Ocean Ridge, Palm Beach (4-10 fathoms); off Lantana, Palm Beach (10 fathoms); off Cape Florida (8 fathoms) (all T. Van Hyning); Biscayne Bay (T. McGinty); Key West (B. R. Bales); Fort Jefferson and Bird Key Reef, Dry Tortugas Keys (both T. Van Hyning). BAHAMAS: Octagon Point, New Providence (P.D. Ford); Governor's Harbour, Eleuthera Id.; Little San Salvador Id.; Arthurstown, Cat Id.; Clarencetown, Long Id.; Rum Key; Fortune Id.; Matthewtown, Great Inagua (all MCZ). CUBA: Habana, (M. L. Jaume); Varadero; Punta de los Colorados, Cienfuegos (both MCZ), HISPANIOLA: Miragoane; Santa Bárbara de Samaná (both MCZ). VIRGIN ISLANDS: St. John (M. Dewey).

#### Key to Western Atlantic *Lucapina*

- Orifice placed in the first third; shell with almost parallel sides *L. philippiana*  
Orifice placed posteriorly to the first third; shell usually with curved sides (almost parallel in *sowerbii*) 2
- Shell concentrically sculptured with laminae which form scales where they intercept the radial ribs; orifice a little contracted in the middle *L. aegis*  
Shell concentrically sculptured with threads which form nodules where they intercept the radial ribs; orifice not contracted 3
- Color mauve or pink; outside of orifice generally surrounded by a bluish black stain; usually of uniform color; rays, if present, scarcely set off from the ground color *L. suffusa*  
Color white, cream or buff; outside of orifice not stained; color pattern very apparent *L. sowerbii*

#### *Lucapinella* Pilsbry

*Lucapinella* Pilsbry 1890, Man. of Conch. (1), 12, p. 179.

Genotype, *Lucapinella callomarginata* Dall

Shell depressed conical, rather small, with the apex subcentral and completely occupied by the large orifice. The shell is sculptured with irregular radial ribs, crossed by laminae which form small scales. Margin thickened, so much so that in adult specimens the cren-



ulations are blunted. In general it rests on a plane but sometimes its posterior end is slightly raised. Internal callus of the orifice narrow, its posterior extremity roundly truncated. Muscle impression of a uniformly narrow width. Pilsbry (1891, Man. of Conch. (1), 12, p. 195) gives the following characteristics for the soft parts of this genus: "Animal with a fleshy foot, much too large to be contained in the shell; mantle-edge thickened, papillose on its lower edge and having narrow processes extending up over the shell-edge; tentacles short, obtuse; foot surrounded by a row of epipodial papillae; dorsal pore surrounded by papillar processes." There are two known species of this genus in the Western Atlantic.

### *Lucapinella limatula* Reeve, Plate 5, fig. 1-3

*Fissurella limatula* Reeve 1850, Conch. Icon., 6, *Fissurella*, pl. 15, fig. 115 (locality unknown).

*Fissurella aculeata* Reeve 1850, Conch. Icon., 6, *Fissurella*, pl. 15, fig. 111 (locality unknown).

*Fissurellidea limatula* Reeve, Dall 1889. Bull. Mus. Comp. Zoöl. 18, p. 409 (off Habana, in 80 fathoms. Coast of North Carolina, in 15-20 fathoms).

*Description.* Shell generally thin and small, not exceeding 20 mm. in length, depressed and attenuated anteriorly. Base ovate. Slopes straight or somewhat concave. Orifice almost at the shell center, triangular, with its sides projected upwards. Its length is from one-third to one-fifth that of the shell. Sculpture consists of alternately large and small ribs anteriorly, but posteriorly and laterally there are three riblets between each pair of primary ribs, the central one being the strongest. The shell is crossed by numerous concentric laminae which form small, erect, imbricated scales where they intercept the radial ribs and riblets. The growth lines are numerous and clearly distinct between the laminae. Color white, yellow, pink or brown, either solid or with 6 broad rays of deep pink, dark brown or black extending from the apex to the margin. These may be arranged in two ways: either with one anterior, one posterior and two on each side, or with three on each side. Margin thickened and crenulated, sometimes with the crenulations in pairs. Interior polished white, the outside color showing through the shell. Muscle scar rather deeply impressed, narrow, of a uniform width and lying very close to the margin. Internal callus of the orifice narrow, roundly truncated behind and outlined by a marked indenture.

	length	width	height	orifice length	
(large)	18	10	3	4 mm.	Sanibel Id., Florida
(average)	13	8	3	3.5	Boca Grande Key, Florida

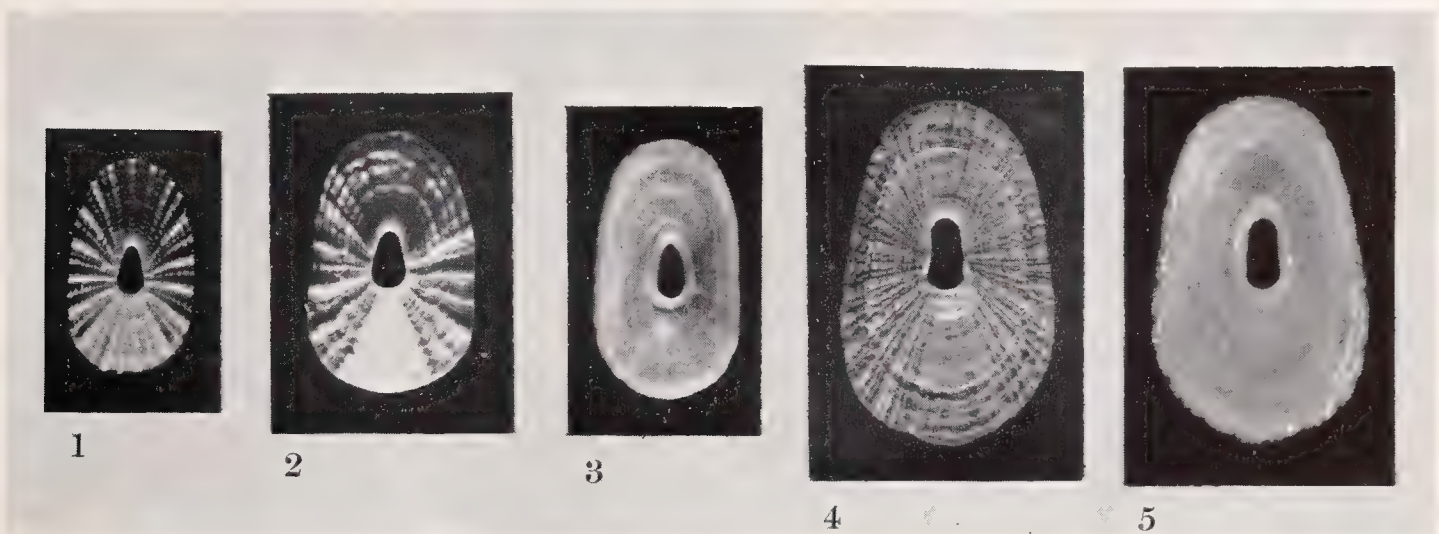


Plate 5. Fig. 1. *Lucapinella limatula* Reeve, Boynton Beach, Florida (2×). Fig. 2 and 3. *Lucapinella limatula* Reeve, Sanibel Id., Florida (2×). Fig. 4 and 5. *Lucapinella limatula hassleri* P. Farfante (Holotype) off Cabo Bermeja, Argentina (2×).

*Types.* The type figure is that of Reeve, Conch. Icon., 6, *Fissurella*, pl. 15, fig. 115. The types are probably in the British Museum. As Reeve gave no locality, Punta de los Colorados, Cienfuegos, Cuba, is here selected as the type locality.

*Remarks.* This species is very closely related to *L. callomarginata* Dall of the Pacific coast, but it is thinner, more brightly colored and its orifice is triangular instead of long oval. *L. limatula* lives completely under water at a depth varying from 6 to 80 fathoms. It is rather rare.

*Range.* North Carolina and south to the Virgin Islands, West Indies.

*Records.* FLORIDA: off Palm Beach, 50-67 fathoms; Boynton Beach; off Cape Florida, Biscayne Key, 50 fathoms; Destin, 18-20 fathoms (all T. McGinty); off Hollywood, 35-60 fathoms (L. A. Burry); Sanibel Id., 6-7 fathoms; Boca Grande Key (both J. S. Schwengel). CUBA: off Habana, *Blake*, 80 fathoms; Playa de Baracoa, Habana; Punta de los Colorados, Cienfuegos (all MCZ). HISPANIOLA: El Canal, Cabo Macoris (MCZ). VIRGIN ISLANDS: St. Thomas (MCZ).

### **Lucapinella limatula hassleri**, new subspecies, Plate 5, fig. 4-5

*Description.* Similar in its general characters to *L. limatula*, but differs in being thicker, more elevated, having less pronounced ribs which bear very small scales. The orifice is long-oval instead of triangular, its sides projected to form very pronounced teeth.

	length	width	height	orifice length	
(large)	17	11	5	4 mm.	Holotype
(average)	15	9	4	4	Paratype

*Types.* Holotype, Mus. Comp. Zoöl. No. 152227, off Cabo Bermeja, Argentina (S. Lat. 41° 17'; W. Long. 63°), *Hassler*, 17 fathoms. Paratypes, from the same locality and from off Mouth of Río Negro, Argentina (S. Lat. 41° 40'; W. Long. 63° 13'), 30 fathoms.

*Range and Records.* Known only from the type series.

Named for the survey steamer, *Hassler*, which made a trip to California by way of Cape Horn. The scientific work was done under the direction of Louis Agassiz.

### **Lucapinella henseli** v. *Martens*

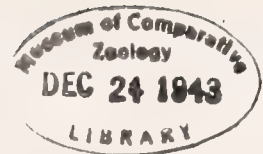
*Fissurella (Lucapinella) henseli* v. Martens 1900, Nachrichtenblatt Deutschen Malakozoologischen Gesellschaft, p. 187 (Desterro, Santa Catarina Province [Brasil]).

*Description.* Shell oblong, slightly elevated in the middle and distinctly narrower in front and in the middle. Margin subplane. Sculptured with radiating unequal ribs 5 to 7 in front and 5 larger posteriorly. Near the margin there are rather wide gray rays. Orifice oblong, large, slightly contracted in the middle. Internal callus of the orifice white. Margin crenulated by separated groups of fine denticles, with a white interior thickening. The interior color white. Length 23-26 mm.; width 15-16; height 4.5-6 mm.; orifice length 5-6 mm.; orifice width 2 mm.

*Remarks.* I am indebted to Dr. J. Bequaert for the following translation of von Martens remarks (German): "Greatest width a little behind the orifice: margin in one specimen at about the same level all around, but in the smaller specimens it is level only forward and behind, whereas it is somewhat raised at mid-length. Among the species in Reeve (Conch. Icon.) and Pilsbry (Man. of Conch.) it is most like *F. exquisita* and *F. limatula*, but both of these are not so much narrowed anteriorly and differ in sculpture." I have not seen this species and no specimens are available for study at this time. From the description it would appear very close to *L. limatula*. It has not been figured.

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## THE GENUS *DIODORA* IN THE WESTERN ATLANTIC

BY

ISABEL PÉREZ FARFANTE  
Guggenheim Fellow, Cuba, 1942-44

The genus *Diodora* is found in all tropical and temperate waters, being particularly rich in species along the Western Atlantic coast where it is found from New England south to Patagonia. Many of the species live in the inter-tidal area or just below. A few, however, occur in the deeper waters down to at least 800 fathoms.

All species in this genus are highly sculptured, most of them possessing a fine and intricate pattern. Color and color-pattern, however, though present in many species, are not highly developed and are limited to dark colored rays. Very little is known about the ecology and habits of our species. Members of *Diodora* as well as *Fissurella* are known as key-hole limpets.

I am deeply indebted to Miss Marion Bills for the beautiful photographs on plates 1 and 2; plate 3, fig. 1-8; plate 5, fig. 1-9. The remainder are by Mr. Fred Orchard of the Peabody Museum to whom I am also indebted for his skill in preparing the illustrations for this paper and the one on *Fissurella*.

### *Diodora* Gray

*Diodora* J. E. Gray 1821, London Medical Repository, **15**, p. 233.

*Fissuridea* Swainson 1840, Treat. on Malacology, p. 356.

*Diadora* J. E. Gray 1847, Proc. Zool. Soc. London, **15**, p. 147.

*Glyphis* Carpenter 1857 (*non* Agassiz 1843), Catalogue Mazatlan Shells, p. 220.

*Capiluna* Gray 1857, Guide Syst. Moll. British Museum, p. 166.

Genotype (monotypic) *Patella Fissurella apertura* Montagu (= *Diodora graeca* Linné)

Shell conical, elevated or depressed, the size varying between wide limits. Apex in front of the shell center: in young specimens curved and slightly twisted, inclined backward and with a fissure in front of it. In the adult, this small and slightly twisted portion is totally lacking. Orifice at the summit or immediately anterior to it, variable in shape. Surface of the shell sculptured by conspicuous radiating ribs and concentric threads or laminae. Basal margin of the shell resting upon a plane or slightly elevated in the middle part of the sides; never raised at the ends. Margin strongly crenulated. Muscle impression frequently indistinct, but when distinct, not uniform in width and with the anterior part incurved at the ends. A small and narrow connecting ridge bridges the area between the incurved ends. A few species have the muscle scar completely oval and of a uniform width. The orifice is bounded by a callus which is truncated posteriorly and sometimes excavated at this region forming a deep pit. Shell completely external, not covered by the mantle and capable of containing all the soft parts.

The animal possesses one pair of tentacles with the eyes on little projections on their outer bases. Snout short, oval and disc-shaped with the mouth in the middle of the disc.

Pilsbry states "epipodium consisting of a fringe of short filamentous processes, alternately larger and smaller, becoming more obsolete posteriorly where it is marked by little tubercles in place of the filaments. Mantle-edge smooth or papillose, usually broad" (1891, *Man. of Conch.* (1) 12, p. 203). The central tooth of the radula in *Diodora* is large, while in *Fissurella* it is very small.

#### Key to the genera *Fissurella* and *Diodora*

- Shell with the internal callus of the orifice the same width throughout; sometimes with its basal margin raised at the ends. Central tooth of the radula narrow *Fissurella*  
 Shell with the internal callus of the orifice truncated and frequently excavated posteriorly; with its basal margin never raised at the ends. Central tooth of the radula wide. *Diodora*.

#### Key to Western Atlantic *Fissurella*

1. Shell with the entire margin resting flat in a plane 2  
 Shell with basal margin not flat, but with the extremities raised, so that it rests only upon the middle of each side 8
2. Shell very heavy and elevated; sculptured with smooth riblets *F. nimbose* 3  
 Shell moderately heavy or thin, sculptured with more or less nodulose or scaly ribs
3. Ribs strongly nodulose: shell inside white, with radiating grooves *F. nodosa* 4  
 Ribs with small nodules or scales; shell inside colored, not white, smooth
4. Internal callus of the orifice from buff to brown 5  
 Internal callus of the orifice green 6
5. Orifice long and trilobated; from 15 to 20 primary ribs; basal margin the same width at both ends (elliptical) *F. barbouri*  
 Orifice short and oval; 9 to 10 primary ribs; basal margin narrowed anteriorly (ovate). *F. angusta*
6. Orifice almost circular, without teeth; color arranged in lines or blotches *F. barbadensis*  
 Orifice elongated, sometimes with two small teeth on each side; color arranged in rays 7
7. Internal callus of the orifice bounded by a black line *F. clenchi*  
 Internal callus of the orifice bounded by a red line *F. rosea*
8. Orifice elliptical; ribs separated *F. subrostrata*  
 [Johnsonia, No. 11, p. 20] 9  
 Orifice long, narrow and with a mid-horizontal widening; ribs close-set
9. Shell with the anterior extremity truncated; about 55 radiating ribs *F. punctata*  
 Shell with the anterior extremity rounded, not truncated; 46 or 47 radiating ribs *F. fascicularis*

#### Key to Western Atlantic *Diodora*

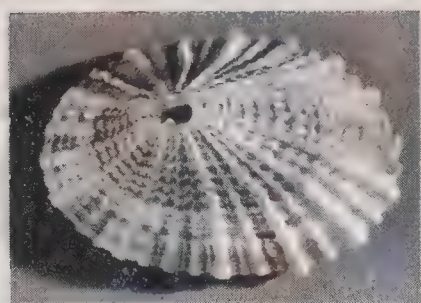
1. Shell sculptured with numerous radiating equal or subequal ribs 2  
 Shell sculptured with larger and smaller radiating ribs, not necessarily alternating 5
2. Shell with a trilobated orifice; ribs crossed by raised concentric threads 3  
 Shell with the orifice oblong-ovate, with a tooth each side, ribs crossed by concentric striae *D. patagonica*
3. Surface shiny and beaded; shell colored with black or brown lines, generally arranged in rays *D. minuta*  
 Surface dull and reticulated; shell unicolored, or, if with rays, these are solid in color and placed anteriorly and laterally, not posteriorly 4
4. Orifice placed completely anteriorly; radiating ribs close-set *D. sayi*  
 Orifice placed a little in front of the middle; radiating ribs, rather widely separated *D. bermudensis*
5. Ribs alternately larger and smaller 6  
 Ribs every fourth a little larger 12
6. Orifice circular 7  
 Orifice not circular 8
7. Shell elevated and reaching a great length (50 mm.); sculpture consisting of fine close-set ribs and concentric threads *D. tanneri*  
 Shell depressed and small, not exceeding 25 mm. in length; sculpture consisting of strong and widely separated ribs and laminae *D. meta*
8. Radiating sculpture consisting of rather widely separated erect ribs crossed by coarse laminae 9  
 Radiating sculpture consisting of fine close-set ribs crossed by threads 11
9. Orifice key-hole shaped; sculpture very heavy *D. listeri*  
 Orifice not key-hole shaped; sculpture pronounced, but delicate 10

10. Orifice oblong with a tooth each side; shell unicolorous or with solid rays, not freckled  
Orifice ovate, toothless; shell freckled with brown spots *D. aguayoi*  
*D. jaumei*
11. Orifice trilobated; shell with the apex completely curved anteriorly; front slopes very short and steep; posterior slope very convex  
Orifice oblong; apex a little in front of the middle, not curved forward; slopes straight *D. arcuata*  
*D. harrassowitzi*
12. Orifice triangular; shell with black rays, solid, spotted, or dotted  
Orifice not triangular; no black coloration *D. dysoni*  
13
13. Shell thin and very small; sculpture exceedingly fine; orifice circular  
Shell heavy; reaching a fairly large size; orifice not circular *D. flaviana*  
14
14. Orifice trilobated; color of principal ribs oyster white, sharply contrasting with the greenish or bluish gray rays  
Orifice key-hole shaped; color of principal ribs does not contrast with rest of shell; no definite color pattern *D. viridula*  
*D. cayenensis*

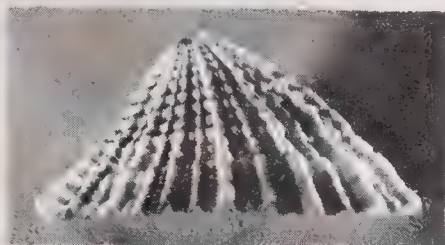
### *Diodora listeri* d'Orbigny, Plate 1, fig. 1-10

*Fissurella listeri* d'Orbigny 1850-1853, [in] R. de la Sagra, Hist. Phys. Pol. Nat. Cuba, Moll., 2, p. 197, pl. 24, fig. 37-39 (Cuba, Saint Lucia and Martinique).

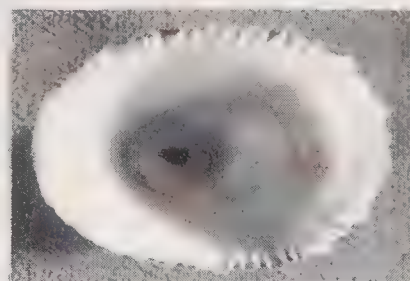
*Description.* Shell heavy, large, from 30 to 45 mm. in length, conical and elevated. Base ovate. Anterior slope generally straight, sometimes slightly concave; posterior slope convex. Summit in front of the middle, pierced by a key-hole shaped orifice with the rear wall thickened. It is rather small, its length being from one-seventh to one-eleventh that of the shell. Sculpture consists of 38 or 40 strong, rounded ribs, alternately larger



1



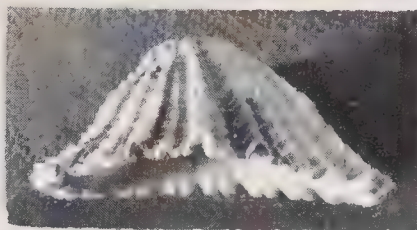
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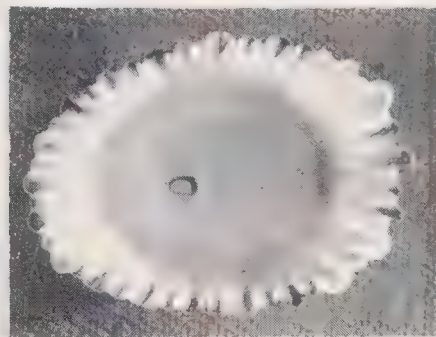
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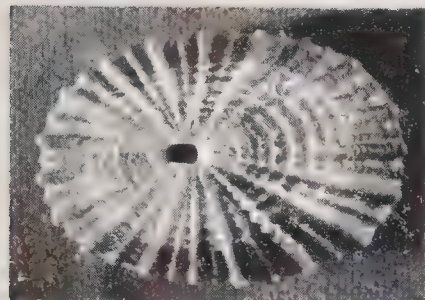
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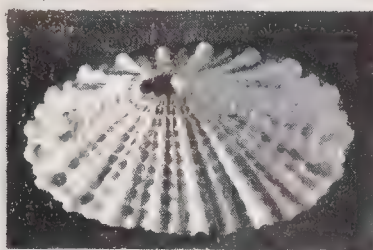
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10

Plate 1. *Diodora listeri* d'Orbigny. Fig. 1-4. Garden Key, Tortugas, Florida (fig. 1-3, nat. size; fig. 4, 5×). Fig. 5-6. Missouri Key, Lower Florida Keys (nat. size). Fig. 7. Biscayne Bay, Florida (nat. size). Fig. 8, Lake Worth, Florida (nat. size). Fig. 9. Virgin Gorda, Virgin Islands (nat. size). Fig. 10. Cienfuegos, Cuba (nat. size).

and smaller, the interspaces being deeply excavated and separated by rather broad deep grooves which bear an intermediate riblet. Crossing the shell there are from 9 to 12 concentric laminae which, where they intercept the ribs, form large nodules or scales and cut the interstices into square pits. Between these laminae are a variable number of fine threads. Color very variable: it may be unicolored in white, cream or gray; it may have black, gray or brown rays; or it may have a similar ground with a wide dark gray basal band. The orifice externally is sharply outlined or stained in blue black. Margin strongly crenulated with paired denticulations, each paired group widely and deeply separated from its neighbors. The inside color is milky white, light gray or green, the colors of the outside showing through, while the ribs and concentric ridges are seen in the form of white lines. Internal callus of the orifice the same color as the interior, sometimes stained at the sides and front with blue-black. Muscle impression hardly discernible, continuous and of a uniform width.

	length	width	height	orifice length	
(large)	43	32	23	4 mm.	Eight Mile Rock, Grand Bahama
(average)	34	24	14	4	Dry Tortugas Keys, Florida

*Types.* The type specimens of *D. listeri* may be at the British Museum. I here select Habana, Cuba to be the type locality, as d'Orbigny gave only island designations in his original description.

*Remarks.* This species is very common throughout its area. It lives generally attached to rocks, but has been found on coral reefs, on wooden and even on iron pilings. The typical sculpture is constant in character and is quite different from that of *D. cayenensis*, a species which appears to be rather closely related to it. *D. listeri* has much stronger and more widely spaced radiating ribs and concentric laminae than those occurring in *D. cayenensis*. The difference in coarseness is so great that when they are compared the two species are very easily separated.

*Range.* Eastern and southwestern Florida, Bermuda, the West Indies and south to British Guiana.

*Records.* FLORIDA: St. Augustine; South Lake Worth; Cape Florida (6 fathoms) (all T. Van Hyning); Biscayne Bay; Sanibel Id. (both MCZ); Key Largo (E. M. Davis); Indian Key (Yale); Lower Matecumbe Key; Sandy Key (both B. R. Bales); Missouri Key (T. McGinty); Pelican Shoals (J. S. Schwengel); Stock Id. (T. Van Hyning); Key West (MCZ); Sand Key (AMNH); Boca Grande; Marquesas Key; Dry Tortugas (all T. Van Hyning). BAHAMAS: Eight Mile Rock, Grand Bahama; Strangers Key, Great Abaco; Alicetown, Bimini Ids.; South Beach, New Providence; Governors Harbour, Eleuthera; Little San Salvador Id.; Arhurstown, Cat Id.; Simms, Long Id.; Watling Id.; Samana Cay; Matthewtown, Great Inagua (all MCZ). BERMUDA: (MCZ). CUBA: Vedado; Matanzas City (both MCZ); Varadero (H. Sarasúa); Playa de Jibacoa (J. L. Mayor); Cabo Roteño; Caibarién (both P. J. Bermúdez); Guantánamo Naval Base; Punta de los Colorados, Cienfuegos; Bahía de Cochinos, *Atlantis*, station 3328 (260–275 fathoms) [dead specimen] (all MCZ). HISPANIOLA: Monte Cristi; Puerto Plata; Puerto Sosúa; Santa Bárbara de Samaná; El Canal, Cabo Macorís; Miragoane; Cap Haitien; Gonave Id. (all MCZ). JAMAICA: Montego Bay (AMNH). PUERTO RICO: San Juan; Arecibo (both MCZ); Boca de Cangrejos; Laiza Vieja (both Univ. of Mich.). VIRGIN ISLANDS: St. Thomas (AMNH); St. John; Marina Cay and Guana Id., Tortola (all M. W. Dewey); Virgin Gorda (MCZ). LESSER ANTILLES: Barbados;

Trinidad (both MCZ): Fontenay Beach, Grenada (H. G. Kugler); Tobago (AMNH). CARIBBEAN IDS.: Swan Id. (MCZ). PANAMA: Colón (MCZ). BRITISH GUIANA: Corentyne River (H. G. Kugler).

**Diodora cayenensis** Lamarck, Plate 2, fig. 1-6

*Fissurella cayenensis* Lamarck 1822, An. s. Vert., 6, pt. 2, p. 12 (mers de la Guyane).

*Fissurella alternata* Say 1822, Journ. Acad. Nat. Sci. Philadelphia, 2, pt. 2, p. 224 (coast of the United States).

*Fissurella fumata* Reeve 1850, Conch. Icon., 6, *Fissurella*, pl. 9, fig. 63 (locality unknown).

*Fissurella larva* Reeve 1850, Conch. Icon., 6, *Fissurella*, pl. 13, fig. 98 (Island of St. John's, West Indies).

*Fissurella viminea* Reeve 1850, Conch. Icon., 6, *Fissurella*, pl. 14, fig. 105 (locality unknown).

*Description.* Shell moderately heavy, from 25 to 40 mm. in length, conical, elevated and narrower anteriorly. Front slope straight or concave, posterior convex. Base ovate or sub-oblong. Apex anterior to shell center, more or less curved forward, and with the orifice placed immediately before it. The latter is key-hole shaped, the rear wall thickened and sometimes excavated obliquely, the sides frequently projecting upwards to form one prominent tooth which sometimes divides into two, while frontally and laterally it may sometimes have a very fine black line on the outside. Its length is from one-sixth to one-ninth that of the shell. Surface sculptured with numerous close set radiating sharp ribs, every fourth one larger. Concentric overlapping growth laminae cross the shell forming small scales where the ribs are intercepted. Color very variable: may be unicolored milky white, cream, buff, light pink or dark gray. With any of these colors as a ground, there may be eight or nine gray or brown rays which are solid, in broken lines, or in scattered spots; with the same ground color there may be a broad basal band of dark gray or black. Margin sharply and finely crenulated. Interior color white or bluish gray, the color pattern and sculpture of the outside showing through. The internal callus of the orifice is of the same color as the rest of the inside. It is sharply truncated and excavated obliquely, forming a deep pit behind; sometimes it is encircled by a black line. Muscle scar slightly impressed, narrower anteriorly.

	length	width	height	orifice length	
(large)	39	24	15	5 mm.	Simms, Long Id., Bahamas
(average)	30	19	13	4	Biscayne Bay, Miami, Florida

*Types.* Probably in the Geneva Museum. The type figures are those of B. Delessert 1841, *Recueil Coquilles Décrites par Lamarck*, Paris, pl. 24, fig. 5a-c. The type locality is French Guiana.

*Remarks.* This is an exceedingly variable species, the most variable characters being the general shape of the shell and the coloration. The color pattern has probably been chiefly responsible for the variety of names applied to this species. The very large collection of material at hand indicates that it is impossible to draw any line among these different forms. Certain specimens possess two sets of color characteristics each one of which has had a name applied to it.

It is exceedingly unfortunate that the well known name of *alternata* Say must be replaced by an earlier one proposed by Lamarck; both appeared in 1822, but that of Lamarck was published in May while that of Say was published in June.

*D. cayenensis* is found from the intertidal realm to depths of about 20 fathoms. It occurs mainly on rocks.

*Range.* Maryland and south, including the Gulf of Mexico, the West Indies and South America, to Brasil.

*Records.* MARYLAND: (AMNH). VIRGINIA: Hog Id. (MCZ). NORTH CAROLINA: Beaufort (MCZ). SOUTH CAROLINA: Charleston; Sullivan Id. (both MCZ). FLORIDA: Fernandina (T. Van Hyning); St. Augustine (MCZ); Melbourne (T. Van Hyning); Fort Pierce (T. McGinty); off Fort Walton (13-19 fathoms) (L. A. Burry); Palm Beach (J. S. Schwengel); off Lantana (10 fathoms) (T. Van Hyning); Boynton Beach (T. McGinty); Ft. Lauderdale; Hollywood (both L. A. Burry); Biscayne Bay (R. Humes):

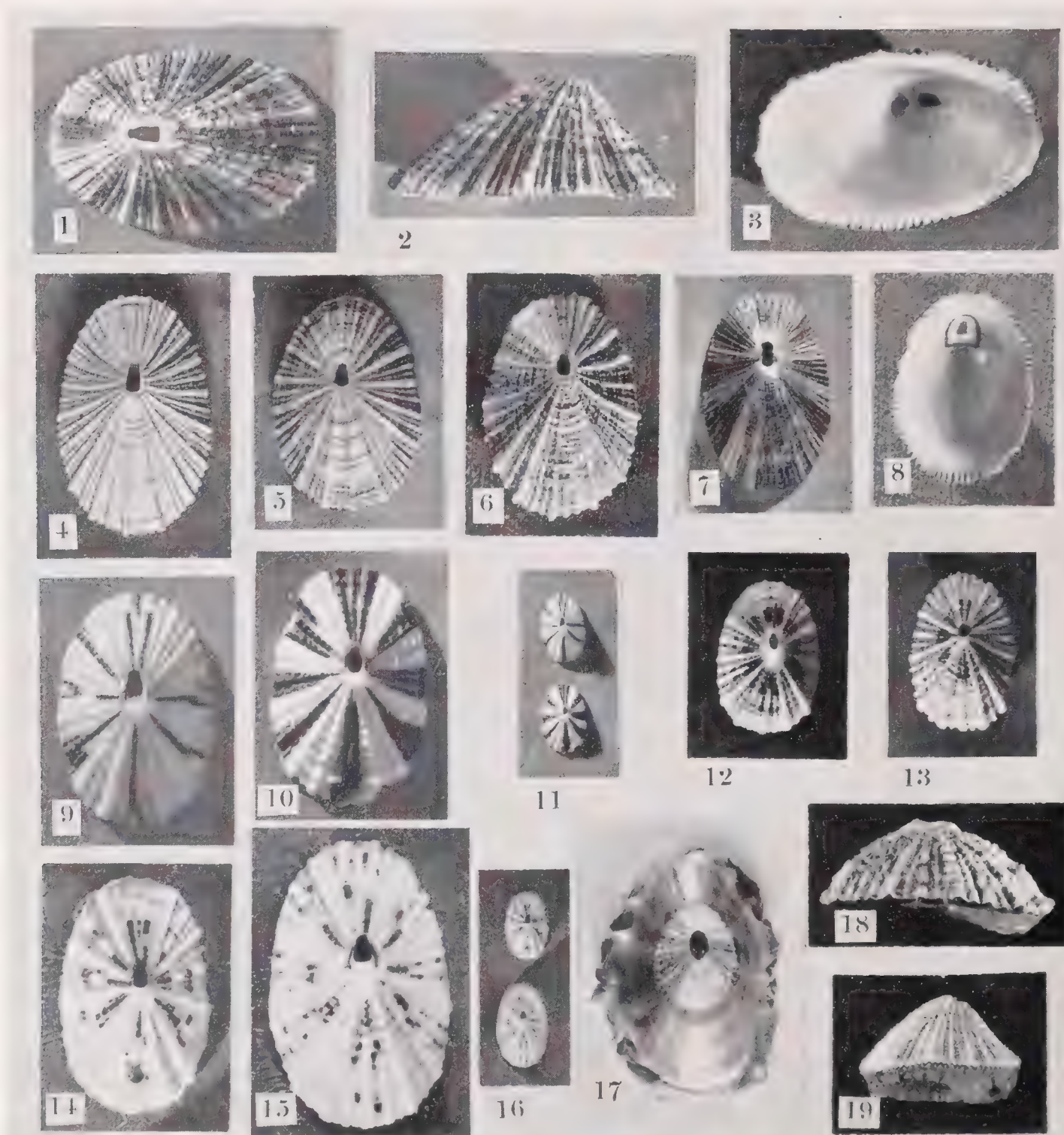


Plate 2. Fig. 1-3. *Diodora cayenensis* Lamarck, Tortugas, Florida (nat. size). Fig. 4. *Diodora cayenensis* Lamarck, Puerto Esperanza, Pinar del Río, Cuba (nat. size). Fig. 5. *Diodora cayenensis* Lamarck, Charleston, South Carolina (nat. size). Fig. 6. *Diodora cayenensis* Lamarck, Bonita Springs, Florida (nat. size). Fig. 7-8. *Diodora patagonica* d'Orbigny, Nova Almeida, Espirito Santo, Brasil (nat. size). Fig. 9-11. *Diodora dysoni* Reeve, Sarasota Bay, Florida (fig. 8-9,  $3\times$ ; fig. 10, nat. size). Fig. 12-13. *Diodora dysoni* Reeve, Adelaide, New Providence, Bahamas (nat. size). Fig. 14-16. *Diodora dysoni* Reeve, Bermuda (fig. 14-15,  $3\times$ ; fig. 16, nat. size). Fig. 17. *Lucapina*. Fig. 18. *Fissurella*. Fig. 19. *Diodora*. The last three figures are to show the position of the soft parts in the three genera (all nat. size).



Key West, *Blake*; Pavilion Key; Bonita Springs; off Sanibel Id. (6-15 fathoms) (all MCZ); Sarasota Bay (AMNH); Boca Grande (H. Dodge); off Big Sarasota Pass (7-8 fathoms) (T. Van Hyning); Pass-à-Grille (E. M. Davis); Gulfport (MCZ); Tampa Bay; St. Petersburg; off Tarpon Springs; St. Joseph's Bay; Camp Walton (all T. Van Hyning); off Destin (T. McGinty); Cedar Keys (AMNH); Upper Matecumbe Key; Sugarloaf Key; Bonefish Key (all B. R. Bales); Fort Jefferson, Dry Tortugas (T. Van Hyning). BERMUDA: Agar's Id.; Shelly Bay; Hemington Sound (all MCZ). BAHAMAS: Nassau, New Providence (P. D. Ford); Hatchet Bay, Eleuthera (MCZ); Cape St. Maria, Long Id.; Samana Cay (all MCZ). CUBA: Puerto Esperanza, Pinar del Río (Belén Rogés); Playa de Baracoa, Habana (J. L. Mayor); Cayo Francés, Caibarién (P. J. Bermúdez). HISPANIOLA: Monte Cristi; Puerta Plata (both MCZ). JAMAICA: Montego Bay (MCZ). PUERTO RICO: Humacao Beach; Mayagüez (both MCZ). VIRGIN ISLANDS: St. Thomas; St. John (both MCZ); Guana Id., Tortola (M. W. Dewey). LESSER ANTILLES: Ft. James Beach, Antigua (B. Baker); Pigeon Point, Tobago; Stables Bay and Scotland Bay, Trinidad (MCZ). MEXICO: Veracruz; Chalalacas; off Isla Mujeres (all MCZ). HONDURAS: Puerto Cortés (MCZ). PANAMA: Colón (MCZ). COLOMBIA: Cartagena (MCZ). VENEZUELA: off Curaçao (MCZ). FRENCH GUIANA: Cayenne (MCZ). BRASIL: Manguinhos, Ilha de Itaparica; Pituba (both P. de Oliveira).

### *Diodora dysoni* Reeve, Plate 2, fig. 9-16

*Fissurella dysoni* Reeve 1850, Conch. Icon., 6, *Fissurella*, pl. 12, fig. 86 (Honduras).

*Diodora microsticta* Dall 1927, Proc. United States Nat. Mus., 70, Art. 19, p. 9 (South Florida to Cape San Roque, Brasil).

*Description.* Shell small, seldom exceeding 20 mm. in length, depressedly conical and with straight slopes. Base ovate. Apex slightly in front of the middle and characterized by a blunt knob situated behind the posterior wall of the small, almost triangular orifice. Sculpture consists of 18 strong ribs, between which there are three intercallary riblets. Numerous concentric laminae cross the shell, forming a rather heavy lattice-like appearance. Color milky white or cream with eight solid, broken or dotted black rays. The orifice is bounded laterally and anteriorly by a black line. Margin sharply crenulated with the denticles arranged in groups of four. Inside color white. Internal callus of the orifice broad, sharply truncated and excavated behind. It has the same color as the rest of the inside. Muscle scar faint.

	length	width	height	orifice length	
(large)	22	15	11	3 mm.	Sanibel Id., Florida
(average)	17	11	6	2	Nassau, New Providence, Bahamas

*Types.* The types of this species are in the British Museum, the type locality being Honduras, Dyson collector.

*Remarks.* The sculpture of *D. dysoni* and *D. cayenensis* is quite similar, but in shells of equal size, the sculpture of *D. dysoni* is much stronger and the laminae are more widely spaced. In *dysoni* the orifice is triangular, while in *cayenensis* it is key-hole shaped. Color rays or spots are never colored black in *cayenensis*. When Dall described *D. microsticta*, he considered the specimens in which the black rays were broken or dotted, as well as those in which they are terminated at some distance from the margin, to be different from *D. dysoni*. However, I believe *D. microsticta* to be the same species. Variation is extensive in color pattern and a long series shows all connecting links between them. All other characters other than the color pattern are identical.

*Range.* Florida, the Bahamas and south to Brasil.

*Records.* FLORIDA: Sanibel (MCZ); Hollywood (35–60 fathoms) (L. A. Burry); Sarasota Bay (AMNH). BERMUDA: Gibbet Id.; Long Bird Id. (both MCZ). BAHAMAS: Arthurstown, Cat Id. (MCZ); Adelaide, New Providence (P. D. Ford). VIRGIN ISLANDS: St. Thomas (MCZ); Guana Id., Tortola (M. W. Dewey). LESSER ANTILLES: Guadeloupe (AMNH); Barbados (T. McGinty). HONDURAS: (AMNH).

**Diodora patagonica** d'Orbigny, Plate 2, fig. 7–8

*Fissurella patagonica* d'Orbigny 1847, Voyage dans l'Amérique Méridionale, 5, p. 476, pl. 64, fig. 1–3 (Rio de Janeiro [Brasil]; Rio Negro [Argentina]).

*Diodora metcalffi* Reeve, Conch. Icon., 6, *Fissurella*, pl. 11, fig. 75 (locality unknown).

*Description.* Shell medium in size, about 30 mm. in length, depressed conical. Anterior slope straight, posterior slope convex. Base oblong-ovate. Apex directed forward, situated at the beginning of the second third and pierced by the orifice. The orifice has the same shape as the basal margin and is slightly contracted in the middle, its length being from one-eighth to one-tenth that of the shell. The surface is sculptured with numerous close-set, rather sharp, radiating ridges which are closely decussated throughout with concentric striae. Shell is alternately rayed in buff and a greenish brown. The orifice is always outlined by a fine black line. Margin of shell thin, very sharply crenulated. Inside color grayish white. Internal callus of the orifice thick and outlined by an indenture. It has the same color as the rest of the inside and is surrounded by a dark gray streak. Muscle scar deeply impressed.

	length	width	height	orifice length	
(large)	30	20	11	4.5 mm.	Trinidad
(average)	27	17	11	4	Nova Almeida, Espirito Santo, Brasil

*Types.* The type of this species is probably in the British Museum. As d'Orbigny gave two widely separated localities, I here select as type locality, Rio de Janeiro.

*Remarks.* *D. patagonica* is a fairly abundant species from Trinidad south along the east coast of South America. It is not found in the rest of the West Indies. *D. metcalffi* Reeve has been constantly considered a synonym of *D. cayenensis*, but the specimens that we have seen agree exactly with Reeve's figure and description. These in turn agree with d'Orbigny's. This species is related to *D. cayenensis*, but the obvious differences in the sculpture, the shape of the orifice and the basal margin make it impossible to confuse them.

*Range.* Trinidad south through Brasil to Argentina.

*Records.* TRINIDAD: Magueripe Bay (MCZ). BRASIL: Nova Almeida, Espirito Santo, Thayer Expedition (MCZ); Rio de Janeiro (d'Orbigny 1847, p. 476). ARGENTINA: Rio Negro (d'Orbigny 1847, p. 477).

**Diodora sayi** Dall, Plate 3, fig. 1–8

*Fissurella alternata* Say, var. *sayi* Dall 1899, Bull. Mus. Comp. Zool., 18, p. 407 (off Habana, Cuba).

*Description.* Shell depressedly conical with the apex completely directed forward, medium in size, generally not exceeding 30 mm., narrower in front and from thin to moderately heavy. Anterior slope short, straight or concave; posterior, long and convex. Base oblong-ovate. Orifice placed in the anteriorly directed apex; it is long, narrow and tends to be trilobated, its length being from one fourth to one sixth that of the shell. Surface dull; sculpture consists of fine close set, nearly equal, radiating ribs which are crossed by numerous concentric threads. Color uniformly white, cream or faintly olive. In the lat-

ter case there are seven slightly darker rays, placed three on each side and one at the front. Margin finely crenulated, the denticulations tending to be arranged in pairs. Interior color the same as the outside; when rays are present, they show through. Internal callus of the orifice sharply truncated behind, of the same color as the inside and sometimes bounded by an olive-green, interrupted streak.

	length	width	height	orifice length	
(large)	29	27	11	5.5 mm.	off Delray, Florida
(average)	15	9	5	4	off Pelican Shoals, Florida

*Types.* Holotype, Museum Comparative Zoölogy, No. 125767, *Blake*, station 62, from off Habana, Cuba (N. Lat.  $23^{\circ}9'$ ; W. Long.  $82^{\circ}1'$ ) in 30 fathoms. Paratypes from the same station as well as from the following *Blake* stations: station 2, off Habana in 805 fathoms; station 32, off Yucatan (N. Lat.  $23^{\circ}32'$ ; W. Long.  $88^{\circ}5'$ ) in 95 fathoms; off Yucatan in 640 fathoms.

*Remarks.* Dall considered this form as a variety of *D. alternata* (= *cayenensis*) but its characteristics are strikingly different from those of that species. *D. sayi* possesses another shape, having the apex nearer to the anterior end. The sculpture of *D. sayi* consists of nearly equal ribs, while the sculpture of *D. cayenensis* has every fourth rib noticeably larger. The orifice of *D. sayi* is longer and is trilobated in outline; that of *D. cayenensis* being key-hole shaped.

*D. sayi* exists only below low water in depths ranging from 12 to 95 fathoms. Records from much greater depths are based upon dead shells. Live material may not exist at such depths.

*Range.* Shallow to deep water from southeast Florida, Greater Antilles, along the Central American coast to Brasil.

*Records.* FLORIDA: Palm Beach (12–14 fathoms); Pelican Shoals (45 fathoms); off Destin (all J. S. Schwengel); off Hollywood (35–60 fathoms) (L. A. Burry); off Delray (80 fathoms) (T. Bayer). CUBA: off Habana, *Blake*, station 2 (805 fathoms); off Habana, *Blake*, station 62 (80 fathoms) (all MCZ). MEXICO: off Yucatan, *Blake*, station 32 (95 fathoms); off Yucatan, *Blake* (640 fathoms) (both MCZ). BRASIL: Recife; off Bahía, *Hassler* (40 fathoms) (both MCZ).

### *Diodora harrassowitzi* v. *Ihering*, Plate 3, fig. 9–12

*Lucapina harrassowitzi* v. *Ihering* 1927, Archiv. für Molluskenkunde, 59, p. 97, pl. 6, fig. 9–12, 15–16 (Itapema, Sta. Catharina, Brasil).

*Description.* Shell small, about 12 mm. in length, moderately heavy, conical and elevated. Base oblong-ovate. Slopes straight. Apex a little in front of the middle, pierced by a long-oblong, almost parallel-sided orifice, about 1.5 mm. in length. Sculpture consists of alternately larger and smaller radiating ribs crossed by concentric raised threads which form small nodules where they intercept the ribs. Shell unicolored a light orange-buff. Margin strongly crenulated, the denticulations being in pairs. Inside color white or cream, the sculpture of the outside showing through. Internal callus of the orifice sharply truncated behind, the same color as the rest of the inside. Muscle scar rather deeply impressed.

	length	width	height	orifice length	
(large)	12	8	4	1.5 mm.	Holotype
(small)	9	6	3	1.3	West Indies

*Types.* Holotype, Senckenberg Museum, Frankfurt, a. M., Germany, no. 3277, Itapema, Sta. Catharina, Brasil, H. von Ihering collector.

*Remarks.* This is an exceedingly rare species; the only specimens seen are four without data and included with specimens of *D. cayenensis*.

*Range and Records.* Known only from the type locality.

***Diodora bermudensis* Dall and Bartsch, Plate 3, fig. 13**

*Fissuridea bermudensis* Dall and Bartsch 1911, Proc. United States Nat. Mus., 40, p. 286 (Bermuda).

*Description.* "Shell small, white, elevated, reticulately sculptured: apex a little in advance of the middle of the shell, rather pointed: the anal perforation long-oval, the margins excavated in the middle, internally with a thickened margin, subtruncated behind: sculpture of radiating threads with wider deep interspaces, crossed between the apex and the base by about a dozen concentric lines, representing old margins, nodulating the radials and forming deep pits between the intersections; interior of the shell white, the margin forming a regular oval, and often internally radially grooved in harmony with the external ribs."

length      width      height  
5              3.5      3 mm. Cotype

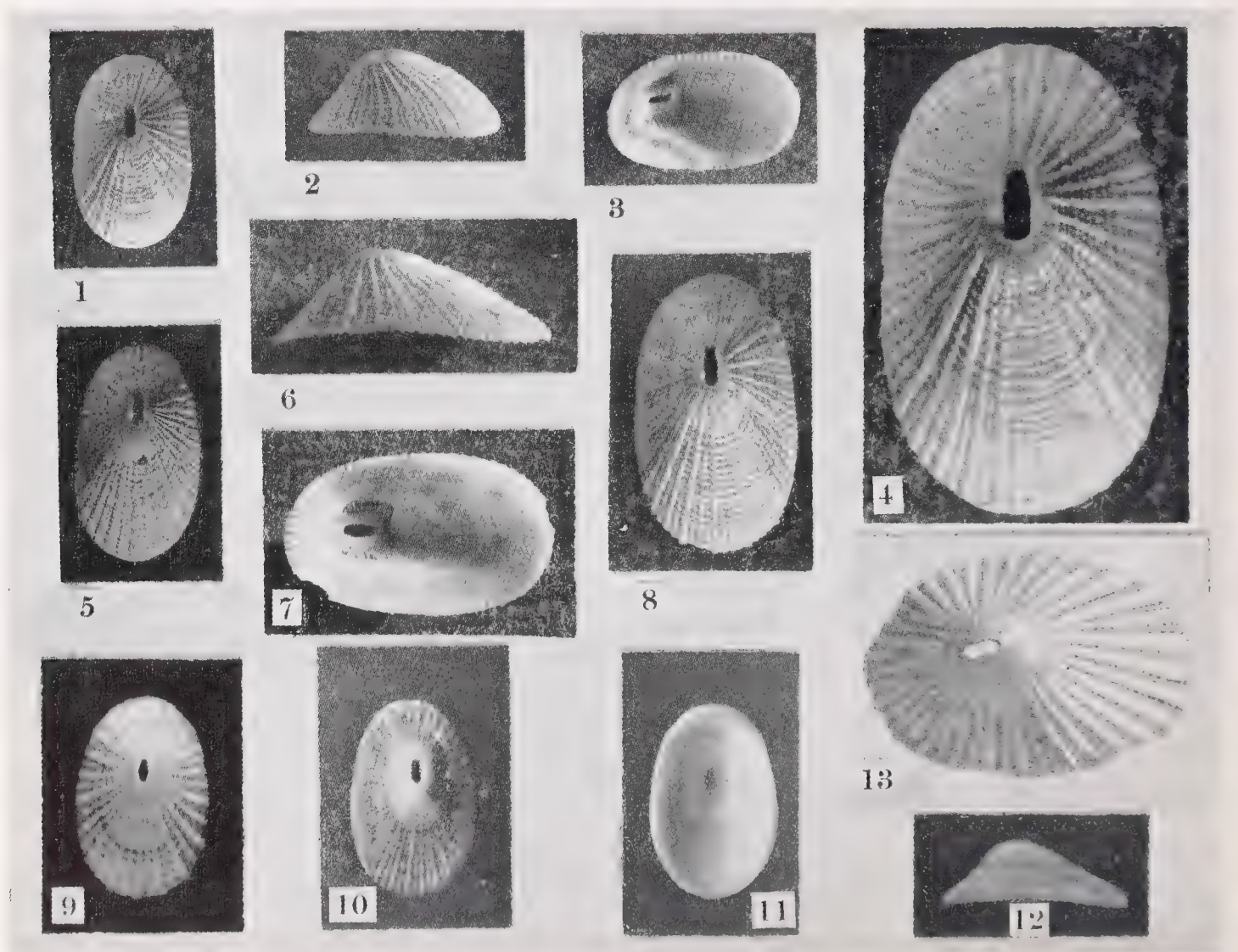


Plate 3. Fig. 1-4. *Diodora sayi* Dall, off Pelican Shoals, Florida (1-3, 2×; 4, 5×). Fig. 5. *Diodora sayi* Dall, off Pelican Shoals, Florida (2×). Fig. 6-8. *Diodora sayi* Dall, off Palm Beach, Florida (3×). Fig. 9. *Diodora harrassowitzi* von Ihering, West Indies (2×). Fig. 10-12. *Diodora harrassowitzi* von Ihering, Itapema, Sta. Catharina, Brasil (after von Ihering) (2×). Fig. 13. *Diodora bermudensis* Dall and Bartsch, Bermuda (after Dall and Bartsch) (8×).

*Types.* Cotypes, United States National Museum, no. 221618, Bermuda. Arthur Haycock collector.

*Range and Records.* Known only from Bermuda.

*Remarks.* I have not seen any specimens of this very distinctive *Diodora*. The above description and figure are copied from the report of Dall and Bartsch.

***Diodora aguayoi***, new species, Plate 4, fig. 1-3

*Description.* Shell thin, small, about 15 mm. in length, conical, elevated and somewhat narrower anteriorly. Front slope straight, posterior and lateral slopes slightly concave at the orifice and below continuing straight to the border. Apex a little in front of the middle, pierced by a small oblong anteriorly directed orifice which has a rounded tooth on each side. Its length is from one sixth to one seventh that of the shell. Sculpture consists of numerous, fine alternately larger and smaller radiating ribs, decussated by numerous concentric threads which form nodules or small scales where they intercept the ribs. Shell uniformly colored grayish white, cream or pale olive and sometimes with 4 or 8 irregularly placed darker rays. Margin finely crenulated, with paired denticles. Inside color the same as the outside, with the sculpture showing through as fine radiating and concentric white lines. Internal callus of the orifice sharply truncated and excavated behind, colored the same as the rest of the interior.

	length	width	height	orifice length	
(large)	14	10	11	2 mm	Holotype
(average)	12	9	10	1.5	Paratypes

*Types.* Holotype, Museum of Comparative Zoölogy no. 125768, off Sandy Bay, Barbados, in 100 fathoms, *Hassler*, 1871. Paratypes from the same locality.

*Remarks.* This species would appear to be near to the *D. cayenensis* complex, but actually it is not at all related. *D. aguayoi* is a thinner species and smaller than *D. cayenensis*. Its shape is different, having the posterior and lateral slopes concave near the apex and becoming straight toward the margin, a condition quite different from that found in *D. cayenensis*. The sculpture of *D. aguayoi* consists of alternately larger and smaller ribs which are separated by a narrow groove while in *D. cayenensis* the ribs are close set with every fourth larger than the three in between. Also, in *D. aguayoi* the orifice is in part flat on top and strongly angled on the anterior slope, a condition not occurring in any other *Diodora* existing in the Western Atlantic area. This species is only known from fairly deep water in depths between 80 and 450 fathoms.

*Range.* Bermuda and south through the West Indies in fairly deep water.

*Records.* BERMUDA: off Castle Rock (80-100 fathoms). CUBA: off Habana, *Blake*, station 51 (450 fathoms). LESSER ANTILLES: off Sandy Bay, Barbados, *Hassler*, (100 fathoms) (all records are MCZ).

Named for Dr. C. G. Aguayo of the University of Habana, who was responsible for my first interest in mollusks.

***Diodora jaumei*** *Aguayo and Rehder*, Plate 4, fig. 4-8

*Diodora jaumei* Aguayo and Rehder 1936, Mem. Soc. Cubana Hist. Nat., 9, No. 4, p. 236, pl. 24, fig. 6 (Varadero, Matanzas and La Chorrera, Habana, Cuba).

*Description.* Shell 15 to 21 mm. in length, conical, rather elevated, with the apex a little in front of the middle. Base ovate. Slopes straight or very slightly convex, particularly the posterior. Orifice small, ovate, extending anteriorly from the apex, its narrower

end being frontally placed. Surface lusterless, sculptured with rounded, strong, alternately large and smaller ribs crossed by concentric laminae which form squamous nodules where they intercept the ribs, cutting the interstices into rectangular pits. Between the laminae are intercalated two or three threads. Color from white to buff, freckled all over

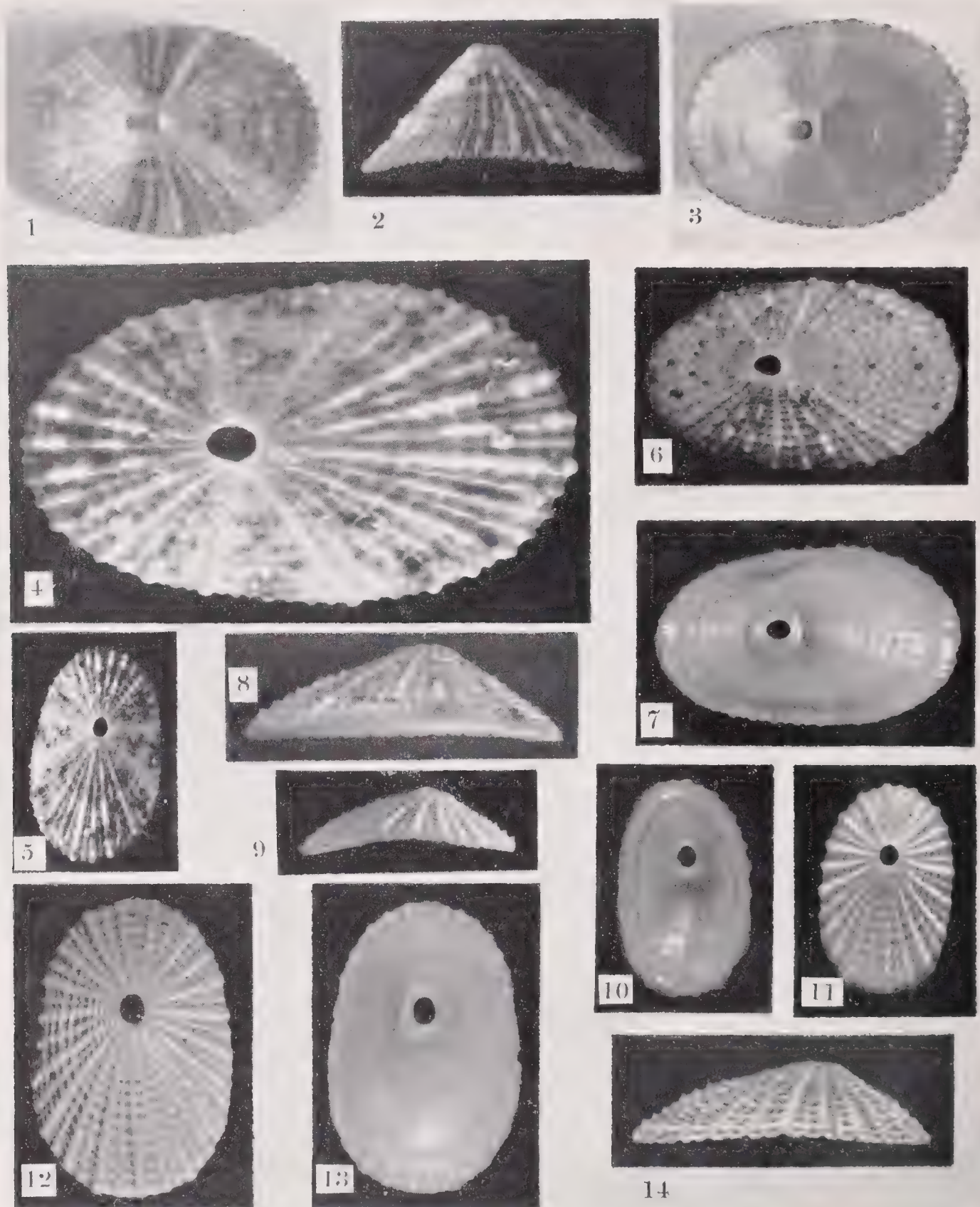


Plate 4. Fig. 1-3. *Diodora aguayoi* P. Färfante (Holotype), off Sandy Bay, Barbados, Lesser Antilles (3×). Fig. 4-5. *Diodora jaumei* Aguayo and Rehder, Bird Key Reef, Tortugas (5×). Fig. 5-8. *Diodora jaumei* Aguayo and Rehder, Pirates Cove, Key West, Florida (3×). Fig. 9-11. *Diodora meta* von Ihering, off Sanibel Id., Florida (3×). Fig. 12-14. *Diodora meta* von Ihering, off Sanibel Id., Florida (3×).

with elongated brown spots. When the specimens are worn the spots turn pinkish. Sometimes there are present light brown rays varying in number from 5 to 7 over which the spots are clearly visible. Margin finely crenulated, the denticulations arranged in pairs. Inside color white with the sculpture of the outside showing through as fine radiating and concentric white lines. Internal callus of the orifice white, oval, truncated posteriorly.

	length	width	height	orifice length	
(large)	21	13	7	3.5 mm.	Varadero, Cuba
(average)	16	9	5	1.5	Dry Tortugas, Florida

*Types.* Holotype, United States National Museum no. 420974 Varadero, Matanzas Province, Cuba, M. L. Jaume collector. Paratypes from the same locality and from La Chorrera, Habana, Cuba.

*Remarks.* This delicate and beautiful species is rather rare although widely distributed. It has usually been collected in depths of 10 to 60 fathoms, though G. W. Van Hyning found live specimens on rocks at low water at Tortugas, Florida. A few specimens have been obtained in beach drift. From young specimens of *D. listeri*, which it approximates, it differs by having a less pronounced sculpture, with the ribs more closely set. The orifice of *D. jaumei* is ovate and not key-hole shaped as it is in *D. listeri* and also the orifice is not outlined or stained with black as it is in this latter species.

*Range.* Florida, from Lake Worth south to Tortugas and north along the Gulf coast to Camp Walton, Cuba and south to Trinidad.

*Records.* FLORIDA: Lake Worth; off Lantana (10 fathoms) (both T. Van Hyning); off Palm Beach (100 fathoms) (J. S. Schwengel); off Hollywood (20-60 fathoms); Pirates Cove, Key West (both L. A. Burry); Biscayne Bay (R. Humes); Camp Walton (T. Van Hyning); Pelican Shoals (45 fathoms) (J. S. Schwengel); Sand Key (T. Van Hyning); Dry Tortugas (B. R. Bales). CUBA: La Chorrera, Habana (C. G. Aguayo and M. L. Jaume); Varadero, Matanzas (MCZ). LESSER ANTILLES: Chaguaramas Bay, Trinidad (H. G. Kugler).

### *Diodora meta* v. *Ihering*, Plate 4, fig. 9-14

*Lucapina meta* v. *Ihering* 1927, Archv. für Molluskenkunde, 59, p. 98, pl. 1-4, 13-14 (Itapema, Sta. Catharina, Brasil).

*Description.* Shell thin, small, about 15 mm. in length and depressedly conical. Base oval or ovate. Anterior slope straight, posterior slope convex. Apex a little in front of the middle. Orifice small, about 1 mm. long, circular in shape and situated slightly in front of the apex. Sculpture consists of 37 or 38 strong, radiating and widely separated ribs, between which there are alternated fine riblets. Concentric, separated laminae give a lattice-like appearance to the shell surface, forming nodules or scales where these laminae intercept the ribs. It is typically unicolored a milky white. Margin finely crenulated. Interior color polished white, the outside sculpture showing through in the form of radiating and concentric white lines. Internal callus of the orifice the same color as the rest of the inside; it is round, truncated and slightly excavated behind.

	length	width	height	orifice length	
(large)	16	11	4	1.4 mm.	Itapema, Sta. Catharina, Brasil
(average)	14	9	4	1.3	Sanibel Id., Florida

*Types.* Holotype, Senckenberg Museum, Frankfurt a.M., no. 3279, Itapema, Sta. Catharina, Brasil.

*Remarks.* This beautifully sculptured species is exceedingly rare. It occurs in shallow water, living apparently below the low-water line though occasionally washed up on the beaches. At this writing only the two extremes in its distribution are known, namely Florida and Brasil. Shallow water dredging in the West Indies and along the coasts of Central and northern South America should indicate its presence.

*Range.* Southern Florida and Brasil.

*Records.* FLORIDA: off Palm Beach (12–14 fathoms) (J. S. Schwengel); off Hollywood (35–60 fathoms) (L. A. Burry); off Sanibel Id. (5 fathoms) (MCZ); off Sanibel Id. (4–6 fathoms) (J. S. Schwengel); Garden Key, Dry Tortugas (T. Van Hyning). BRASIL: Itapema, Sta. Catharina (H. v. Ihering, 1927).

### *Diodora viridula* Lamarck, Plate 6, fig. 1–4

*Fissurella viridula* Lamarck 1822, An. s. Vert., 6, pt. 2, p. 13 (locality unknown); B. Delessert 1841, Recueil de Coquilles Décrites par Lamarck, Paris, pl. 24, fig. 1a–d (mers de Chine).

*Fissurella bicolor* "C. B. Adams" Pilsbry 1891, Man. of Conch. (1), 12, p. 226 (West Indies).

*Description.* Shell medium in size, from 20 to 30 mm. in length, elevated, conical and narrower anteriorly. Front slope straight or slightly concave, posterior slope more or less convex. Apex in front of the middle, the orifice being situated immediately before it. The orifice is long, narrow and trilobated, sometimes having two small teeth on each side. Externally it is outlined or stained with black; its length is from one-sixth to one-eighth that of the shell. Sculpture consists of from 18 to 20 principal radiating ribs colored oyster-white or light gray, between which there are three smaller ribs, the middle one generally larger and all three colored dark greenish or bluish gray. Numerous growth lines cross the shell, forming nodules, sometimes strong, sometimes very fine. Margin strongly crenulated, the indentations of the principal ribs being deeper than those of the intermediates, thus causing the indentations of the latter to appear in groups of three. Color pattern of the outside is seen in the crenulations. Inside color polished bluish or greenish gray, the sculpture of the outside showing through as white lines. Internal callus of the orifice narrow, long-oval, truncated and excavated behind. Its color is the same as on the inside and it is surrounded by a black line which is irregularly rayed anteriorly and laterally. Muscle impression distinct.

	length	width	height	orifice length	
(large)	32	23	15	4 mm.	Virgin Gorda, Virgin Islands
(average)	26	19	11	3.5	Barbados, Lesser Antilles

*Types.* The type of *D. viridula* is in Lamarck's collection at the Geneva Museum. As Lamarck gave no locality and Delessert gave "mers de Chine," the seas of China, for this species in error, I select that of Cienfuegos, Cuba, to be the type locality.

*Remarks.* This well marked species is not closely related to any others in the Western Atlantic. It is characterized by the prominent radial ribs being oyster-white, the intermediate ribs being colored a greenish or bluish grey. It is rather widely distributed but not at all common, living attached to rocks in the lower inter-tidal zone.

*Range.* Florida, the Bahama Islands and south through the Antilles and Gulf of Mexico to Trinidad.

*Records.* FLORIDA: Ragged Keys, Biscayne Bay (L. A. Burry). BAHAMAS: Eight Mile Rock, Grand Bahama (MCZ); Nassau, New Providence (P. D. Ford); Little San Salvador Id.; Arthurstown, Cat Id.; Simms, Long Id.; Matthewtown, Great Inagua (all



MCZ). CUBA: Varadero; Guantánamo Naval Base; Puerto Escondido; Cienfuegos (all MCZ). HISPANIOLA: Puerta Plata (T. McGinty); El Canal, Cabo Macorís; Puerto Sosúa; Santa Bárbara de Samaná; Jérémie (all MCZ). JAMAICA: (MCZ). PUERTO RICO: Boca de Cangrejos (Univ. of Mich.); Arecibo (MCZ). VIRGIN ISLANDS: St. Thomas (MCZ); Virgin Gorda (M. W. Dewey). LESSER ANTILLES: Barbados; Trinidad (both MCZ). CARIBBEAN ISLANDS: Swan Id. (MCZ).

***Diodora minuta* Lamarek, Plate 5, fig. 1-4**

*Fissurella minuta* Lamarek 1822, An. s. Vert., 6, pt. 2, p. 15 (locality unknown).

*Fissurella elongata* C. B. Adams 1845, Proc. Boston Soc. Nat. Hist., 2, p. 8 (Jamaica).

*Fissurella gemmulata* Reeve 1850, Conch. Icon., 6, *Fissurella*, pl. 16, fig. 12 a-b (locality unknown).

**Description.** Shell rather thin, small, generally not exceeding 15 mm. in length, depressedly conical. Apex situated at the anterior third of the shell. Basal margin the same width at both ends, elliptical, the sides subparallel and a little raised in the middle so that the shell rests upon its ends. Front slope slightly concave, back slope convex. Orifice

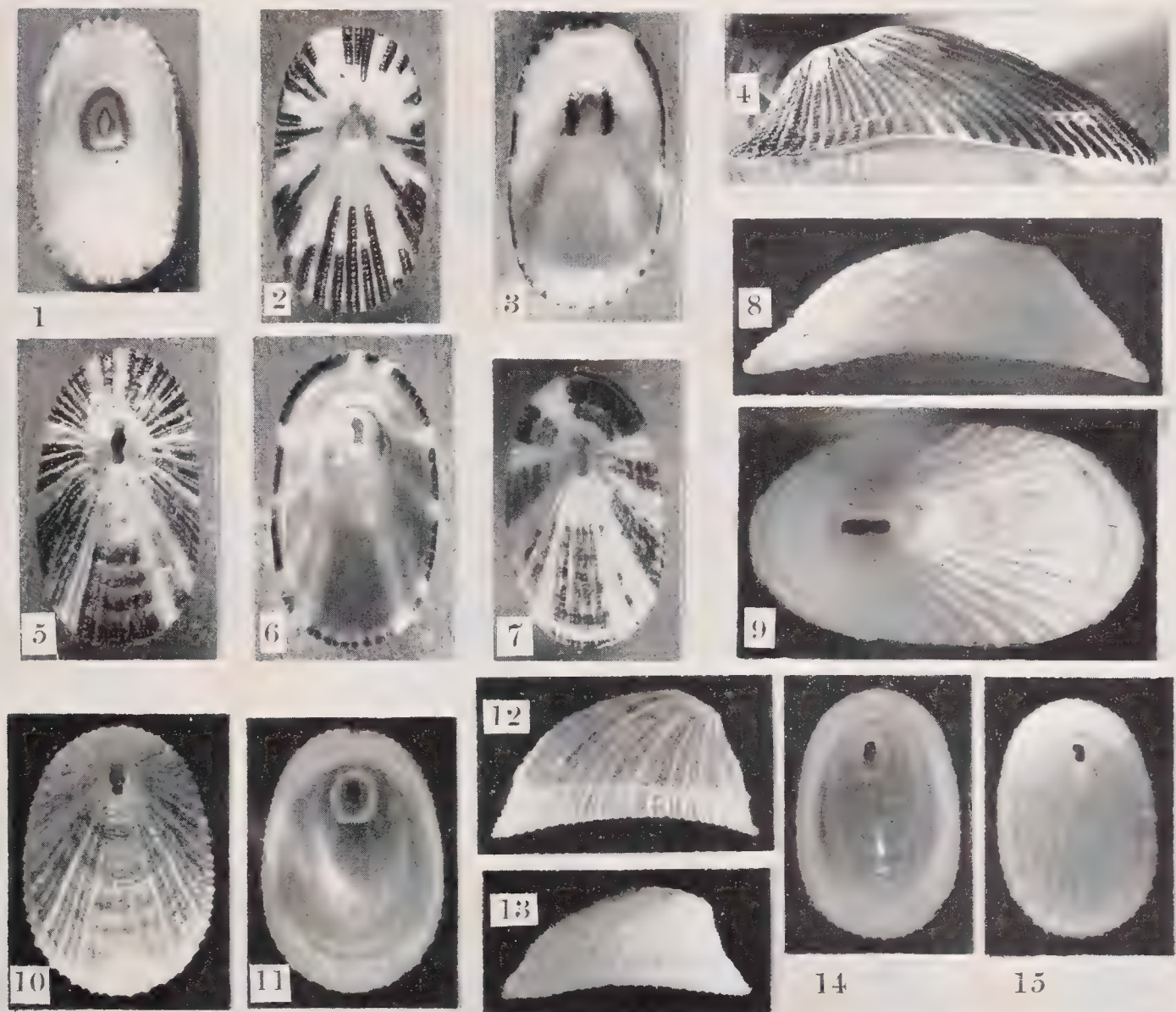


Plate 5. Fig. 1. *Diodora minuta* Lamarek, Athol Id., Bahamas (3×). Fig. 2-3. *Diodora minuta* Lamarek, Little San Salvador Id., Bahamas (3×). Fig. 4. *Diodora minuta* Lamarek, Arthurs-town, Cat Id., Bahamas (3×). Fig. 5-6. *Diodora minuta variegata* Sowerby, Athol Id., Bahamas (3×). Fig. 7. *Diodora minuta variegata* Sowerby, Guana Id., Tortola, Virgin Islands (3×). Fig. 8-9. *Diodora minuta variegata* Sowerby, Andros Id., Bahamas (3×). Fig. 10-12. *Diodora arcuata* Sowerby, Toco, Trinidad (3×). Fig. 13-15. *Diodora arcuata* Sowerby, Tobago, Lesser Antilles.

narrow and trilobated, with its posterior wall at the apex. Sometimes it is stained with black. Surface of shell shiny, sculptured with numerous rounded, subequal, radiating ribs, crossed by concentric raised threads which produce a beaded surface. Color oyster-white with numerous black or dark brown lines, generally arranged in seven or eight streaked rays, which form triangles in shape. Margin very finely crenulated. Interior color of shell a polished oyster-white, the color rays of the outside showing through. Internal callus of the orifice the same color as the inside, frequently bounded by a black streak.

	length	width	height	orifice length	
(large)	16.5	9	5	2 mm.	Arthurstown, Cat Id., Bahamas
(average)	11	6	3	1.5	Pelican Shoals, Florida

*Types.* The type of this species is in Lamarck's collection at the Geneva Museum. That of *F. clongata* C. B. Adams, is at the Museum of Comparative Zoölogy no. 155533 (Holotype). The type figures are those of *B. Delessert* 1841, Recueil Coquilles Décrites par Lamarck, Paris, pl. 24, fig. 3a-d. As Lamarck gave no locality, I select Arthurstown, Cat Id., Bahamas, as the type locality.

*Remarks.* This small, pretty species is rare and so far as known rather restricted in its range. As the records indicate below, the specimens from Florida occur mainly in fairly deep water. Bahama specimens were found under rocks in rather exposed places and washed up on the beaches.

*Range.* Florida, the Bahamas and south through the Greater and to the northern Lesser Antilles.

*Records.* FLORIDA: off Lantana (32 fathoms) (T. Van Hyning); Boynton Beach (T. McGinty); off Ft. Lauderdale (20-60 fathoms) (L. A. Burry); off Cape Florida (6 fathoms) (T. Van Hyning); Pelican Shoals (B. R. Bales); off Sand Key, *Blake*, (80 fathoms) (MCZ); Dry Tortugas (T. Van Hyning). BAHAMAS: Alicetown, Bimini Ids.; Nassau, New Providence; Little San Salvador Id.; Matthewtown, Great Inagua; Arthurstown, Cat Id.; Seymours, Long Id. (all MCZ); Atholl Id., New Providence (P. D. Ford). CUBA: Habana (C. G. Aguayo); Guantánamo Naval Base (MCZ). JAMAICA: (MCZ). PUERTO RICO: Boca de Cangrejos (Univ. of Mich.); Arecibo (MCZ). VIRGIN ISLANDS: St. Thomas (MCZ); Guana Id., Tortola; Virgin Gorda (both M. W. Dewey). LESSER ANTILLES: off Sombrero Id., *Blake* (72 fathoms) (MCZ).

### *Diodora minuta variegata* Sowerby, Plate 5, fig. 5-9

*Fissurella variegata* Sowerby 1862, Thes. Conch., 3, p. 200, *Fissurellidae*, pl. 7, fig. 172, 173 (Isle of St. Thomas).

*Description.* The orifice and general shape are similar to those of *D. minuta*, the color and color pattern being the determining characteristics. *D. minuta variegata* may be unicolorated or with a secondary color in addition. When unicolorated, it is white or cream. When the secondary color is present, it is in the form of color triangles which are generally brownish or olivaceous. The color triangles in this subspecies are solid, the color appearing on both the ribs and in the spaces between, while in *D. minuta* the color triangles have only the radiating ribs pigmented. The sculpture may be the same, but occasional examples of *D. minuta variegata* show a reticulated pattern rather than the usual one of fairly strong radiating ribs crossed by fine concentric threads.

	length	width	height	orifice length	
(large)	15	9	5	2 mm.	Staniard Creek, Andros Id., Bahamas
(average)	12	7	4	1.5	Guana Id., Tortola, Virgin Islands

*Types.* The types of *D. minuta variegata* are probably at the British Museum. The type locality is St. Thomas, Virgin Islands.

*Remarks.* In my opinion, *variegata* is only a subspecies of *D. minuta*, as the differences between the two, though rather constant, are not at all great. It is fairly rare and so far has not been found in Florida.

*Range.* The Bahama Islands and south to the northern Lesser Antilles.

*Records.* BAHAMAS: Fox Hill, New Providence (MCZ); Staniard Creek, Andros Id.; Atholl Id., New Providence (all P. D. Ford); Arthurstown, Cat Id. (MCZ). CUBA: Punta de los Colorados, Cienfuegos (MCZ). HISPANIOLA: Monte Cristi; Puerto Sosuá; Santa Bárbara de Samaná (all MCZ). JAMAICA: (AMNH). PUERTO RICO: Boca de Cangrejos (Univ. of Mich.). VIRGIN ISLANDS: St. Thomas (MCZ); Guana Id., Tortola (M. W. Dewey).

### *Diodora arcuata* Sowerby, Plate 5, fig. 10-15

*Fissurella arcuata* Sowerby 1862, Thes. Conchy. 3, p. 199, *Fissurellidae*, pl. 7, fig. 163, 164 (Island of St. Thomas).

*Description.* Shell rather small, about 10 mm. in length, conical, elevated, sometimes to a considerable degree and slightly narrower in front. Summit completely curved forward, situated in the first third. Anterior slope short and steep; posterior slope very convex. Orifice situated at the apex, very small and trilobated, the central portion broader than the ends. Surface dull, sculptured with numerous alternating larger and smaller radiating ribs. These are crossed by many fine concentric threads which form very minute scales where they intercept the ribs; both ribs and threads are so close-set that the whole shell has a scaly appearance. Basal margin narrowed anteriorly, ovate, with the sides arched so that the shell rests upon the two ends alone. Color white or cream, with 8-10 tan or light brown, solid or broken rays. Margin very finely and sharply crenulated. Interior color a polished white. Internal callus of the orifice also white, oval and very slightly truncated behind.

	length	width	height	orifice length	
(large)	12	8	5	2 mm.	Palm Beach, Florida
(average)	10	7	5	1.5	Tobago Id., Lesser Antilles

*Types.* The type of this species is probably in the British Museum. The type locality is St. Thomas, Virgin Islands.

*Remarks.* *D. arcuata* is apparently related to *D. minuta variegata* but differs by being higher, the apex definitely curved forward, the anterior slope shorter and the posterior slope more pronouncedly convex. The sculpture also is different, being scaly in *D. arcuata*, and beaded or reticulated in *D. minuta variegata*; finally, the color rays in *D. arcuata* are a lighter brown.

This is an exceedingly rare species and although it probably extends through the arc of the Greater and Lesser Antilles, we know of its occurrence from only five localities. It occurs in shallow water attached to rocks.

*Range.* Florida, Bahamas, Greater and Lesser Antilles south to Trinidad.

*Records.* FLORIDA: Palm Beach (12-14 fathoms) (J. S. Schwengel). BAHAMAS: Arthurstown, Cat Id. (MCZ). PUERTO RICO: Boca de Cangrejos (Univ. of Mich.). VIRGIN ISLANDS: St. Thomas (Sowerby 1862, in explanation of figures). LESSER ANTILLES: Tobago; Toco, Trinidad (both MCZ).

**Diodora fluviana** Dall, Plate 6, fig. 5-8

*Glyphis fluviana* Dall 1889, Bull. Mus. Comp. Zoöl. 18, p. 408, pl. 14, fig. 6, 6a (off Bahía Honda, Cuba).

**Description.** Shell very thin and small, about 9 mm. in length, conical and elevated. Slopes concave near the apex, becoming later straight or slightly convex. Summit anterior to shell center, a little curved forward and pierced by the orifice. The latter is about 1 mm. long and circular in shape. Sculpture consists of 17 or 18 principal ribs between which are intercalated 3 riblets, the central one being stronger than the other two. The shell is crossed by close-set concentric threads which form small nodules or scales where they intercept both ribs and riblets. Shell dull, may be unicolored either white or olive-green; or may be white with the green color forming an interrupted band at the margin. Some of the principal anterior ribs are colored orange. The shell is translucent,

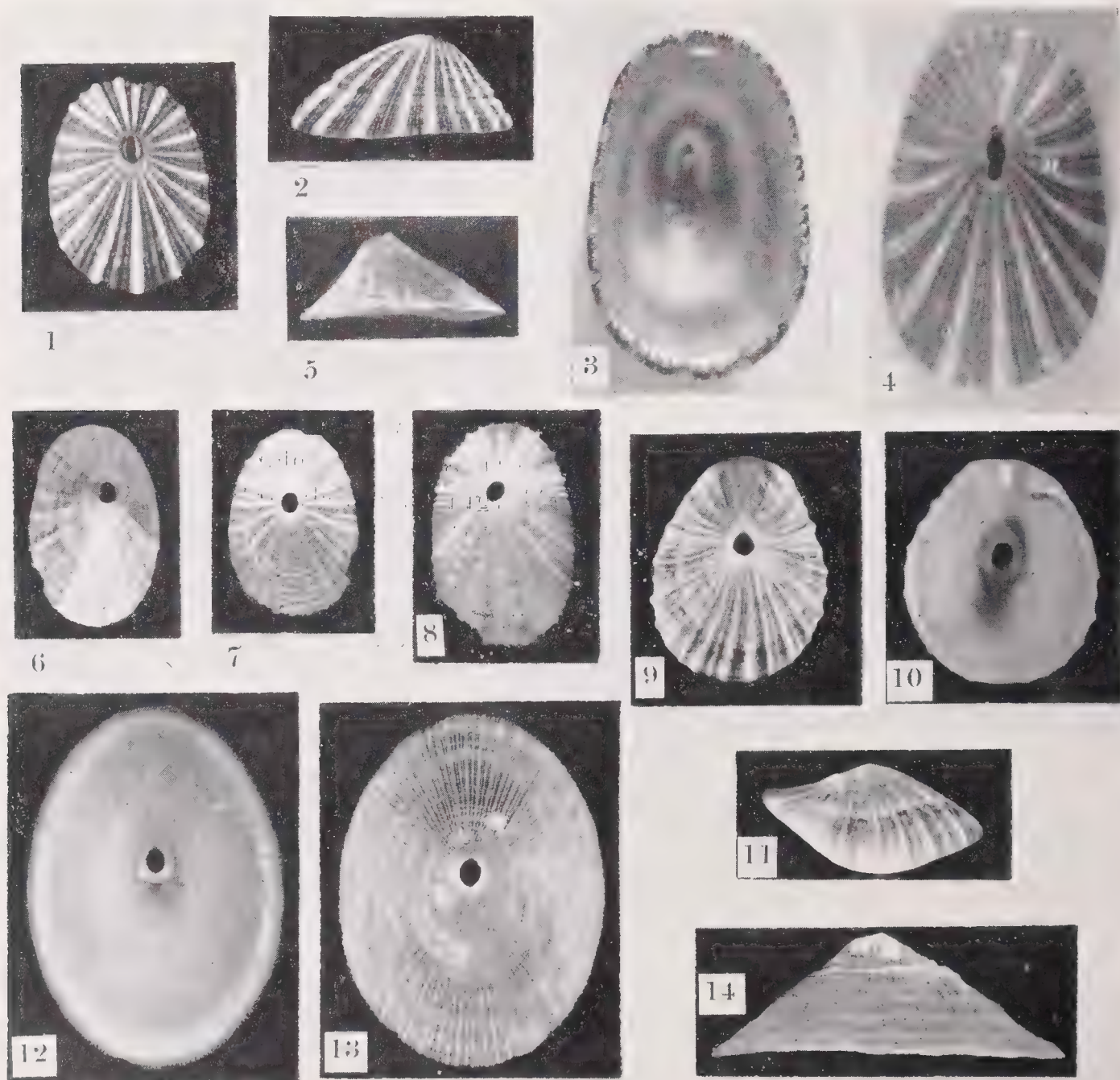


Plate 6. Fig. 1-2. *Diodora viridula* Lamarck, Barbados, Lesser Antilles (nat. size). Fig. 3-4. *Diodora viridula* Lamarck, Cienfuegos, Cuba (3×). Fig. 5-6. *Diodora fluviana* Dall, off Grenada Id., Lesser Antilles (Paratype, 3×). Fig. 7. *Diodora fluviana* Dall, off Palm Beach, Florida (3×). Fig. 8. *Diodora fluviana* Dall, off Lower Keys, Florida (3×). Fig. 9-11. *Fissurella subrostrata* Sowerby, West Indies (nat. size). Fig. 12-14. *Diodora tanneri* Verrill, off Sagua la Grande, Cuba (nat. size).

the color of the exterior being visible on the inside: the stronger sculpture of the outside showing through in the form of shallow grooves, while the riblets are seen as fine lines. Interior surface glossy. Internal callus of the orifice truncated-oval, the same color as the rest of the inside.

	length	width	height	orifice length	
(large)	10	6	4	0.75 mm.	off Lower Keys, Florida
(average)	8	5	3.5	0.5	Grenada Id., Lesser Antilles

*Types.* Holotype, Museum of Comparative Zoölogy no. 7632, off Bahía Honda, Cuba (N. Lat.  $23^{\circ}02'30''$ ; W. Long.  $83^{\circ}11'$ ) *Blake*, station 21 in 287 fathoms. Paratypes from off Grenada, Lesser Antilles, *Blake*, station 247 in 170 fathoms.

*Remarks.* This is a well marked species, not particularly close in its relationships to other Western Atlantic *Diodora*. It is rare and only a few specimens have been obtained in fairly deep water (100 to 805 fathoms).

*Range.* Southern Florida and south through the Greater and Lesser Antilles, probably to Trinidad.

*Records.* FLORIDA: off Palm Beach (100 fathoms) (J.S. Schwengel); off Lower Keys (L. A. Burry). CUBA: off Bahía Honda, *Blake*, station 21 (287 fathoms); off Habana, *Blake*, station 247 (170 fathoms) (both MCZ). LESSER ANTILLES: off Grenada, *Blake*, station 247 (170 fathoms) (MCZ).

### *Diodora tanneri* Verrill, Plate 6, fig. 12-14

*Diodora tanneri* Verrill 1883, Proc. United States Nat. Mus. (for 1882), **5**, p. 333 (off Delaware Bay); Verrill 1884, Trans. Connecticut Acad., **6**, p. 255, pl. 19, fig. 13, 13a.

*Description.* Shell rather thin, large, reaching a length of 50 mm., conical and moderately elevated. Slopes straight, the posterior sometimes slightly convex. Base broadly ovate. Apex in front of the middle, pierced by a circular orifice. The latter is small, from one-tenth to one-twelfth the length of the shell. Sculpture consists of numerous, very fine, close-set radiating ribs, some beginning at the orifice, while the remaining interstitial ribs commence progressively below. The long ribs become increasingly stronger near the base of the shell. These ribs are crossed by numerous raised concentric threads which form nodules or small scales where they intercept the radial ribs. Color uniform oyster-white or yellowish gray. Margin very finely crenulated. Inside color a lustrous oyster-white. The internal callus of the orifice the same color as the interior, rounded and truncated behind. Muscle impression hardly visible.

	length	width	height	orifice length	
(large)	50	33	15	4 mm.	off Virginia
(average)	40	28	16	3	off Barbados

*Types.* Holotype, United States National Museum, off Delaware Bay, *Fish Hawk*, 1881, station 1046 in 104 fathoms.

*Remarks.* This is one of the most beautiful species in the genus. It is quite different from the other Western Atlantic species and not closely related to any of our forms. It is very rare and has been found only in depths of 100 to 400 fathoms.

*Range.* From Delaware Bay south through the Greater and Lesser Antilles to Barbados.

*Records.* DELAWARE: off Delaware Bay, *Fish Hawk*, station 1046 (104 fathoms)

(Verrill 1883, p. 333). VIRGINIA: off Virginia (N. Lat.  $37^{\circ}46'$ : W. Long.  $74^{\circ}10'$ ), *Atlantis*, station 3986 (106 fathoms) (MCZ): off Virginia, *Albatross*, station 2264 (167 fathoms) (Yale). GEORGIA: off Brunswick, *Atlantis*, station 3781 (265–290 fathoms) (MCZ). CUBA: off Sagua la Grande, Sta. Clara (N. Lat.  $23^{\circ}21'30''$ : W. Long.  $79^{\circ}54'$ ), *Atlantis*, station 3446 (360 fathoms). LESSER ANTILLES: off Barbados, *Blake*, station 288 (399 fathoms) and *Hassler* (100 fathoms) (both MCZ).

\* \* \* \*

I add the following *Fissurella* omitted from my report in *Johnsonia*, no. 10. Additional study, particularly of *Diodora*, indicates that this species is a true *Fissurella*.

***Fissurella subrostrata* Sowerby, Plate 6, fig. 9–11**

*Fissurella subrostrata* "Gray" Sowerby 1835, Conch. Illust., *Fissurella*, pt. 73, fig. 35 [with name in explanation of plates and p. 6 of Catalogue of the species] (St. Vincents [Lesser Antilles]).

*Description.* Shell heavy, elevated, about 30 mm. in length, compressed and attenuated anteriorly and broadly rounded posteriorly. Both extremities raised, the anterior much more so, to such a degree that the front slope is almost parallel to the plane upon which the shell rests. Outline ovate. Anterior and lateral slopes straight; posterior, convex. Orifice situated on the anterior portion of the second third, elliptical in form, its length being about one-seventh that of the shell. Surface sculptured with about 26 strong, very widely separated radiating ribs; those situated anteriorly are less pronounced. The interspaces between the ribs have several striae. Laminae, which are low and rather separated, cross the shell forming small scales over the ribs. Ground color buff, the ribs being of a lighter shade, with several brown striae between the ribs. Margin crenulations rather widely spaced. Inside color polished cream. Internal callus of the orifice the same color as the rest of the inside. Muscle scar wide and deeply impressed, lying near the margin.

length	width	height	orifice length	
30	24	13	4.5 mm.	West Indies

*Types.* The type of *F. subrostrata* is in the British Museum, the type locality being St. Vincent, Lesser Antilles.

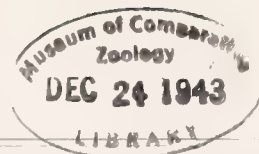
*Remarks.* This is an exceedingly rare species. It has been considered a *Diodora* but it has all the characteristics of a *Fissurella*. The internal callus of the orifice is the same width throughout, not truncated; the extremities of the shell are raised, a characteristic never present in the genus *Diodora*. *F. subrostrata* is related to *F. punctata* and *F. fascicularis* from which it differs by its elliptical orifice which is quite different from the cross-shaped orifice of the latter species. Its sculpture consists of rather widely separated ribs, while in that of the others, the ribs are close-set. Finally, although the ground color is buff, there is absent the more or less extensive red color found in *F. punctata* and *F. fascicularis*.

This species probably lives well below the low-water line. Nothing is known about its life history nor, for that matter, its habits. I have seen only one specimen and this agrees perfectly with the figure and description of Sowerby.

*Range and Records.* Known only from the type locality.

# JOHNSONIA

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TROCHIDAE

NUMBER 12

## THE GENERA GAZA AND LIVONA IN THE WESTERN ATLANTIC

BY  
W. J. CLENCH AND R. T. ABBOTT

Both of these genera are important members of the Western Atlantic fauna: *Gaza*, as possessing four of the six known forms and *Livona*, as a genus peculiar to this region. The family Trochidae to which they both belong, is large and extensively distributed all over the world. In addition, it is a family that is exceedingly rich in deep sea species. Possessing nacreous shells which are frequently polished for ornaments, the smaller species strung for necklaces and others are cut up for art work. *Trochus niloticus* has considerable use in button manufacturing and a large trade was established by the Japanese in the Western Pacific for this purpose. The collecting of this species with small boats enabled them to reach most if not all of the Western Pacific Islands and the islands comprising the East Indies. Such a procedure enabled them to gain an incredible amount of data, not by any means limited to this reef-loving mollusk.

We are indebted to Paul Bartsch of the United States National Museum for the generous loan of their material on *Gaza*. This collection has added much to the value of our data. Credit is given in the records as USNM.

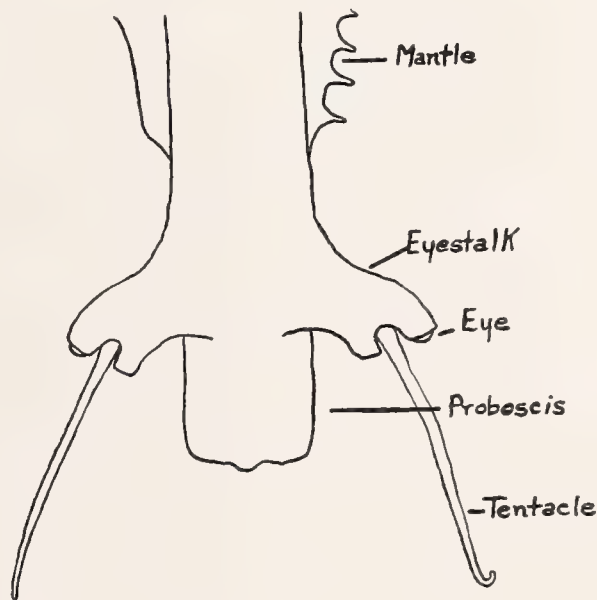


Plate 1. *Livona pica* Linné

Shell with animal extended.  
Cable Beach, Guantánamo, Cuba.  
(Reduced about one-third)

Outline of head  
(Enlarged about 3×). Both  
drawn by R. T. Abbott.

**Gaza Watson**

*Gaza* Watson 1879, Jour. Linn. Soc. **14**, p. 601; Watson 1886, Report on the Voyage of H.M.S. Challenger, Zoology, **15**, p. 93.

Shell turbinate to depressed turbinate, rather thin, generally highly opalescent. Umbilicus deep, rather wide and partially or completely covered by a columellar pad or callus. Operculum corneous, multispiral, thin and colored a pale amber.

Genotype (monotypic) *Gaza daedala* Watson

*Gaza* is one of the most beautiful of our deep-sea mollusks. It possesses a thin and delicate structure which differs quite sharply from most other trochoids. It is highly opalescent, even on the main portion of the whorls which is covered with a very thin periostracum. A few of the species are finely sculptured and the early whorls are rather deeply pigmented with opalescent purple. Though still exceedingly rare, future dredgings, particularly off Florida and in the West Indies, should bring to light many more specimens.

**Gaza superba** Dall, Plate 2, fig. 1-2

*Callogaza superba* Dall 1881, Bull. Mus. Comp. Zoöl. **9**, p. 49 (off Montserrat, West Indies).

*Gaza* (*Callogaza*) *superba* Dall 1889, Bull. Mus. Comp. Zoöl. **18**, p. 354, pl. 22, fig. 4-4a.

*Gaza superba* Dall, Clench and Aguayo 1938, Mem. Soc. Cubana Hist. Nat. **12**, p. 380.

**Description.** Shell 30 to 40 mm. in width, thin, turbinate and opalescent. Whorls 8 to  $8\frac{1}{2}$ , strongly convex. Color old ivory with an opalescent sheen on all portions of the shell. Early whorls faintly wine-colored. Aperture subelliptical. Umbilicus deep and fairly wide; the whorls within visible and slightly inset. Columellar callus or pad nearly covering the umbilical opening. Outer lip slightly thickened and reflexed. Spire somewhat

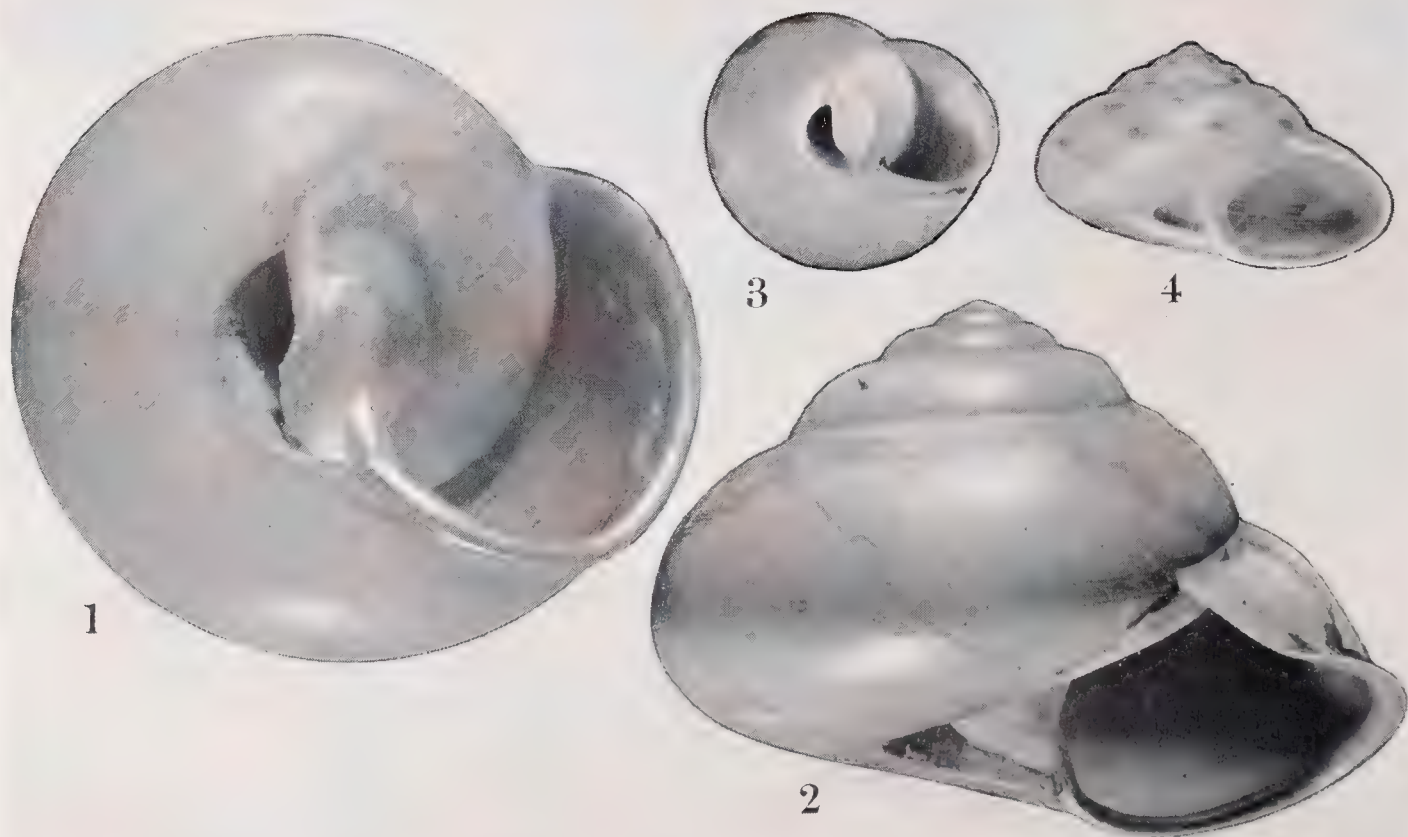


Plate 2. Fig. 1. *Gaza superba* Dall, off Habana, Cuba. Holotype ( $2\times$ ). Fig. 2. *Gaza superba* Dall, off Mobile Bay, Alabama ( $2\times$ ). Fig. 3. *Gaza watsoni* Dall, off Habana, Cuba. Holotype ( $2\frac{1}{2}\times$ ). Fig. 4. *Gaza watsoni* Dall, off Matanzas, Cuba ( $2\frac{1}{2}\times$ ).



elevated. Suture distinct and impressed. Nuclear whorls smooth. Spiral sculpture of minute incised lines, scarcely apparent on early whorls, fairly strong on later whorls. Axial sculpture of very fine growth lines. Periostracum absent. Operculum thin, light brown in color and multispiral.

	height	width	
(large)	32	40 mm.	(Dall 1889, p. 354)
(average)	25.5	35.5	off Montserrat, Lesser Antilles
(small)	20	27.5	off Barbados, Lesser Antilles

*Types.* Lectotype, Museum Comparative Zoölogy, no. 7541, *Blake*, station 153, from off Montserrat, Lesser Antilles in 303 fathoms. Cotype, Mus. Comp. Zoöl. no. 7542, *Blake*, station 274, from off Barbados in 209 fathoms.

*Remarks.* Much more material is needed before a complete understanding can be had of all these species. The records would indicate that all are pretty well distributed throughout the West Indies, though at this writing these records are fairly well scattered. The subspecies, *G. superba cubana* Cl. and Ag. may eventually prove to be a distinct species. There appears to be no overlap in the size of the two forms.

*Range.* Deep water (155 to 324 fathoms) northern Gulf of Mexico and probably throughout the West Indies south to northern South America.

*Records.* ALABAMA: *Albatross*, station 2376 (N. Lat. 29°03'; W. Long. 88°16') off Mobile Bay in 324 fathoms (USNM). FLORIDA: *Albatross*, 2397 (N. Lat. 28°42'; W. Long. 86°36') northern Gulf of Mexico in 280 fathoms (USNM). VIRGIN ISLANDS: *Blake*, station 129, off St. Croix in 314 fathoms (USNM). LESSER ANTILLES: *Blake*, station 153, off Montserrat in 303 fathoms (MCZ); *Blake*, station 274, off Barbados in 209 fathoms (MCZ); *Blake*, station 275, off Barbados in 218 fathoms and station 281 in 288 fathoms (both USNM). COLOMBIA: *Albatross*, station 2143 (N. Lat. 9°30'45''; W. Long. 76°25'30'') off Morrosquillo in 155 fathoms (USNM).

### ***Gaza superba cubana* Clench and Aguayo, Plate 3, fig. 1-2**

*Gaza superba cubana* Clench and Aguayo 1940, Mem. Soc. Cubana Hist. Nat. 14, p. 81, pl. 15, fig. 3 (off Sagua la Grande, Santa Clara, Cuba).

*Description.* Shell 23 mm. in width, thin, depressed turbinate and opalescent. Whorls 7, strongly convex. Color old ivory with an opalescent sheen on all portions of the shell. Early whorls often a vivid wine-color. Aperture subelliptical. Umbilicus deep and fairly wide, the whorls within visible and slightly inset. Columellar callus or pad nearly covering the umbilical opening. Outer lip slightly thickened and reflexed. Spire somewhat depressed. Suture distinct and impressed. Nuclear whorls smooth. Spiral sculpture of minute incised lines, scarcely apparent on early whorls, fairly strong on later whorls. Axial sculpture of very fine growth lines. Periostracum absent. Operculum unknown.

height	width	
13	23 mm.	Holotype. Off Sagua la Grande, Santa Clara Prov., Cuba
13.5	22.5	Paratype. Off Punta Alegre, Camagüey Prov., Cuba

*Types.* Holotype, Museum Comparative Zoölogy, no. 135151, *Atlantis*, station no. 3448 (N. Lat. 23°21'; W. Long. 79°56') off Sagua la Grande, Santa Clara Prov., Cuba in 380 fathoms. The following paratypes are all from the *Atlantis* dredgings and all are off the northern coast of Cuba: station 3419 (N. Lat. 22°46'; W. Long. 79°00') off Punta Alegre in 180 fathoms; station 3469 (N. Lat. 23°12'; W. Long. 81°22') off Ma-

tanzas in 425 fathoms; station 3475 (N. Lat.  $23^{\circ}18'$ ; W. Long.  $80^{\circ}48'$ ) off Cárdenas in 400 fathoms; station 3476 (N. Lat.  $23^{\circ}18'30''$ ; W. Long.  $80^{\circ}52'$ ) off Cárdenas in 360 fathoms; station 3485 (N. Lat.  $23^{\circ}13'$ ; W. Long.  $81^{\circ}22'$ ) off Matanzas in 385 fathoms (all MCZ and Museo Poey, Habana).

*Remarks.* See under *G. superba* Dall.

*Range.* Known only from deep water (180 to 425 fathoms) off northern Cuba.

*Records.* (See also under Types). FLORIDA: off Tortugas in 197 and 249–358 fathoms (USNM).

### *Gaza fischeri* Dall, Plate 3, fig. 3–5

*Gaza fischeri* Dall 1889, Bull. Mus. Comp. Zoöl. **18**, p. 355, pl. 37, fig. 6 (off St. Lucia, West Indies); Clench and Aguayo 1938, Mem. Soc. Cubana Hist. Nat. **12**, p. 380.

*Description.* Shell 27 mm. in width, thin, depressed turbinate and opalescent. Whorls 6 to  $6\frac{1}{2}$ , strongly convex. Color old ivory with a brilliant opalescent sheen on all portions of the shell. Early whorls rarely wine-colored. Aperture subelliptical. Umbilicus deep and fairly wide but whorls within not visible. Columellar callus or pad completely covering the umbilical opening. Outer lip slightly thickened and reflexed. Spire somewhat depressed. Suture distinct and impressed. Nuclear whorls smooth. Spiral sculpture of minute incised lines, scarcely apparent on early whorls, fairly strong on later whorls. Axial sculpture of numerous fine comma-shaped ridges on the upper portion of the whorls, strongly developed on the early whorls, but usually absent on the body whorl. Periostracum absent. Operculum thin, corneous, light amber in color and multispiral.

height	width	
17.5	27.5 mm.	Off Sagua la Grande, Santa Clara Prov., Cuba
17	24	Off St. Lucia, Lesser Antilles

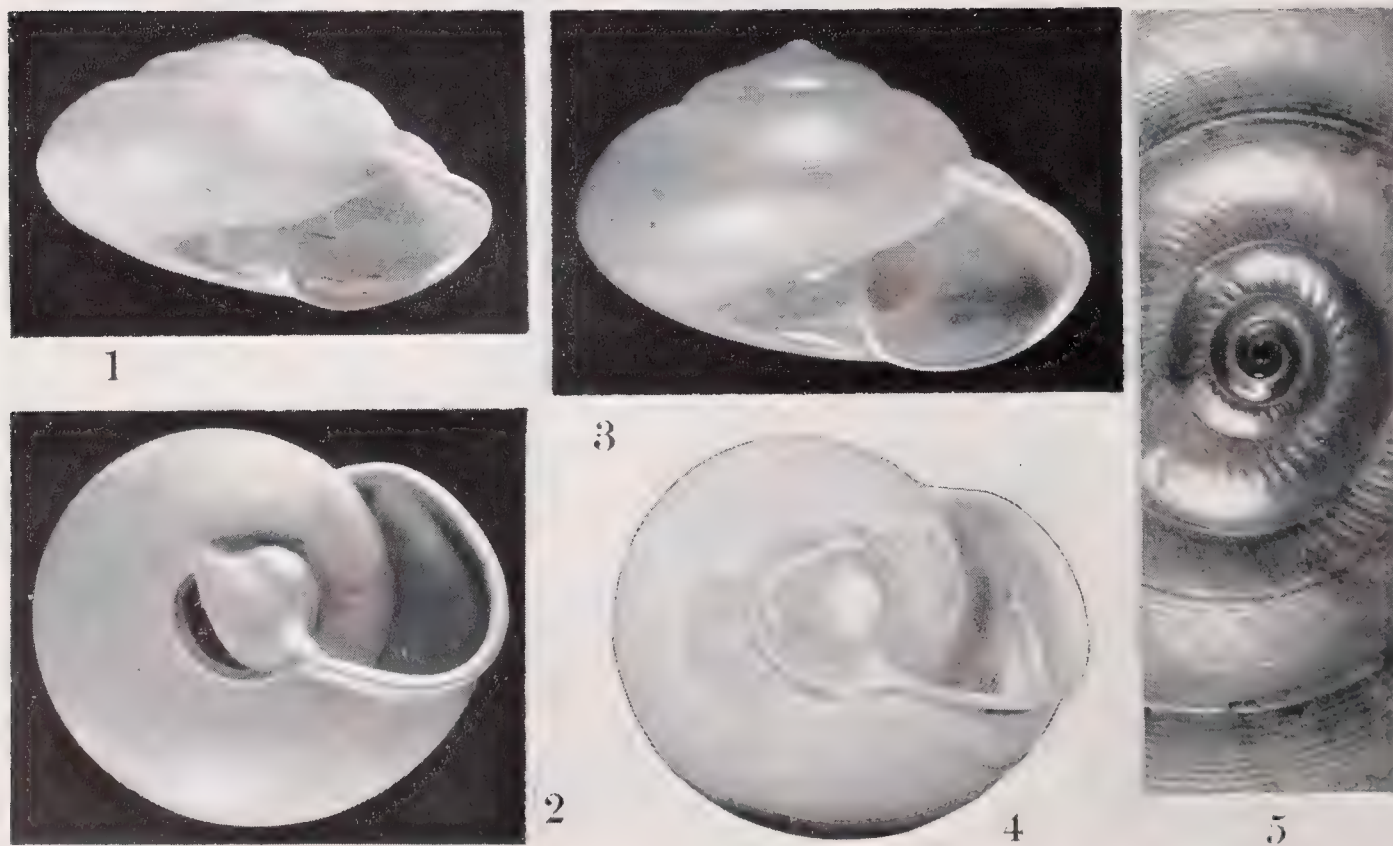


Plate 3. Fig. 1–2. *Gaza superba cubana* Cl. and Ag., off Sagua la Grande, Cuba. Holotype ( $2\times$ ). Fig. 3. *Gaza fischeri* Dall, off Sagua la Grande, Cuba ( $2\times$ ). Fig. 4. *Gaza fischeri* Dall, off St. Lucia, Lesser Antilles. Lectotype ( $2\times$ ). Fig. 5. *Gaza fischeri* Dall, off Cárdenas, Cuba ( $6\times$ ).

*Types.* Lectotype, Museum Comparative Zoölogy, no. 7543, *Blake*, station 221, off St. Lucia, Lesser Antilles, in 423 fathoms.

*Remarks.* See under *G. superba* Dall.

*Range.* Known only from deep water (423 to 500 fathoms) off northern Cuba and south to St. Lucia, Lesser Antilles.

*Records.* CUBA: *Atlantis*, station 2991 (N. Lat. 23°21'; W. Long. 80°23') off Sagua la Grande in 475 fathoms; *Atlantis*, station 3471 (N. Lat. 23°21'; W. Long. 80°56') off Cárdenas in 500 fathoms (both MCZ); *Albatross*, station 2351 (N. Lat. 22°41'; W. Long. 84°16'30'') off Cayo Jutias, north coast of Pinar del Rio in 426 fathoms (USNM). LESSER ANTILLES: *Blake*, station 221, off St. Lucia in 423 fathoms (MCZ).

### Subgenus *Callogaza* Dall

*Callogaza* Dall 1881, Bull. Mus. Comp. Zoöl. 9, p. 50; Dall 1889, Bull. Mus. Comp. Zoöl. 18, p. 356.

This subgenus differs from *Gaza* s.s. in possessing minor color blotches or patches and having strongly shouldered whorls.

Subgenotype (subsequent designation 1889) *Callogaza watsoni* Dall

### *Gaza (Callogaza) watsoni* Dall, Plate 2, fig. 3-4

*Callogaza watsoni* Dall 1881, Bull. Mus. Comp. Zoöl. 9, p. 50 (off Habana, Cuba).

*Margarita flogyra* Dall 1881, Bull. Mus. Comp. Zoöl. 9, p. 42, (off Bahía Honda, Cuba).

*Gaza (Callogaza) watsoni* Dall 1889, Bull. Mus. Comp. Zoöl. 18, p. 356, pl. 22, fig. 7-7a; pl. 23, fig. 1-1a; pl. 24, fig. 2-2a.

*Gaza watsoni* Dall, Clench and Aguayo 1938, Mem. Soc. Cubana Hist. Nat. 12, p. 381.

*Description.* Shell 15 mm. in width, thin, depressed turbinate and opalescent. Whorls 6 to 7, strongly convex and shouldered. Color old ivory with an opalescent sheen on all portions of the shell. First whorl dark amber. In addition, there is a series of small irregular patches of light brown disposed along the whorls. Aperture subcircular. Umbilicus deep and fairly wide, the whorls within visible and slightly inset. Columellar callus or pad slightly covering the umbilical opening. Outer lip slightly thickened and reflexed. Spire somewhat depressed. Suture distinct and impressed. Nuclear whorls smooth. Spiral sculpture of minute incised lines scarcely apparent on early whorls, fairly strong on later whorls. Axial sculpture of numerous comma-shaped ridges on the upper portion of each whorl, strongly developed on the early whorls and much finer on the body whorl. Periostracum absent. Operculum thin, corneous, light amber in color and multispiral.

	height	width	
(large)	10.5	14.5 mm.	Off Barbados, Lesser Antilles
(average)	8	11	Holotype. Off Habana, Cuba

*Types.* Holotype, Museum Comparative Zoölogy, no. 7544, *Blake*, station 12, off Habana, Cuba in 177 fathoms.

*Remarks.* This species is smaller than all other West Indian forms of *Gaza*, has a proportionately heavier shell, much stronger spiral sculpture, far less opalescence and rather strongly shouldered whorls.

*Range.* Known only from deep water (117 to 500 fathoms) from northern Cuba south to Brasil.

*Records.* CUBA: *Blake*, station 12, off Habana in 117 fathoms. (MCZ); *Atlantis*, station 2999, off Matanzas in 190 fathoms and station 3463 in 230 fathoms (both MCZ);

*Atlantis*, station 2963, Bahía de Cochinos in 190 fathoms (MCZ). VIRGIN ISLANDS: *Caroline*, station 100, off Tortola in 100 to 300 fathoms (USNM). LESSER ANTILLES: *Caroline*, station 102, off Anegada in 90 to 500 fathoms (USNM); *Blake*, station 299, off Barbados in 140 fathoms (MCZ). SOUTH AMERICA: *Albatross*, station 2756, off Para River, Brasil in 391 fathoms (USNM).

### Key to the Western Atlantic *Gaza*

- |  |                 |
|--|-----------------|
| 1. Shell with small, brown color patches; whorls shouldered  | <i>watsoni</i>  |
| 2. Shell without brown color patches; whorls usually rounded | 3               |
| 3. Columellar pad completely covering the umbilicus          | <i>fischeri</i> |
| 4. Columellar pad partially covering the umbilicus           | 5               |
| 5. Shell less than 30 mm. in width; spire depressed          | <i>cubana</i>   |
| 6. Shell greater than 30 mm. in width; spire elevated        | <i>superba</i>  |

### Livona Gray

*Livona* Gray 1842, Syn. Cont. of British Museum, ed. 44, p. 57; Gray 1847 (November) Proc. Zool. Soc. London, p. 145. [*Meleagris* Denys de Montfort 1810, non Linné 1758, non Fischer von Waldheim 1835; *Cittarium* Philippi 1847 (February); *Livonia* of authors, not of Gray 1855, are synonyms.]

Genotype (monotypic) *Turbo pica* Linné

Shell turbiniform, large and elevated with strongly rounded whorls. Aperture nearly circular. Umbilicus deep with a tooth-like extension of the callus projecting over the umbilical opening. The radula possesses a large number of lateral teeth. Operculum circular, chitinous and multispiral. This genus contains but a single species.

The status of the name *Livona* is still uncertain. Gray instituted the name first in 1841 (Synopsis of the Contents of the British Museum, ed. 42, 1840 [1841]) without any definition. He defined it in 1842 (44th. ed.) but did not cite any species. As their title would indicate, these were but guidebooks to the exhibition cases of shells in the British Museum. Gray, in 1847 (citation above) published a list of genera with synonymies and included type designations. However, if the 1842 publication is eventually ruled out, the name of this genus will change to *Cittarium* Philippi, which appeared in February 1847, as Gray's generic list did not appear until November of the same year. *Turbo pica* Linné is monotypic for *Meleagris* Mont., *Livona* Gray, and *Cittarium* Phil.

An excellent review of this situation covering Gray's use of *Livona* and other genera first introduced in the British Museum Guides, has been published by Iredale (1913, Proc. Malac. Soc. 10, pp. 294-309).

### *Livona pica* Linné, Plate 1 and Plate 4

*Turbo pica* Linné 1758, Syst. Nat. ed. 10, p. 763 (M. Sardinico).

*Meleagris picus* Linné, Denys de Montfort 1810, Conchyliologie Systématique, Paris, p. 207, figured p. 206 (Martinique).

*Cittarium pica* Linné, Philippi 1847, Zeit. f. Malak. 4, p. 20.

*Livona pica* Linné, Gray 1847, Proc. Zool. Soc. London, p. 145.

*Trochus picoides* Gould 1853, Boston Jour. Nat. Hist. 6, p. 381 (Santa Barbara [California]).

*Trochus (Livona) picoides* Gould 1862, Otia, p. 185.

*Livona picoides* Gould, Carpenter 1864, Supp. Report British Asso. Ad. Sci. for 1863, pp. 535, 537, 652 (Santa Barbara [California]).

*Description.* Adult shell 50 to 100 mm. (2 to 4 inches) in size, heavy and moderately sculptured. Whorls 8 to 9. Mottlings of blue black streaks over a white base. Frequently,

the white is tinged with green algal stain and in large specimens the mottlings are often deep brownish purple on the last whorl. Columella and interior of aperture glazed with an iridescent white. Inner edge of lip possesses rich cobalt mottlings. Aperture subcircular. Outer lip simple and slightly thickened just within the aperture. Edge of the lip is sharp and strong. Umbilicus round, narrow and very deep, with a white single toothed callus slightly protruding over one side. The rough, wavy suture between whorls is slightly indented. A slight, flat depression runs parallel to and a little below the suture. Entire outer shell is corrugated with small irregular bumps. Occasional young specimens show very fine spiral incised lines under a 10x hand lens. Axial sculpture consists of fine and somewhat oblique growth lines. In corroded but living specimens, the first five whorls are worn rough and white. Periostracum not present.

Operculum circular, multispiral, slightly concave, and of a thick, translucent chitin. When dried the color is a rich, chestnut brown; in living specimens it is an opalescent blue-green. It fits snugly well within the aperture. Muscular attachment scar is one-third the area of the operculum and is roughly kidney-shaped.

The foot of the animal is thick, oval in outline, the length of the shell when extended, with a simple smooth border. Head large, bearing a large blunt snout or proboscis and two large eye-stalks. Each eye-stalk or peduncle is split into two blunt lobes, the outer one carrying a single eye. Between the lobes, a thin, slightly tapering tentacle projects forward. Covering the dorsal side of the animal is a mantle whose border may be seen when the animal is extended. The left epipodial lobe running back from the head carries a series of about twenty saw-tooth lobes. The right lobe is smooth. At the posterior half of the foot the operculum is set in a cup-like skin fold, or epipodium whose border possesses a number of dainty filaments or epipodial tentacles. Color of ventral side of foot a solid cream. Dorsal side is light yellow with a heavy dusting of purplish brown horizontal streaks. Mantle and its lobes a dull greyish white. Head and its appendages jet black. Tentacles black at the base and fading to a light grey towards the tip. Underneath the operculum the cup depression of the foot and its filaments are a cream yellow.

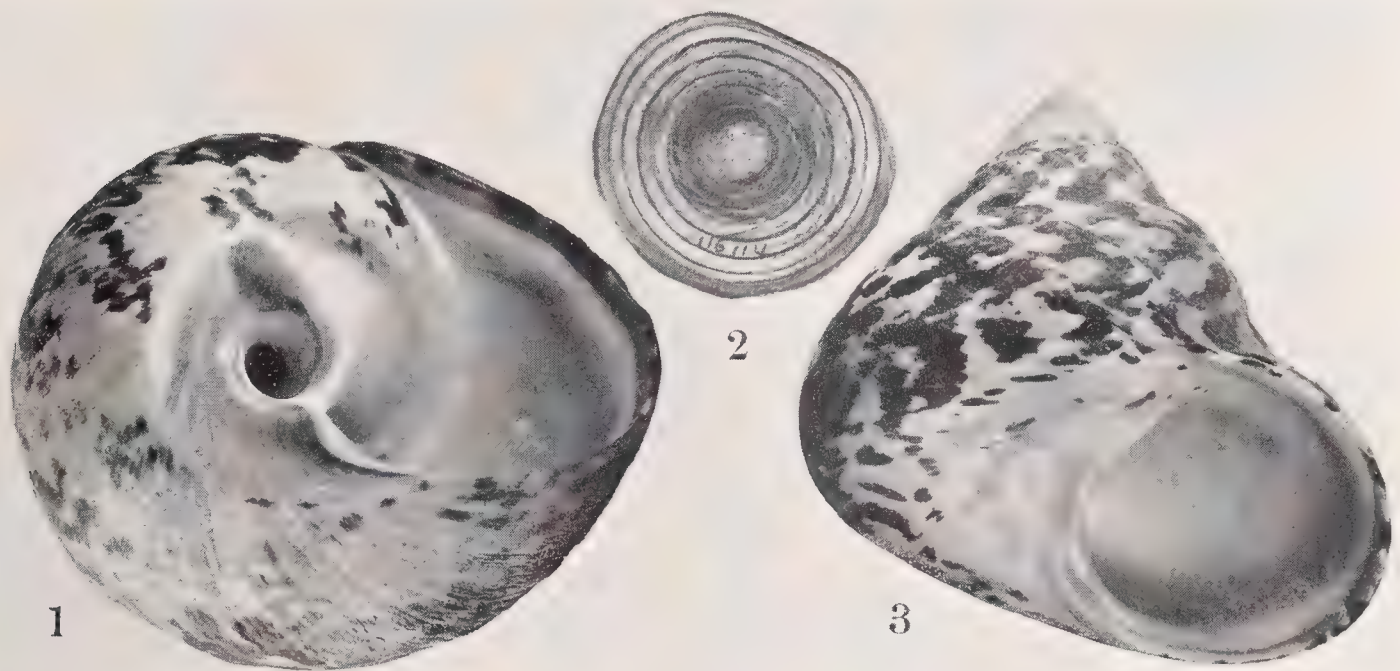


Plate 4. *Livona pica* Linné

Fig. 1. Alicetown, North Bimini Id., Bahamas. (Reduced about one-third). Fig. 2. Operculum.  
Fig. 3. Governors Harbour, Eleuthera Id., Bahamas. (Reduced about one-third).

This species has been figured beautifully by Kiener (1875, *Coquilles Vivantes*, 11, p. 64, pl. 1) under the name of *Trochus pica*, showing both the shell and the animal.

	height	width	
(large)	100	105 mm.	Carriacou, Grenadines, Lesser Antilles
(average)	65	68	Arthurstown, Cat. Id., Bahamas

*Types.* We select Linné's reference to Gaultieri (1742, pl. 68, fig. B) to be the type figure. As Linné's reference to the "Sea of Sardinia" is obviously an error, we designate that of Martinique Id., Lesser Antilles, cited by Denys de Montfort, to be the type locality.

*Common name.* West Indian Top-Shell.

*Remarks.* This is a rather abundant species throughout the West Indies. It is found along rocky coasts, in exposed places as well as in tide pools and under loose slabs of rock. It is partially inter-tidal though it exists more abundantly below low water line. We have found as many as twenty large specimens under a single slab of rock (Cienfuegos, Cuba).

It is an excellent food and makes a really fine chowder to which we can testify, though the greenish color of the chowder, imparted by the liver, is not particularly appealing. In the immediate vicinity of populated areas, this mollusk may be quite rare, owing to its use as food. This is particularly true of the Bahamas and, we believe, of Jamaica also. Fluck has reported (*Nautilus* 19, p. 78, 1905) its use as a food by the natives of Nicaragua.

Young chitons and more particularly *Acmaea cubensis simplex* Pils. are frequently attached to the lower columellar area. This latter may possibly be a commensal though nothing, so far as we are aware, is known about its relationships with *Livona*. This peculiar association with *Livona* should have a meaning other than a mere and casual place of attachment.

*Livona pica* is found as a fossil in Bermuda and hermit crabs are responsible mainly for the specimens that are to be found on the beaches. According to Verrill (1902, *Trans. Connecticut Academy* 11, p. 708) *L. pica* existed alive in post Columbian times, but has apparently since died out. He further states that in 1901 a large number of the species were brought alive from the Bahamas and liberated in Hamilton Harbor. A.J. Peile (1926, *Proc. Malac. Soc.* 17, p. 73) makes note of this introduction but states that they have not survived.

Its occurrence alive in Florida still needs confirmation. Dall's record (1889, p. 160) from Charlotte Harbor (West Florida) was based apparently on the specimens obtained by Bartlett during the cruise of the "Blake." This record is certainly open to question and we suspect that a mixture of material took place or else a wrong assignment of locality. It is not listed in Perry's report (*Bull. American Paleon.* No. 95, 1940) on our southwestern Florida shells, a report based almost entirely on the shells of Sanibel and Captiva Islands. These islands form the southwestern limits of Charlotte Harbor. Its occurrence only on rocky shores precludes its living along the sand and mangrove margin of Charlotte Harbor.

Mr. Van Hyning has loaned us a specimen of this species which had been collected alive by a sponge fisherman from a "Rock reef, 40 miles N.W. of Tarpon Springs, Florida," Economos collector. Again we strongly suspect an error. This is well beyond its expected range and any West Indian species occurring this far to the north should occur alive on the lower Florida Keys.

The above data both for southern Florida and Bermuda would indicate that this species has died out within comparatively recent times. This would point perhaps to a climatic change over a long period or to a low temperature at a critical time during breeding. The number of South Florida "crab" shell records are rather numerous, which would also seem to indicate their recent destruction. Verrill, quoted above, believed them to be alive in 1812, based on the broken shells found in the kitchen middens at Castle Island, Bermuda.

*Trochus picoides* Gould, described as from Santa Barbara, California, is still unknown. It is not recognized by recent writers on our West Coast shells, either as a species or as a synonym. We have not seen the original specimens, but believe them to be *L. pica*, of the West Indies that had become mixed in with material collected by Colonel Jewett in California and reported upon by Gould. It has not been collected since Jewett's time.

*Range.* Southern Florida (dead), Bermuda (fossil), Bahamas and south to Trinidad. It is reported to occur along the northern coast of South America.

*Records.* FLORIDA: reef, 40 mi. N.W. of Tarpon Springs [questioned] (T. Van Hyning); Charlotte Harbor [questioned] (MCZ); Bush Key, Tortugas Ids. [crabshells] (T. Van Hyning); Upper Matecumbe Key [Indian mound] (F. B. Lyman); Boynton Beach [crab shells] (P. P. McGinty). BERMUDA: [fossil] (MCZ). BAHAMAS: Joe Key, Little Abaco Id.; Nassau, New Providence; North Bimini Id.; Weymss Bight, Eleuthera; Little San Salvador; Simms, Long Id.; Arthurstown, Cat Id.; Landrail Point, Crooked Id.; Matthewtown, Gt. Inagua (all MCZ). CUBA: Cayo Francés, Caibarién (P. J. Bermúdez); Cayo Romano; Guantánamo Naval Base; Cienfuegos (all MCZ). HISPANIOLA: Cap Haitién; Miragoane (both W. J. Eyerdam); Puerto Plata; Puerto Sosúa; Monte Cristi; Santa Bárbara de Samaná (all MCZ). JAMAICA: Port Antonio (MCZ). PUERTO RICO: Ponce (MCZ); Caja de Muertos; Rio Piedras (both Univ. of Mich.); San Juan (D. Thomas). VIRGIN ISLANDS: Little Camanoe Id., Tortola; Virgin Gorda (both M. Dewey); St. Thomas; St. John; St. Croix (all MCZ). LESSER ANTILLES: Ft. James, Antigua; Basse Terre, St. Kitts; Guadeloupe; Barbados (all MCZ); Carriacou, Grenadines (H.G. Kugler); Pigeon Point, Tobago Id. (H.G. Kugler); Toco; Trinidad; (MCZ). CARIBBEAN ISLANDS: Navassa; Cayman Brac; Utila and Roatan Islands, Bay Islands (all MCZ). CENTRAL AMERICA: Limón, Costa Rica; Glover's Reef, British Honduras (both MCZ).

\* \* \* \*

Whiteaves, J. F.: Catalogue of the Marine Invertebrata of Eastern Canada. Geological Survey of Canada, Ottawa, no. 722, pp. 1-272, 1901. [Mollusca, pp. 115-213]. An excellent catalogue with detailed notes, synonymies and records of the marine shells occurring in Nova Scotia and north to Hudson Bay. There is also listed the principal zoological explorations in this area and the collections studied that form the basis of this report.—W. J. CLENCH

## Guantánamo Bay, Cuba

Because of its many types of natural habitats Guantánamo Bay in eastern Cuba is one of the most interesting collecting grounds in the Greater Antilles. From the shallow mud and sand flats and shaded mangrove waters of the bay to the rock-bound shores and coral reefs of the outer coast, every kind of molluscan habitat is found, and from this region over one hundred marine species may be collected in a single day's search.

Guantánamo Bay is situated to the east of the Sierra Maestra on the south side of Oriente Province. A cross-country railroad connects western Cuba with Guantánamo City which is some eight miles north of the Bay. Short side-lines run to Caimanera and Boqueron on the shores of the Bay itself. Water commerce from the United States is through the United States Naval Base and Boqueron.

Outside the Bay along the eastern coast line and within the bounds of the naval station there is a series of four beaches—Cable, Cuesco, Blue and Windmill. On each beach, a few minutes search along the high water line will often bring rich reward. Occasional specimens of beautiful and rare cones, such as *Conus granulatus*, *C. daucus* and *C. ranunculus* have been collected after a tropical squall. Though these beach specimens lack the perfection of live shells, they give us a fairly accurate census of the shell population just off shore. Cable Beach is an easily accessible and ideal collecting spot for live material. Several rocky headlands project out into the sea and here as elsewhere along the coast is found a representative collection of the littoral genera, *Chiton*, *Tectarius*, *Nerita* and *Thais*. The smooth black boulders along certain sections of the beach are continually being washed with ocean water, and in this exposed spot surprisingly, *Planaxis* and *Tegula* thrive by the thousands. Beyond the beach itself where the water is four or five feet deep, there is often a partially submerged reef where large coral blocks offer ample protection from the surf.

The finest collecting of all is in places such as this. Swimming trunks, canvas shoes, a diving mask or water-glass, and a collecting bag are the only equipment needed. During the daylight hours many of the mollusks take refuge under boulders. Turn over a loose rock, and as the first wisps of disturbed sand settle away, a host of brittlestars, sea urchins and shells is revealed. A quick appraisal of the exposed bottom and underside of the rock must be made, for often a choice specimen, unnoticed, will quickly move off to a new hiding place. The delicate *Lima* clam with its score of pink waving tentacles will pulsate to new quarters in a few seconds, and the dainty, translucent golden marginnellas will hastily disappear into the sand. Cones (*C. citrinus* and *C. regius*) withdraw into their shells and may be left among the last to be picked up. The egg capsules of *Conus citrinus* are found in a string of white, corn kernel-shaped cases adhering to the underside of the rock. It will take a few minutes of careful observation for the small camouflaged specimens to become evident.

There are several tidepools along the shore near Cable Beach. Some are shallow and shaded by the high cliffs; others are either covered with brown or green seaweed, while a few have rock bottoms encrusted with coralline algae. A number of pools are deep and flushed by each ocean breaker. Night collecting with a flashlight is profitable in places like these—wandering *Cypraccassis*, *Cypraea* and the yellow-fleshed *Coralliophora* sometimes being found.

Within the Bay there are several grassy flats which offer a different type of collecting. A great deal of collector's joy may be had by wading, waist deep, over the eel-grass



covered bottom and picking up large specimens of *Vasum*, *Cassis* and *Strombus*. In this last genus, four species are found at Fisherman's Point. Below Radio Point where the water is slightly brackish the uncommon *Nerita fulgurans* Gmelin is exceedingly abundant. Under the mangrove trees in many places in the Bay the hermit crabs have brought up from the deeper water beautiful specimens of *Murex* and *Melongena*.

There are numerous fossil outcrops in the vicinity of the naval base, and in many places large quantities of semi-fossil shells have been dredged up and used to fill in low land. The land shell collecting is not particularly good, though a few *Liguus* are found between Caimanera and Guantánamo City. There are several good colonies of *Polymita versicolor* near the banks of the Yateras River, some twelve miles northeast of the Bay. A colony also exists near Boqueron on the east side of the Bay. The region about the Yateras River is the type locality for many land species originally collected by Gundlach.

In January, 1930, W. J. Clench, H. A. Rehder and W. E. Schevill spent a week collecting, mainly along the coastal area of the Base, after returning from Navassa Island some 95 miles to the south. I append below two references which deal directly with collecting at the Naval Base.—R. T. ABBOTT

#### REFERENCES

- Henderson, J. B. Collecting Days About the Naval Station, Guantánamo Bay, Cuba. *Nautilus* **31**, pp. 41-44, 1917.  
 Remington, P. S. Rambles of a Midshipman. *Nautilus* **35**, pp. 118-121, 1922.

\* \* \* \*

Gualtieri, Nicholas, *Index Testarum Conchyliorum*, Florence, Italy. Folio, 23 pages (introduction) and 110 plates with text for each plate, 1742.

Nicholas Gualtieri was professor at the University of Pisa and later a physician in Florence, Italy. His collection of shells must have been one of the largest and most important in Europe during the middle of the eighteenth century. It was world wide in scope.

His report upon this collection was extensive and consisted of a series of 110 plates, 105 of which are on mollusks. The remaining 5 plates are on crustaceans and echinoderms. It was published in folio size with full sized plates each having two large or several small shells printed from very fine woodcuts. Most of these plates were originally painted by J. Menabouni and the blocks cut by P. A. Pazzi.

Linné made frequent use of Gualtieri's report and, in many cases, the figures to which Linné referred are the best of the several references that he quotes.

Copies of this work are uncommon though I do not believe they are really rare. My own copy has an early though not an original binding. On the fly-leaf there is a printer's mark with a hand written "501" which would indicate a large edition for that time even if this number was not exceeded.

Under our caption of "Types" in *Johnsonia*, the name of Gualtieri has and will appear often as author of the accepted "type figure" representing the species in question.

—W. J. CLENCH

### Voyage of the "Argo"

The Royal Mersey Steam Yacht *Argo*, of 750 tons register, made a short visit to the West Indies and the Coast of South and Central America in 1876. The *Argo* left Liverpool, England on January 16 and returned to the same port on May 27, 1876.

The expedition was sponsored by and under the direction of Mr. Reginald Cholmondeley who was particularly interested in the study of birds. However, the Reverend H. H. Higgins, John Chard and James Woods of the Liverpool Museum were invited to join the expedition to collect invertebrates.

Shallow water dredging and shore collections were made at several places. The lists of mollusks are all short and hardly give any adequate picture of the fauna, but certain importance is attached to this paper as so few of these localities have ever had any data whatsoever available in published form.

Two new species were described, *Sconsia barbadensis* and *Murex (Chicorens) imbricatus*, under the authorship of Higgins and Marrat. Small collections of mollusks were made at most localities, and the following are those when such are listed. LESSER ANTILLES: Barbuda; St. Kitts; Dominica; St. Vincent; Grenada; Trinidad. VENEZUELA: La Guaira; Puerto Cabello; Tucacas. COLOMBIA: Santa Marta; Punta Sabanilla. CUBA: Habana. MEXICO: Veracruz. BAHAMA ISLANDS: Nassau, New Providence; Long Key Island; Athol Id.; [Great] Abaco.—W. J. CLENCH

#### REFERENCE

Higgins, H. H. Mollusca of the Argo Expedition to the West Indies, 1876. Proc. Literary and Philosophical Society of Liverpool **31**, pp. 405-423., pl. 1, 1877.

\* \* \* \*

### Voyage of the "Chazalie"

The *Chazalie* made two trips from Europe to the West Indian region, the first from January to May, 1895 and again from December 1895 to April 1896. In all, there were 57 stations, 9 of which were in the Eastern Atlantic at Madeira, Canary and Cape Verde Islands and at Cap Blanc, French West Africa. The remaining stations were in the West Indies and along the Northern coast of South America. A few stations were for land collecting, a limited number for shore collecting and 17 dredging stations were made in depths ranging from 3 to 43 fathoms.

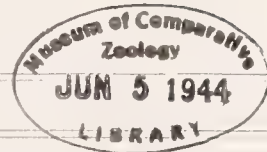
Collections of mollusks were made by R. de Dalmas during the first voyage and R. de Dalmas and J. Versluys, Jr. during the second voyage. The report upon the mollusks collected was made by P. Dautzenberg (1900, Mém. Soc. Zool. de France **13**, p. 145-265, pl. 9-10). The report is carefully done, with a list of all shells collected, their localities and synonymies, and with a station list including dates, localities and depths.

The following new species were described from the Western Atlantic: *Drillia gibbosa minor*, *rodochroa*, *chazaliei*, *claudoni*, *jousseau mei*, *Phos chazaliei*, *Chlamys bavayi*, *Pecten chazaliei*, *Nuclula dalmasi*, *Leda chazaliei* and *Tellina versluysi*.

The following localities are those at which marine collecting was done: LESSER ANTILLES: Guadeloupe; Martinique. CARIBBEAN ISLANDS: Los Testigos; Blanquilla; Margarita; La Tortuga; Curaçao. VENEZUELA: Gulf of Paria; Cumana; Gulf of Maracaibo. COLOMBIA: Bahía Honda; Riohacha; Santa Marta.—W. J. CLENCH

# JOHNSONIA

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CARDIIDAE

NUMBER 13

## THE FAMILY CARDIIDAE IN THE WESTERN ATLANTIC<sup>1</sup>

BY

W. J. CLENCH AND L. C. SMITH<sup>2</sup>

The family Cardiidae is an exceedingly important one in the class Pelecypoda. These are the true cockle shells or heart clams. The family possesses many species and is world-wide in distribution, though the numbers are much reduced south of the tropics. The most ornate and highly colored species are limited mainly to the tropical and temperate zones. There is a wide range in size within this family, from the very small deep sea species to those whose capaciousness is equalled or exceeded only by the tridacnids, certain Chinese *Anadonta* and a few species of *Panope*.

*Cerastoderma edule* Linné is an important item of food in the British Isles and Western Europe. Lister mentioned that in his time cockles were eaten raw as well as cooked. Jeffreys in 1863 pointed out that in England "cockle-gathering is a useful, though humble branch of national industry." Elsewhere, *Cardium* species are not reported as so used,



Plate 1, *Trachycardium muricatum* Linné  
Tice Island, Caxambas, Florida (about 3×)

<sup>1</sup>Included genera are *Cerastoderma*, *Clinocardium*, *Dinocardium*, *Laevicardium*, *Microcardium*, *Papyridea*, *Serripes*, *Trachycardium* and *Trigoniocardia*.

<sup>2</sup>Lillian Cassat Smith, Assistant, Department of Mollusks, Museum of Comparative Zoölogy.

but this may be due to the fact that they are not generally numerous enough to be developed commercially.

Some species are inter-tidal, though most exist below low-water line to 100 fathoms. Certain species are found beyond this depth though few are known to exist in profound depths. They live generally in sand or sandy mud, at or just below the surface. According to Step (1927, p. 142) *C. edule* Linné has been known to climb up submerged posts, spinning a byssus to aid in the ascent. On Sanibel Island, *D. robustum vanhyningi* is often seen pushing its way out of the sand and forcing itself a few feet along the sand bars by means of its strong muscular foot.

Most of the material studied in this number occurs north of South America, but it is probable that the species reported from Trinidad extend south along the coast of Brasil.

In the Western Atlantic there are twenty-one named forms, not a large number, though fairly proportionate on the basis of species in most families that are world-wide in distribution. These are grouped into nine genera and three subgenera.

This report is based in part upon the studies of R. A. McLean,<sup>1</sup> former student of the senior author and now Assistant Curator of Mollusks in the Academy of Natural Sciences, Philadelphia. His references given for all species have greatly facilitated our work on this number.

For many years practically all members of the family Cardiidae were referred to a single genus, *Cardium*. During the past 15 years much critical work has been done on this family, several new generic names instituted and many lesser categories raised to full generic rank.

We have followed the studies of Ralph B. Stewart<sup>2</sup> and A. Myra Keen<sup>3</sup> who have worked out the genera very meticulously.

The genus *Cardium* in the restricted sense does not occur in the Western Atlantic. Children, in 1823, designated the type of the genus to be *Cardium costatum* Linné, which is a large, thin and highly costate species, quite different from most other members of the family. It occurs on the West African coast.

### Genus *Trachycardium* Mörch

*Trachycardium* Mörch 1853, Catalogus Conchyliorum, Comes de Yoldi, 2, p. 34.

Genotype, *Cardium isocardia* Linné (by subsequent designation, von Martens 1870).

Shell strongly ribbed and generally with numerous arched, recurved or denticulated scales on the ribs. The posterior slope has these scales much accentuated and may be the only area on the shell surface where scales occur. Shells in this genus are generally higher than long.

There are four species of *Trachycardium* in the Western Atlantic.

<sup>1</sup> McLean, R. A. 1939, Mem. Soc. Cubana Hist. Nat. 13, pp. 157-173, pl. 23-26.

<sup>2</sup> Stewart, R. B. 1930, Gabb's California Cretaceous and Tertiary Type Lamellibranchs, Special Publ. no. 3, Acad. Nat. Sci. Philadelphia, pp. 252-280.

<sup>3</sup> Keen, A. M. 1937, Nomenclatural Units of the Pelecypod Family Cardiidae, Bull. du Musée Royal d'Histoire Nat. de Belgique, 13, no. 7, pp. 1-22.

Key to the species of the genus *Trachycardium*

- |  |                    |
|--|--------------------|
| 1. Shell with strong imbricated scales on the ribs   | 2                  |
| Shell nearly smooth or with denticulated scales on the ribs  | 3                  |
| 2. Ribs 31-37. Scales extending across each rib  | <i>isocardia</i>   |
| Ribs 27-31. Scales covering about half of each rib   | <i>egmontianum</i> |
| 3. Disc of shell with the ribs smooth. Denticulated scales on the last few ribs of posterior slope   | <i>magnum</i>      |
| Disc of shell with the ribs generally denticulated. Ribs on remainder of shell strongly denticulated | <i>muricatum</i>   |

***Trachycardium isocardia* Linné, Plate 2**

*Cardium isocardia* Linné 1758, Syst. Nat., ed. 10, p. 679 (locality unknown); McLean 1939, Mem. Soc. Cubana Hist. Nat. **13**, p. 159.

*Cardium eburniferum* Guppy 1875, Ann. Mag. Nat. Hist. (4) **15**, p. 51, pl. 7, fig. 3 (South coast of Trinidad).

**Description.** Shell varying from 50 to 75 mm. in height, inflated, subelongated, rather heavy and strongly ribbed. External color creamy, generally with reddish brown irregular patches. Interior color consists of a wide band of salmon, shading to purple, which extends from the umbo to the ventral margin of the shell, leaving both the anterior and posterior sides whitish. The inner margin is yellowish. Umbones prominent, subcentral. Ligament strong and prominent. Lunule small and relatively inconspicuous. Escutcheon not defined. Sculpture consists of 31 to 37 radiating ribs which possess numerous arcuate imbricated scales, completely crossing each rib. These scales are much more strongly developed on the posterior slope of both valves. The margin of the shell is strongly serrated. Periostracum a dull straw color, rather inconspicuous.

	length	height	width	
(large)	60	75	60 mm.	Monte Cristi, Hispaniola
(average)	51	63	50	Tobago, Lesser Antilles

**Types.** We select Linné's reference to Franz M. Regenfuss 1758 (*Auserlesne Schnecken, Muscheln und andre Schaalthiere*, p. 37, pl. 5, fig. 56) to be the type figure. Regenfuss gave the Danish West Indies (Virgin Islands) as the type locality. We restrict the type locality to St. Thomas in this island group.

**Common name.** Prickly cardium.

**Remarks.** See *T. egmontianum*.

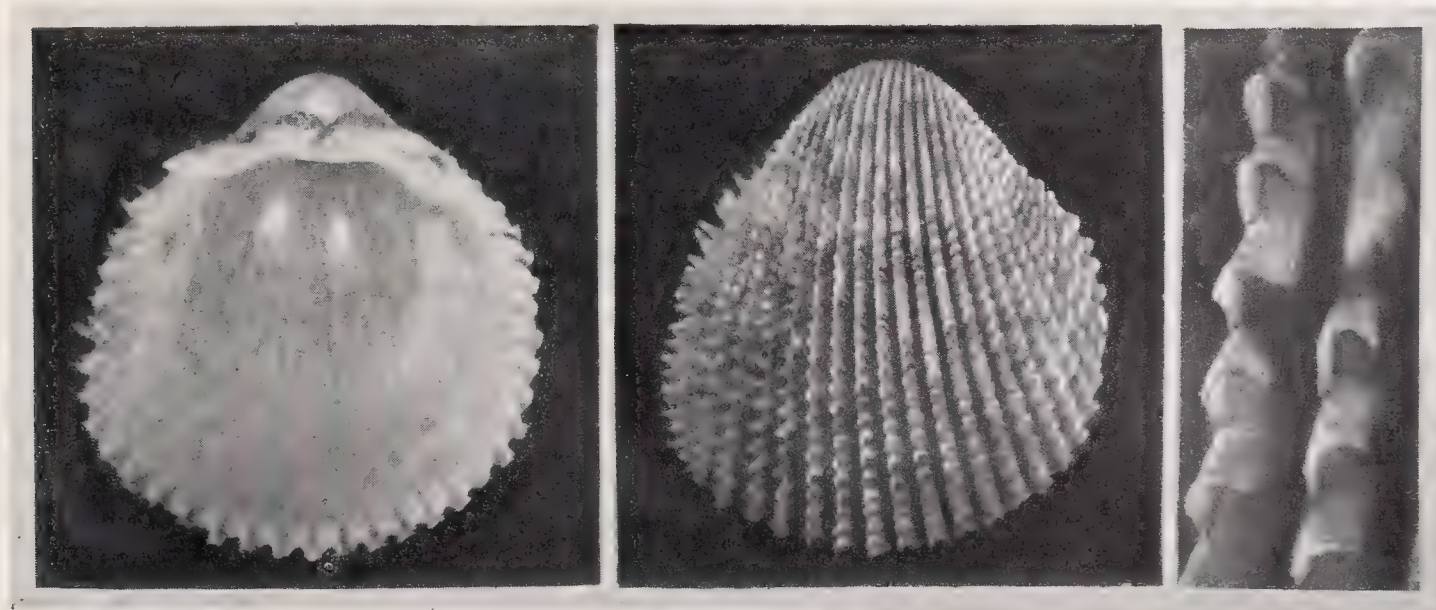


Plate 2. *Trachycardium isocardia* Linné  
Tobago Island, Lesser Antilles (natural size); sculpture (6×)

*Range.* Hispaniola, Jamaica, Puerto Rico, the Virgin Islands and south to the northern coast of South America. It probably extends north along the Central American coast, at least as far as southern Mexico.

*Records.* HISPANIOLA: Monte Cristi; Santa Bárbara de Samaná (both MCZ). JAMAICA: (MCZ). PUERTO RICO: Mayagüez (MCZ); Humacao (Univ. of Michigan). VIRGIN ISLANDS: Guana Id., Tortola; Caneel Bay, St. John (both M. Dewey); St. Croix (H. A. Beatty); St. Thomas (MCZ). LESSER ANTILLES: Nevis; Fontenary Beach and Grand Anse, Grenada (all H. G. Kugler); Tobago (MCZ); Chaguaramas, Trinidad (H. G. Kugler). MEXICO: Veracruz (M. E. Bourgeois).

### *Trachycardium egmontianum* Shuttleworth, Plate 3

*Cardium egmontianum* Shuttleworth 1856, Jour. de Conch. **5**, p. 172 (Egmont Key, Tampa Bay, Florida).

*Cardium floridanum* Heilprin 1887, Trans. Wagner Free Inst. Sci. Philadelphia, **1**, p. 92, pl. 11, figs. 25-25a (Pliocene; Caloosahatchie formation, Florida).

*Cardium isocardia* Linné, Dall 1901 (in part) Bull. United States Fish Commission 1900 [1901] **1**, p. 488.

*Cardium isocardia egmontianum* Shuttleworth, McLean 1939, Mem. Soc. Cubana Hist. Nat., **13**, p. 160.

*Description.* Shell varying from 40 to 60 mm. in height, inflated, subelongated, rather heavy and strongly ribbed. External color white to tawny or gray with most specimens showing patches of color which may be yellow, brown or occasionally purple. Interior generally suffused with shades of salmon and purple extending to the ventral margin. Anterior area whitish, posterior margin fringed with yellow. Umbones prominent and subcentral. Ligament strong. Lunule small and relatively inconspicuous. Escutcheon not defined. Sculpture consists of 27 to 31 radiating ribs which possess numerous arcuate imbricated scales, which are more fully developed on the posterior side of each rib and on the posterior slope of each valve. Margin strongly serrated. Periostracum grayish to straw colored and rather inconspicuous.

	length	height	width	
(large)	48	59	45 mm.	Lake Worth, Florida
(average)	39	47	35	Egmont Key, Florida

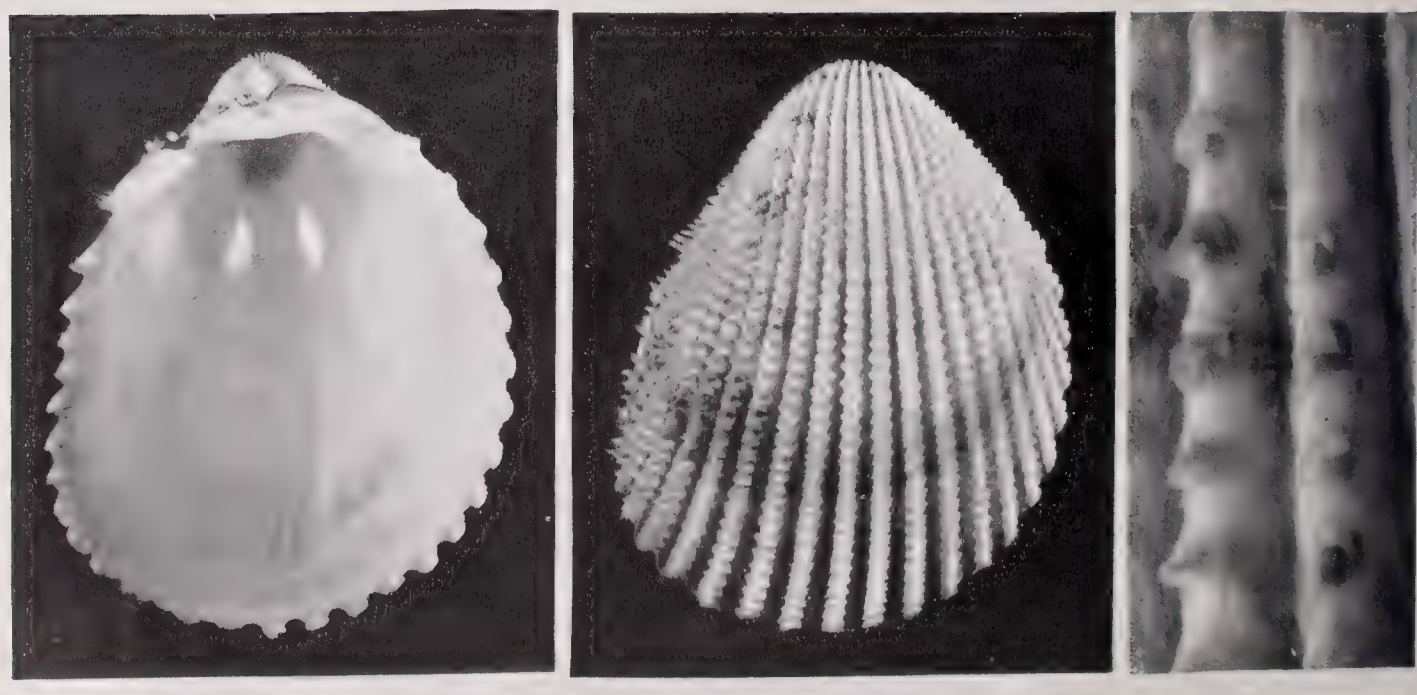


Plate 3. *Trachycardium egmontianum* Shuttleworth  
Indian River, St. Lucie Inlet, Florida (natural size); sculpture (6×)

*Types.* According to Sherborn, the Shuttleworth collection is still in Berne, Switzerland. The type locality is Egmont Key which is at the mouth of Tampa Bay, Florida. The original specimens were collected by Rugel.

*Common name.* Prickly cardium.

*Remarks.* In our opinion, *T. egmontianum* is a distinct species. It is, of course, closely related to *T. isocardia*. The differences, though slight, are remarkably constant and, so far as we have been able to detect, there are no intergrades. Our material indicates no overlap of ranges. *T. egmontianum* differs from *T. isocardia* by the following characteristics: *T. isocardia* possesses larger imbricated scales which render its appearance much more spinose. These scales on *T. isocardia* extend completely across the rib while the scales produced on *T. egmontianum* cover little more than half the rib. *T. egmontianum* has 27 to 31 ribs, while *T. isocardia* has 31 to 37 ribs. In *T. egmontianum*, the interior coloration is more diffused and extends to the posterior margin, leaving only the anterior side white. On the other hand, the interior coloration of *T. isocardia* is produced in a broad band from the umbones to the central margins, leaving both anterior and posterior sides whitish. This is not to be confused with the yellowish coloration on the posterior margin which both species possess. Generally, *T. isocardia* reaches a larger size. Albino specimens of *T. egmontianum* have been reported from Florida and we have specimens from Cayo Francés, Caibarién, Cuba.

*Range.* North Carolina south to Florida, the Bahamas and Cuba.

*Records.* NORTH CAROLINA: Beaufort Bay (MCZ). FLORIDA: Canaveral; Cocoa Beach; North Inlet, Lake Worth; Biscayne Bay; Dry Tortugas; Pavilion Key; Cape Romano; Naples; Sanibel Id.; Sarasota; Egmont Key, Tampa; Clearwater; Cedar Keys (all MCZ). BAHAMAS: North Bimini Id.; Hatchet Bay and Governors Harbour, Eleuthera; Orange Creek, Cat Id.; Simms, Long Id. (all MCZ); Stocking Id., Great Exuma (W. Gunther); Nassau Harbor, New Providence (A. H. Patterson). CUBA: Cayo Francés, Caibarién (P. J. Bermúdez); mouth of Río Arimao, Cienfuegos (MCZ).

### Subgenus *Acrosterigma* Dall

*Acrosterigma* Dall 1900, Trans. Wagner Free Inst. Sci. Philadelphia, 3, pt. 5, p. 1073.

Subgenotype, *Cardium dalli* Heilprin (by original designation).

Shell similar in outline to *Trachycardium* s. s. but having the scale ornamentation of the disc reduced to vestiges along the sides of the ridges. The hinge plate and position of the teeth are about the same in both groups.

### *Trachycardium* (*Acrosterigma*) *magnum* Linné, Plate 4, figs. 1-2

*Cardium magnum* Linné 1758, Syst. Nat. ed. 10, p. 680 (Jamaica); *ibid.* 1767, ed. 12, 1, part 3, p. 1123; Gmelin 1790, Syst. Nat. ed. 13, p. 3250; W. Wood 1815, General Conchology, London, p. 221, pl. 53, fig. 3.

*Cardium leucostomum* Born 1780, Testacea Musei Caesarei Vindobonensis, p. 46, pl. 3, fig. 6 (Jamaica). (Refers to Lister, pl. 331, fig. 168).

*Cardium marmoreum* Lamarck 1819, Animaux sans Vertèbres 6, p. 9 (Jamaica). (Refers to Lister, pl. 331, fig. 168).

*Cardium elongatum* Sowerby 1831, Genera of Recent and Fossil Shells, *Cardium*, fig. 1; *non Cardium elongatum* Bruguière 1789.

*Cardium subelongatum* Sowerby 1840, Proc. Zool. Soc. London, 8, p. 108 (St. Thomas [Virgin Islands]).

*Description.* Shell ranging from 55 to 90 mm. in height, moderately inflated, elongate, rather heavy and strongly ribbed. External color a light cream with a series of warm reddish brown, irregular patches. Generally, there is a suffusion of reddish color over the posterior slope. Interior china white with a blush of orange buff color extending from the umbonal area to about the mid-region. As a rule, the posterior margin is a pale yellowish color, merging into a pale purple at the extreme edge. Umbones moderately prominent, subcentral. Ligament strong and prominent. Lunule small and relatively inconspicuous. Escutcheon not defined. Sculpture consisting of 32 to 35 radiating ribs. There are small denticulated scales on the ribs of the posterior region only. Ribs in the mid-area are quite smooth on the surface, but in the channels between, their sides are finely ribbed. On the anterior slope, the ribs show a superimposed rippling of overlapping folds to make the appearance of fine pleating. Margin serrated. Periostracum brownish, conspicuous on the posterior slope.

	length	height	width	
(large)	67	87	46 mm.	Little San Salvador Island, Bahamas
(average)	50	65	39	St. Johns, Virgin Islands

*Types.* We select Gmelin's reference in the thirteenth edition of *Systema Naturae* (Lister 1685, *Hist. Syn. Meth. Conchyliorum*, pl. 331, fig. 168) to be the type figure of this species. Linné in the original description cited no references and had apparently based his description on a specimen. His locality of Jamaica, however, leaves little question as to what the species could be, as there are only two other species in this genus large enough to fall into this category and these were both described by Linné, namely *T. isocardia* and *T. muricatum*.

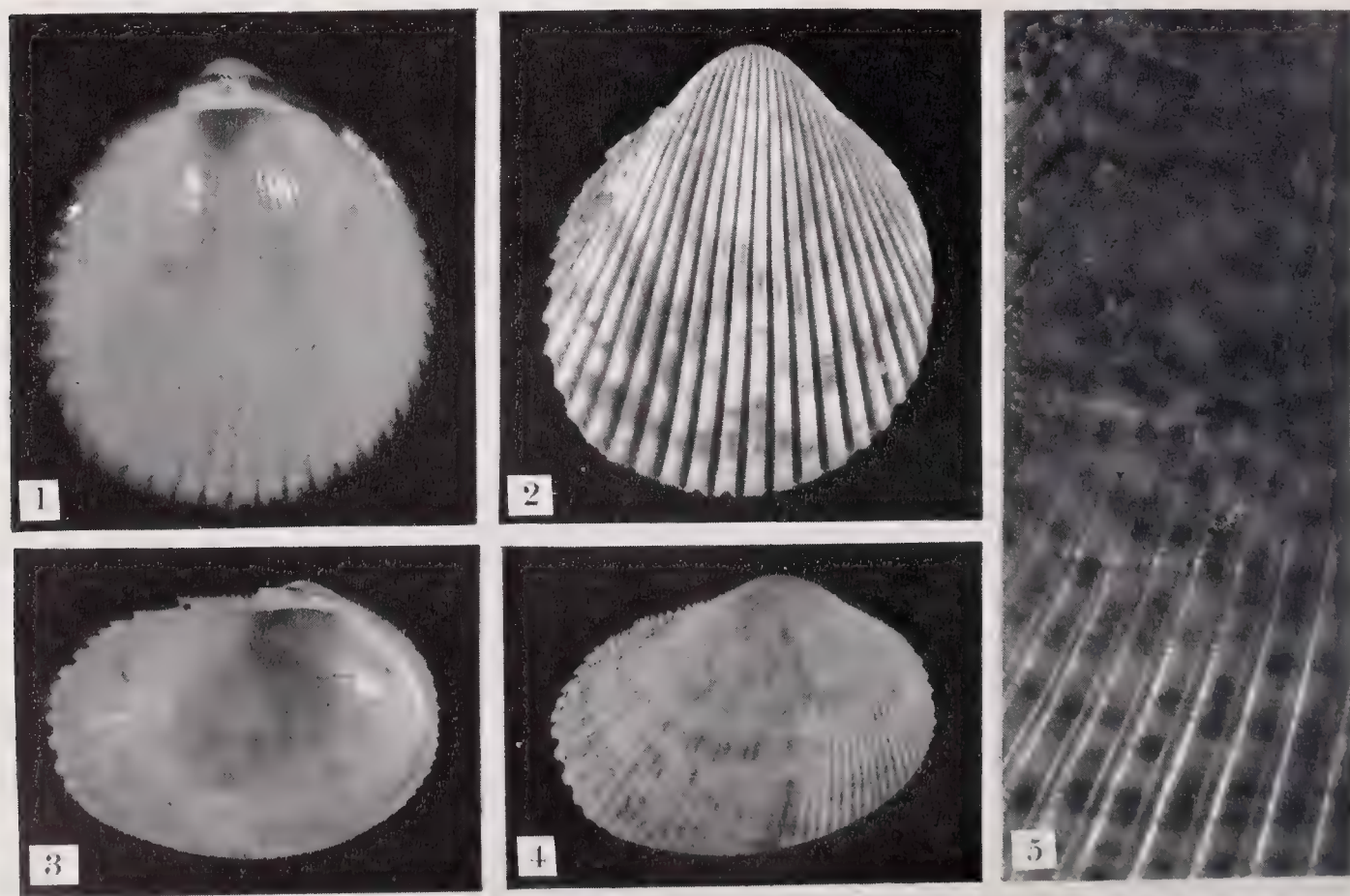


Plate 4. Fig. 1-2, *Trachycardium magnum* Linné, Barbados (natural size). Fig. 3-4, *Papyridea hiatus* Meuschen, St. Thomas, Virgin Islands (natural size). Fig. 5, *P. hiatus* Meuschen, Lake Worth, Florida (6×)



*Remarks.* In our opinion, there is no question but that this is Linné's species. The differences cited by Bruguière, Wood, and others appear to be quite trivial and in many cases, their opinions were based on figures published as wood cuts which seldom, if ever, were executed with exactness.

Bruguière's *T. elongatum* was probably based on an East Indian specimen. *T. magnum* and *T. elongatum* are exceedingly close, the differences being very slight indeed. However, it seems best to keep them separate until more material is available for serious comparative study. Bruguière pointed out that *T. elongatum* possesses 39 to 40 ribs, while *T. magnum* generally has 32 to 35. However, we possess specimens of *T. magnum* showing a variation in the number of ribs, one specimen having 40 ribs, two specimens with 38 while all others have less than 36 ribs. We believe that this variation in the number of ribs has been responsible for most of the confusion which has existed.

Mr. A. H. Patterson, who has collected *T. magnum* in the Bahamas, reports that the foot of this species is phosphorescent. The discovery was made during a black-out which occurred while he was cleaning the shell.

See *Remarks* under *T. muricatum*.

*Range.* South Florida, Bahamas, south through the West Indies to Brasil.

*Records.* FLORIDA: Garden Key, Dry Tortugas (T. Van Hyning). BAHAMAS: Eight Mile Rock, Grand Bahama Id.; Strangers Cay, Little Abaco Id.; Cat Cay, Bimini Ids.; Dick's Point, New Providence; Governors Harbour, Eleuthera; Arthurstown, Cat Id.; Simms, Long Id.; Little San Salvador; Matthewtown, Gt. Inagua (all MCZ); Nassau Harbor (A. H. Patterson). HISPANIOLA: Puerto Sosúa (MCZ). JAMAICA (MCZ). PUERTO RICO: Humacao (Univ. of Mich.). VIRGIN ISLANDS: The Baths, Virgin Gorda; Marina Cay, Tortola (both M. Dewey); St. John; St. Thomas (both MCZ). LESSER ANTILLES: Barbados; Trinidad (both MCZ). BRASIL: Off Bahía (S. Lat. 11°45'; W. Long. 37°27') Hassler, station 15, in 200 fathoms (MCZ).

### Subgenus *Dallocardia* Stewart

*Dallocardia* Stewart 1930, Spec. Publ. no. 3, Acad. Nat. Sci. Philadelphia, p. 264.

Subgenotype, *Cardium quadragenarium* Conrad (original designation).

Species of this subgenus are quite close in their relationship to *Trachycardium* s.s. They differ, however, in possessing a hinge plate which is narrower and lighter in structure. The cardinal teeth are slightly posterior. *T. muricatum* is considered a *Dallocardia* since its ornamentation and outline are so similar to those of the subgenotype *T. quadragenarium* Conrad, of the West Coast.

### *Trachycardium* (*Dallocardia*) *muricatum* Linné, Plates 1 and 5

*Cardium muricatum* Linné 1758, Syst. Nat., ed. 10, p. 680 (Gulf of Campeche [Mexico]); *non Cardium muricatum* Linné 1758, Syst. Nat. ed. 10, p. 679.

*Cardium campechiense* Röding 1798, Museum Boltenianum, p. 191, no. 407 (locality not given) refers to Chemnitz 1782, Conchylien-Cabinet (1) 6, p. 186, pl. 17, fig. 178 (West Indies).

*Cardium gossei* Deshayes 1854, Proc. Zool. Soc. London, p. 330 (West Indies).

*Description.* Shell ranging from 40 to 65 mm. in height, inflated, subcircular to subquadrate in outline, moderately heavy and strongly ribbed. External color a light cream with irregular patches of brownish red. Occasional specimens, however, are diffused with

shades of yellow and orange. Interior white, sometimes yellow-tinted. Florida specimens show a wash of yellow over most of the interior. Under the umbones there is a yellowish patch, bordered on either side by streaks of wine-red. This is a characteristic feature and is rarely absent. Occasionally, however, this patch becomes an area of solid color superimposed on the yellow. Umbones prominent, subcentral. Ligament strong and prominent. Lunule small and relatively inconspicuous. Escutcheon not defined. Sculpture consists of 30 to 40 radiating ribs which possess small denticulated scales. These scales are more numerous on the anterior and posterior slopes and are frequently absent on the mid-area of the disc. These denticulated scales vary in their position on the ribs, those of the anterior slope being developed on the anterior side of the rib, while the other ribs show development of the scales pointing posteriorly. The line of demarkation is somewhere between the 11th and 14th ribs on the anterior slope, usually marked by 1 to 3 ribs which bear a double row of scales. Beyond this area, the single rows of scales are on the posterior side of the rib. Margins strongly serrated. Periostracum brownish and fairly conspicuous, particularly near the margins.

	length	height	width	
(large)	60	63	41 mm.	Gulf of San José, Argentina
(average)	39	42	28	Naples, Florida

*Types.* Linné's description was probably based upon a specimen, as he gives no references. Because of this, we here select Chemnitz, Conchylien-Cabinet (1), 6, pl. 17, fig. 178 to be the type figure. We here limit the type locality to Veracruz, in the Gulf of Campeche, Mexico.

*Remarks.* This species is most readily differentiated from *T. magnum*, which is nearest in relationship, by having the denticulated scales more or less well distributed over the entire shell. In *T. magnum*, the scales are limited to the posterior slope. Furthermore, *T. magnum* is far more elongated.

*Range.* North Carolina south to Argentina, including the West Indies and the Gulf of Mexico.

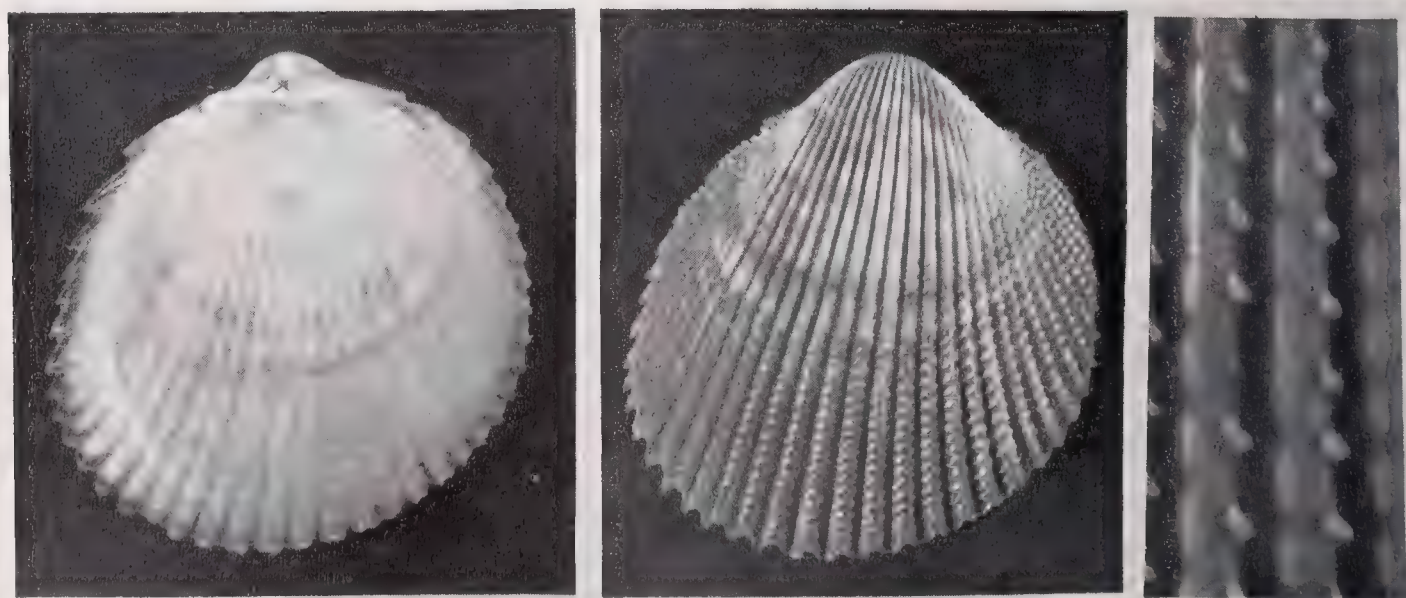


Plate 5. *Trachycardium muricatum* Linné  
Jamaica (natural size); sculpture (6×)

*Records.* NORTH CAROLINA: Beaufort Bay (MCZ). SOUTH CAROLINA: Myrtle Beach; Charleston (both MCZ). FLORIDA: Canaveral; North Inlet, Lake Worth; Biscayne Bay; Sugar Loaf Key; Sombrero Key; Key West; Cape Sable (all MCZ); Tice Id., Caxambas (M. Bills); Sanibel Id.; Sarasota; Pass-a-Grille (all MCZ). TEXAS: Port Aransas; Matagorda Bay (both MCZ). BAHAMAS: West End, Grand Bahama Id.; Cave Cay, Little Abaco Id.; Whale Cay Channel, Great Abaco Id.; South Bimini Id.; Mangrove Cay, Andros Id.; Dick's Point, New Providence; Simms, Long Id. (all MCZ). CUBA: Habana; Nuevitas; Caibarién; La Milpa, Cienfuegos Bay; Fish Point, Guantánamo Bay (all MCZ). HISPANIOLA: Monte Cristi; Santa Bárbara de Samaná (both MCZ). JAMAICA: Port Antonio; Portland Bight (both MCZ). PUERTO RICO: Mayagüez; Guanica; Ponce (all MCZ); Río Herrera, near Loiza Vieja (R. Kenk); Humacao (Univ. of Mich.). VIRGIN ISLANDS: Bogart's Bay, Tortola; Caneel Bay, St. John (both M. Dewey); St. Thomas (MCZ). LESSER ANTILLES: Guadeloupe; Le Marin, Martinique; Pigeon Point, Tobago (all MCZ); Fontenary Beach, Grenada; Saline Bay and Mayaro Bay, Trinidad (all H. G. Kugler). MEXICO: Alvarado, Veracruz (M. E. Bourgeois). BRITISH GUIANA: 4 miles east of Georgetown (MCZ). BRASIL: Penha, Ilha de Itaparica, Estado da Bahia; Praia da Bôa Viragem, Nietheroy, Estado do Rio de Janeiro; Praia de Mucuripe, Fortaleza, Estado de Ceará; Praia Comprida, Victoria, Estado de Espirito Santo; Praia de Imbituba, Estado de Santa Catarina (all P. de Oliveira). ARGENTINA: Golfo San José (A. Carcelles); off Belem Head, Golfo de San Matías in 25 fathoms (*Hassler Voyage*, MCZ).

### Genus *Dinocardium* Dall

*Dinocardium* Dall 1900, Trans. Wagner Free Inst. Sci. Philadelphia 3, pt. 5, p. 1074.

Genotype, *Cardium magnum* Born (= *Cardium robustum* Solander) (by original designation).

Shell large with more or less coloration. Its sculpture is without spines or elevated scales. Anterior ribs have slightly raised arcuate imbrications. Posterior ribs are depressed and smooth.

There is only the type species and its subspecies in the Western Atlantic.

### *Dinocardium robustum* Solander, Plate 6

*Cardium magnum* Born 1780, Testacea Musei Caesarei Vindobonensis, p. 46, pl. 3, fig. 5; *non Cardium magnum* Linné 1758, Syst. Nat. ed. 10, p. 680.

*Cardium robustum* Solander 1786, Portland Catalogue, p. 58 (Florida).

*Cardium ventricosum* Bruguière 1789, Encyclopédie Méthodique 1, p. 228 (Campeachy [Mexico]).

*Cardium maculatum* Gmelin 1790, [in] Linné, Syst. Nat. ed. 13, p. 3225.

*Cardium carolinensis* Conrad 1863, Proc. Acad. Nat. Sci. Philadelphia for 1862 [1863], p. 576 (Florida). [Based on fig. 1, pl. 19, p. 63, *Cardium magnum* Born, Toumey and Holmes 1857, Pleiocene Fossils of South Carolina, Charleston, S.C.]

*Description.* Shell varying from 75 to 106 mm. (3 to 4 inches) in height, inflated, subquadrate, moderately heavy and strongly ribbed. External color straw, with only occasional specimens showing color patches which are mostly confined to the upper portion of the disc. The posterior slope is mainly mahogany red, shading toward purple near the margin of the shell. Interior color rose, shading to a brownish rose on the posterior and basal margins; anterior margin white. Umbones high and full. Ligament large. Lunule and escutcheon poorly defined. Sculpture consisting of 32 to 36 broadly-rounded radiat-

ing ribs. The first eight ribs of the posterior slope are flattened, roughened only by many fine growth lines. The whole posterior area has an appearance of comparative smoothness.

	length	height	width	
(large)	106	104	75 mm.	Beaufort Bay, North Carolina
(large)	99	94	72	Corpus Christi, Texas
(average)	86	85	63	Off North Carolina, N. Lat. $35^{\circ}50'$ ; W. Long. $75^{\circ}26'$ (in 10 fathoms)

*Types.* The type figure is that of Born (1780 *Testacea Musei Caesarei Vindobonensis* p. 46, pl. 3, fig. 5). Born's reference to Jamaica was in error, since he undoubtedly thought he was dealing with *T. magnum* Linné as to name and locality. Solander gave Florida as the type locality of *D. robustum*. However, he referred to the figure in Lister, pl. 328, fig. 165, which was recorded from Campeche, Mexico. This latter locality can be accepted as the type locality of *D. robustum*, which is the typical subquadrate form pictured by Lister.

*Remarks.* See under *D. robustum vanhyningi*.

*Range.* Along the Atlantic coast, from Cape May, New Jersey, (Dall 1900, p. 386) south to Central Florida and in the Gulf of Mexico from North Florida west and south to British Honduras in Central America.

*Records.* VIRGINIA: ten miles south of Virginia Beach (MCZ). NORTH CAROLINA: N. Lat.  $35^{\circ}50'$ ; W. Long.  $75^{\circ}26'$  (in 10 fathoms); Beaufort Bay (both MCZ); Ocrocoke Island (Charleston Museum). SOUTH CAROLINA: Myrtle Beach (MCZ); Sullivan's Id.; Isle of Palms; Folly Island; Edisto Island and Capers Island (all Charleston Museum), Charleston (MCZ). GEORGIA: Brunswick Beach, St. Simon's Id.; Sea Island, Glynn Co. (both MCZ). FLORIDA: Seabreeze; Amelia Id.; Coronado; Cocoa Beach; Canaveral (all MCZ). LOUISIANA: Grand Isle and Shell Isle (both M. L. Hayes). TEXAS: Corpus Christi; Port Aransas (both MCZ). MEXICO: Alvarado, Veracruz (M. E. Bourgeois).

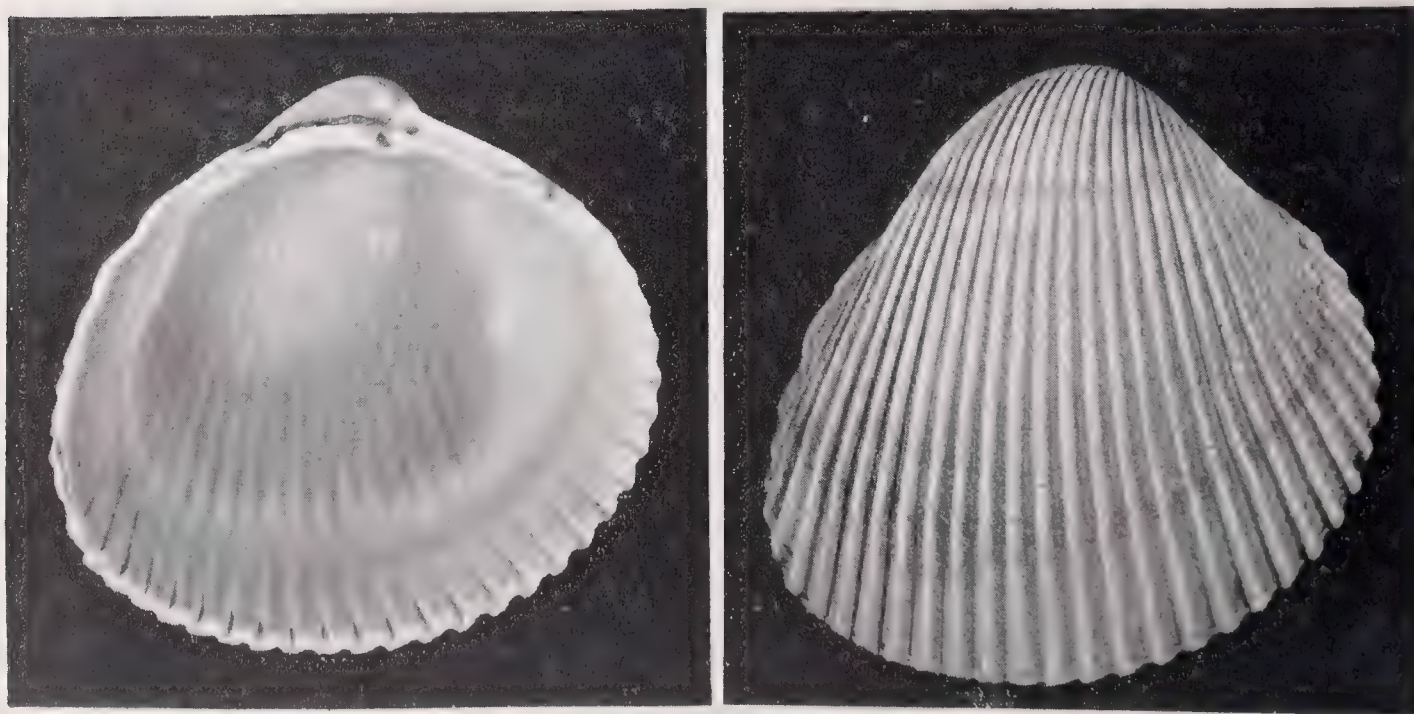


Plate 6, *Dinocardium robustum* Solander  
Off North Carolina in 10 fathoms (reduced from  $3\frac{1}{4}$  inches)

**Dinocardium robustum vanhyningi**, new subspecies, Plate 7

*Cardium ventricosum* Lamarek 1819, (in part) Anim. s. Vert. **6**, p. 10; Ency. Méth. **2**, pl. 299, fig. 1; non *C. ventricosum* Bruguière 1789.

*Cardium magnum* 'Born' Reeve 1844, Conch. Icon. **2**, **Cardium**, pl. 4, fig. 20; non *C. magnum* Linné.

*Description.* Shell varying from 80 to 120 mm. ( $3\frac{1}{2}$  to 5 inches) in height, inflated, lengthened obliquely, moderately heavy and strongly ribbed. External color straw, marked with irregular bands of blotches which are mahogany red, shading to purplish brown. These blotches are distinct and are generally on the ribs. The posterior slope is mainly mahogany red, shading toward purple near the margin of the shell. Interior color a rose brown, distributed rather generally, except along the anterior margin which is white. Umbones high and full. Ligament large. Lunule and escutcheon poorly defined. Sculpture consisting of 32 to 36 ribs, broadly rounded and radiating from the umbones. The posterior slope descends sharply. The first eight ribs of the posterior slope are flattened and roughened only by many fine growth lines giving the whole posterior area an appearance of comparative smoothness.

	length	height	width	
(large)	93	117	80 mm.	Sanibel Island, Florida
(average)	82	110	70	Pavilion Key, Florida

*Types.* Holotype, Museum of Comparative Zoölogy no. 151146, Sanibel Island, Florida. Additional paratypes from Sanibel Island.

*Remarks.* The subspecies *vanhyningi* is exceedingly close to the typical form. The differential characteristics, however, appear to be constant, and these, coupled with the difference in ranges, make it necessary to separate the two forms.

*D. robustum vanhyningi* is a common cockle on the west coast of Florida, between Cape Sable and the Tampa Bay area. This subspecies differs from *D. robustum* in being more obliquely elongated, which gives it a decidedly triangular appearance and produces a much

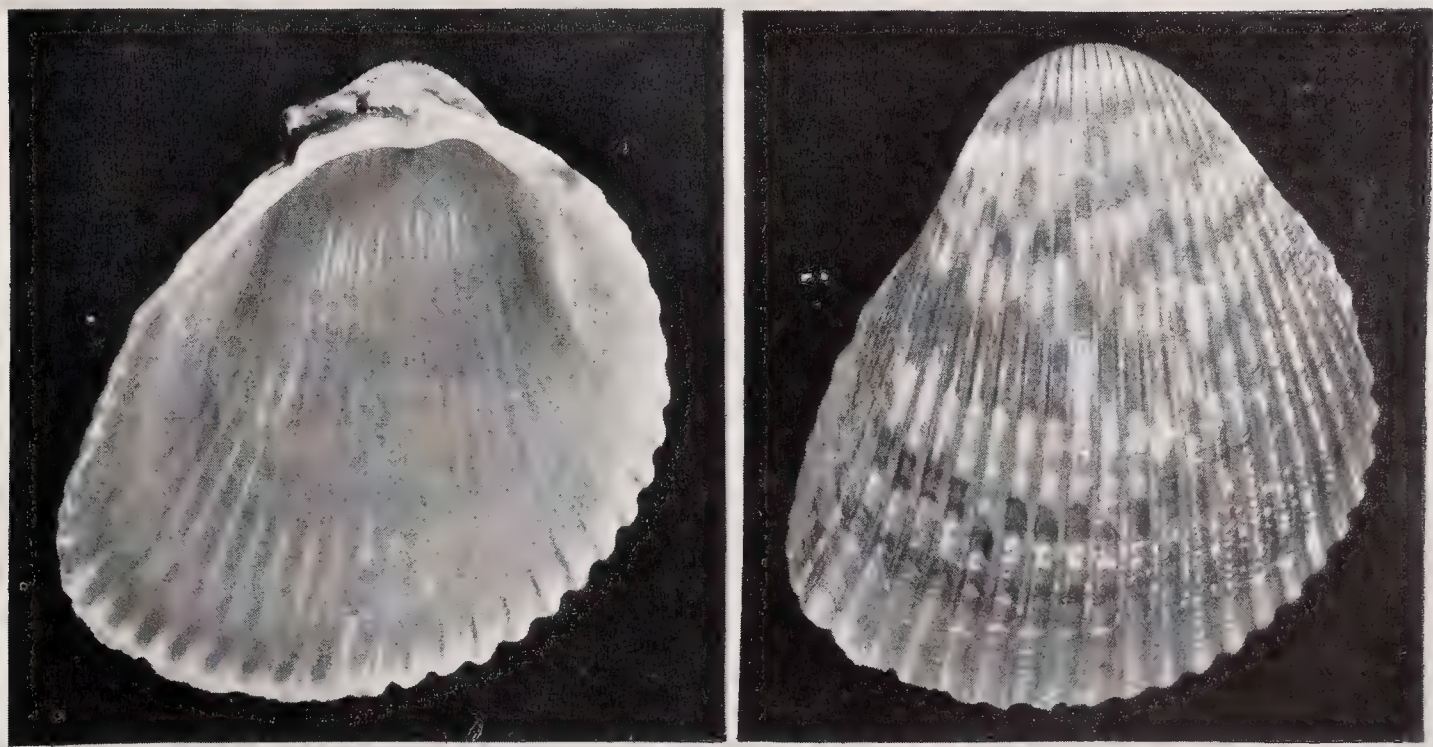


Plate 7. *Dinocardium robustum vanhyningi* Clench and Smith  
Sanibel Island, Florida (reduced from  $3\frac{1}{2}$  inches)

steeper angle at the margin of the posterior slope. The average size of *D. r. vanhyningi* is considerably greater than that of *D. robustum*. In addition it has much more color.

It is possible that these two forms may intergrade where their ranges meet or overlap along the northwest Florida coast, but as yet we have no proof that this is the case. Our present material shows definitely a geographical segregation of this new subspecies.

Named for Mr. T. Van Hyning, Director of the Florida State Museum, Gainesville, Florida.

*Range.* Cape Sable region north to Clearwater, Florida.

*Records.* FLORIDA: Clearwater; Port Tampa; Egmont Key; Mullet Key, Tampa Bay; Casey Key Beach; 2 mi. N.W. of Nokomis, Manatee Co.; Pass-a-Grille; Long Key, Sarasota; Lemon Bay; Boca Grande; Sanibel Island; Marco Island; Naples; Pavilion Key (all MCZ).

### Genus *Cerastoderma* Poli

*Cerastoderma* Poli 1795, Testacea Utriusque Siciliae 2, pp. 252, 258.

Genotype, *Cardium edule* Linné (by subsequent designation, von Martens 1870).

Shell unicolored, white, gray or dull cream, and possessing a coarse periostracum. The shell is round or oval, ribbed radially and not gaping. Ligament short and straight.

The two species that occur in the Western Atlantic are found north of the Carolinas and usually in deep water.

#### Key to the species of the genus *Cerastoderma*

Ribs flattened, sculpture weak, often obsolete on the disc	<i>pinnulatum</i>
Ribs arcuate, sculpture strong over entire surface of shell	<i>elegantulum</i>

### *Cerastoderma pinnulatum* Conrad, Plate 8, figs. 1-7

*Cardium pinnulatum* Conrad 1831, Jour. Acad. Nat. Sci. Philadelphia, 6, pt. 2, p. 260, pl. 11, fig. 8 (Massachusetts).

*Description.* Shell small, varying from 6 to 14 mm. in height, inflated, subovate, thin and strongly ribbed. External color cream. Interior glossy white. Rarely, a specimen shows a suffusion of orange brown color, more pronounced toward the posterior. Umbones subcentral and low. Ligament inconspicuous but strong. Lunule and escutcheon poorly defined. The sculpture consists of 22 to 28 radiating ribs which are flattened and gently rounded. These ribs possess thin, slightly arched scales, except on the posterior slope where these scales are denticulated. The scales are often obsolete on the disc. Margin strongly serrated. Periostracum dull cream color and rather inconspicuous.

	length	height	width	
(large)	13.1	12.5	8.2 mm.	Cultivator Shoals, Georges Bank, off Massachusetts in 65 fathoms
(average)	9	8.8	5.3	Off Duxbury, Massachusetts in 18 fathoms

*Types.* Academy of Natural Sciences, Philadelphia, no. 63763. (Conrad's original number was 1087.) The type locality of Massachusetts is here restricted to Woods Hole, Mass.

*Remarks.* This species is found mainly below low-water line and is far more abundant north of Cape Cod than it is south of this point. Mr. James Miller reports that on the banks off Nova Scotia it is the most abundant mollusk dredged.

*C. pinnulatum* is readily distinguished from young specimens of *C. ciliatum* by possessing small and separated scales on the ribs. The rib scales on *C. elegantulum* are arched and overlapping. It is to be noted, however, that the rib scales on *C. pinnulatum* are frequently worn or broken away, but they usually leave behind scars where they were attached.

*Range.* Labrador to North Carolina (McLean 1939, p. 163).

*Records.* LABRADOR: Nain in 7 fathoms; Greedy Harbor in 12 fathoms. NOVA SCOTIA: Le Have Bank in 45 fathoms; off Mosher River; Cape Sable in 40 fathoms; about 43 miles west by south from Cape Sable in 110 fathoms. NEW BRUNSWICK: Bradelles Bank in 66 fathoms; Grand Manan in 15 fathoms. MAINE: Perry in 10 fathoms; Eastport; Copscook Bay; Frenchmans Bay; Duck Island, Mt. Desert; Isle au Haut; Rockland in 45 fathoms; Wiscasset; Casco Bay. NEW HAMPSHIRE: Off New Hampshire (N. Lat.

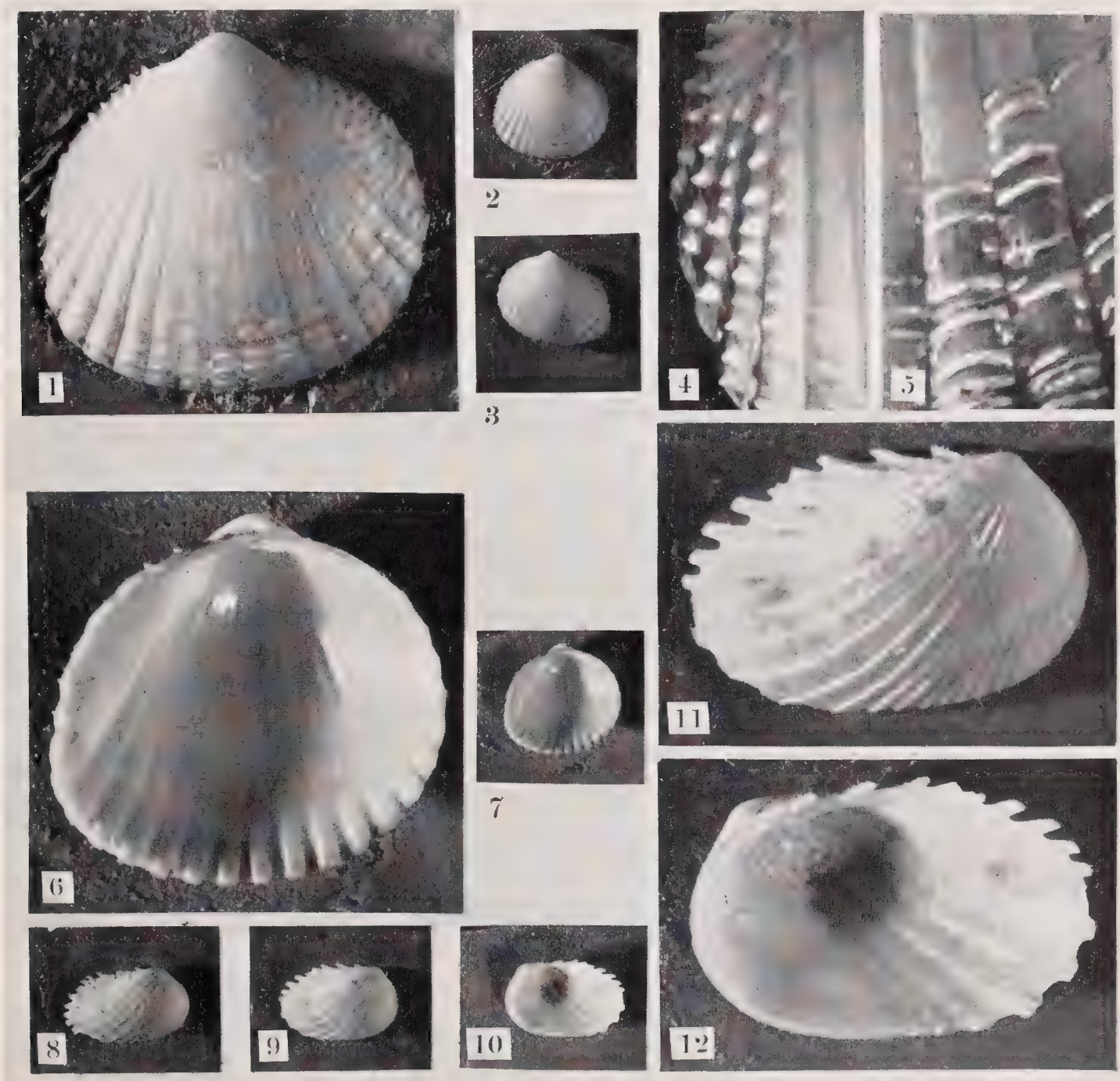


Plate 8. Fig. 1-7, *Cerastoderma pinnulatum* Conrad, Georges Bank, off Massachusetts (fig. 1 and 6, 3 $\times$ ; fig. 2, 3 and 7, natural size; fig. 4, 7 $\times$ ; fig. 5, 10 $\times$ ). Fig. 8-12, *Papyridea semisulcatum* Gray, Puerto Sosúa, Hispaniola (fig. 8-10, natural size; fig. 11-12, about 3 $\times$ )

42°00'; W. Long. 69°50') in 105 fathoms. MASSACHUSETTS: Kettle Island, Magnolia; Salem; off Duxbury in 18 fathoms; Plymouth; Woods Hole; Cultivator Shoal, Georges Bank in 65 fathoms; Buzzards Bay; Martha's Vineyard. RHODE ISLAND: 4 miles south of Block Island in 21 fathoms; 34 miles south of Block Island in 35 fathoms; 57 miles south of Block Island in 50 fathoms (all MCZ). NEW YORK: Orient, Long Island (R. Latham). NEW JERSEY: Off New Jersey (N. Lat. 40°12'; W. Long. 72°26') in 33 fathoms (MCZ).

### *Cerastoderma elegantulum* Beck, Plate 9

*Cardium elegantulum* Beck 1842, [in] Möller Naturhist. Tidsskrift (1), 4, p. 93 (Greenland); G. O. Sars 1878, Mollusca Regionis Arcticae Norvegiae, p. 47, pl. 5, fig. 5a-b; non *Cardium elegantulum* Römer 1849; non *Cardium elegantulum* d'Orbigny 1850.

*Description.* Shell small, reaching about 14 mm. in length, inflated, subovate, moderately heavy and strongly ribbed. External color yellowish white. Interior glossy white. Umbones subcentral and low. Ligament strong. Lunule and escutcheon poorly defined. The sculpture consists of 22 to 28 radiating, ornate ribs which possess compact, arched, overlapping scales. Margin strongly serrated. Periostracum inconspicuous.

	length	height	width	
(large)	11.5	10	7 mm.	Hammerfest, Norway
(average)	9.5	8.1	5.8	Greenland

*Types.* The location of Beck's types is unknown to us. The type locality is Greenland. A specific place should be named as the type locality when more material is at hand for study.

*Remarks.* We can add little here. This species is either very rare or exists only in

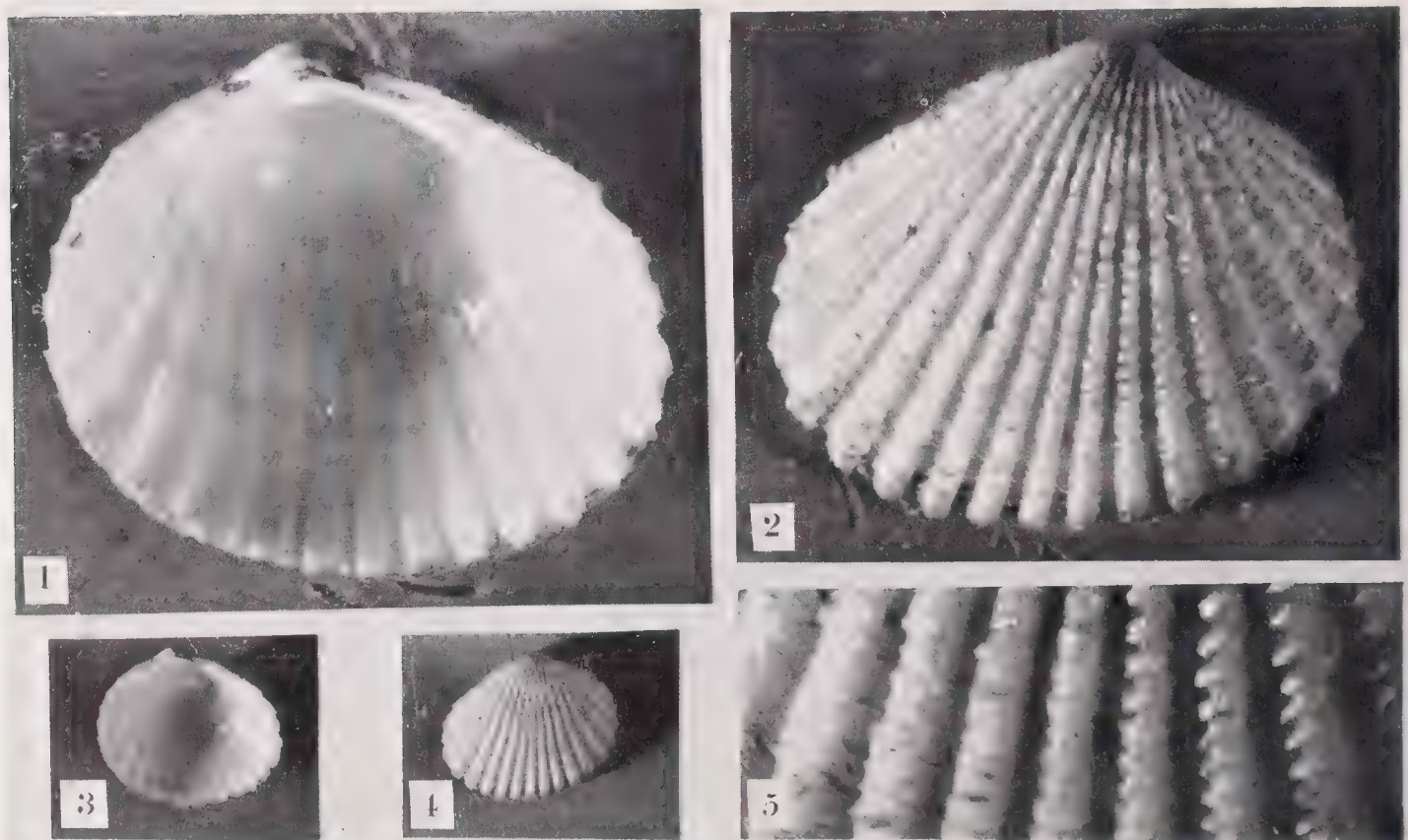


Plate 9. *Cerastoderma elegantulum* Beck

Fig. 1-5, Hammerfest, Norway (fig. 1-2, 6×; fig. 3-4, 2×; fig. 5, 12×)



the extreme northern latitudes as Owen Bryant failed to locate any specimens during his extensive dredgings off the coast of Labrador. The compact arched and overlapping scales on the ribs readily differentiate this form from *C. pinnulatum*.

*Range.* Greenland and Northern Europe. Probably circumpolar.

*Records.* GREENLAND. NORWAY: Hammerfest (both MCZ).

### Genus *Clinocardium* Keen

*Clinocardium* Keen 1936, Trans. San Diego Soc. Nat. Hist. 8, p. 119.

Genotype, *Cardium nuttallii* Conrad 1837 (original designation).

Shell medium to large, trigonal, oblique, usually ventricose. Umbones recurved, position of the umbones usually about two-thirds the distance between the posterior and the anterior ends of the shell. Sculpture of from 28 to 55 rounded radial ribs and concentric growth lines which may cross the ribs as conspicuous loops but never as spines. Ligament long, narrow and oval. Interior porcellaneous. Margins serrated. Hinge arched, cardinals in each valve slightly nearer the anterior than the posterior laterals. Muscle scars large, pallial line simple.

### *Clinocardium ciliatum* O. Fabricius, Plate 10

*Cardium ciliatum* O. Fabricius 1780, Fauna Groenlandica, p. 410 (Greenland); G. O. Sars 1878, Mollusca Regionis Arcticae Norvegiae, p. 46, pl. 5, fig. 4a-b.

*Cardium islandicum* Bruguière 1789, Ency. Méth. 1, p. 222 (Iceland). [Refers to Chemnitz, Conchylien-Cabinet (1), 6, p. 200, pl. 19, fig. 195-6]; Gmelin 1790, [in] Linné, Syst. Nat. ed. 13, p. 3252.

*Cardium edule* N. Mohr 1786, IIsandsk Naturhistorie, p. 128 (Iceland); *non Cardium edule* Linné 1758.

*Cardium boreale* Broderip and Sowerby 1829, Zool. Jour. 4, p. 368 (Arctic Ocean); *non C. boreale* Reeve.

*Cardium pubescens* Couthouy 1838, Boston Jour. Nat. Hist. 2, p. 61, pl. 3, fig. 6 (Massachusetts Bay).

*Cardium arcticum* Sowerby 1840, Proc. Zool. Soc. London 8, p. 106, (Arctic Sea); Sowerby 1841, Conchological Illust., fig. 26.

*Cardium dawsoni* Stimpson 1862, Proc. Acad. Nat. Sci. Philadelphia, p. 58, text figure. (Pleistocene: Hudson Bay).

*Cardium hayesii* Stimpson 1868, Proc. Acad. Nat. Sci. Philadelphia, p. 142 (Disco Island, [Greenland]).

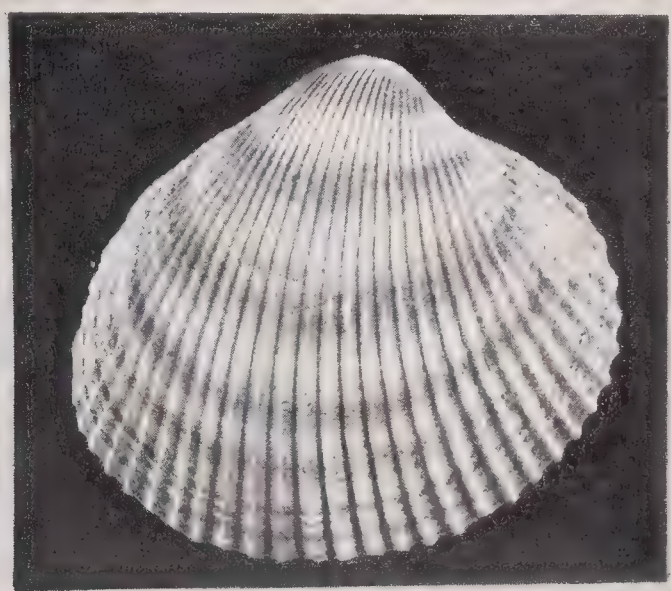


Plate 10. *Clinocardium ciliatum* Fabricius  
Banquereau Bank, off Nova Scotia in 80 fathoms (natural size)

*Description.* Shell varying from 45 to 70 mm. in height, inflated, subovate, moderately thin and strongly ribbed. External color drab with most specimens showing concentric bands of darker coloration. Young specimens pale cream. Interior coloration ivory, with occasional specimens showing horizontally arranged patches of a darker color. Umbones subcentral, prominent but fairly low. Ligament strong. Lunule and escutcheon faintly outlined. Sculpture consisting of 32 to 38 radiating ribs. The ribs are ridged, crossed by growth lines, which appear to be quite rough under a 10x lens. Margin strongly serrated. Periostracum conspicuous, grayish in color.

	length	height	width	
(large)	70	65	43 mm.	Penobscot Bay, Maine
(average)	57	51	35	Banquereau Bank, off Nova Scotia, in 80 fathoms

*Types.* Fabricius' types are in the Copenhagen Museum (I. S. Oldroyd, 1924, p. 142). The type locality is Greenland.

*Remarks.* *C. ciliatum* is the only representative of the genus *Clinocardium* in the Western Atlantic. This species, among our northern forms, differs strikingly from both *Cerastoderma pinnulatum* and *C. elegantulum* by lacking scales on the ribs. In cross-section, the ribs of *C. ciliatum* are V-shaped. See remarks under *C. pinnulatum* for differentiating young specimens of these two species.

*C. ciliatum* is not an abundant species at the southern limit of its range, but to judge by the numerous lots obtained by Owen Bryant off Labrador, it is fairly abundant in that region.

*Range.* Circumpolar; in the Western Atlantic from Greenland south to Massachusetts.

*Records.* GREENLAND. LABRADOR: off Hebron, in 100 fathoms; off Beachy Id. in 80 fathoms; Port Manvers in 30 fathoms; Nain; Shoal Tickle, 20 miles southeast of Nain; Gready Harbor; off Egg Harbor in 20 fathoms; Battle Harbor in 50 fathoms. NEWFOUNDLAND: St. Pierre Bank. NOVA SCOTIA: Banquereau Bank in 80 fathoms; Middle Bank in 35 fathoms; 15 miles east of Sable Id. in 55 fathoms. NEW BRUNSWICK: Bradelles Bank in 35 fathoms; Grand Manan. QUEBEC: Mingan Id. off Saguenay. ONTARIO: Moose River, St. James Bay. MAINE: Eastport; Frenchmans Bay; Trenton Point; Penobscot Bay in 45 fathoms; Portland. MASSACHUSETTS: Ipswich Bay in 13 fathoms; Brewer Ledge, Provincetown; Duxbury in 18 fathoms; off Manomet in 12 fathoms; Georges Bank (N. Lat. 42°04'; W. Long. 66°00') in 55 fathoms (all MCZ).

### Genus *Papyridea* Swainson

*Papyridea* Swainson 1840, Treatise on Malacology, p. 374.

Genotype, *Cardium soleniforme* Bruguière 1789 (= *C. hiatus* Meuschen 1787) (by subsequent designation Gray 1847).

Shell transversely oval, inequilateral, the anterior and posterior sides almost always gaping. Radially and obliquely ribbed, the ribs often more or less spiny. Posterior portion of shell longer than anterior, with the ribs of the posterior slope extending beyond the margins of the valves, so that the ribs of the opposing valves form a series of interlocking teeth.

#### Key to the species of the genus *Papyridea*

Shell more than 20 mm. in length	<i>hiatus</i>
Shell less than 20 mm. in length	<i>semisulcatum</i>

**Papyridea hiatus** Meuschen, Plate 4, figs. 3-5

*Cardium hiatus* Meuschen 1787, Museum Geversianum p. 442 (locality not given). [Refers to Gualtierius 1742, Index Test. Conchy. pl. 85, fig. H].

*Cardium spinosum* Meuschen 1787, Museum Geversianum p. 442 (locality not given); *non C. spinosum* Solander 1786, Cat. Portland Museum p. 105. [Meuschen refers to Lister 1685, Syn. Meth. Conchy. pl. 342, fig. 179 (Jamaica)].

*Solen bullatum* of authors, not of Linné 1758.

*Cardium soleniforme* Bruguière 1789, Ency. Méth. Vers 1, pt. 1, p. 235 (Santo Domingo and Martinique).

*Cardium hiuleum* Reeve 1845, Conch. Icon. 2, **Cardium**, no. 123 (locality unknown). [Dall (1900, p. 387) considers this species of Reeve's a monstrosity].

**Description.** Shell varying from 30 to 40 mm. in length, thin, longer than high, gaping at both ends and having its radial ribs slanted obliquely. External color white, with a finely blotched pattern of color markings which are usually pinkish purple but may show shades of yellow and chestnut. The interior coloration is much the same as the exterior, with the color blotches showing through. There is usually a pattern of color immediately under the umbones, consisting of two streaks of wine-red bordering a portion of cream color. The ventral margin is often marked with fine spots of a warm rose brown color. Umbones fairly prominent and located nearer the anterior end. Ligament relatively strong and conspicuous. Lunule and escutcheon not defined. The sculpture consists of 40-55 fine, obliquely radiating ribs which are minutely spinose, giving a file-like texture to the shell. On the posterior slope, the spines are more fully developed, are denticulate and are located on the posterior side of each rib. The scales on the anterior half of the shell are fine, close-set, sharply arched imbrications which cover the narrow ribs. The margins of the shell are serrated, the deepest serrations being on the posterior margins. Periostracum grayish and quite conspicuous on the anterior and posterior slopes and along the margin of the shell.

	length	height	width	
(large)	41	31	19 mm.	St. Thomas, Virgin Islands
(average)	32	21	15	Lake Worth, Florida

**Types.** We here select Lister 1685 (Syn. Meth. Conchy. pl. 342, fig. 179) to be the type figure which was given by Meuschen as his only reference for *C. spinosum*. Jamaica is the type locality.

**Common name.** Spiny Paper Cockle.

**Remarks.** Unfortunately, the well-known name, *Papyridea spinosum*, must be changed to *P. hiatus* as the above synonymy indicates.

This species, though widely distributed, does not appear to be very abundant. Our field experience shows that it exists a little below the low-water line. Fresh specimens are remarkably spinose but readily lose the minute spines on the disc by being beach rolled.

**Range.** North Carolina to Brasil (McLean 1939, p. 165).

**Records.** NORTH CAROLINA: Shackleford Bank, Beaufort (U. of Mich.). SOUTH CAROLINA: Pawley's Island (Charleston Museum). FLORIDA: Lake Worth; Pompano; Sombrero Key; Sugar Loaf Key; Key West; Sanibel Island; Pass-a-Grille (all MCZ); Sunrise Beach, St. Petersburg (Charleston Museum). BAHAMAS: Eight Mile Rock, Grand Bahama Island; North Bimini Island; Governors Harbour, Eleuthera; Simms, Long Island (all MCZ). CUBA: Cabañas (C. G. Aguayo); Cayo Caimán, Caibarién (P. J. Bermúdez); Guantánamo Bay (MCZ). HISPANIOLA: Cabo Macorís (MCZ). Jamaica

(MCZ). VIRGIN ISLANDS: St. Thomas (MCZ); Guana Island, Tortola (M. Dewey). LESSER ANTILLES: Fontenary Beach, Grenada (H. G. Kugler). CARIBBEAN ISLANDS: Aruba (Charleston Museum).

### **Papyridea semisulcatum** Gray, Plate 8, figs. 8-12

*Cardium semisulcatum* Gray 1825, Ann. of Phil. **25**, (n.s.) p. 138 (locality not given).

*Cardium ringiculum* Sowerby 1834, Conch. Illus. pl. 48, fig. 11 (St. Vincents); Sowerby 1841, Proc. Zool. Soc. London **8**, p. 106 (Ceylon).

*Cardium petitianum* d'Orbigny 1846, [in] Ramon de la Sagra, Hist. L'Isle de Cuba, Mollusques, **2**, p. 309, pl. 27, fig. 50-52 (Guadeloupe [Lesser Antilles]).

*Description.* Shell small, thin and delicate, varying from 8 to 15 mm. in length. There is a slight gap at the anterior end but none at the posterior end where the serrations are so greatly developed that they cause an interlocking of the valves. The radial ribs are slanted obliquely. External color is generally white, though a few specimens show pink tinges of color and a few are orange-yellow. The interior color is the same as the exterior. Umbones prominent and located nearer to the anterior end. Ligament relatively strong and conspicuous. Lunule and escutcheon not defined. The sculpture consists of about 30 ribs. On the anterior slope, the first six or eight ribs are very narrow and show a very fine bead-like crenulation. Toward the middle of the shell the ribs become wider, flatter and much smoother, showing only wavy lines in place of the imbrications. Toward the posterior slope, the ribs become raised and narrower, but retain the wavy sculpture of the disc. On the last few ribs of the posterior slope there are a few denticulate scales. Only the posterior half of the shell shows serrated margins and these are markedly developed. Periostracum grayish and quite conspicuous on the posterior and anterior slopes.

	length	height	width	
(large)	13	9	6.2 mm.	Guana Island, Tortola, Virgin Islands
(average)	9	6	4.8	Arthurstown, Cat Island, Bahamas

*Types.* Gray's types are in the British Museum. As Gray did not give a type locality we select St. Vincent, Lesser Antilles, as cited by Sowerby for *C. ringiculum*. McLean (1900, p. 165) was in error in citing Cuba as a locality on the authority of d'Orbigny. The latter gave only Guadeloupe Island in his description of *C. petitianum*.

*Remarks.* We can add little to what is known about this species. From our material, we judge that it is a comparatively rare species. We have few dredged specimens, but according to Dall (1889, p. 54) this species (as *C. petitianum* d'Orb.) has been dredged in depths of 300 fathoms.

*Range.* Southern Florida, Bermuda (Verrill and Bush 1900, p. 519) and south through the West Indies to Trinidad (McLean 1939, p. 165).

*Records.* FLORIDA: Off Key West: Pelican Shoals. BAHAMAS: Nassau, New Providence; Arthurstown, Cat Island; Matthewtown, Gt. Inagua (all MCZ). CUBA: Pueblo Nuevo, Matanzas Bay (P. J. Bermúdez). HISPANIOLA: Cabo Macorís; Puerto Sosúa (both MCZ). VIRGIN ISLANDS: Guana Island, Tortola; Devils Bay, Virgin Gorda (both M. Dewey); St. Thomas (MCZ).

### Genus **Trigoniocardia** Dall

*Trigoniocardia* Dall 1900, Trans. Wagner Free Inst. Sci. **3**, pt. 5, p. 1075.

Genotype, *Cardium graniferum* Broderip and Sowerby (by original designation).

Shell with the posterior slope sharply to moderately descending. Strongly ribbed, the ribs generally being somewhat smaller on the posterior slope. Channels between the ribs concentrically sculptured with fine thread-like ridges. The anterior lateral teeth are crowded against the cardinals.

#### Key to the subgenera of *Trigoniocardia*

1. Hinge having the anterior laterals relatively close to the cardinals and the posterior laterals more remote *Trigoniocardia* s.s.
2. Hinge having the anterior laterals almost as far removed from the cardinals as the posterior laterals *Americardia*

#### Subgenus *Trigoniocardia* Dall

Shell with the posterior slope moderately descending, strongly ribbed and possessing concentric sculpture between the ribs: generally white or grayish on the outside, white or slightly colored with streaks or a blotch of reddish brown on the inside. Hinge having the anterior lateral teeth close to the cardinal teeth, the posterior laterals more distant.

#### Key to the species of the subgenus *Trigoniocardia*

1. Shell with about 16 ribs, three or four of which are much larger than the others *ceramidum*
2. Shell with about 26 ribs, all of which are about the same size *antillarum*

#### *Trigoniocardia antillarum* d'Orbigny, Plate 11, figs. 3-4

*Cardium antillarum* d'Orbigny 1846, [in] Ramon de la Sagra, Hist. L'Isle de Cuba, Mollusques, 2, p. 309, pl. 27, fig. 53-55. (Cuba; Jamaica; Martinique and Guadeloupe.)

*Cardium guppyi* Thiele 1910, Zool. Jahrbuch., Suppl. 11, pp. 129-130, pl. 9, fig. 25-26 (Barbados).

*Description.* Shell small, moderately heavy, varying from 10 to 15 mm. in length, inflated, subquadrate and strongly ribbed. External color white with occasional specimens showing small patches of chestnut color and some showing a pinkish tinge. Interior white. A good many specimens show a pattern of chestnut color under the umbones, in

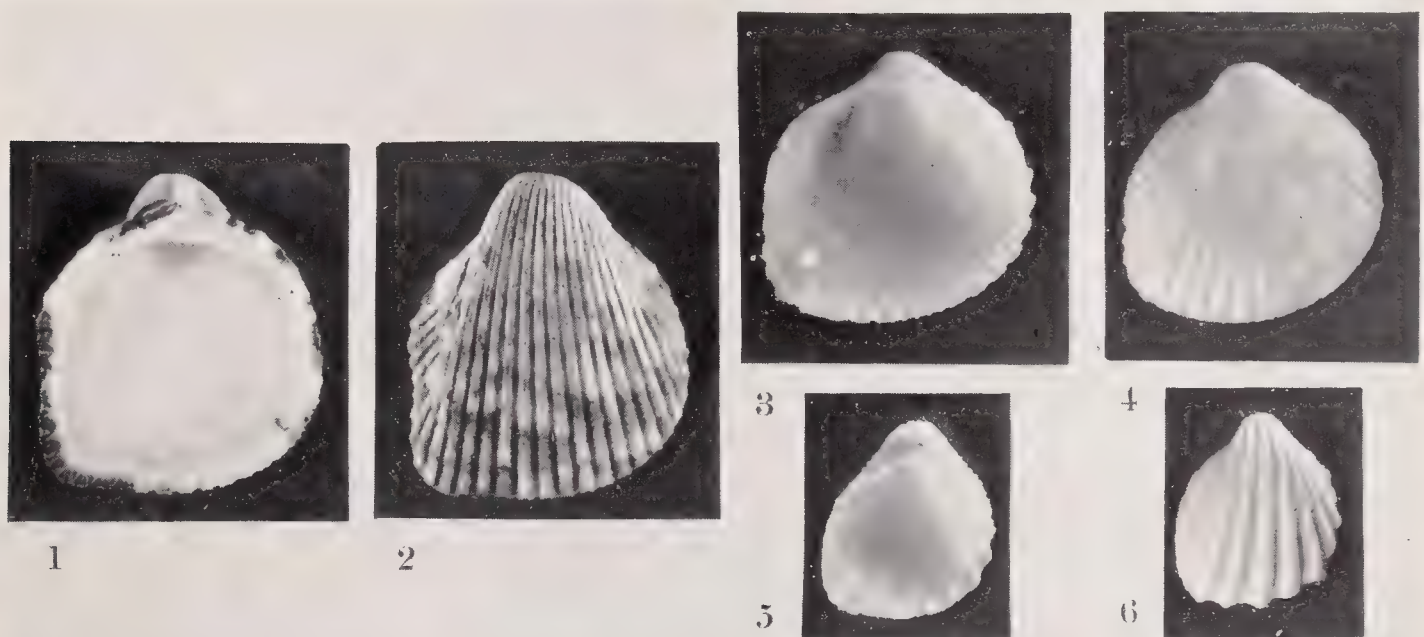


Plate 11. Fig. 1-2, *Trigoniocardia medium* Linné, Guadeloupe, Lesser Antilles (natural size). Fig. 3-4, *T. antillarum* d'Orbigny, Pueblo Nuevo, Matanzas Bay, Cuba (3×). Fig. 5-6, *T. ceramidum* Dall, St. Thomas, Virgin Islands (2×)

the form of two streaks, the longer streak following the posterior slope, some specimens having a solid patch of chestnut color. Umbones prominent, subcentral. Ligament small. Lunule and escutcheon not seen. The sculpture consists of 26–29 radial ribs which are about the same width over the entire shell. About 9 of the ribs are on the moderately sharply descending posterior slope. Some shells show low imbrications on all ribs. Some have imbrications only on the anterior slope. A good many have comparatively smooth ribs. The channels between the ribs have a very fine concentric sculpture which can be seen with a powerful lens. Margins strongly serrated. Periostracum inconspicuous.

	length	height	width	
(large)	14.5	14.5	11.5 mm.	Orange Creek, Cat Island, Bahamas
(average)	9.2	9.5	7	Fox Hill Beach, New Providence, Bahamas

*Types.* The types are probably in the British Museum (Sherborn 1940, p. 103). The type locality is Habana, Cuba, selected by McLean (1939, p. 166) from among the several localities given by d'Orbigny.

*Remarks.* *T. antillarum* is very similar to *T. ceramidum* in size, shape and general coloration. *T. antillarum* runs slightly larger and often shows some color blotches which *T. ceramidum* does not possess. The sculpture is the best differentiating character, since *T. ceramidum* has three or four very prominent ribs on the disc of the shell.

*Range.* Straits of Florida, Bahamas and south through the Lesser Antilles (Dall 1889, p. 52).

*Records.* BAHAMAS: Whale Cay Channel, Gt. Abaco Island; Cat Cay, Bimini Islands; Adelaide, New Providence; Orange Creek, Cat Island; Little San Salvador, 18 miles west of Cat Island; Mangrove Cay, Andros Island; Cape St. Maria, Long Island; Matthewtown, Gt. Inagua (all MCZ). CUBA: Pueblo Nuevo, Matanzas Bay; Caibarién; Cayo Megano Grande, Camagüey (all P. J. Bermúdez); La Chorrera (C. G. Aguayo). JAMAICA: (Charleston Museum). VIRGIN ISLANDS: Bogart's Bay, Tortola; Devil's Bay, Virgin Gorda; Caneel Bay, St. John (all M. Dewey).

### **Trigoniocardia ceramidum** Dall, Plate 11, figs. 5–6

*Cardium* sp. indet. Dall 1881, Bull. Mus. Comp. Zoöl., 9, p. 132 (off Havana in 182 fathoms).

*Cardium ceramidum* Dall 1886, Bull. Mus. Comp. Zoöl., 12, p. 269, pl. 4, fig. 6, (off Havana; Samaná Bay [Hispaniola]; St. Thomas).

*Description.* Shell small but heavy, varying from 6–10 mm. in length, inflated, subquadrate and strongly ribbed. External color creamy white. Interior greyish white. Umbones prominent and subcentral. Ligament small. Lunule and escutcheon not seen. The sculpture consists of 16–18 ribs, three or four of which are very heavy and wide on the disc. They become very fine on the sharply descending slope and gradually finer on the anterior side. There are minute denticulated scales placed on the ridge of the rib, nearly always seen on the slopes but very often obsolete on the ribs of the disc. The channels between the ribs have very fine concentric sculpture. Margins strongly serrated. Periostracum grayish and inconspicuous.

	length	height	width	
(large)	10.5	9.6	8 mm.	Monte Cristi, Hispaniola
(average)	9.5	9.6	7	Mayagüez, Puerto Rico

*Types.* Co-types, Museum of Comparative Zoölogy, no. 8005, from off Habana, Cuba, in 182 fathoms.

*Remarks.* The shape of this species is quite variable, particularly in the ratio of height to length. In addition, it varies greatly in the degree of spinosity. See remarks under *T. antillarum*.

*Range.* Greater Antilles.

*Records.* CUBA: off Habana in 182 fathoms. HISPANIOLA: Monte Cristi; Puerto Plata. JAMAICA. PUERTO RICO: Mayagüez. VIRGIN ISLANDS: St. Thomas (all MCZ).

### Subgenus *Americardia* Stewart

*Americardia* Stewart 1930, Special Publication no. 3, Acad. Nat. Sci. Philadelphia, p. 267.

Subgenotype, *Cardium medium* Linné (by original designation).

Shell fairly heavy and generally blotched with brown or brownish red. Hinge having the anterior lateral and posterior lateral teeth about the same distance from the cardinal teeth.

### *Trigoniocardia* (*Americardia*) *medium* Linné, Plate 11, figs. 1-2

*Cardium medium* Linné 1758, Systema Naturae ed. 10, p. 678 (Indian Ocean); Gmelin 1790, Syst. Nat. ed. 13, p. 3246 (American Ocean).

*Cardium venustum* Dunker 1861, Malacozool. Blätter 8, p. 37 (Antillean Seas).

*Hemicardium columba* Heilprin 1887, Trans. Wagner Free Inst. Sci. Philadelphia, 1, p. 93, pl. 11, fig. 26-26a (Pliocene; Caloosahatchie formation, Florida).

*Description.* Shell varying from 25 to 55 mm. in height, inflated, inequilateral, heavy and strongly ribbed. External color white, mottled with shades of reddish brown, color deepest on the posterior slope. The interior is usually white but may show shades of orange, rose-brown or purple which is more pronounced on the inside of the posterior slope. Umbones prominent and subcentral. Ligament strong. Lunule and escutcheon not defined. The sculpture consists of from 33 to 36 radiating ribs, about twelve of which are on the sharply descending posterior slope. These ribs are covered with close-set, chevron-shaped plates. On old specimens, particularly those which have been exposed to wave action, these plates or scales have disappeared, leaving hardly any indication of their insertion points. There is a very inconspicuous concentric sculpture between the ribs. Margin strongly serrated. Periostracum grayish, inconspicuous.

	length	height	width	
(large)	38	45	37 mm.	Orange Creek, Cat Island, Bahamas
(average)	30	34	28	Guadeloupe, Lesser Antilles

*Types.* We here select Lister 1685 (Syn. Meth. Conchy. pl. 316, fig. 153) to be the type. The type locality, according to Linné in 1758 and 1767, was the Indian Ocean. Gmelin, in 1790, changed it to the American Ocean. Habana, Cuba is the type locality selected by McLean (1939, p. 167).

*Range.* Bermuda, North Carolina and south through the West Indies to Brasil (Dall 1889, p. 52).

*Records.* BERMUDA: South of Castle Rock in 80-100 fathoms (MCZ). FLORIDA: Lake Worth; Biscayne Bay in 4 fathoms; Key Largo; Knight's Key; Bonefish Key;

Sugar Loaf Key; Key West (all MCZ). BAHAMAS: Strangers Cay, Little Abaco Id.; West End, Grand Bahama; North Bimini Id.; Dick's Point, New Providence; Savannah Sound, Eleuthera; Orange Creek, Cat Island; Stocking Island, Great Exuma; Simms, Long Island; Samaná Cay, Crooked Island Group; Matthewtown, Gt. Inagua (all MCZ). CUBA: Matanzas Bay; Cienfuegos (both MCZ); Cayo Francés, Caibarién; La Chorrera (both P.J. Bermudéz). HISPANIOLA: Monte Cristi; Porto Sosúa; Santa Bárbara de Samaná; Cabo Macorís (all MCZ). PUERTO RICO: Ponce; Mayagüez (both MCZ). VIRGIN ISLANDS: Guana Island, Tortola; Caneel Bay, St. Johns; The Baths, Virgin Gorda Island (all M. Dewey); St. Croix; St. Thomas (both MCZ). LESSER ANTILLES: Antigua (Charleston Museum); Guadeloupe; off Barbados in 100 fathoms (both MCZ); Grand Anse, Grenada; Carenage, N.W. Trinidad (both H.G. Kugler). COLOMBIA: Cartagena (MCZ).

### Genus *Laevicardium* Swainson

*Laevicardium* Swainson 1840, Treatise on Malacology, p. 373.

*Liocardium* Agassiz 1846, Nomenclatoris Zoölogici Index Universalis, p. 212.

Genotype, *Cardium oblongum* Gmelin (by subsequent designation, Stoliczka 1871).

Shell generally inflated, moderately thin, smooth to very finely ribbed, not gaping. Lateral teeth prominent and large, the anterior laterals being nearer to the cardinals. Cardinal teeth small but well developed.

#### Key to the species of the genus *Laevicardium*

- |  |                    |
|--|--------------------|
| 1. Shell minutely papillose on slopes and border                           | <i>mortoni</i>     |
| Shell not papillose  | 2                  |
| 2. Shell smooth and polished, moderately large, more than 22 mm. in height | <i>laevigatum</i>  |
| Shell smooth and polished, small, less than 22 mm. in height               | 3                  |
| 3. Shell subquadrate, with pink umbones                                    | <i>sybariticum</i> |
| Shell very oblique, color in an allover pattern                            | <i>pictum</i>      |

### *Laevicardium laevigatum* Linné, Plate 12, figs. 1-5

*Cardium laevigatum* Linné 1758, Systema Naturae, ed. 10, p. 680 (locality unknown); Linné 1767, Syst. Nat. ed. 12, p. 1123; Gmelin 1790, Syst. Nat. ed. 13, p. 3251 (Atlantic Ocean and Indian Ocean); Born 1780, Musei Caesarei Vindobonensis, p. 47; Lamarck 1819, Anim. s. Vert. 6, p. 11.

*Cardium citrinum* Wood 1815, General Conchology, p. 223, pl. 54, fig. 3 (Mediterranean; Indian Ocean; South America and West Indies).

*Cardium brasilianum* Lamarck 1819, Anim. s. Vert., 6, p. 5 (Rio de Janeiro, Brasil).

*Cardium oviputamen* Reeve 1844, Conch. Icon. 2, **Cardium**, pl. 7, fig. 36 (locality unknown).

*Cardium vetellinum* Reeve 1844, Conch. Icon. 2, **Cardium**, pl. 7, fig. 37 (locality unknown).

*Cardium lamareckii* d'Orbigny 1846, Voyage dans L'Amerique Merionale 5, p. 591 (Coast of Brasil) *non Cardium lamareckii* Reeve 1845.

*Cardium lineatum* 'Gmelin' Krebs 1864, the West Indian Marine Shells, p. 115 (West Indies); *non C. lineatum* Gmelin 1790 [in] Linné's Syst. Nat. ed. 13, p. 3246.

*Cardium glabratum* Römer 1869, [in] Martini und Chemnitz Conchylien-Cabinet (2), 10, pt. 2, p. 91-92, pl. 13, figs. 8-9 (Island of Margarita, Antillean Seas).

*Cardium serratum multilineatum* Dall and Simpson 1901, Bull. United States Fish Commission for 1900, 20, (1), p. 489 (Mayagüez Harbor, Porto Rico).

\* \* \* \*

*Note.* *Laevicardium serratum* Linné is the name frequently used for this species, but in error. Linné in 1758 and 1767 gave no references and no locality for his *Cardium ser-*



*ratum*. Gmelin, however, in the 13th edition (1790) gave a single reference, that of Chemnitz 1782, *Conchylien-Cabinet* (1), 6, pl. 18, figs. 185–186. These must, therefore, stand as the type figures of *L. serratum*, which is in our collection from several localities in the Indo-Pacific. The name *L. serratum* must replace that of *L. biradiatum* Bruguière 1789. Bruguière refers to the same figures in Chemnitz mentioned above as his only reference.

Gmelin, in the 13th edition of Linné's *Systema Naturae*, apparently in error, transposed the non-binomial names of Chemnitz (*Cardium citrinum* and *Cardium laevigatum*). Since the non-binomial names in the first eleven volumes of the twelve-volume set of Chemnitz that comprises the first series of the *Conchylien-Cabinet* have been ruled out, the names as used by Gmelin must stand.

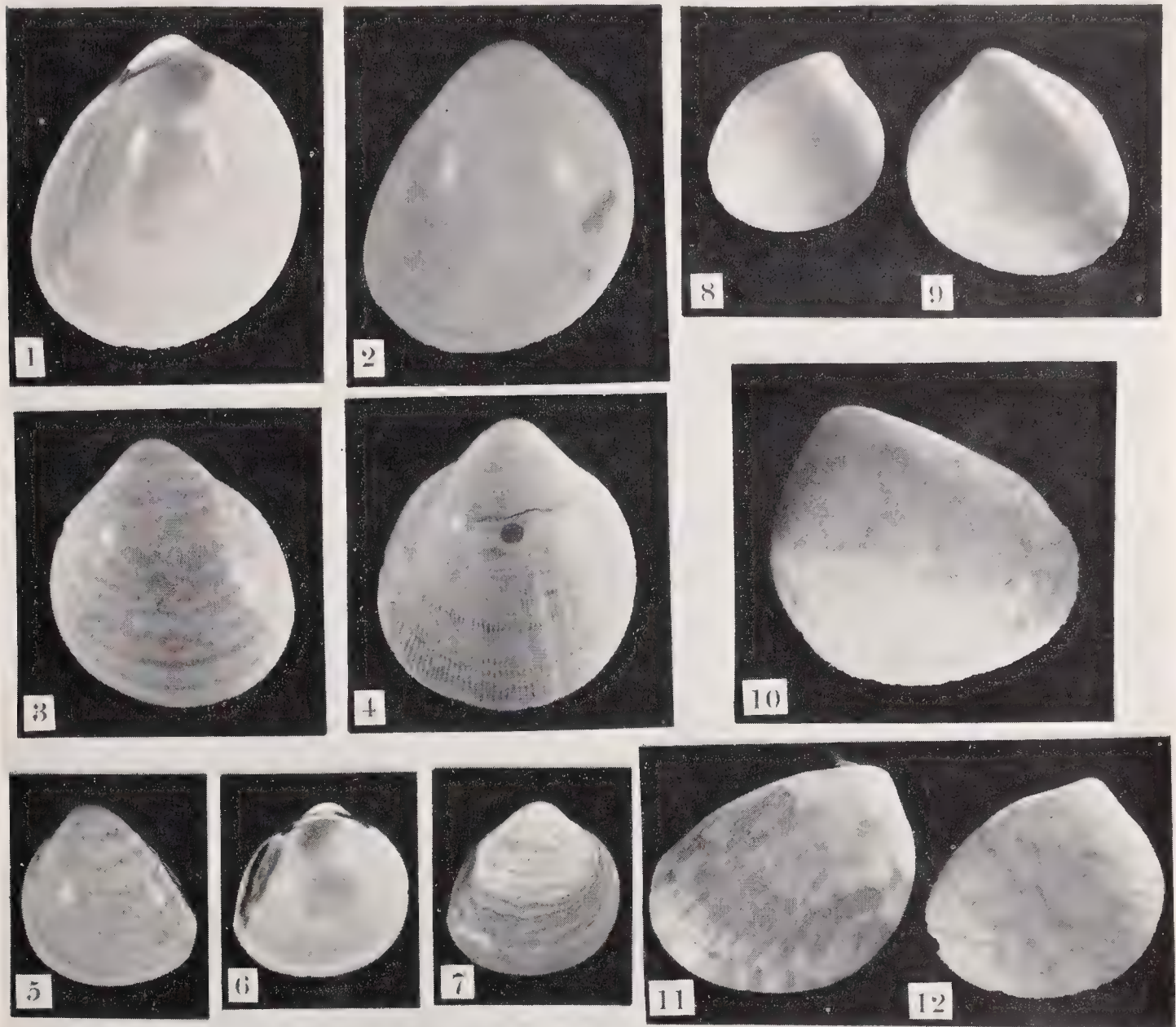


Plate 12. Fig. 1–2, *Laevicardium laevigatum* Linné, Lake Worth, Florida (natural size). Fig. 3, *L. laevigatum* Linné, Monte Cristi, Hispaniola (natural size). Fig. 4, *L. laevigatum* Linné, Puerto Plata, Hispaniola (natural size). Fig. 5, *L. laevigatum* Linné, Salinas, Estado da Bahia, Brasil (natural size). Fig. 6–7, *L. mortoni* Conrad, Orient, Long Island, New York (natural size). Fig. 8–9, *L. sybariticum* Dall, off Castle Rock, Bermuda ( $2\times$ ). Fig. 10, *L. pictum* Ravenel, Lectotype, off Charleston, South Carolina ( $2\times$ ). Fig. 11, *L. pictum* Ravenel, off Fort Walton, Florida ( $2\times$ ). Fig. 12, *L. pictum* Ravenel, off Charleston, South Carolina ( $2\times$ )

*Description.* Shell varying from 30–70 mm. in height, smooth, shining and polished, inflated, subelongate to subquadrate, thin to moderately heavy and obscurely ribbed. This is a very variable shell in color, shape and sculpture. The external color may be a pure white, white with rose borders or white with mottlings of brown; or it may be yellow, ranging through shades of canary yellow to burnt orange. The interior coloration is also very variable but is usually harmonious with the exterior. Generally, the color is strongest on the posterior slope but it may be diffused over the interior. The color ranges from the faintest blush to intense shades of yellow-orange and pinkish purple. White shells usually have shades of pink or purple on the inside. Shells which are yellow on the outside usually have a diffused interior coloration, with shades of yellow sometimes streaked with purple. Umbones are subcentral and vary in height proportionately to the size and age of the shell. The ligament is long and strong. There is a well defined, smooth area on both the anterior and posterior slopes, the posterior extending to the ventral margin, the anterior comprising about one-third of the anterior slope. The posterior side of the shell is nearly straight, the anterior rounded. There are about 60 very fine, radiating ribs which may often be seen but rarely felt on the body of the shell. The margin of the shell is serrated from the border of the smooth posterior area to the area of smoothness on the anterior slope. Serrations on some shells are much coarser than on others. Periostracum thin and somewhat deciduous.

	length	height	width	
(large)	50	61	41 mm.	Gulf of Paria, Trinidad, Lesser Antilles
(average)	32	40	22.5	Sugar Loaf Key, Florida, in 2 fathoms

*Types.* The type is that of Chemnitz, Conchylien-Cabinet (1) 6, pl. 18, f. 189, as given by Gmelin in Linne's Syst. Nat. ed. 13, p. 3251. The type locality is Matanzas Bay, Cuba, designated by McLean (1939, p. 169).

*Common name.* Egg-shell heart clam.

*Remarks.* We recommend the grouping of the two subspecies *L. multilineatum* Dall and Simpson and *L. brasilianum* Lamarck with the typical species *L. laevigatum* Linné since it seems impossible to separate them. There is such a range of color, size, shape and lineation that we cannot find consistent characteristics which justify keeping them apart. Dall states, "There are intermediate specimens which can be assigned to one form about as well as the other" (1901, p. 489).

The West Indian form named *Cardium serratum multilineatum* Dall and Simpson was probably described from a series of shells that had more pronounced lineation than the average but nearly all of the shells in this group have obscure vestiges of ribs, more or less developed. However, if this particular form is to retain a separate name, it must be *L. glabratum* Römer, which name has 32 years priority.

In Brasil, at the southern end of the range, specimens appear to be smaller than the typical and possess a more or less consistent color pattern of zigzag lines on the disc and broken bars of reddish brown color on the posterior slope. This latter color is repeated in pattern on the interior. However, parallelism in color, shape and size appear in sporadic individuals throughout the entire range. The southern form was named *Cardium brasilianum* by Lamarck in 1819.

We have one very large single valve from Ponce, Puerto Rico, which measures 82

mm. in height. It may be fossil. It was obtained on the spoil dump near the harbor entrance and may have come from several feet down in the harbor mud.

*Range.* Cape Hatteras to Brasil.

*Records.* NORTH CAROLINA: Off Cape Hatteras (N. Lat.  $35^{\circ}52'$ ; W. Long.  $75^{\circ}09'$ ) (MCZ); Ocracoke Island (Charleston Museum). SOUTH CAROLINA: Sullivan's Island (Charleston Museum). FLORIDA: St. Lucie Inlet (M. Cannon); Cape Canaveral; Beacon Hill; Cocoa Beach; Lake Worth; Biscayne Bay; Madera Bay; Key West; Tortugas; Pavilion Key; Sanibel Island; Pass-a-Grille; Anna Maria Key; Gulfport; Cedar Keys; (all MCZ). BERMUDA: Shelly Bay; Hungry Bay (both MCZ). BAHAMAS: Angel Fish Point, Little Abaco Island; Holmes Cay, Grand Bahama Island; North Bimini Island; Nassau, New Providence; Tarpum Bay, Eleuthera; Arthurstown, Cat Island; Watlings Island; Little San Salvador; Stocking Island, Gt. Exuma; Simms, Long Island; Samana Cay, Crooked Island Group; Matthewtown, Gt. Inagua (all MCZ). CUBA: La Chorrera, Habana (C. G. Aguayo); Caibarién (P. J. Bermúdez). HISPANIOLA: Monte Cristi; Puerto Plata (both MCZ). JAMAICA: Portland Bight (MCZ). PUERTO RICO: Ponce; Mayagüez (both MCZ). VIRGIN ISLANDS: St. Thomas; St. John (both MCZ); Guana Island, Tortola; Devil's Bay, Virgin Gorda (both M. Dewey); St. Croix (H. A. Beatty). LESSER ANTILLES: St. Christopher; St. Lucia in 10 fathoms; Barbados (all MCZ); Bugo Reef, Tobago Island; Couva Bank, Gulf of Paria, Trinidad (both H. G. Kugler). CARIBBEAN ISLANDS: Aruba (MCZ). MEXICO: Veracruz (MCZ). PANAMA: Colón (MCZ). COLOMBIA: Cartagena (MCZ). VENEZUELA: Cumana (MCZ). BRASIL: Río de Janeiro (MCZ); Ilha de Itaparica, Estado da Bahía; Pedra Furado, Estado da Bahía; São João da Barra, Estado do Río de Janeiro; Ilha de São Sebastião, Estado de São Paulo (all Paulo de Oliveira); Pernambuco (MCZ).

### *Laevicardium pictum* Ravenel, Plate 12, figs. 10–12

*Liocardium pictum* Ravenel (March) 1861, Proc. Acad. Nat. Sci. Philadelphia, p. 44 (off Charleston Bar, South Carolina); *non Cardium pictum* Dunker (April) 1861, Malak. Blätter 8, p. 37.

*Description.* Shell small, varying from 11 to 25 mm. in height, moderately thin, polished, only moderately inflated and triangular in shape. The external color is white or cream with delicate shading and patterning of rose or brown. The shell shows some iridescence. Some specimens show brown zig-zag lines which cross the disc. The interior may be white or it may have shades of rose, yellow, or purple, alone or in combination. The umbones are very low and far toward the anterior side. The ligament is small. Lunule and escutcheon are not defined; however, there are areas of comparative smoothness on the posterior and anterior slopes which surround the escutcheon and lunule areas. The sculpture consists of sub-obsolete radial and concentric ribs and still finer growth lines which can be seen under a lens. The margins are very finely serrated on about half of the shell. The periostracum is very inconspicuous.

	length	height	width	
(large)	16	20.2	12 mm.	Dewees Island, South Carolina
(average)	12	14	6.7	Off Fort Walton, Florida

*Types.* Lectotype here chosen, Charleston Museum no. R 3200 (Ravenel collection) from stomachs of fish off Charleston Bar, Charleston, South Carolina. Paratypes from the same locality in the Charleston Museum.

*Remarks.* For many years *L. pictum* has been considered a synonym of *L. laevigatum*. It was originally described from specimens found in the stomachs of fish taken in 45 fathoms of water, near Charleston, South Carolina. (See Plate 12, fig. 10). We have seen Ravenel's types, as well as other specimens taken near Charleston. *L. pictum* differs from *L. laevigatum* by being smaller, less inflated and having the very low umbones at the extreme anterior portion of the shell, giving it a very oblique shape. The color pattern is quite different. Through the kindness of L. A. Burry we have seen a fine series of specimens of *L. pictum* collected off Fort Walton, Florida, in 13–19 fathoms. They are identical in shape, color pattern and size with specimens from Charleston and prove very conclusively that *L. pictum* is entirely separate from both *L. laevigatum* and *L. sybariticum*. See remarks under *L. sybariticum*.

*Range.* Bermuda, South Carolina, Florida and Gulf of Mexico.

*Records.* BERMUDA: in 7 fathoms (MCZ). SOUTH CAROLINA: off Charleston, stomachs of fish; Folly Beach; Pawley's Island; Dewees Island (all Charleston Museum). FLORIDA: dredged, Lake Worth, Boynton Inlet; off Palm Beach in 85 fathoms (both T. Bayer); off Dania in 17 fathoms (MCZ); off Fort Walton in 13–19 fathoms (L. A. Burry).

### **Laevicardium sybariticum** Dall, Plate 12, figs. 8–9

*Laevicardium serratum sybariticum* Dall 1886, Bull. Mus. Comp. Zoöl., 12, no. 6, p. 270 (off Barbados, Lesser Antilles).

*Description.* Shell thin, polished, small, varying from 9 to 17 mm. in height, inflated and subquadrate. External color creamy white with delicate shadings of pink. The umbones are a deep pink. The interior is white and usually shows delicate pink shades. The umbones are conspicuously colored, subcentral and moderately high. Ligament small. Lunule and escutcheon not defined but their areas are smooth. The sculpture consists of minutely fine growth lines and minutely fine radial ribs. Periostracum thin, deciduous and rather smooth.

	length	height	width	
(large)	14.5	17	10 mm.	South of Castle Rock, Bermuda
(average)	8.5	9	5	Flanagan Passage, St. John, Virgin Islands

*Types.* Lectotype, Museum of Comparative Zoölogy, no. 74296, taken by the *Blake* in 100 fathoms, off Barbados, Lesser Antilles.

*Remarks.* This is a deep water species and is not a common shell. It may be distinguished from the young of *L. laevigatum* by the characteristically colored umbones. It is more inflated than *L. pictum*, is more delicate and is quite square in shape, while *L. pictum* is flat, scarcely inflated at all and is quite triangular in shape.

*Range.* Bermuda south through the West Indies in 17 to 190 fathoms.

*Records.* BERMUDA:  $\frac{3}{4}$  mi. south of Castle Rock in 80–100 fathoms. FLORIDA: off Dania in 17 fathoms. BAHAMAS: Whale Cay Channel, Great Abaco. CUBA: Bahía de Cochinos in 180–190 fathoms. VIRGIN ISLANDS: Flanagan Passage, St. John in 27 fathoms. LESSER ANTILLES: off Barbados in 100 fathoms. CARIBBEAN ISLANDS: off Swan Island in 60 fathoms (all MCZ).

**Laevicardium mortoni** Conrad, Plate 12, figs. 6-7

*Cardium mortoni* Conrad 1830, Journ. Acad. Nat. Sci., Philadelphia, **6**, pp. 259-260, pl. 11, figs. 5-7. (Rhode Island and Long Island Sound); Dall 1889, Bull. United States National Mus. no. 37, p. 54, pl. 58, fig. 8 (showing soft parts).

*Description.* Shell varying from 15 to 25 mm. in height, inflated, moderately thin, not gaping. External color a dirty white with or without patterns of brown zigzag markings. Interior smooth and shining, generally tinged with yellow and having a deep purple patch on the posterior side. The interior coloration is very variable. It may be pale with only a few flecks of brownish purple or it may be diffused with shades of purplish brown arranged in concentric patterns, the color most intense in the umbonal cavity. The margins are usually white. Umbones are high and often purplish in color. The ligament is long and quite strong. The lunule and escutcheon are not defined; however there is an area of comparative smoothness on both slopes, the posterior slope descending rather sharply. The anterior lateral teeth are very prominent. The sculpture consists of fine concentric ridges which are minutely papillose on most specimens. The papillose sculpture is invested in, or intensified by the periostracum which becomes quite heavy on the posterior and anterior slopes and a little less heavy along the lower margin. The interior of the shell displays minutely fine, smooth radiating ribs. The margins show very fine serrations.

	length	height	width	
(large)	23	24	19.5 mm.	Westerly, Rhode Island
(average)	17.5	18	12.8	Gulfport, Florida

*Types.* Academy of Natural Sciences, Philadelphia, no. 54147, from Long Island, New York. (Conrad's original number was 1064).

*Common name.* "Duck clam." Mr. Roy Latham of Orient, Long Island, reports, "The black duck, scaup, golden-eye, and some other ducks commonly feed upon this cockle."

*Remarks.* This shell is easily distinguished from *L. laevigatum* by having the minutely papillose exterior, lacking in *L. laevigatum* which is smooth, shiny and polished. *L. mortoni* exists alive at low water mark and in very moderate depths up to one or two fathoms.

It is difficult to understand its occurrence at Caibarién, Cuba. The specimens were taken alive by Dr. Bermúdez and there is no question of the identification. This is the only authentic record we have seen for the West Indies.

*Range.* Massachusetts to Guatemala.

*Records.* MASSACHUSETTS: Provincetown; Yarmouth; Dennisport; Hyannisport; Cotuit Highlands; Woods Hole; Marion; New Bedford; Katama Bay, Martha's Vineyard; Wawinet, Nantucket (all MCZ). RHODE ISLAND: East Greenwich; Buttonwoods; Watch Hill; Westerly (all MCZ). NEW YORK: Orient; Mattituck, Long Island (Roy Latham) Greenport; Northport Harbor, Long Island (MCZ). NORTH CAROLINA: Beaufort (MCZ). FLORIDA: Lake Worth; Coconut Grove; Madera Bay; Lignumvitae Key; Sombrero Key; Cape Sable; Sanibel Island (all MCZ); Boca Grande (H. Dodge); Sarasota; Gulfport; Clearwater; Cedar Keys (all MCZ). CUBA: La Sortija, Caibarién (P.J. Bermúdez). TEXAS: Indianola; Port Aransas; Olivia (all MCZ). GUATEMALA: Puerto Barrios (Univ. of Mich.).

## Serripes Gould

*Aphrodite* Lea 1834, Trans. American Phil. Soc. (n.s.) **5**, p. 111; *non Aphrodite* Link 1807; *non Aphrodite* Hübner 1820; *non Aphrodite* Leske 1775; *non Aphrodite* Lendenfeld 1886.

*Aphrodita* Leach 1839 (pro *Aphrodite* Lea) [in] Sowerby, Conch. Man. p. 70; *non Aphrodita* Linné 1758.

*Serripes* 'Beck' Gould 1841, Invertebrata of Massachusetts, Cambridge, p. 93.

Genotype, *Cardium groenlandicum* Bruguière 1789 (by monotypy).

*Description.* Valves generally smooth over the disc but with broad flattened sub-obsolete ribs over the slopes. Hinge plate very narrow; cardinal teeth nearly wanting. Muscular and pallial complex well impressed. Shell moderately gaping.

### *Serripes groenlandicus* Bruguière, Plate 13, figs. 5-7

*Venus islandica* 'Linné' Fabricius 1780, Fauna Groenlandica, p. 411 (Ipikfaunak, Greenland); *non Venus islandica* Linné 1767.

*Cardium groenlandicum* Bruguière 1789, Ency. Méth., **1**, p. 222 (Greenland); Gmelin 1790 [in] Linné Syst. Nat., ed. 13, p. 3252 (Greenland and Iceland). [Both authors refer to Chemnitz, Conchylien-Cabinet **6**, pl. 19, fig. 198.]

*Maetra radiata* Donovan 1799, British Shells **5**, p. 161 (Portsmouth, England).

*Cardium edentula* Montagu 1808, Test. Brit. Suppl., p. 29 (Portsmouth [England]).

*Cardium radiatum* 'Donovan' Gray 1824, Append. Parry's Voy. 1819-20, p. 244; *non Dryadin* 1837; *non* Reeve 1845.

*Aphrodite columba* Lea 1834, Trans. American Phil. Soc. (n.s.) **5**, p. 111, pl. 18, fig. 54 (locality unknown).

*Cardium boreale* Reeve 1844, Conch. Icon. **2**, **Cardium**, pl. 22, fig. 131 (Greenland); *non Cardium boreale* Broderip and Sowerby 1829.

*Cardium fabricii* Deshayes 1854, Proc. Zool. Soc. London, p. 333 (Greenland).

*Serripes groenlandicus protractus* Dall 1900, Trans. Wagner Free Inst. Sci. Philadelphia **3**, pt. 5, p. 112 (Greenland).

*Description.* Shell large, varying from 50 to 90 mm. in height, thin to moderately heavy, inflated, subquadrate, longer than high and gaping slightly at the posterior. The exterior color is cinereous, with some specimens showing concentric bars of dark brown which border growth stages. Interior color is flat to grayish white. Anterior margin rounded, the posterior side somewhat elongated. Umbones high, inflated and subcentral. Lunule and escutcheon not defined. Ligament large and very strong. The sculpture consists of many broad flattened sub-obsolete ribs which appear accentuated on the posterior and anterior slopes. They may be obsolete or only faintly indicated on the disc. There are concentric ridges which are somewhat irregular but prominent, indicating periods of growth. Muscle scars and pallial line deeply impressed. Pallial line truncated posteriorly. Margins of shell faintly serrated.

	length	height	width	
(large)	99	84	59 mm.	Penobscot Bay, Maine
(average)	72	60	38	Egg Harbor, Labrador

*Range.* Circumpolar; in North America extending south as far as Cape Cod, Massachusetts and Puget Sound, Washington.

*Records.* GREENLAND: Dove Bay, Danmark Haven; Egedesminde. LABRADOR: Kamaktervik Bay; Egg Harbor in 7 fathoms; between Cape Mugford and Hebron in 60 fathoms; Nain in 7 fathoms; Shoal Tickle. NEWFOUNDLAND: Grand Banks (Gould's specimen). NEW BRUNSWICK: Grand Manan Bank. NOVA SCOTIA: East of Sable Island in 55 fathoms. MAINE: Eastport in 60 fathoms; Mt. Desert in 5 fathoms; off Owl's

Head, Penobscot Bay in 40 fathoms. MASSACHUSETTS: Cultivator Shoal, Georges Bank in 65 fathoms; Middle Bank in 35 fathoms (all MCZ).

### *Microcardium* Thiele

*Microcardium* Thiele 1934, Handbuch der Systematischen Wiechtierkunde pt. 3, p. 878.

Genotype, *Cardium (Fulvia) peramabile* Dall 1881 (by subsequent designation, Keen 1937).

Shell delicate, much inflated, with many radial ribs crossed by concentric sculpture. Hinge plate narrow, posterior laterals more distant from the cardinals than are the anterior laterals. Cardinals enlarged, laterals reduced. A very deep pit between the two cardinal teeth in the left valve. Cardinals of right valve proportionately very high.

#### Key to the species of the genus *Microcardium*

Shell generally white and with about 90 minute ribs	<i>peramabile</i>
Shell with color and with more than 150 minute ribs	<i>tinctum</i>

### *Microcardium peramabile* Dall, Plate 13, figs. 1-2

*Cardium (Fulvia) peramabilis* Dall 1881, Bull. Mus. Comp. Zoöl. **9**, p. 132 (type locality not indicated).

*Cardium peramabile* Dall, Keen 1937, Bull. Mus. Royal Hist. Nat. Belgique **13**, no. 7, p. 14.

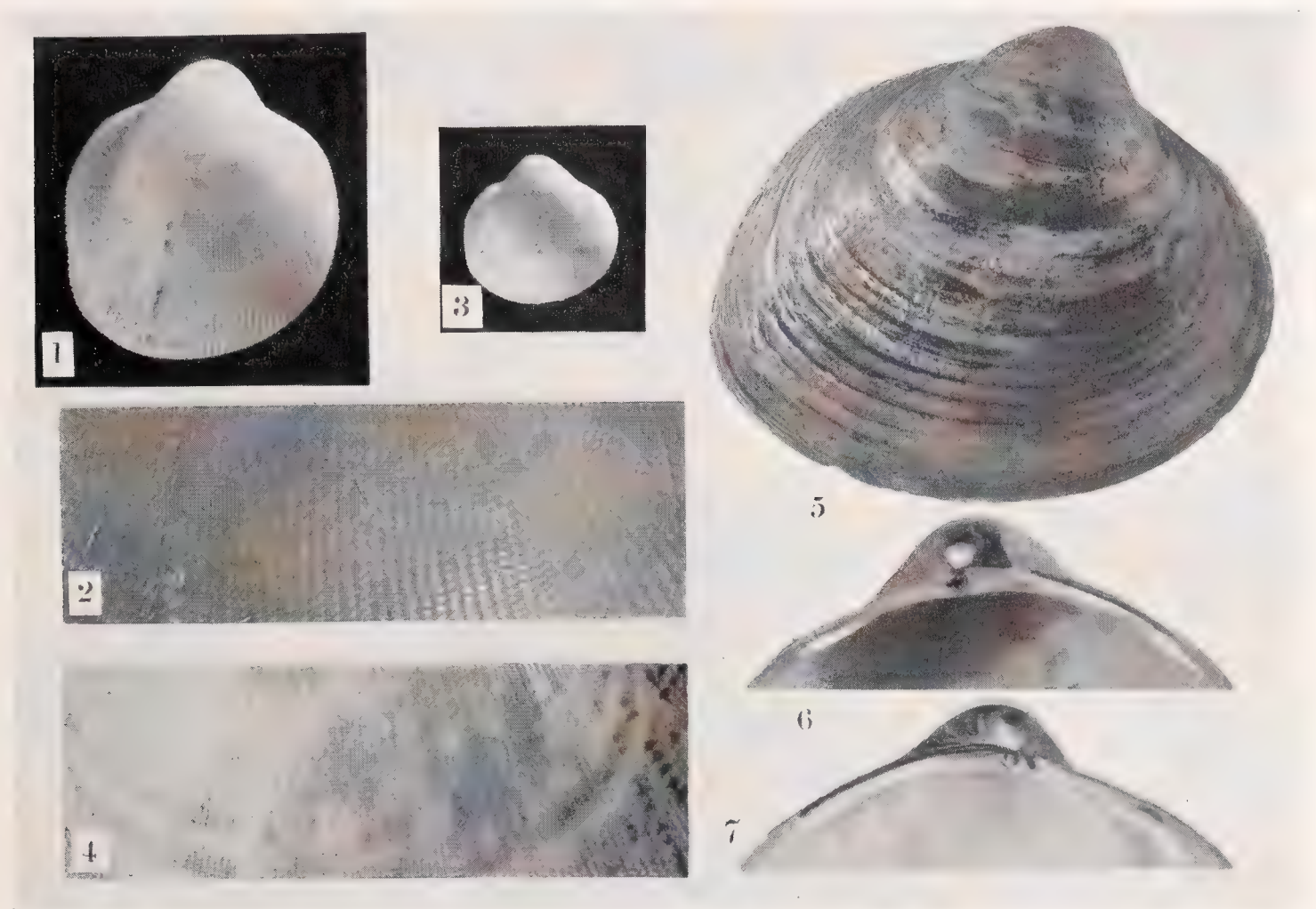


Plate 13. Fig. 1-2, *Microcardium peramabile* Dall, Bahía de Cochinos, Santa Clara, Cuba (fig. 1, 2x; fig. 2, right valve (6x)). Fig. 3-4, *M. tinctum* Dall, off Barbados, Lesser Antilles (fig. 3, 2x; fig. 4, left valve 6x). Fig. 5, *Serripes groenlandicus* Bruguière, off Owl's Head, Penobscot Bay, Maine (slightly reduced). Fig. 6-7, hinge plate of *S. groenlandicus* Bruguière, off Owl's Head, Penobscot Bay, Maine (slightly reduced)

*Description.* Shell small, varying from 11 to 20 mm. in height, thin, much inflated, subquadrate and not gaping. The color is white, sometimes mottled with delicate shades of brown on the anterior slope. The color of the interior is similar to that of the exterior. Umbones are subcentral, high and prominent. Ligament small. Lunule small but well defined. The escutcheon is not defined. The sculpture is of two types, the more accentuated being on the posterior portion which covers a little more than one-third of the shell. A single prominent rib, larger than any other on the shell, marks the division line between the two areas of sculpture. The anterior sculpture consists of about 45 minute but distinct radiating ribs a little wider than their interspaces and beautifully reticulated by concentric ridges. In the region immediately in front of the umbones, the radiating riblets fail, or become obsolete, and the concentric ones become crowded, wrinkled and irregular. The rib which separates the two types of sculpture is often crested. Beyond this rib, the posterior part of the shell bears about 45 radiating ribs which are more slender than the ribs of the anterior area and have proportionately wider interspaces. The concentric ridges here are merely thin lamellae. There are minute denticulated scales on the posterior slope which have their origin in the interspaces. The ribs are extended beyond the margins, giving a very fine, accentuated serration. Periostracum cream colored and fairly conspicuous on the border and slopes.

	length	height	width	
(large)	16	18	15 mm.	Bahía de Cochinos, Santa Clara, Cuba
(average)	13.5	14.5	12	Bahía de Cochinos, Santa Clara, Cuba

*Types.* Lectotype, Museum of Comparative Zoölogy no. 8010, off Yucatan (N. Lat.  $23^{\circ}13'$ ; W. Long.  $89^{\circ}16'$ ) *Blake*, station 36 in 84 fathoms.

*Remarks.* This rather remarkable deep sea form has very unusual sculpture for a species of this family in that the reticulated surface shows a strongly developed concentric sculpture. On the upper portion of the disc the sculpture is most uniform and fine and looks almost as if it had been machine-cut.

Though its range is rather extensive, it appears to be common only in the deep water off Cuba.

*Range.* Rhode Island south through the Lesser Antilles in 18–350 fathoms.

*Records.* RHODE ISLAND: South of Block Island in 80 fathoms. FLORIDA: off Sand Key, *Blake*, station 9 in 111 fathoms; off Sombrero Key, *Bache*, in 72 fathoms. CUBA: off Habana, *Blake*, station 50, in 119 fathoms; Bahía de Cochinos, *Atlantis*, station 3332, in 175–225 fathoms; Bahía de Corrientes, Pinar del Rio, *Atlantis*, station 3315, in 350 fathoms; off Cayo Coco, Camagüey, *Atlantis*, station 3393 in 220 fathoms; off Punta Alegre, *Atlantis*, station 3419, in 180 fathoms. VIRGIN ISLANDS: off St. Croix, *Blake*, station 132 in 115 fathoms. MEXICO: off Yucatan, *Blake*, station 36, in 84 fathoms; Yucatan Channel, *Bache*, in 100 fathoms. LESSER ANTILLES: off Grenada, *Blake*, station 254 in 164 fathoms; off Dominica, *Blake*, station 177, in 18 fathoms; off Barbados, *Blake*, station 273, in 103 fathoms (all MCZ).

### *Microcardium tinctum* Dall, Plate 13, figs. 3–4

*Cardium peramabilis tinctum* Dall 1881, Bull. Mus. Comp. Zoöl. 9, p. 133; *ibid.* 12, p. 270 (type locality not indicated).



*Description.* Shell small, varying from 7 to 12 mm., thin, inflated, subquadrate and not gaping. The color is white with faint diffusion of delicate shadings of pink, some shells showing small patches of color near the margins. The interior is white with delicate shades of pink along the posterior slope. The umbones are pink, subcentral, high and prominent. Ligament small. Lunule small but well defined. Escutcheon not outlined. The sculpture consists of more than 150 minute but distinct radiating ribs crossed by finer, almost indistinct concentric lines. The interspaces are very fine. The posterior slope possesses minute denticulated scales protruding from about every fourth interspace. These scales are generally white but an occasional specimen shows scales of a delicate coral shade. The serrations are extremely fine but very distinct.

	length	height	width	
(large)	13	12	9 mm.	off Barbados
(average)	9	8	7	off Barbados

*Types.* Lectotype, Museum of Comparative Zoölogy, no. 8022, off Fredrikstadt, St. Croix, Virgin Islands, *Blake*, station 127, in 38 fathoms.

*Remarks.* This species is very similar to *M. peramabile* but it can be easily differentiated. It does not have the sharp line of demarkation between the sculptures of the posterior and anterior slopes. It also has many more ribs and much more color.

*Range.* Southern Florida south through the Lesser Antilles in 7-225 fathoms.

*Records.* CUBA: Bahía de Cochinos, *Atlantis*, station 3332, in 175-225 fathoms. VIRGIN ISLANDS: off St. Croix, *Blake*, station 127 in 38 fathoms. LESSER ANTILLES: off Barbados, *Blake*, in 100 fathoms; off Barbados, *Blake*, station 287, in 7-50 fathoms (all MCZ).

\* \* \* \*

### Notes

*C. apertum* Bruguière 1789, Ency. Méth. Vers 1, pt. 1, p. 226 is based upon the figure of Martini 1782, Conchylien-Cabinet, (1) 6, pl. 18, fig. 181-183.

This species is said to have come from Jamaica. It is unknown in the Western Atlantic.

*C. pictum* Dunker 1861, Malak. Blätter, 8, p. 37 (West Indies): *non C. pictum* Ravenel.

According to Dall (1900, p. 388) this is probably a European species. Dunker, himself, compared it with *C. papillosum* Poli which occurs in the Mediterranean.

*C. regulare* Bruguière 1789, Ency. Méth. Vers 1, pt. 1, p. 227 (Santo Domingo).

This species occurs in the Mediterranean Sea.

*C. rugatum* Dillwyn 1817, Desc. Cat. Recent Shells, p. 125 (Jamaica and the East Indies).

This species is an absolute synonym of *C. apertum* Bruguière as it is based upon the same figures quoted for this latter species.

*C. squamosum* Gmelin 1790 in Linné's Systema Naturae, ed. 13, p. 3256 (no locality).

This name is based upon the figure of Gualtieri 1742, Index Testarum Conchyliorum, pl. 71, fig. N. This illustration may be that of *T. isocardia* Linné, of the Western Atlantic, or it may be that of *T. consors* Sowerby, of the Eastern Pacific. If this species is eventually considered the same as *T. isocardia* it will become a synonym. If it should be decided that the figure is that of *T. consors*, the name would take priority and would replace this latter name.

*C. venustum* Gabb 1873, Trans. American Phil. Soc. **15**, p. 251 (Tertiary: Santo Domingo); H. A. Pilsbry 1921, Proc. Acad. Nat. Sci. Philadelphia, p. 421, pl. 25, fig. 2, 7; *non C. venustum* Dunker 1861.

This species has been considered a synonym of *L. laevigatum*, but we agree with Pilsbry that it is distinct and that its general characteristics appear to be beyond the range of variation which we find in *L. laevigatum*.

\* \* \* \*

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Plates 1, 9 and 10 by Marion A. Bills, remaining plates by Frederick P. Orchard.

\* \* \* \*

#### Book Review

Apgar, Austin C. 1891: Mollusks of the Atlantic Coast of the United States South to Cape Hatteras, Journ. New Jersey Natural History Society **2**, no. 2, pp. 75-162, 3 plates. This little book is not common. It is particularly useful as it covers in fair detail the region south of Cape Cod to Cape Hatteras as well as the territory to the North. The region between Cape Cod and Cape Hatteras has been infrequently dealt with, and is usually considered in conjunction with areas far more extensive. Good descriptions are given for the shells of this area. An excellent key is provided covering most of the families found north of North Carolina. A glossary of molluscan terms is included. The plates are limited, illustrating only a few species. The third plate provides a printed protractor and millimeter scales, useful in measuring specimens.—W. J. CLENCH.

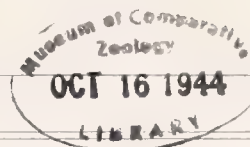
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MODULIDAE



NUMBER 14

## THE GENUS *MODULUS* IN THE WESTERN ATLANTIC

BY  
R. TUCKER ABBOTT

The family *Modulidae* possesses but a single genus, *Modulus*, which contains about a dozen species. Nearly all of these are found in shallow waters in tropical and semi-tropical areas. There are only two species in the Western Atlantic and, to judge by the number of specimens in museums, our own *Modulus modulus* Linné is the only really abundant one of all the world forms. This species is mainly intertidal and consequently accessible to collectors. Others in the genus live well below the low-water line and are consequently less frequently collected.

There is considerable variation among specimens of a *Modulus* species even at the same locality. The several characters of *Modulus modulus* appear in any number of combinations in many widely scattered regions of the Western Atlantic and this has given rise to a rather long list of synonyms. A careful study of a large series of this species shows no line of demarcation among the variously formed individuals.

### Genus *Modulus* Gray

[?] *Aplodon* Rafinesque 1819, Jour. de Physique, de Chimie, d'Historie Naturelle **88**, p. 425 [Pilsbry 1930, Proc. Acad. Nat. Sci. Philadelphia **82**, p. 324, Genotype, *A. nodosum* Rafinesque].

*Modulus* Gray 1842, Synopsis of the contents of the British Museum, ed. 44, p. 60; Gray 1847, Proc. Zool. Soc. London, **15**, p. 150.

*Haplodon* Agassiz 1846 (emendation for *Aplodon* Raf.) Nomen. Zool. Index Univ. p. 172; non *Haplodon* Wagler 1830; non *Haplodon* Muenster 1840.

*Turbinopsis* Conrad 1860, Jour. Acad. Nat. Sci. Philadelphia (2), **4**, p. 289.

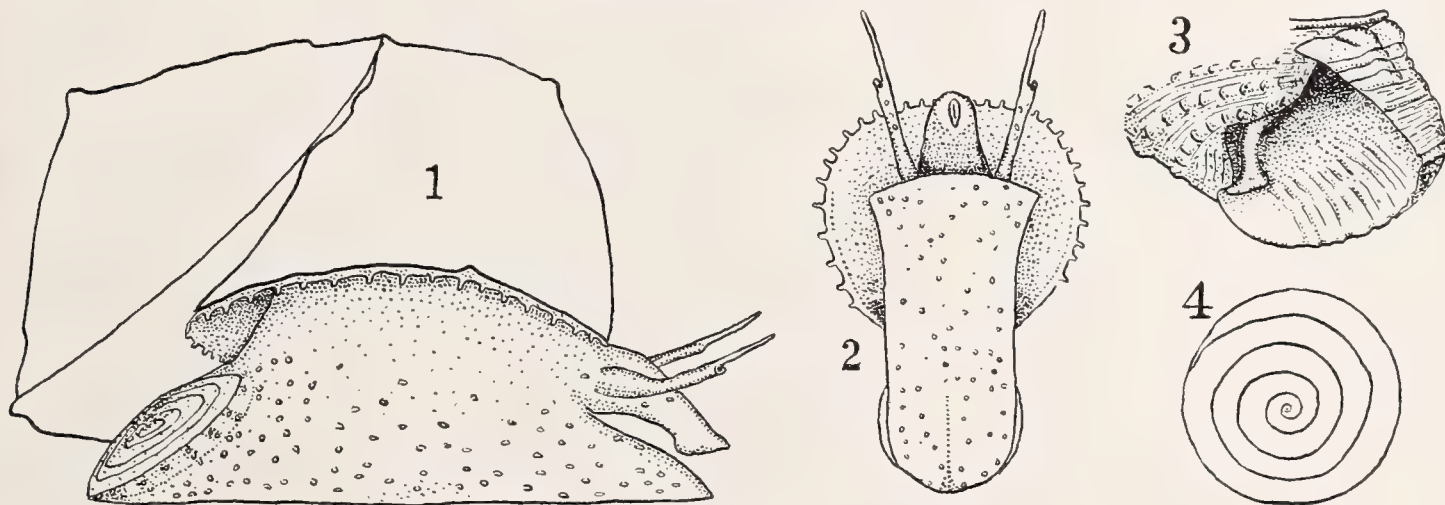


Plate 1. *Modulus modulus* Linné. Fig. 1. Lateral view of animal showing position of operculum. Fig. 2. Ventral view showing foot, head and under edge of mantle. Fig. 3. Aperture view of shell. Fig. 4. Dorsal view of operculum (all about 3×). Drawn by R. T. Abbott.

*Pseudotrochus* Heilprin 1887, Trans. Wagner Free Inst. Sci. Philadelphia, **1**, p. 114 (non Mörch 1852; non Kittl 1899).

*Note.* An earlier name, *Modolus*, was first used by Potiez and Michaud 1838, Galerie des Mollusques **1**, p. 319. This was mentioned under *Monodonta modulus* Linné as a generic name proposed by Beck but was never published until the above two authors gave it mention. If this use is admissible, the name *Modolus* 'Beck' Potiez and Michaud 1838 will replace *Modulus* Gray 1842, both having the same type species, *Trochus modulus* Linné.

Genotype, *Trochus modulus* Linné (subsequent designation by Gray 1847).

Shell top-shaped to more or less depressed with a well developed tooth-like lamella near the base of the columella. Last whorl often descending slightly. Animal without a siphon. Mantle edge bearing tooth-like filaments. Eyes placed midway on the tentacles. The radula is similar to that of *Cerithium*. Operculum multispiral, corneous and thin.

According to Dall (1892, Trans. Wagner Free Inst. Sci. Philadelphia, **3**, p. 294), this genus has existed in America continuously since Cretaceous times.

It seems to us that Pilsbry's use of *Aplodon* Rafinesque in place of *Modulus* Gray is both unwise and untenable. To change a well known and unquestioned name for one unknown and poorly defined is only to set the stage for future trouble. To suppose Rafinesque had a *Modulus* as a "stray marine shell" mixed in with his Kentucky shells, is only to suggest that others among the marine gastropods fitting his brief description could be used equally as well. There are a few trochoids that this description would cover as well as it does *Modulus*.

### **Modulus modulus** Linné, Plate 2, fig. 1-4

*Trochus modulus* Linné 1758, Syst. Nat. ed. 10, p. 757 (locality unknown); Linné 1767, Syst. Nat. ed. 12, p. 1228, [refers to Seba **3**, pl. 34, fig. 12]; Gmelin 1790, Syst. Nat. ed. 13, p. 3568 (Red Sea) [refers to Lister 1688, pl. 653, fig. 52].

*Trochus filosus* Helbling 1779, Abhandl. Privatgesellsch. Böhmer **4**, p. 123, pl. 2, fig. 32-33 (no locality).

*Trochus perlatus* Gmelin 1790, Syst. Nat. ed. 13, p. 3577, [refers to Kaemmerer 1786, Conchy. Cat. Erbrinzen Schwarzburg-Rudolstadt, pl. 12, fig. 1].

[?] *Aplodon nodosum* Rafinesque 1819, Jour. de Physique, de Chimie, d'Histoire Naturelle **88**, p. 425 (Kentucky).

*Trochilus unidens* 'Lister' d'Orbigny 1842 [in] Ramon de la Sagra, Hist. L'Isle de Cuba, Mollusques **2**, p. 57 [d'Orbigny refers to Lister 1688, quoting figures 52-54 which are figures of three different species. We here restrict d'Orbigny's reference to figure 52 which is *Modulus modulus*].

*Trochus lenticularis* 'Chemnitz' d'Orbigny 1842 [in] Ramon de la Sagra, Hist. L'Isle de Cuba, Mollusques, **2**, p. 57.

*Cricostoma striatum* 'Klein' d'Orbigny 1842 [in] Ramon de la Sagra, Hist. L'Isle de Cuba, Mollusques, **2**, p. 57.

*Modulus floridanus* Conrad 1869, American Jour. Conch. **5**, p. 107, pl. 12, fig. 6 (Florida).

*Modulus krebsii* Mörch 1876, Malak. Blätt. **23**, p. 129, (Anguilla [West Indies]).

*Modulus convexior* 'Beck' Mörch 1876, Malak. Blätt. **23**, p. 129 (St. Croix [Virgin Islands]).

*Modulus pisum* 'Beck' Mörch 1876, Malak. Blätt. **23**, p. 130 (St. Bartholomew; Bermuda).

*Modulus canaliculatus* 'Beck' Mörch 1876, Malak. Blätt. **23**, p. 131 (Antilles).

*Ethalia tasmanica* Tenison Woods 1877, Proc. Royal Soc. Tasmania, p. 146 (north coast, Tasmania) [see C. Hedley 1902, Nautilus **16**, p. 49].

*Modulus corrugatus* 'Stimpson' Dall 1884, Proc. United States Nat. Mus. **6**, p. 335; 'Stimpson' Dall 1892, Trans. Wagner Free Inst. Sci. Philadelphia, **3**, pt. 2, p. 295.

*Description.* Shell 10 to 16 mm. in length, umbilicate, solid, rugose and sculptured with a series of coarse spiral cords. Whorls 5 to 6, strongly convex, the last descending just before the aperture in adults. Color grayish white with occasional specimens show-

ing a flecking of purplish-brown. Spire moderately depressed, turbinate and usually obtuse. Aperture subcircular. Outer lip rather thin and reinforced within with a series of short tooth-like ridges in spiral arrangement. Parietal wall glazed purplish. Columella rather thick, arched and terminated by a prominent tooth-like lamella. Umbilicus small, deep and only slightly covered by the columellar fold. In young specimens, it is entirely open. Suture slightly impressed and irregular. Sculpture consists of numerous well developed cords with the strongest cord at the periphery of the whorl. Above the peripheral cord there is a series of axial nodules or costae which may be absent in occasional specimens. The entire spire may be smooth, or almost so, in many cases. Base of shell possesses about 5 well developed cords. Operculum circular, multispiral, thin and colored a transparent amber. Periostracum thin and deciduous.

Animal (see Plate 1) of medium size with the expanded oblong foot slightly shorter than the shell. Head bears a short rounded proboscis and two thin, round tentacles. Eye midway on each tentacle. Mantle lining the inside of the shell thin and bordered by a series of small white fleshy knobs. General color of animal a soft moss green with a dusting of minute chalk-white dots. Color of underside of foot a light pea green; sides moss green with white dots; band running around operculum has series of bars alternately white and green. Base of tentacles green, areas beyond eye are a clear yellow green. Upper part of foot, mantle within the shell, and visceral mass variously shaded with brilliant, glistening yellows and greens.

	length	width	
(large)	14	15 mm.	Charlotte Harbor, Florida
(average)	11	12	Cienfuegos Bay, Cuba
(small)	9	9.5	Agars Island., Bermuda

*Types.* We here select Lister 1688, *Historiae Conchyliorum*, 2, pl. 653, fig. 52, as the type figure and Barbados, originally given by Lister, as the type locality.

*Common name.* Atlantic Modulus.



Plate 2. Fig. 1. *Modulus modulus* Linné, Tampa Bay, Florida. Fig. 2. *M. modulus* Linné, East side of Boca Chica Key, Florida. Fig. 3-4. *M. modulus* Linné, Tarpon Bay, Sanibel Id., Florida. Fig. 5-6. *M. carchedonius* Lamarck, Gulf of Paria, off Pointe-à-Pierre, Trinidad. Fig. 7. *M. carchedonius* Lamarck, Jamaica (all 2×).

*Remarks.* A common species found abundantly on shallow water eel-grass flats, especially in sheltered bays. In particularly quiet warm waters, the shells become covered with algae and live barnacles. Young slipper shells, *Crepidula fornicata* Linné, often attach themselves to the backs of this species. Commonly found in beach drift in a smooth wave-worn condition. The moss green color of the animal blends with the green eel-grass.

Heavily nodulous and rounded specimens found in many localities in west Florida and the entire West Indies were erroneously considered a distinct species by Conrad (*M. floridanus*). A study of specimens from a number of localities indicates that *modulus* varies greatly in size, sculpturing and coloring and that actually there are only two living species in the Western Atlantic. The second species (*M. carchedonius* Lamarck) is limited to the West Indies and not, so far, recorded from Florida. Corroded and beach-worn specimens of *modulus* are likely to be confused at first with *carchedonius*, but the traces of worn down nodules and coarse, irregularly-sized threads on the last whorl will identify it as *modulus*. We have also seen specimens from Hispaniola, Virgin Islands and Brasil which show a remarkable enlargement of the nodules into almost blunt spines. The spire is somewhat elongated in certain of these shells.

No figure or locality reference was given by Linné in his 1758 *Systema Naturae* (10th ed.) when describing *modulus*. In the 12th edition he refers in error to a wood cut of a fish (Seba, 3, pl. 34, fig. 12). Gmelin in the 13th edition correctly refers to Lister, pl. 653, fig. 52, a figure readily recognized as this species. Although Lister gave the locality as Barbados, Gmelin erroneously assigned it to the Red Sea. (See *types*.)

Dall's record (1902, p. 295) of this species from 25 miles off Hatteras, North Carolina, is possibly an accidental specimen that had been transported by some migrating fish or other mechanical means. It is not known to occur between Hatteras and east Florida.

*Range.* Bermuda, Florida, the Gulf of Mexico and south through the West Indies to Brasil.

*Records.* FLORIDA: Lake Worth; Madera Bay; Key West; Tortugas; Charlotte Harbor; Boca Grande; Sarasota; Tampa Bay; Cedar Keys (all MCZ). LOUISIANA: Chandeleur Id. (USNM). TEXAS: Port Aransas; Olivia (both MCZ); Pass Cabella (USNM). BERMUDA: Castle Harbor and Agars Id. (both MCZ). BAHAMAS: West End, Grand Bahama; Strangers Cay, Little Abaco; Bimini Islands; Nassau, New Providence; Arthurstown, Cat Island; Mangrove Cay, Andros Island; Simms, Long Island (all MCZ). CUBA: Habana; Bahía Honda; Guantánamo; Cienfuegos Bay (all MCZ); Caibarién; Matanzas; Cabana Bay (all P.J. Bermúdez). ISLE OF PINES: Nueva Gerona (MCZ). HISPANIOLA: Jérémie (MCZ); Cap Haitien; Miragoane (both W. J. Eyerdam); Monte Cristi; Puerto Plata; Santa Bárbara de Samaná (all MCZ). PUERTO RICO: San Juan (MCZ); Desecheo Id. (USNM). JAMAICA: Montego Bay (MCZ); Kingston (USNM). VIRGIN ISLANDS: St. Thomas; St. John (both MCZ); Tortola and Virgin Gorda (both M. Dewey). LESSER ANTILLES: Antigua; Barbados (both USNM); Guadeloupe (MCZ); Carenage and Chaguaramas Bays, Trinidad (both H. G. Kugler). CARIBBEAN ISLANDS: Cozumel Id.; Ruatan Id. (both USNM). CENTRAL AMERICA: Yucatan, Mexico; Colón, Panama (both USNM). SOUTH AMERICA: Cartagena and Santa Marta, Colombia (both MCZ); Cumaná, Venezuela (MCZ); Cabo de São Roque; Brasil (USNM).

**Modulus carchedonius** Lamarck, Plate 2, fig. 5-7

*Monodonta carchedonius* Lamarck 1822, Anim. s. Vert. 7, p. 33 (locality unknown) [refers to Chemnitz 1788, Conchy.-Cab. (1) 10, pl. 165, fig. 1583-1584 (Barbados)].

*Monodonta angulata* C.B. Adams 1845, Proc. Boston Soc. Nat. Hist. 2, p. 7 (Jamaica).

*Modulus carchedonicus* 'Lamarck' A. Adams 1851, Proc. Zool. Soc. London 1850 [1851] p. 203 (Atooi, California).

*Monodonta sayii* 'Nuttall' A. Adams 1851, Proc. Zool. Soc. London 1850 [1851] p. 203. [This reference was based upon a nude name of Jay (1839) A Catalogue of the Shells in the Collection of J. C. Jay, New York, p. 72 (Atooi)].

**Description.** Shell 10 to 16 mm. in length, narrowly umbilicate, solid and sculptured with a series of strong spiral threads which may be slightly nodulose. Whorls 6 to 7, flat to slightly concave with the last sharply angulated at the periphery. The last whorl in adults is slightly descending before the aperture. Color grayish white with the threads spotted more or less regularly with purplish brown. An occasional specimen will have the peripheral thread a solid purplish color. Spire extended, conical and acute. Aperture subquadrangular. Outer lip rather thin and reinforced within by a series of short tooth-like ridges in spiral arrangement. Parietal wall glazed white. Columella rather thick, arched, and terminated by a prominent tooth-like lamella. Umbilicus very small, deep and nearly covered by the columellar fold. In young specimens it is usually entirely closed. Suture minutely impressed and usually bordered by two strong threads. Sculpture consists of numerous slightly beaded spiral threads or fine cords with the strongest at the periphery. Above the peripheral cord there are no axial costae. Base of shell possesses about 8 fine cords. Operculum circular, multispiral, thin and amber colored. Periostracum thin and tinged a light blue-green.

	length	width	
(large)	17	16 mm.	off Point-à-Pierre, Trinidad
(average)	11	11	Jamaica
(small)	10	10	La Punta, Santa Clara Prov., Cuba

**Types.** The location of Lamarck's types is unknown to us. We select the island of Barbados as given by Chemnitz as the type locality, based upon Lamarck's reference. The holotype of *M. angulatus* C. B. Adams from Jamaica is No. 149300, Museum of Comparative Zoölogy.

**Common name.** Angled Modulus.

**Remarks.** *Modulus carchedonius* Lamarck is not a very common species and is likely to live in water deeper than six feet. It shows very little variation in its characteristics and may best be separated from *M. modulus* Linné by its angulate contours, lack of nodules, neatness of its spiral sculpturing and, especially in the young, by its nearly closed umbilicus.

The columellar tooth in *carchedonius* is never colored, while in *modulus* is frequently touched with purplish brown.

*Monodonta sayii*, a nude name, was listed, probably erroneously, as a synonym by A. Adams under *Modulus carchedonius* Lamarck and given the locality of Atooi, California. Atooi is an old and alternate name for Kauai Island in the Hawaiian Islands.

A nude name listed as a synonym of a species automatically takes the description of that species. As far as we have been able to trace the history of this name, A. Adams was the first to make the name valid. Thus *M. sayii* must be considered a synonym of *Modulus carchedonius* Lamarck. Nuttall's original specimens from Hawaii will have to be renamed or, more probably, assigned to some other described genus and species.

*Range.* Greater Antilles south to the northern coast of South America.

*Records.* CUBA: La Punta, Isabela de Sagua; Caibarién (both P.J. Bermúdez); Santiago; Cabanas; Mariel (all USNM); Cienfuegos Bay (MCZ). HISPANIOLA: Port au Prince (USNM); Monte Cristi; Santa Bárbara de Samaná; Puerto Sosuá (all MCZ). PUERTO RICO: San Juan; Mayagüez; Desecheo Id. (all USNM). JAMAICA: Kingston (USNM). VIRGIN ISLANDS: St. Thomas (USNM). LESSER ANTILLES: off Pointe-à-Pierre, Trinidad, in 3 fathoms (H.G. Kugler). CARIBBEAN ISLANDS: Curaçao (USNM). CENTRAL AMERICA: Belize, British Honduras (USNM); Fox Bay, Colón, Panama (USNM). SOUTH AMERICA: Puerto Colombia and Cartagena, Colombia (both USNM).

\* \* \* \*

During the studies made on the Western Atlantic *Modulus*, the following notes were obtained on the Eastern Pacific species which has frequently been confused with our Atlantic *M. carchedonius*.

### ***Modulus catenulatus* Philippi**

*Modulus catenulatus* Philippi 1849, Conchy.-Cab. (2), 2, pt. 3, p. 110, pl. 18, fig. 4 (locality not given).

*Modulus trochiformis* Eydoux and Souleyet 1852, Voyage de la Bonite, Zoologie 2, p. 598, pl. 36, fig. 1-5, pl. 37, fig. 25-31 (Isla de Puná, Guayaquil, Ecuador).

As Philippi did not give a type locality, that of Guayaquil, Ecuador, is here selected, based upon the voyage of the *Bonite*.

\* \* \* \*

### **Book Review**

Dall, W.H. and C.T. Stimpson 1901: The Mollusca of Porto Rico, Bulletin United States Fish Commission 1, pp. 351-524, 3 plates, 1900 [1901]. This excellent report deals with the land, freshwater and marine species of the island of Puerto Rico. The report is based mainly upon the mollusks collected by the *Fish Hawk* in 1899, though many additional data have been added, obtained from the literature published up to 1900. A systematic catalogue is appended to the main report in which the classification is considered to the subgenus. A list of the dredging stations by the *Fish Hawk* in Puerto Rican waters is included with the number, date, depth, locality and other pertinent data. 535 marine species are listed, many old species fully described and many figured including the 42 species considered as new.—W. J. CLENCH



## Harvard-Bahama Expedition, 1904

During the month of July, 1904, an investigation was made of Grand Bahama, Little and Great Abaco Islands and a few of the many islands that fringe Great Abaco to the east and north. The party consisted of Glover Allen, Thomas Barbour and Owen Bryant. Collections were made mainly of mammals, reptiles, amphibians and mollusks, though other groups of animals were collected as well. Incidental collecting was also made on the Island of New Providence and, during August, Owen Bryant made an independent visit to Mangrove Cay in the southern portion of Andros Island where many marine shells were collected as well as a series of land and freshwater mollusks of this hitherto unexplored island.

A sixty ton schooner, the *William H. Albury*, was chartered for the expedition. She was fifty-nine feet overall and drew about six feet of water. Six men composed her captain and crew. The expedition left Nassau for Hopetown, Elbow Cay, Great Abaco Island, a distance of some 98 miles north of New Providence. This trip was made over the deep water of the North East Providence Channel which lies open to the big swells of the Atlantic. Shore collecting was done at Hopetown for two days and from there the expedition left for the main island of Great Abaco.

Shallow water dredging was done with a 20 inch "Blake" dredge in 3-20 fathoms. Collections were also made by aid of a water glass as well as through shore collecting.

Marine collecting was excellent along the outer shores of Great and Little Abaco and their associated cays. That on the north coast of Grand Bahama Island on the shallow bank side was very poor. This area has much marl along the shallow shore and but few marine species can exist there. This shallow coast is composed of badly weathered limestone with the pockets between the rocks filled with mud from a few inches to a few feet in depth. In addition there are long stretches of mangrove fringing the coast and existing as islands along the shore. The high land which doesn't exceed 25 feet is covered with Bahama pine and an exceedingly tough tangle of xerophytic plants which make collecting very difficult and sometimes impossible.

Many records obtained by this expedition have appeared in *Johnsonia* and there are many more to follow. The following are the important stations where most of the marine shells were collected.

**GREAT ABACO ISLAND:** Hopetown, Elbow Cay, Marsh Harbour; Sweetings Village; The Marls; Great Guana Cay; Whale City Channel. **LITTLE ABACO ISLAND:** Cedar Harbour; Pensacola Cays; Moraine Cay; Stranger Cay; Great Sale Cay. **GRAND BAHAMA ISLAND:** Riding Point. **ANDROS ISLAND:** Mangrove Cay.

A more detailed account of this important trip was published privately by G. M. Allen and Thomas Barbour. The marine bivalves collected have been listed by W. J. Clench and R. A. McLean. The land shells collected by Mr. Bryant on Mangrove Cay, Andros Island, as well as the other land and freshwater shells collected by the party have been reported on by W. H. Dall.

Allen, G. M. and T. Barbour 1904, Narrative of a Trip to the Bahamas. Cambridge, Mass., pp. 1-10, 3 plates.

Dall, W. H. 1905, Report on the Land and Freshwater Shells Collected in the Bahamas in 1904 by Mr. Owen Bryant and Others. Smithsonian Miscellaneous Collections 47, pt. 4, pp. 433-452, 2 plates.

Clench, W. J. and R. A. McLean 1937, Marine Bivalves from Little and Great Abaco, Grand Bahama and Eleuthera, Bahama Islands. Mem. Soc. Cubana Hist. Nat. 11, pp. 31-42, 2 plates.

This last reference also includes the records of the material collected on the Harvard-Grand Bahama Expedition in 1936.—W. J. CLENCH

## Harvard-Grand Bahama Expedition, 1936

In April 1936, I had the experience of collecting on several islands on the Little Bahama Bank in the northern Bahamas with James C. and Gilbert Greenway. Gilbert Greenway had his sea-plane in Nassau when I arrived and two days after my arrival in early April, we left Nassau for West End, Grand Bahama Island. We made daily trips, mainly to Great and Little Abaco, as there was but meager collecting on the north coast of Grand Bahama and the rough seas on the south coast made plane landings impossible. After two weeks, Gilbert Greenway left for Nassau and James Greenway and I took a motor boat to Eight Mile Rock about 25 miles east of the western end of Grand Bahama. This little settlement is at the south entrance of Hawksbill Creek, a tidal creek which cuts through the island to the north coast. At the end of three weeks, I left Jim with his bird collecting and I proceeded to Nassau and Eleuthera Island.

Marine collecting at West End was fair, particularly for the larger species, such as *Strombus* and *Cassis*. Time for collecting at this locality was limited as it was more important, having a plane, to visit many of the small and rather inaccessible islands in the Abaco Island chain. The week spent on Eight Mile Rock was quite profitable for marine shells. Long stretches of beaches exist both east and west of the settlement and rock collecting was rich enough to be called "good pickings," especially in the more protected areas at the mouth of Hawksbill Creek.

Island collecting in the Abacos was a real joy. To pick your island on the chart, see it come into view five miles away and 2000 feet up was a thrill that I should not want to forget. Gil would pick out a "soft spot," taxi up to a beach and Jim and I would wade ashore, hunt for the land material and then for the marine shells. Most of these islands were tough going with their tangle of xerophytic vegetation. Occasionally we would find some really lush growth such as existed on Water Cay, north of Grand Bahama where the vegetation was rank and the soil deep and moist. Such places are rare in the Bahamas.

The real island was the center of three little cays known as Joe Cays. These were north of Little Abaco. This small cay was about one-fourth of a mile long and about 20 odd feet high. It faced deep water on the open Atlantic on the east, and the shallow water of the bank on the west. Its outer rocky slopes were covered with a tough tangle of bushes, but its inner area was flat, grass-floored and spotted with palmettos. Each dead palmetto frond had 20 to 30 land snails underneath, *Plagioptycha abacoensis* v. Mts., a rather rare land shell which is limited to the northern Bahama Islands.

Marine localities follow and the references lead to more detailed information.

GRAND BAHAMA ISLAND: West End; Wood Cay; Eight Mile Rock; Holmes Cay; East End Bush. LITTLE ABACO ISLAND: Foxtown; Joe Cay; Cave Cay. GREAT ABACO ISLAND: Angel Fish Point; Sand Bank, Crossing Bay; Great Abaco opposite Whale Cay; Mores Island.

Clench, W. J. 1937, Descriptions of New Land and Marine Shells from the Bahama Islands. Proc. New England Zoological Club, **16**, p. 17-26, 1 plate.

Clench, W. J. and McLean, R. A., 1937, see previous page.

Clench, W. J. 1938, Land and Freshwater Mollusks of Grand Bahama and the Abaco Islands, Bahama Islands, Mem. Soc. Cubana Hist. Nat. **12**, p. 303-333, 2 plates.

Two marine species were described as new, namely *Strombus samba* Cl. and *Oliva reticularis greenwayae* Cl.—W. J. CLENCH

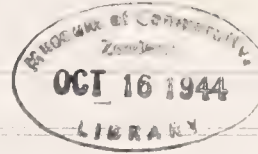
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COLUMBARIIDAE



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## THE GENUS COLUMBARIUM IN THE WESTERN ATLANTIC

BY

WILLIAM J. CLENCH

The family Columbariidae consists of but a single genus, *Columbarium*. Tomlin (1928, p. 330) established the family for this genus as it possessed several characteristics that sharply differentiated it from other genera in the Fasciolariidae, Muricidae and Conidae, the various families to which '*Fusus*' *pagodus* Lesson had been assigned.

The twelve known species of *Columbarium* are all found in moderate depths extending from 76 to 550 fathoms. Future dredgings will probably indicate both shallower as well as deeper ranges as our present data are based almost entirely upon single records for most of the species.

### Genus *Columbarium* v. *Martens*

*Columbarium* v. *Martens* 1881, *Conchologische Mittheilungen* **2**, p. 105.

Genotype, *Pleurotoma* (*Columbarium*) *spinicincta* v. *Martens* (here selected).

Shell generally small, proportionately long and possessing a long extended siphonal canal. Nuclear whorls (two) are bulbous and smooth, remaining whorls usually strongly carinated; the peripheral carina may or may not be serrated. Operculum subtriangular in shape with the nucleus located at the apex. Numerous growth lines are concentrically formed above the nucleus.

### *Columbarium sarissophorum* *Watson*, Plate 1, fig. 1

*Fusus sarissophorus* *Watson* 1882, *Jour. Linn. Soc. London* **16**, p. 392, (off Pernambuco [Brasil] in 350 fathoms); *Watson* 1886, *Report H. M. S. Challenger* **15**, p. 196, pl. 14, fig. 1.

*Description.* Shell small, about  $\frac{3}{4}$  of an inch in length; thin, imperforate and serrately carinated. Whorls 7 and strongly angulated at the periphery. Color a porcellaneous white. Aperture subquadrate in shape, with the base continued below into a long canal. Outer lip thin and sharp. Inner lip thinly glazed. Spire short and conical. Suture deep and well defined. Nuclear whorls 2, glassy, cylindrical and non-carinated. Sculpture consisting of five spiral lines above and five below the bluntly serrated keel or carina but formed some what more delicately above the carina. The spiral lines become obsolete on the base of the canal. Axial sculpture of very fine, thread-like growth lines. Operculum unknown.

height	width	aperture
19.3	7	13.8×2.7 mm. off Pernambuco, Brasil

*Types.* British Museum, obtained by the *Challenger*, station 122, (S. Lat. 9°5': W. Long. 34°50') off Pernambuco, Brasil in 350 fathoms.

*Remarks.* The above description is based on both the description and figure of *Watson* in the *Challenger* report. Only a single specimen was obtained and no more have been secured since the dredging of the *Challenger* in 1873. In relationship, it appears nearest

to *C. bermudezi* Cl. and Ag. but differs in having a less produced spire, a more strongly serrated peripheral keel and a greater development of the spiral sculpture.

*Range and Records.* Known only from the type locality.

**Columbarium bermudezi** *Clench and Aguayo*, Plate 1, fig. 3

*Columbarium bermudezi* Clench and Aguayo 1938, Mem. Soc. Cubana Hist. Nat. **12**, p. 383, pl. 28, fig. 7 (off Sagua la Grande, Cuba in 360 fathoms).

*Description.* Shell imperforate, thin, elongated and keeled. Color a dull white or grayish white. Whorls 8, each with a peripheral keel strongly developed except on the two smooth nuclear whorls. Aperture subquadrate with the base continued with a greatly lengthened canal. Spire elevated. Palatal lip thin and simple. There is a peripheral keel which is at first initiated on the second whorl as a series of small tubercles or elevations along the periphery. Between the fourth and fifth whorls these tubercles are connected by a keel and beyond this point the keel becomes very strong and the tubercles much less so. On the last two whorls the tubercles form a series of rather evenly spaced crenulations. Sculpture of exceedingly fine growth lines. No spiral sculpture indicated other than a few faint spiral threads on the canal. Canal long, about as long as the shell from the base of the aperture to the spire tip. Operculum unknown.

length	width (including keel)	
27.5	7 mm.	Holotype

*Types.* Holotype, Museum of Comparative Zoölogy, no. 135007, *Atlantis*, station no. 2989, off Sagua la Grande, Santa Clara Province, Cuba (N. Lat. 23°10'; W. Long. 80°04') in 360 fathoms. Paratype in the Museo Poey, Habana.

*Remarks.* This species appears nearest in its relationships to *C. sarissophorum* Watson. *C. bermudezi* is larger and proportionately narrower throughout with a more extended spire.

*Range.* Known only from off the North coast of Cuba.

*Records.* All records are from the *Atlantis* dredgings. CUBA: station 3475, off Cardenas (N. Lat. 23°18'; W. Long. 80°48') in 400 fathoms; station 3457, off Sagua la Grande (N. Lat. 23°23'; W. Long. 80°36') in 550 fathoms; station 3422, off Caibarién (N. Lat. 23°05'; W. Long. 79°29') in 250 fathoms; station 2982A, off Punta Alegre (N. Lat. 22°48'; W. Long. 78°50') in 210 fathoms.

**Columbarium atlantis** *Clench and Aguayo*, Plate 1, fig. 4

*Columbarium atlantis* Clench and Aguayo 1938, Mem. Soc. Cubana Hist. Nat. **12**, p. 382, pl. 12, fig. 1 (off Matanzas, Cuba in 421 fathoms).

*Description.* Shell rather thin, faintly shining, elongated and spinose. Color white. Whorls 9, regularly increasing in size. Nuclear whorls ( $1\frac{1}{4}$  bulbous, smooth and glass-like, remaining whorls sculptured. Aperture semicircular, the lower portion continued into a greatly lengthened and narrowly opened canal. Spire extended. Palatal lip thin. Sculpture of numerous peripheral spines developed along a somewhat sharpened carina. The spines are large and deflected downwards and are eight in number on the body whorl. Spiral sculpture of rather coarse thread-like ridges which are slightly wavy above the periphery of each whorl. The ridges are more strongly developed below the periphery on the body whorl and continue spirally below for nearly half the length of the canal. Beyond this point the canal becomes smooth. Axial sculpture of fine and numerous growth lines. Operculum unknown. Periostracum thin and pale yellowish.

length	width (exclusive of spines)	
35.2	6 mm.	Holotype

*Types.* Holotype, Museum of Comparative Zoölogy, no. 135004. *Atlantis*, station no. 2999, off Matanzas, Cuba (N. Lat.  $23^{\circ}10'$ ; W. Long.  $81^{\circ}29'$ ) in 230 fathoms. Paratype from the same area in the Museo Poey, Habana.

*Remarks.* This species is superficially close in its appearance to *C. bartletti*, both being about the same size and both possessing a strongly spinose peripheral keel. However, *C. bartletti* has a deep channel at the suture, its outer rim supporting a series of strong bosses, thus giving the upper margin of the whorl a crenulated appearance.

*Range and Records.* Known only from off Matanzas, Cuba. See types.

***Columbarium bartletti* Clench and Aguayo, Plate 1, fig. 5**

*Columbarium bartletti* Clench and Aguayo 1940, Mem. Soc. Cubana Hist. Nat. 14, p. 86, pl. 14, fig. 3 (off Homer's Cove, Westmoreland, Jamaica, in 254 fathoms).

*Description.* Shell thin, probably dull, elongated and spinose. Color a creamy-yellow. Whorls 10, regularly increasing in size. Nuclear whorls (2) bulbous, smooth and glass-like, remaining whorls sculptured. Aperture subquadrate, the basal area near the axis extended to form a very lengthened and narrow canal. Spire extended. Outer or palatal lip of the aperture thin and not expanded. Columella straight and extended below to form the axis of the lengthened canal. Sculpture of rather numerous, long, horizontally flattened spines developed on the acutely keeled periphery. The spines are extended horizontally or slightly deflected downwardly. Sculpture on the earlier whorls consists

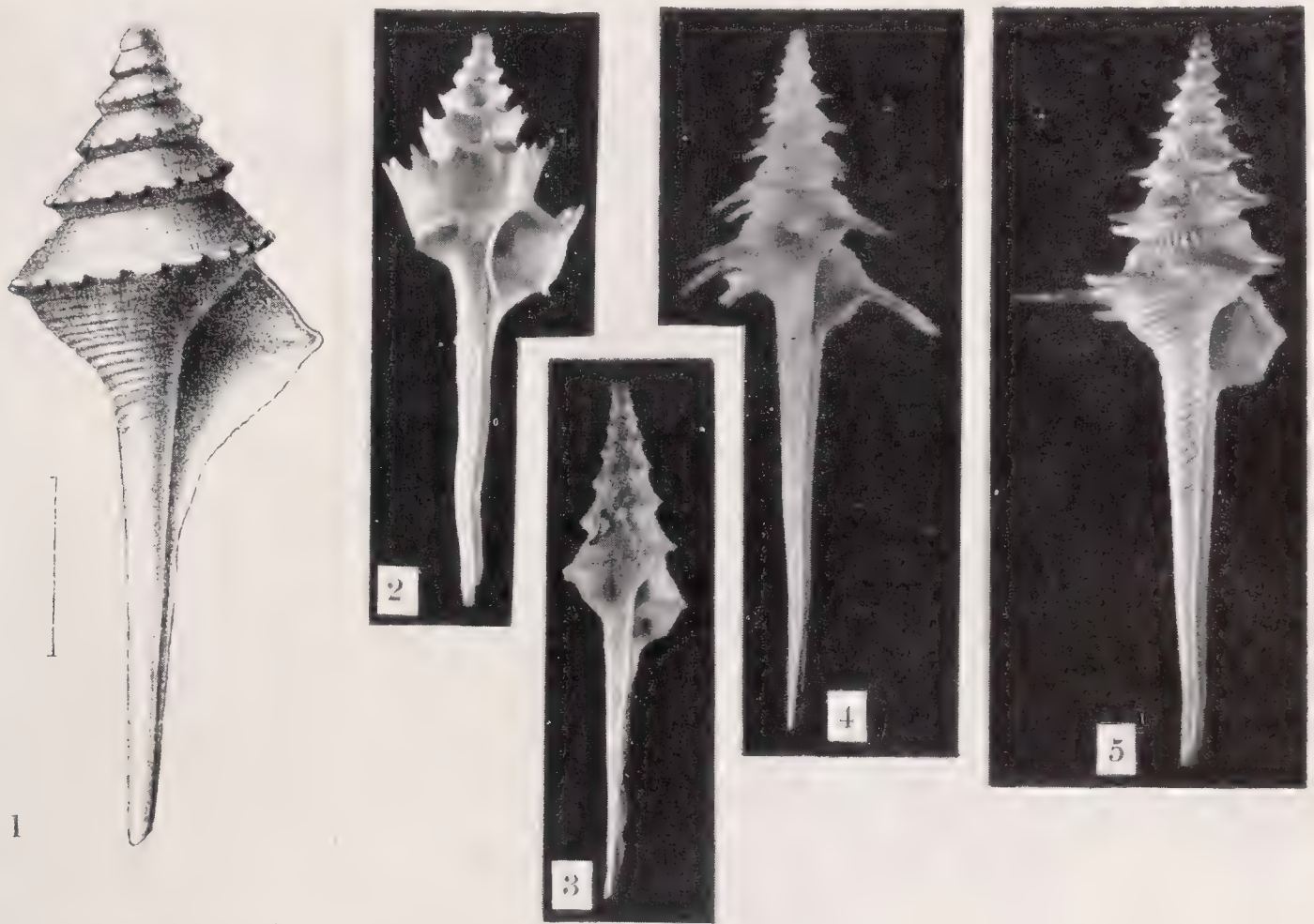


Plate 1, fig. 1. *Columbarium sarissophorum* Watson, Holotype, after Watson ( $4.5\times$ ). Fig. 2. *C. pagoda* Lesson, Tosa, Japan (nat. size). Fig. 3. *C. bermudezi* Clench and Aguayo, Holotype, off Sagua la Grande, Santa Clara, Cuba ( $2\times$ ). Fig. 4. *C. atlantis* Clench and Aguayo, Holotype, off Matanzas, Cuba ( $2\times$ ). Fig. 5. *C. bartletti* Clench and Aguayo, Holotype, off Homer's Cove, Westmoreland, Jamaica ( $2\times$ ).

of a few fine irregular threads above and below the periphery but most prominent near the base of the spines. Below the periphery on the body whorl the spiral sculpture is strong and consists of many regular oblique threads which extend halfway down the canal. Axial sculpture consists of numerous and very fine growth lines extending even out on the spines. Above the periphery there is a series of strong bosses which form a crenulated ridge free from the whorl above. These bosses appear distinctly at the fifth whorl, continuing and becoming increasingly stronger towards the last whorl. Operculum unknown. Periostracum a light yellowish.

length      width (exclusive of spines)  
39.3      8.2 mm. Holotype

*Types.* Holotype, Museum of Comparative Zoölogy, no. 104729, *Blake*, station 9 (N. Lat. 18°12'; W. Long. 78°20') off Homer's Cove, Westmoreland, Jamaica, West Indies, in 254 fathoms. A paratype is in the Museo Poey, Habana.

*Remarks.* See under *Columbarium atlantis* Clench and Aguayo.

*Range and Records.* Known only from the type locality.

\* \* \* \*

A figure is given of *Columbarium pagoda* Lesson (Plate 1, fig. 2) from off Tosa, Japan. This was the first of the several species to be discovered.

The list below includes the remaining species known in this family so far described or recognized as belonging to the family. I concur with Iredale, that several small species both recent and fossil that have been described, mainly in the genus *Fusus*, will probably be found to be members of *Columbarium* when the type specimens can be reexamined.

### **Columbarium formosissimum Tomlin**

*Columbarium formosissimum* Tomlin 1928, Ann. South African Mus. **25**, p. 331, pl. 25, fig. 1 (65 miles off Cape St. Blaize, Union of South Africa in 90 fathoms).

### **Columbarium hedleyi Iredale**

*Columbarium hedleyi* Iredale 1936, Records of the Australian Mus. **19**, p. 316, pl. 24, fig. 18-18a (23 miles east of Sydney, New South Wales, Australia in 250 fathoms).

### **Columbarium natalense Tomlin**

*Columbarium natalense* Tomlin 1928, Ann. South African Mus. **25**, p. 331, pl. 25, fig. 2 (12 miles off Cape Natal, Union of South Africa in 85 fathoms).

### **Columbarium pagoda Lesson, Plate 1, fig. 2**

*Fusus pagoda* Lesson 1831, Illustrations de Zoologie, pl. 40 and text (locality not given); Kiener 1840, Icon. Coquilles Vivantes **5**, p. 7, pl. 5, fig. 2 (locality unknown); Reeve 1847, Conch. Icon. **4**, **Fusus**, pl. 8, fig. 32 (near Kiusu, Strait of Korea).

*Fusus diadema* 'Lesson' Sowerby 1880, Thesaurus Conchyliorum **4**, **Fusus**, p. 79, plate 410, fig. 53 (locality unknown).

### **Columbarium radiale Watson**

*Fusus radialis* Watson 1882, Jour. Linn. Soc. London **16**, p. 382, (off Cape of Good Hope in 150 fathoms); Watson 1886 Rept. H. M. S. Challenger **15**, p. 195, pl. 14, fig. 2.

### **Columbarium pagodoides Watson**

*Fusus (Colus) pagodoides* Watson 1882, Jour. Linn. Soc. London **16**, p. 383 (off Sydney, New South Wales, Australia in 410 fathoms); Watson 1886, Report H. M. S. Challenger **15**, p. 197, pl. 14, fig. 3; non *Fusus pagodoides* 'McCoy' Tenison-Woods 1877 [1878] (nude name).

### **Columbarium spinicinctum v. Martens**

*Pleurotoma (Columbarium) spinicincta* v. Martens 1881, Conchologische Mittheilungen **2**, p. 105, pl. 21, fig. 1-3 (S. Lat. 26°51'; E. Long. 153° [off Moreton Bay, Queensland, Australia] in 76 fathoms).

### **Columbarium trabeatum Iredale**

*Columbarium trabeatum* Iredale 1936, Records of the Australian Mus. **19**, p. 316, pl. 23, fig. 17 (east of Sydney, New South Wales in 110 fathoms).

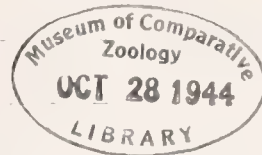
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CASSIDIDAE



NUMBER 16

## THE GENERA CASMARIA, GALEODEA, PHALIUM AND CASSIS IN THE WESTERN ATLANTIC

BY  
WILLIAM J. CLENCH

This number concludes the genera of the family Cassididae that are known to occur in the Western Atlantic. (See *Johnsonia*, No. 9.)

Members of this family are not common as individuals. Though specimens of any one species may not be rare, they seldom if ever occur in profusion. I have seen *Cassis tuberosa* in fair numbers at Settlement Point, Grand Bahama Island, but they occurred far more infrequently than the large *Strombus gigas* which could be had actually by the boat load. Cassids exist in all tropical seas and some species extend well into the temperate zones. About 140 species, subspecies, and forms are known, the largest number existing in the vast Indo-Pacific area. The large cassids of the Western Atlantic are generally found in fairly shallow water, though *Cassis madagascariensis spinella* of the Lower Florida Keys is in water generally deeper than 2 fathoms.

Both *Cassis* and *Phalium* present many very difficult problems in naming. Both genera are exceedingly variable, particularly in size, and this character has but little relative significance. Sculpture is also variable, and extremes in this character show rather remarkable differences. Large series of specimens do show, however, individuals that connect the rather divergent elements by a smooth series of gradations.

Adults among the cassids, especially *Cassis* and *Phalium*, are difficult to determine. The production of a lip is merely a stage in the growth and not an index that final growth has been reached as it is among most other gastropods. The development of a lip indicates a period of rest in the growth of the individual; when new growth starts again, the outer margin of the lip remains behind as a cicatrix. Even this character is variable and not all specimens show the same rate of growth, or produce the same number of lips during a life span. Under "measurements," the "small" specimens measured are only a stage in size, though we selected those having strong and heavy lips, as probably adult.

Similar to other large and attractive shells, the cassids were sought after by the early European collectors and named by their describers with a certain reckless abandon which has left many nomenclatorial problems as yet unsolved. Many published reports are unreliable as confusion has existed, especially in differentiating *C. tuberosa* and *C. flammaea*. The same can be said for the *Phalium* complex where variation is equally extensive. The plates show typical examples of each species, the specimen figured having been selected to show a mid point in the several types of variation that exist for each species.

Genus *Casmaria* H. and A. Adams

*Cassidea* Swainson 1840 [in part]. Treatise on Malacology, p. 299 (*non Cassidea* Bruguière 1789; *non Cassidea* Link 1807).

*Casmaria* H. and A. Adams 1853, Genera of Recent Mollusca, 1, p. 216.

Genotype, *Buccinum vibex* Linné (subsequent designation, Harris 1897).

This genus differs from typical *Phalium* in possessing rather highly polished shells, having the spire somewhat extended and not possessing a parietal shield. The parietal wall in *Casmaria* consists of a smooth, thickened glaze without the outer margin being raised. The lower parietal wall is never papillose or rugose as in *Phalium*, and in addition, the lower outer lip in *Casmaria* is flaring. The false umbilicus is closed.

***Casmaria atlantica***, new species, Plate 1, fig. 1-2

*Description.* Shell rather solid, imperforate, shining and reaching a length of about 45 mm. (about 2 inches). Whorls 8 to 9, somewhat globose and regularly increasing in size. Nuclear whorls smooth and glass-like. Color a light reddish cream to patchy pale buff, overlaid with six spiral bands of squarish spots of light yellow-brown. The spots of the top band just below the sutures are generally a darker brown and more irregularly formed. The spots are prominent and dark brown along the outer edge of the reflected lip of the shell. Spire acute and somewhat produced, cast at an angle of  $56^{\circ}$  to  $58^{\circ}$ . Aperture rounded below and narrow above. Outer lip reflected and thickened, generally with four to six small prickle-like spines near the base of the lip. Parietal wall thinly glazed. Columella broad, twisted and sharply truncated below, its base forming the inner margin of the recurved siphonal canal. There may be one to three weak plications or lamellae on the inner side of the columella. Axial sculpture consists of numerous, exceedingly fine growth lines and the spiral sculpture of microscopic incised lines which are barely visible with a 14 power lens. No varices present on our specimens. Canal short and strongly recurved. False umbilicus closed in both adult and young. Suture slightly indented. Periostracum absent. Operculum unknown.

	length	width	aperture	
(large)	42	23	9×21.5 mm.	Puerto Sosúa, Hispaniola
(average)	32.5	18.5	7.5×20.5	Matthewtown, Great Inagua, Bahamas

*Types.* Holotype, Museum of Comparative Zoölogy, no. 57284, from Puerto Sosúa, Hispaniola. Paratypes from Monte Cristi, Hispaniola; Matthewtown, Great Inagua and Abrahams Bay, Mariguana Island, Bahamas: 4-5 miles N.N.E. of The Elbow, Key Largo, Florida in 50-83 fathoms.

*Common name.* Atlantic Agate Helmet.

*Remarks.* This rare species is the only representative of the genus *Casmaria* in the Western Atlantic. It is remarkably close in all its characters to *Casmaria vibex* Linné of the Indo-Pacific region, but sufficiently different in its more reddish color, thinner shell, constantly poor development of its few prickle-like teeth on the lower outer lip and in its generally smaller size to warrant the status of species. Superficially *Casmaria atlantica* resembles *Seonsia striata* Lam., but the former's recurved siphonal canal, lighter structure and smooth surface readily separate the two genera. The young of the more bulbous-shaped *Phalium cicatricosa* Meuschen and the young of the more elongate-shaped *C. atlantica* are readily separated. *C. cicatricosa* possesses a reticulated sculpture on the spire, small pustules on the plicated columella and, if sufficiently adult, numerous plicate teeth across the outer lip edge and development of the *Phalium* parietal shield.



*Range.* Lower Florida, Bahamas, Greater Antilles and possibly as far south as Venezuela.

*Records.* FLORIDA: 4-5 miles N.N.E. of The Elbow, Key Largo in 50-83 fathoms (L. A. Burry). BAHAMAS: Abrahams Bay, Mariguana Island; Matthewtown, Great Inagua. HISPANIOLA: Monte Cristi; Puerto Sosúa (all MCZ).

### Galeodea Link

*Galeodea* Link 1807, Besch. Nat.-Samml. d. Univ. zu Rostock, p. 113.

*Morio* Denys de Monfort 1810, Conchyliologie Systematique 2, p. 479; *non* Lamarck 1817.

*Echinora* Schumacher 1817, Ess. Vers test. p. 75, 249 [*Echinora tuberculosa* Sch. = *Buccinum echinophorum* Linné].

*Cassidaria* Lamarck 1822, Animaux s. Vert. 7, p. 215.

Genotype *Buccinum echinophorum* Linné (monotypic).

Shell subglobose, rather solid and generally sculptured with strong spiral ridges which may possess rather large tubercles. Parietal shield well developed, smooth and reflected over the false umbilicus. Outer lip reflected, thickened and usually smooth.

The several names considered as synonyms above are all based upon *Buccinum echinophorum* Linné except *Cassidaria* Lamarck. I have been unable to find a type citation for *Cassidaria* other than that of Bucquoy, Dantzenberg and Dollfus in 1882, who were in error in selecting *Cassidaria striata* Lamarck which had been previously selected as a

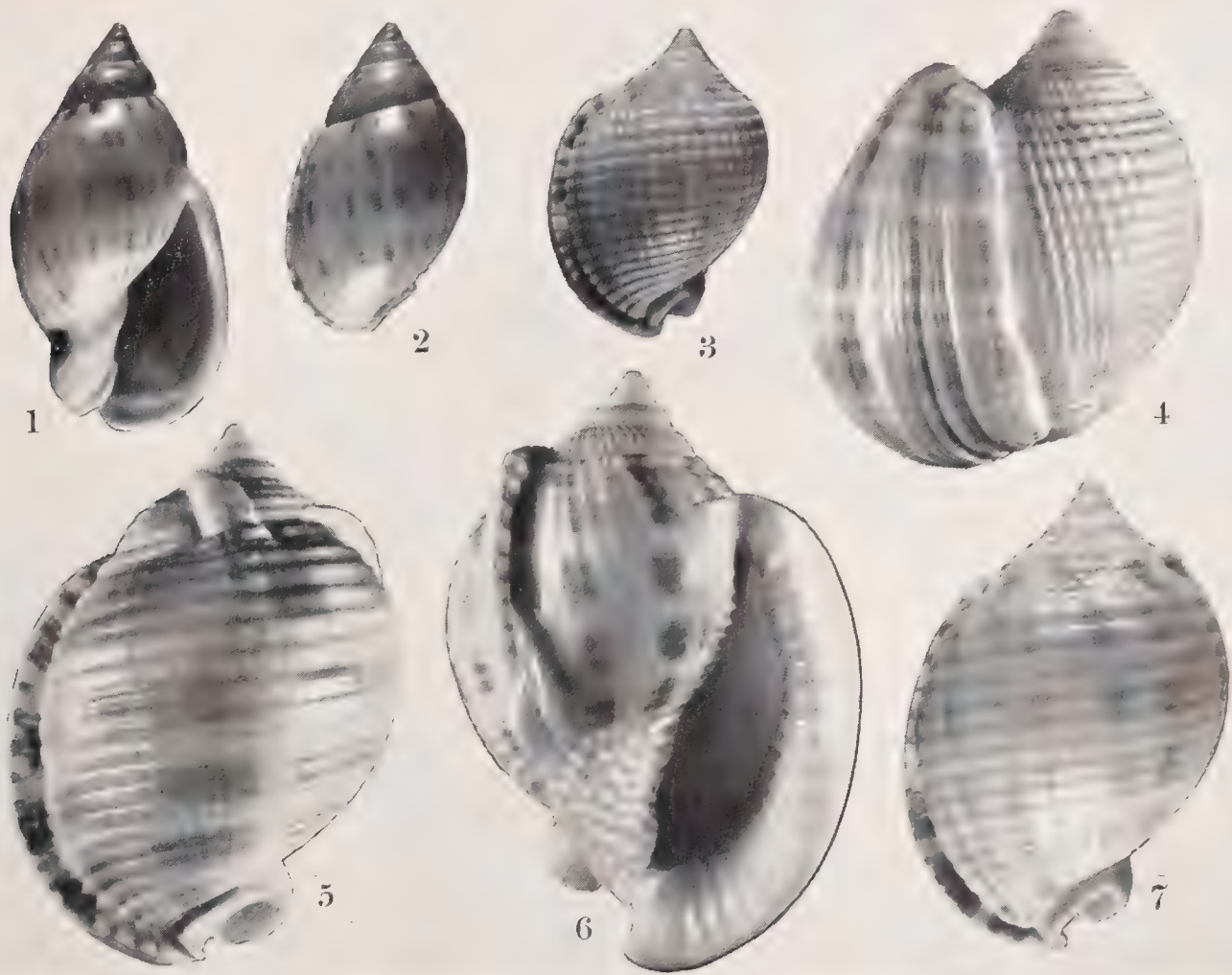


Plate 1, fig. 1, *Casmaria atlantica* Clench, Puerto Sosúa, Hispaniola (Holotype). Fig. 2, *Casmaria atlantica* Clench, Matthewtown, Great Inagua, Bahamas (Paratype). Fig. 3, *Phalium granulatum* Born, San Lorenzo, mouth of Chagres River, Canal Zone. Fig. 4, *Phalium granulatum* Born, West Indies. Figs. 5-6, *Phalium granulatum* Born, Delray Beach, Palm Beach Co., Florida. Fig. 7, *Phalium granulatum* Born, Puerto Plata, Hispaniola (all natural size).

genotype for *Sconsia* by Gray in 1847. We here select *Buccinum echinophorum* Linné as the genotype of *Cassidaria* Lamarck, thus making this genus an absolute synonym of *Galeodea* Link which has fifteen years priority.

### **Galeodea coronadoi** Crosse, Plate 2

*Cassis coronadoi* Crosse 1867, Jour. de Conchy. **15**, p. 64, pl. 4, fig. 1; pl. 5, fig. 1 (Matanzas, Cuba).

*Description.* Shell 100 to 120 mm. (about 4 to 5 inches) in length, solid with globose to subglobose whorls,  $8\frac{1}{2}$  in number, the nuclear whorls smooth. Color a dull chestnut. Outer lip reflected and nearly smooth, parietal wall glazed and forming a parietal shield which is raised or reflected over the false umbilicus. The shield is smooth or only faintly rugose at its lower extremity. Canal short and slightly recurved. Spiral sculpture consists of fairly coarse ridges or threads, uneven in size and unevenly spaced. A few rather large tubercles are developed, particularly on the superior portion of the whorls over which 3 or 4 of the spiral threads pass. Axial growth lines are coarse and form a lace-like pattern with the spiral sculpture. Operculum unknown.

length	width	
99	85 mm.	Matanzas, Cuba
118	81	off Cape Fear, North Carolina

*Types.* The holotype is stated by Watson to be in the collection of H. Crosse which I believe became the property of the Journal de Conchyliologie. The type locality is Matanzas, Cuba.

*Remarks.* So far as now known, only 2 specimens of this very rare species have been obtained. It is larger than the Eastern Atlantic species, *Galeodea echinophora* Linné to which it appears related. It also appears close in its relationship to *Galeodea wyvillei*

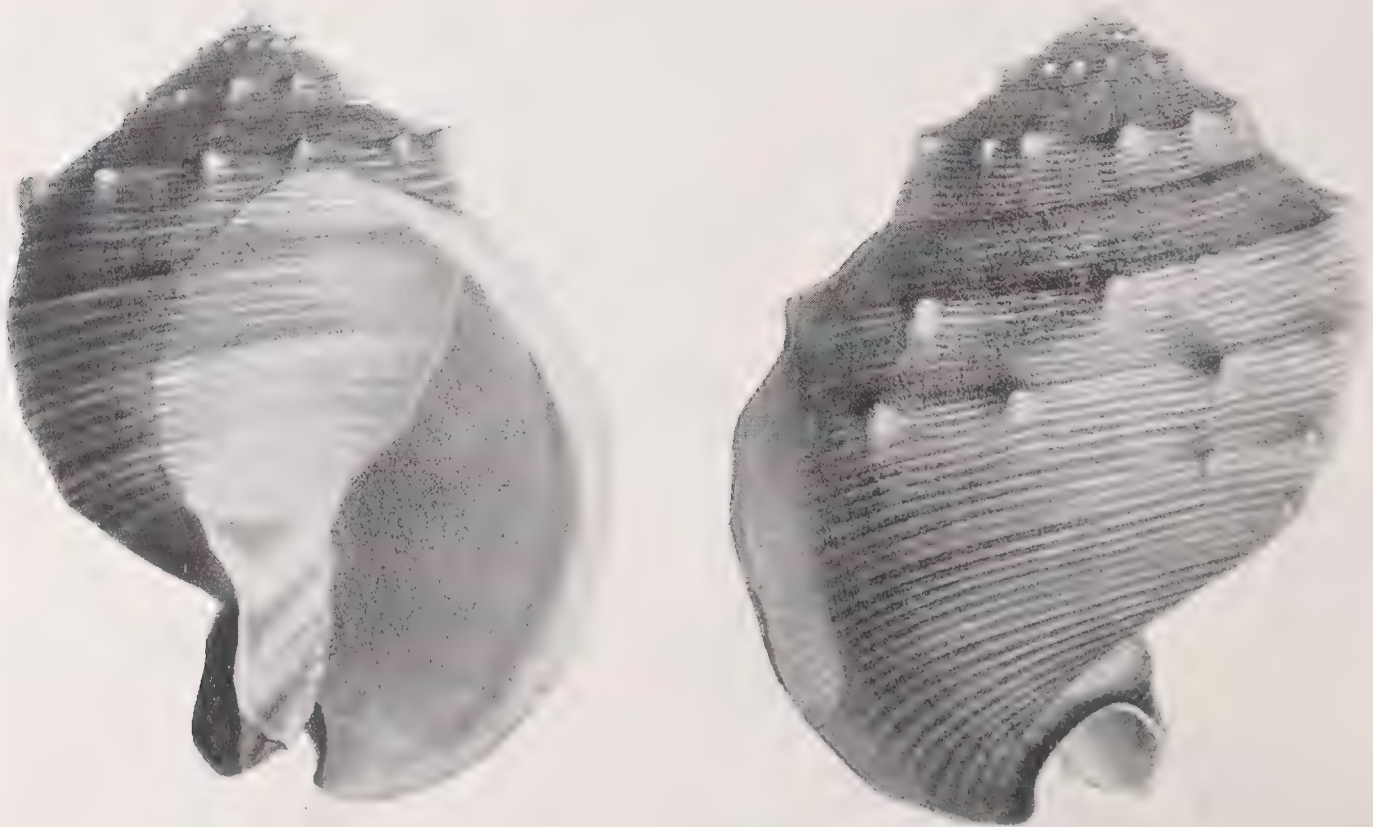


Plate 2. *Galeodea coronadoi* Crosse, Holotype from The Jour. de Conchy. **15**, pl. 4, fig. 1, pl. 5, fig. 1, Matanzas, Cuba.

Watson from the Philippines. Excellent comparative notes are given by Watson for both these species, based upon the actual specimens (Challenger Reports, 15, p. 409, 1886).

*Range.* North Carolina south to the Greater Antilles.

*Records.* NORTH CAROLINA: 40 miles off Cape Fear in 40 fathoms (USNM). CUBA: Matanzas (H. Crosse).

### Genus *Phalium* Link

*Phalium* Link 1807, Besch. Natur.-Samm. d. Univ. zu Rostock, p. 112.

*Bezoardica* Schumacker 1817, Essai nouv. Syst. Vers test. p. 248.

*Cassidea* Swainson 1840 [in part] Treatise on Malacology, p. 299; *non Cassidea* Bruguière 1789.

Genotype, *Buccinum glaucum* Linné (subsequent designation, Dall, 1909, United States Geol. Survey, Prof. Paper 59, p. 62).

Shells are medium in size from about one to five inches in length, globose to moderately lengthened and smooth to fairly coarsely sculptured. Aperture rather large with a strongly reflected lip. On the outer base of the lip there are four or five short but rather sharp spines (subgenus *Phalium* s.s.); those without the palatal spines are grouped in the subgenus *Semicassis*. Parietal area generally with a reflected margin or shield. Lower portion of the parietal area smooth, papillose or finely rugose.

We have retained the use of *Phalium* Link as a genus for our Western Atlantic species, inasmuch as the characters upon which the lesser categories have been segregated do not appear to be of generic value. *Semicassis* Mörch was segregated from *Phalium* on the basis that *Phalium* possessed 4 or 5 small spike-like processes on the lower margin of the outer lip, a character absent in *Semicassis*. The size of these little processes varies, however, not only among the few species of *Phalium* s.s. but even among specimens of the same species. This same character is possessed by *Casmaria* in which the variation exists from completely smooth forms to those in which the processes are well developed. *Tylocassis* Woodring was described as a subgenus under *Semicassis* to contain the American (and European) species which possess a pustulose area on the parietal shield as opposed to the Indo-Pacific species which have a rugose parietal shield area. Again we are dealing with a somewhat variable character. A few specimens of *Phalium granulosum* Born which we have seen show both pustulose and rugose areas on the same shell. In full justification to Woodring, however, this character is fairly constant, and most specimens could be assigned to their geographic areas on the basis of this single character.

### Key to the groups of *Phalium*

- |  |                                  |
|--|----------------------------------|
| 1. Basal area of outer lip with 4 or 5 spines  | <i>Phalium</i> s.s. <sup>1</sup> |
| Basal area of outer lip without spines         | 2                                |
| 2. Lower parietal area rather finely papillose | <i>Tylocassis</i>                |
| Lower parietal area rather finely rugose       | <i>Semicassis</i>                |

### Subgenus *Semicassis* Mörch

*Semicassis* Mörch 1852, Catalogus Conchy. Comes de Yoldi, 1, p. 112.

*Faurotis* Jousseume 1888, Soc. Zool. France, 1, p. 188.

*Echinophoria* Sacco 1890, Mem. del Real. Acad. Sci. Torino (2) 11, p. 39.

*Bezoardica* Dall 1909, United States Geol. Survey, Prof. Paper No. 59, p. 62: *non Bezoardica* Schumacher 1817.

Genotype, *Cassis japonica* Reeve (by subsequent designation, Harris 1897).

<sup>1</sup> *Phalium* s.s. Indo-Pacific; *Semicassis* s.s. Indo-Pacific; *Tylocassis* Western Atlantic, Eastern Atlantic and Eastern Pacific.

Species of this subgenus are similar to *Phalium* but lack the small spines along the outer base of the palatal lip.

### Section *Tylocassis* Woodring

*Tylocassis* Woodring 1928, Carnegie Inst. Washington, pub. No. 385, p. 306.

Section type, *Buccinum inflatum* Shaw, = *P. granulosum* Born (original designation).

Species in this section differ from *Semicassis* by possessing a papillose rather than a rugose sculpture on the lower parietal area. All of the American forms are members of this section.

### *Phalium* (*Semicassis*) *granulatum* Born, Plate 1, fig. 3-7; Plate 3, fig. 1-4

*Buccinum granulatum* Born 1780, Testacea Musei Caesari Vindobonensis, p. 248 (Mediterranean; Amboyna).

*Buccinum gibbum* Gmelin 1791, Syst. Nat. ed. 13, p. 3476, (locality unknown) [refers to Lister, pl. 999, fig. 64].

*Cassis malum* Röding 1798, Museum Boltenianum, p. 31 (refers to Lister, pl. 1056, fig. 9).

*Cassis sepa* Röding 1798, Museum Boltenianum, p. 31 (refers to *Buccinum gibbum* Gmelin).

*Cassis globulus* Röding 1798, Museum Boltenianum, p. 31 (refers to Lister, pl. 999, fig. 64).

*Buccinum inflatum* Shaw 1811, Naturalists Miscellany 22, pl. 959, text (Indian and African Seas); Reeve 1848, Conch. Icon., 5, *Cassis*, pl. 9, fig. 22c; *non B. inflatum* Lamarck 1822.

*Cassis abbreviata* Lamarck 1822, Anim. s. Vert., 7, p. 224 (Coast of Portugal); *non abbreviatum* Gmelin 1790.

*Cassis granulosa* Lamarck 1822, Anim. s. Vert. 7, p. 227, (Mediterranean).

*Cassis laevigata* Menke 1830, Synopsis Methodica Molluscorum p. 144 (Barbados).

*Cassis tessellata* Pfeiffer 1840, Krit. Register zu Martini u. Chemnitz's Syst. Konchyl.-Kab. p. VIII; *non tessellatum* Gmelin 1791.

*Description.* Shell varying from 25-100 mm. in length (about 1-4 inches), solid and rather strong. Whorls 6-8½ and strongly convex. Ground color china white to cream, overlaid with spiral bands that are broken into a series of squares rather uniformly disposed. These color squares of yellow to brown are also arranged in an axial pattern. Inner lip consisting of a glazed area which adheres to the body whorl, the lower portion reflected, forming a shield-like process. The upper portion of the shield possesses a series of ridges which extend back well within the aperture. Lower portion of shield rather coarsely papillose. Outer lip thickened and reflected, the reflected portion turning backwards against the whorl. Occasionally this thickening may extend back one inch. The outer edge of the lip is regularly and rather coarsely crenulated. Each crenulation follows back within the aperture as a pronounced ridge. Spire moderately extended, occasionally concave in profile. Nuclear whorls smooth and glass-like. Spiral sculpture consisting of numerous and rather deeply incised grooves. Axial sculpture consisting of faint ridges which cross the grooves, forming a reticulated pattern. Occasional specimens are rather finely tuberculate on the shoulder of the whorls. One to three varices may be developed. Operculum unknown.

	length	width	
(large)	91	60 mm.	Jamaica
(average)	34	43	Delray Beach, Florida
(small)	30	20.5	Cartagena, Colombia

*Types.* The type figures, here selected, are those of Martini 1773, Conchy.-Cab. (1) 2, pl. 32, fig. 344-345. These same figures were referred to by Lamarck for his *Cassis granulosa*. As Born's localities of Mediterranean Sea and Amboyna are in error, we select that of Puerto Plata, Hispaniola, as the type locality.

*Common name.* Scotch Bonnet (Florida); Granulated Helmet Shell.

*Remarks.* Born made reference to four sets of figures, those of Martini being the best. These figures represent very clearly the West Indian shell which has been known under several names. Lamarck's name, *abbreviata*, has been used to designate the very small specimens, but in our opinion, it is impossible to draw any satisfactory line of demarkation between the various sizes that occur in this species. Large specimens have been known under the name of *inflata* Shaw, but again, these grade imperceptibly with the more abundant middle sized specimens. In addition to their size variation, there are considerable differences exhibited in both the sculpture and the color markings. The small and intermediate specimens have the spiral sculpture strongly developed, while the larger forms, though still possessing it, have it developed to a lesser extent. The larger specimens generally have the color spots more pronounced. Varices are occasionally formed and appear to be more abundant in specimens from certain localities. On young shells and small adults there is a tendency to have the shoulder area of the body whorl somewhat nodulose, generally at the intersections of the spiral and axial ridges. In addition, the small and middle sized specimens are proportionately heavier in structure than the larger forms and the outer or palatal lip much thicker. We figure a specimen (plate 1, fig. 4) which developed a remarkably thick lip, the reflected portion being 25 mm. (1 inch) in length.

The figure by Shaw in the Naturalists Miscellany is much too highly colored, a character that prevails in most of his illustrations.

As stated above, all of the several characters are exceedingly variable and exist in about all of the possible combinations, many of the variations occurring at a single locality. This factor, of course, has given rise to the rather extended synonymy possessed by this species.

*Range.* North Carolina, the Gulf of Mexico, West Indies, and south to Brasil.

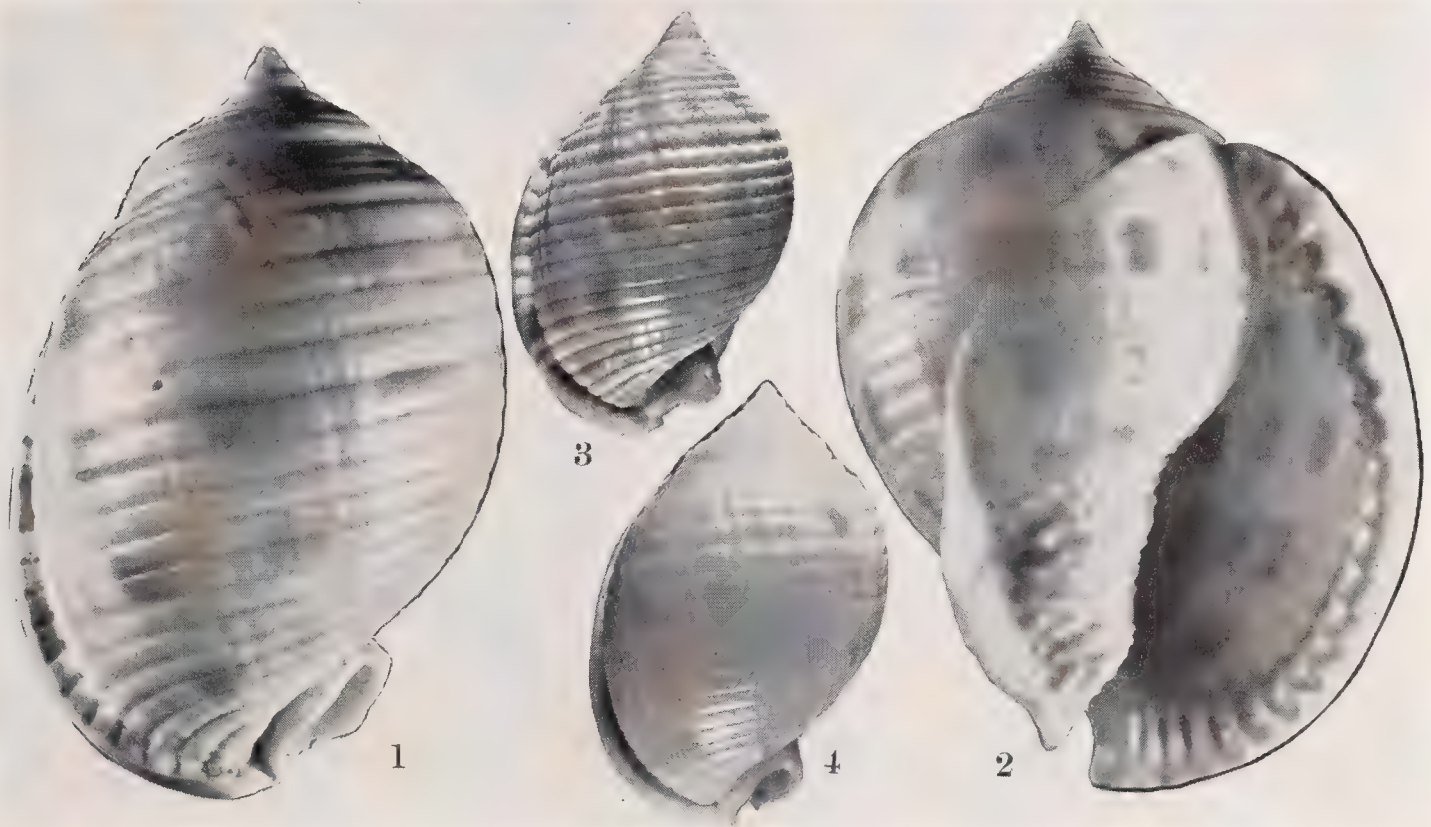


Plate 3. *Phalium granulatum* Born. Fig. 1, Capers Id., South Carolina. Fig. 2, Point-à-Pierre, Trinidad. Fig. 3, Veracruz, Mexico. Fig. 4, Puerto Plata, Hispaniola (all natural size).

*Records.* NORTH CAROLINA: Ocracoke Id. (Charleston Museum). SOUTH CAROLINA: 3½ mi. off Dewee's Id.; Isle of Palms; Cape Romain; Caper's Id.; Botany Bay; Bird Key; Folly Beach (all Charleston Museum). FLORIDA: Jenson Beach (M. Cannon); Palm Beach; Lake Worth (both MCZ); Delray Beach (P. McGinty); Pompano; Tortugas; Naples; Estero Id.; Sanibel Id.; St. Petersburg (all MCZ). TEXAS: Matagorda Bay; Port Aransas; Padre Id. (all MCZ). BAHAMAS: Smith Point, Grand Bahama; Bimini Islands; Andros Id.; New Providence; Little San Salvador; Clarendetown, Long Id. (all MCZ). HISPANIOLA: Monte Cristi; Puerto Plata (both MCZ). PUERTO RICO: Ponce (MCZ); Río Herrera (R. Kenk). JAMAICA: (MCZ). LESSER ANTILLES: San Fernando; Point-à-Pierre and Cedros, Trinidad (H. G. Kugler). MEXICO: Veracruz (M. E. Bourgeois). HONDURAS: Puerto Cortés (Univ. of Michigan). PANAMA: San Lorenzo (J. Zetek). COLOMBIA: Cartagena (MCZ). VENEZUELA: Tucacas Bay (H. G. Kugler). BRITISH GUIANA: Georgetown (H. G. Kugler). BRASIL: Manguinhos, Ilha de Itaparica, Est. da Bahía (A. Oliveira).

**Phalium (Semicassis) cicatricosum** *Meuschen*, Plate 4, figs. 1-5.

*Cassis cicatricosa* Meuschen 1787, Museum Geversianum, p. 392, no. 1290 [refers to Meuschen 1781, Zoophylacium Gronovianum,<sup>1</sup> p. v, pl. 19, figs. 1-2 (Sea of the Indies)].

*Buccinum cicatricosum* Gmelin 1790, Syst. Nat. ed. 13, p. 3475 (India) [refers to the same plate and figures in the Museum Gronovianum above].

*Buccinum recurvirostrum* Gmelin 1790, Syst. Nat. ed. 13, p. 3477 (Barbados) [refers to Lister 1688, Historiae Conchyliorum, 2, pl. 1016, fig. 75].

*Buccinum abbreviatum* Gmelin 1790, Syst. Nat. ed. 13, p. 3478 [refers to Chemnitz 1737, Conchy.-Cab. (1) 10, pl. 153, fig. 1465-1466]; *non Cassis abbreviata* Lamarek 1822.

*Cassis lactea* Kiener 1835, Coquilles Vivantes 8, p. 35, pl. 16, fig. 35 (locality unknown).

*Cassis recurvirostrum* 'Wood' Reeve 1848, Conch. Icon. 5, **Cassis**, no. 16 (Raine's Island, Torres Strait [Queensland]).

*Xenogalea lucrativa* Iredale 1927, Records of the Australian Museum 15, p. 347, pl. 32, fig. 11 (North Australia, Raine's Island, Torres Strait).

*Semicassis cicatricosa peristephes* Pilsbry and McGinty 1939, Nautilus 52, p. 76, pl. 5 (Peanut Island, Lake Worth, Florida).

*Description.* Shell varying from 20 to 60 mm. in length (about 1-2½ inches) rather thin but strong. Whorls 6 to 8 and rather strongly convex. Ground color white or cream and generally overlaid with light buff. In addition there is a series of small dark brown and irregular squares of color marking that are in both spiral and axial arrangement. Inner lip consisting of a thickened glazed area, the parietal shield, which is raised or reflected at its base. The lower area of the shield rather finely papillose, the upper portion having a few short fine spiral ridges. Outer lip thickened and reflected, its inner margin supporting a series of ridges or teeth. Spire not greatly extended. Nuclear whorls smooth and glass-like, following whorls finely reticulated, body or last whorl generally smooth, with the whorl shoulder finely reticulated or possessing small nodules. Axial growth lines may be somewhat coarse on the shoulder area of the body whorl. Some of the larger specimens possess a distinctive malleated surface and have a few incised spiral grooves near the base of the whorl. One to three varices may occur, but the forming of varices appears to be rather uncommon.

<sup>1</sup> Meuschen's Zoophylacium Gronovianum is not considered binomial and his species, *Cassis cicatricosa*, must date from his later publication.

	length	width	
(large)	60	41 mm.	N. Bimini Id., Bahama Islands
(average)	40	28	Virgin Gorda, Virgin Islands
(small)	22.5	15	Little Inagua, Bahama Islands

*Types.* The type figure is that of Meuschen cited above in the *Zoophylacium Gronovianum*. The type locality is Barbados, Lesser Antilles as first localized by Gmelin.

*Common name.* The Scarred Helmet Shell (in reference to the scar-like malleations).

*Remarks.* This species does not appear to be quite as abundant as *P. granulatum* and may have a more restricted range. In most of its characters it approximates *P. granulatum*, though I have seen no specimens that could be called intermediates or that could not be readily assigned to the proper species. The significant difference between the two species is that *C. cicatricosum* possesses a nearly smooth or malleated surface on the body whorl and *P. granulatum* has a moderate to very strong reticulated surface on the body whorl. In addition, *P. cicatricosum* is somewhat more attenuated and does not reach the size that is occasionally reached by *P. granulatum*.

In regard to certain of the synonyms, the names *abbreviatum* Gmelin, *lactea* Kiener, and *peristephes* Pils. and McG. all refer to the small and nodulose specimens. The name, *lucrativa* Iredale, appears from the description and remarks to be based only on the figure of Reeve, which had been published as *recurvirostrum* and with the locality of Raine's Island, Torres Strait. This was a specimen in the Cuming collection and the above locality is certainly open to question. The papillose condition on the base of the shield is a character which is known to occur only in specimens from the Americas and the Eastern Atlantic. This character is clearly indicated in Reeve's figure. (See under *Tylocassis*).

*Range.* Florida, the Bermudas, Bahamas and south to the Lesser Antilles. Our record from Bermuda is open to question. It is not given by Piele in his list of marine shells from these islands (Proc. Malac. Soc. 17, p. 80, 1926).

*Records.* FLORIDA: Peanut Id., Lake Worth (Pilsbry and McGinty). BERMUDA: (MCZ). BAHAMAS: North Bimini Id.; Arthurstown, Cat Id.; Simms, Long Id.; Wat-

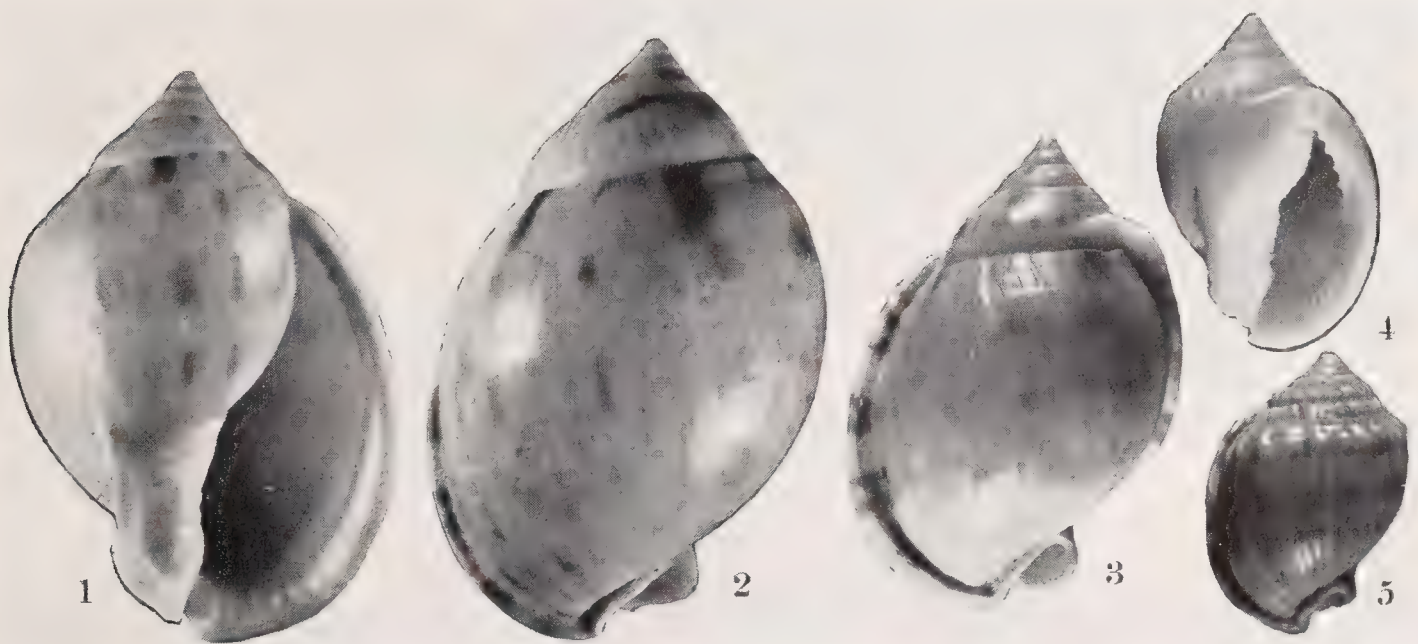


Plate 4. *Phalium cicatricosum* Meuschen. Fig. 1, St. Johns, Virgin Ids. Figs. 2 and 5, North Bimini Id., Bahamas. Fig. 3, Puerto Plata, Hispaniola. Fig. 4, Port de Paix, Hispaniola (all natural size).

ling Id.; Fortune Id.; Matthewtown, Great Inagua; North West Point, Little Inagua (all MCZ). CUBA: Guantánamo Naval Base (MCZ); Cayo Francés, Caibarién (P. J. Bermúdez). HISPANIOLA: Puerto Sosúa; El Canal, Cabo Macorís, Puerto Plata; Monte Cristi (all MCZ); Port de Paix (W. J. Eyerdam). VIRGIN ISLANDS: St. Thomas; St. John (both MCZ); Virgin Gorda; Tortola (both M. W. Dewey); St. Croix (H. A. Beatty). LESSER ANTILLES: Barbados (MCZ).

\* \* \* \*

### Notes

*Buccinum undulatum* Gmelin 1791, Systema Naturae, 13 ed., p. 3475 based on Lister 1688, Historia Conchyliorum, 2, pl. 996, fig. 61 (Barbados).

We agree with Pilsbry and McGinty (Nautilus 52, 1939, p. 77) that this species is unrecognizable either from Gmelin's description or Lister's figure. There appears to be nothing in the Western Atlantic that approximates the figure. European writers have accepted this name for a Mediterranean species. See Buquoy, Dautzenberg and Dollfus, 1882, Moll. Marins de Roussillon, 1, p. 66, pl. 7, fig. 3-4.

*Phalium centiquadrata* Valenciennes from the Eastern Pacific is exceedingly close in its relationships with our Western Atlantic *P. granulatum* Born. Specimens of *centiquadrata* from West Mexico appear to be more nodulose on the body whorl shoulder than specimens of *granulatum*, but certain specimens appear to be indistinguishable.

\* \* \* \*

### Cassis Scopoli

*Cassida* Brünnich 1772, Fund. Zool., p. 248; non *Cassida* Linné 1758; non *Cassida* Agassiz 1846.

*Cassis* Scopoli 1777; Introductio Historiam Naturalem, p. 393.

*Cassidea* Bruguière 1792, Ency. Méth. Vers 1, pt. 2, p. 414; non *Cassidea* Link 1807.

*Cassinia* Rafinesque 1815, Analyse de la Nature, p. 145.

*Goniogalea* Mörch 1857, Catalogus Conch. I.M.N. Suenson, p. 21.

*Fimbriola* 'Megele von Mühlfeld' Scudder 1882, Nomenclator Zoologicus, p. 138.

*Galeodocassis* Sacco 1890, Mem. del Real. Accad. Sci. Torino (2) 11, p. 18.

*Cassisoma* Roverto 1899, Atti. Soc. Ligustica, 10, p. 107.

Genotype, *Buccinum cornutum* Linné (by subsequent designation, Denys de Montfort 1810).

Shells of *Cassis* s.s. are large, strong, and thick in structure, particularly the outer lip and parietal shield. The spire is much depressed and generally slightly convex with the early whorls very small. The thickened lips form a flattened area on the entire base or apertural side of the shell. The aperture is long and narrow, its lower margin recurved backwards to form a short siphonal canal. Both inner and outer margins of the lip are strongly dentate. The operculum is much smaller than the aperture, is somewhat lengthened, rounded at both ends, and possesses a marginal nucleus. Growth lines on the operculum are rather coarse and concentric.

The radula consists of small centrals, small laterals and rather lengthened marginal teeth. (See A. H. Cooke 1895, Cambridge Natural History, 3, p. 223.) The family dates from the Cretaceous period.

These large shells have been held in high esteem, not only for their beauty, but also for their use in cameo cutting. This art was developed in Italy and later in France. A detailed account of this art is given by Tryon 1883, Structural and Systematic Conchology, Philadelphia, 2, p. 200.



**Cassis tuberosa** Linné, Plate 5

*Buccinum tuberosum* Linné 1758, Syst. Nat. ed. 10, p. 735 (locality unknown); Linné 1767, Syst. Nat. ed. 12, p. 1198 (American Ocean) [refers to Gaultieri 1742, Index Test. Conch., pl. 41].

*Buccinum striatum* Meuschen 1787, Museum Geversianum, p. 302.

*Cassidea tuberosa* Bruguière 1792, Encyclopédie Méthodique 1, pt. 2, p. 436 (Guadeloupe; Martinique and Santo Domingo).

*Cassis rotundata* Perry 1811, Conchology, London, pl. 33, fig. 1, text (Coast of America and the West Indies).

*Description.* Adult shell varying from 100 to 230 mm. in length (4 to 9 inches). Solid and generally heavy. Whorls 7 to 10 and globose. Color brownish cream and mottled with patches of dark brown on the lip and a large patch of brown on the mid parietal area. Outer surface of shell has a series of deep crescent-like brownish marks which are in spiral arrangement and have the horns of the crescents directed toward the aperture. Interior of siphonal canal diffused with brown. Aperture long and rather narrow. Umbilicus visible at the base of the siphonal canal. False umbilicus consisting of small shallow depression underneath the parietal shield. Siphonal canal short and recurved. Outer lip rather broad, thickened and slightly reflected, with its inner margin possessing 10 to 12 strong, white and rounded teeth, the spaces in between generally being blotched with dark brown. Parietal shield broad, covering the entire bottom area of the shell, and reflected along its outer margin. Upper and outer corner of the parietal shield generally drawn out into a rounded point. Entire inner margin of parietal area possessing a series of long, narrow ridge-like teeth. Spire depressed and rather sharply pointed. Nuclear whorls exceedingly small. Suture irregular, not prominent. Spiral sculpture consisting of numerous low ridges which are crossed by fine axial threads which produce a fine but definite reticulated surface. There are generally three rows of blunt spines or tubercles,

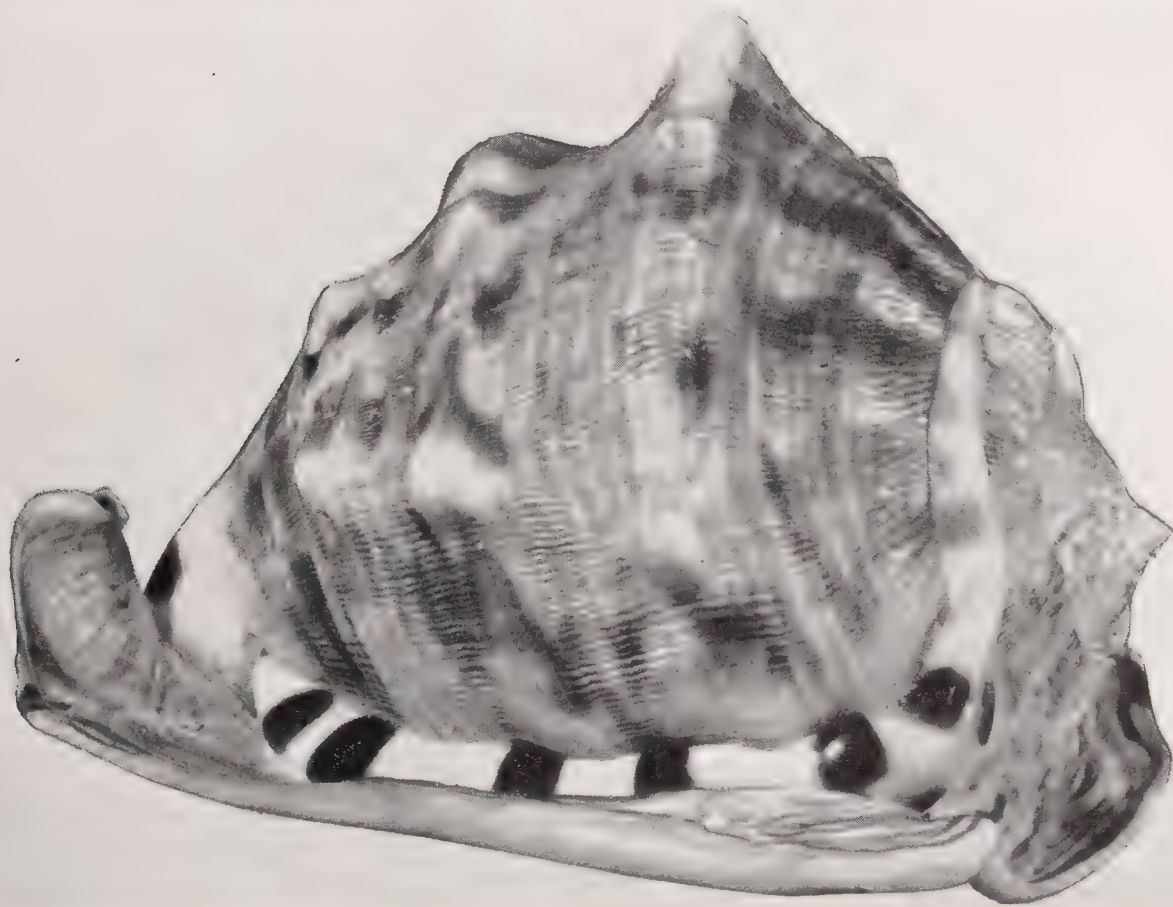


Plate 5. *Cassis tuberosa* Linné, Orange Creek, Cat Id., Bahamas (reduced one-third).

the first row formed at the shoulder of the whorl, the other two rows developed at about the mid area of the whorl. The topmost tubercle, or spine of the first row is generally the largest. No periostracum. Operculum about 1/5 the length of the aperture, narrowing, more or less rounded at both ends and sculptured with rather coarse growth lines.

	length	width	
(large)	220	175 mm.	Cat Island, Bahamas
(average)	178	140	Grand Bahama Island, Bahamas
(small)	122	101	Little San Salvador Island, Bahamas

*Types.* The type figure, here selected, is that of Gaultieri 1742 (Index Test. Conch., pl. 41) as cited by Linné in ed. 12 of the Syst. Nat., p. 1198. The type locality of Hispaniola [Santo Domingo] is here designated. This was one of the three localities given by Bruguière in 1792, the first to localize this species.

*Common name.* King Helmet.

*Remarks.* *Cassis tuberosa* is the most abundant and probably the most widely distributed of the Western Atlantic species in this genus. It differs from both *C. flammea* and *C. madagascariensis* by possessing a fine reticulated surface on mature shells and having a point to the parietal shield on the upper and outer margin. Small specimens are quite similar to *C. flammea* but again can be differentiated by the reticulated pattern of the sculpture on *C. tuberosa* and by the presence of the brownish color that appears between the teeth on the outer lip. General coloration in the two forms is very similar.

*Cassis tuberosa* differs materially from *C. madagascariensis* in the possession of a very fine, netted sculpture as opposed to an indefinite and much coarser reticulated sculpture in *C. madagascariensis*. The coloration of *C. tuberosa* consists of an indefinite buff overlaid with rather dark brownish crescent-like marks while the color of *C. madagascariensis* is generally a uniform pale cream with the parietal shield and outer lip a definite salmon color.

*Range.* Cape Hatteras, North Carolina (Dall 1889, p. 134) and south to Brasil.

*Records.* FLORIDA: Pompano; Lake Worth, Boynton (both MCZ); Ft. Lauderdale in 10 fathoms; off Ft. Walton in 15 fathoms (both L. A. Burry). BAHAMAS: Eight Mile Rock, Grand Bahama Id.; Adelaide, New Providence; Cat Cay, Bimini Ids.; Little San Salvador Id.; Orange Creek, Cat Id.; Clarendon, Long Id.; Savannah Sound, Eleuthera; Abrahams Bay, Mariguana Id.; Matthewtown, Gt. Inagua (all MCZ). CUBA: Guantánamo Bay; Gavilán, Cienfuegos (both MCZ). ISLE OF PINES (MCZ). HISPANIOLA: Puerto Plata; Santa Bárbara de Samaná; Jérémie (all MCZ). BRASIL: Fernando de Noronha (MCZ); Manguinhos, Ilha de Itaparica, Bahía (P. de Oliveira).

### **Cassis flammea** Linné, Plate 6

*Buccinum flammeum* Linné 1758, Syst. Nat. ed. 10, p. 786 (locality unknown) [refers to Rumphius 1741, Rariteitkamer, pl. 23, fig. 2]; Gmelin 1790, Syst. Nat. ed. 13, p. 3473 (American Ocean).

*Cassidea flammea* Bruguière 1792, Encycl. Méth., Vers 1, pt. 2, p. 429 (no locality).

*Cassis alba* Perry 1811, Conchology, London, pl. 33, fig. 2, text (locality unknown).

*Cassis flammea* Lamarck 1822, Anim. s. Vert. 7, p. 220 (Indian Ocean).

*Description.* Adult shell varying from 80 to 130 mm. in length (3 to 5 inches). Solid and strong. Whorls 8-10, globose. Color yellowish cream and mottled with patches of brown on the lip and a large patch of brown on the mid parietal area. Outer surface of shell possesses a series of deep crescent-like brownish marks which are in spiral arrangement and have the horns of the crescent directed toward the aperture. Interior of siphonal

canal stained with brown. Aperture long and rather narrow. Umbilicus visible at base of the siphonal canal. False umbilicus consisting of smallish shallow depressions underneath the parietal shield. Siphonal canal short and recurved upward. Outer lip rather broad, thickened and slightly reflected, with its inner margin possessing 10 to 12 strong but rounded teeth, which are white, spaces in between being uncolored. Parietal shield broad, covering the entire bottom area of the shell and reflected along its outer margin. Upper and outer corner of parietal shield generally rounded. Entire inner margin of parietal area has a series of long, narrow, ridge-like teeth. Spire depressed, and rather sharply pointed, nuclear whorls exceedingly small. Suture irregular and not prominent. Sculpture consisting of numerous axial growth lines which are not cut by spiral ridges, the result being a moderately smooth surface. There are generally three rows of blunt spines or tubercles, the first formed at the shoulder of the whorl, the other two rows developed at the mid area of the whorl. The topmost tubercle or spine of the first row is generally the largest. No periostracum. Operculum about  $1/5$  the length of the aperture, narrow, more or less rounded at both ends and sculptured with rather coarse growth lines.

	length	width	
(large)	135	100 mm.	Grand Bahama Island, Bahamas
(average)	109	82	Cat Island, Bahamas
(small)	72	50	Puerto Sosúa, Hispaniola

*Types.* The type figure, here selected, is that of Rumphius 1741, Rariteitkamer, pl. 23, fig. 2. This is one of the two references given by Linné. His reference to Bonanno

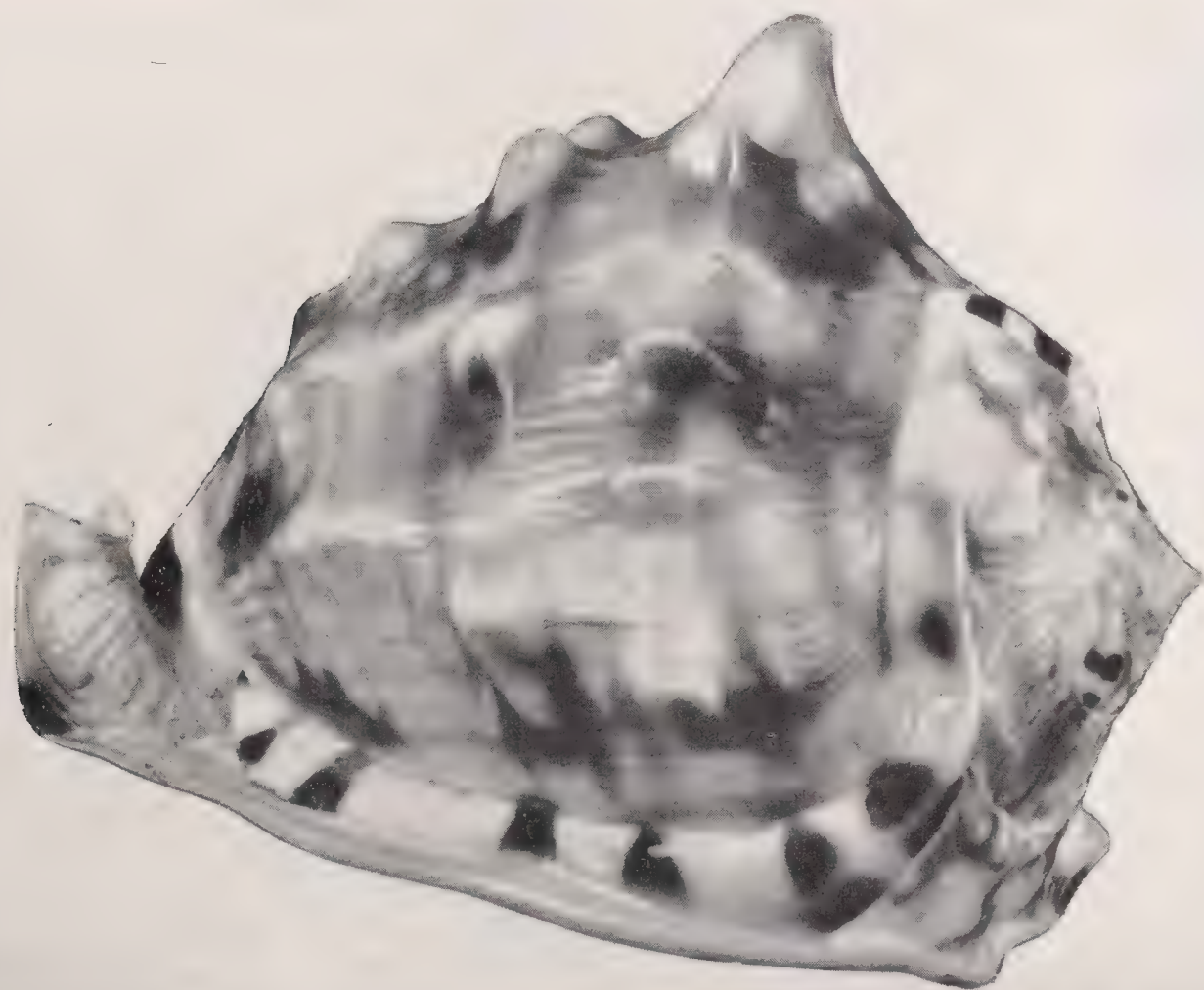


Plate 6. *Cassis flammea* Linné, Alicetown, North Bimini Id., Bahamas (natural size).

1684, *Recreatio Mentis et Oculti*, p. 61, fig. 161, is quite a different species. The type locality, here selected, is Cape St. Maria, Long Island, Bahama Islands.

*Common name.* Flame Helmet.

*Remarks.* *Cassis flammea* is characterized mainly by lacking reticulated sculpture and by possessing a parietal shield and outer lip of yellowish cream, with no blotches of brown between the teeth on the outer lip and by its smaller size. (See remarks under *C. tuberosa*).

*Range.* The Bahamas and south to the Lesser Antilles.

*Records.* BAHAMAS: Settlement Point, Grand Bahama; Alicetown, North Bimini Id.; Governors Harbour, Eleuthera Id.; Arthurstown, Cat Id.; Cape St. Maria, Long Id. (all MCZ). CUBA: Punta de los Colorados, Cienfuegos; Guantánamo Bay (both MCZ). HISPANIOLA: Le Mole, Cape St. Nicholas; Puerto Sosúa; Monte Cristi; (all MCZ); Grand Cayamite Id. (W.J. Eyerdam). ISLE DE LA GONAVE: (W.J. Eyerdam). LESSER ANTILLES: Carriacou Id., Grenadines (H.G. Kugler).

### *Cassis madagascariensis* Lamarck, Plate 7

*Cassis madagascariensis* Lamarck 1822, *Anim. s. Vert.* **7**, p. 219 (Seas of Madagascar; Lamarck 1844 [De-shayes edition] ) *Anim. s. Vert.* **10**, p. 20 [refers to Kiener 1835, *Coquilles Vivantes* **8**, p. 7, pl. 2, fig. 2].

*Cassis cameo* Stimpson 1860, *American Jour. Science and Arts* (2) **29**, p. 443 (Beaufort, North Carolina).

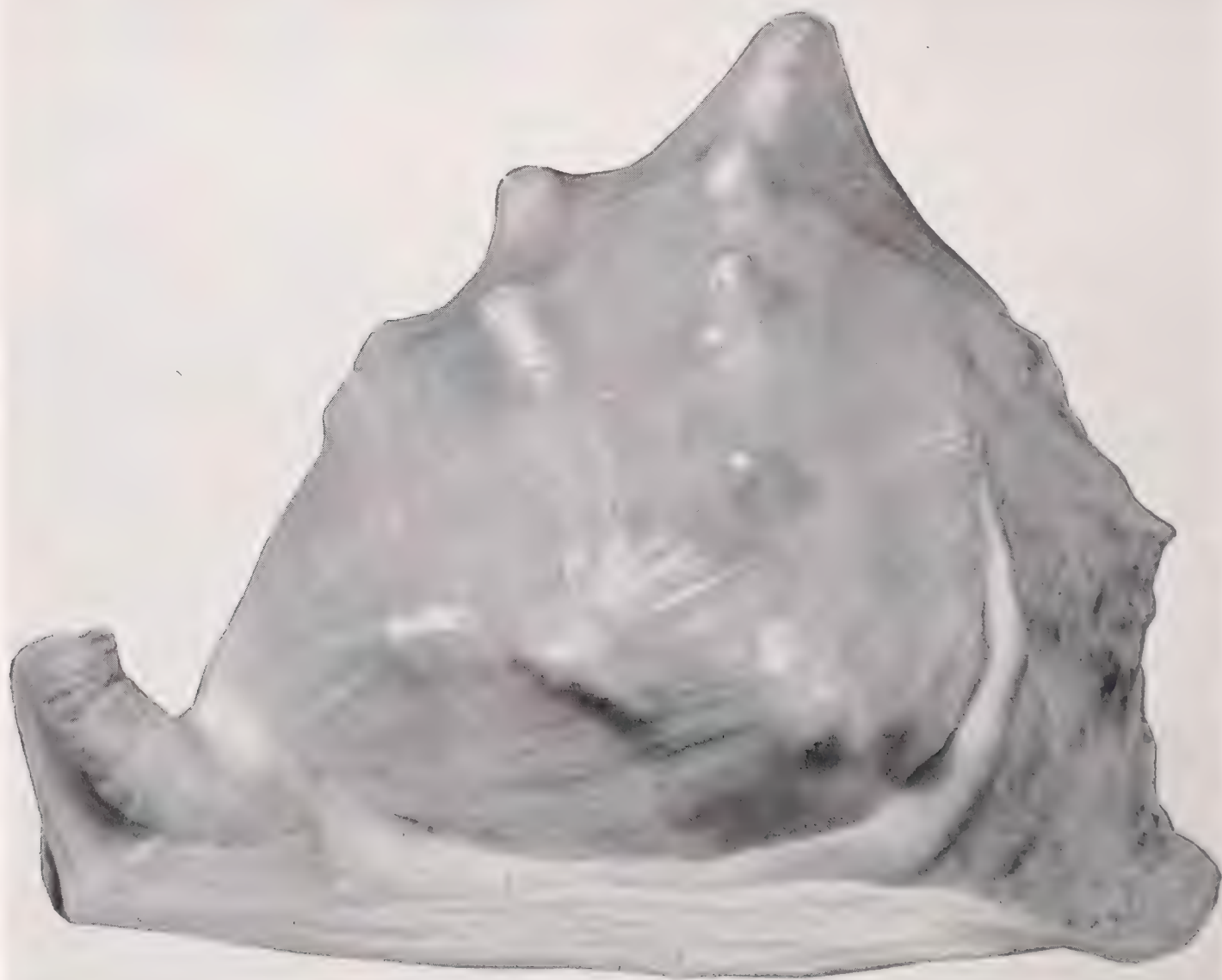


Plate 7. *Cassis madagascariensis* Lamarck, Alicetown, North Bimini Id., Bahamas (slightly reduced).

*Description.* Adult shell varying from 100 to 230 mm. in length (4 to 9 inches). Solid and strong. Whorls 7-10, globose. Color pale cream on outer surface with the patch of dark brown on parietal area of the aperture, remaining portion of parietal shield and outer lip pale to deep salmon. Interior of siphonal canal stained with brown. Aperture long and rather narrow. Umbilicus visible at base of the siphonal canal. False umbilicus consisting of small, shallow depression underneath the parietal shield. Siphonal canal short and recurved upwards. Outer lip rather broad, thickened and slightly reflected, with its inner margin possessing 10 to 12 strong but rounded teeth which are white, the spaces in between occasionally being blotched with dark brown. Parietal shield broad, covering the entire bottom area of the shell and reflected along its outer margin. Upper and outer corner of parietal shield generally rounded. Entire inner margin of parietal area has a series of long, narrow ridge-like teeth. Spire depressed and rather sharply pointed. Nuclear whorls exceedingly small. Suture irregular and not prominent. Spiral sculpture consisting of numerous flattened ridges which are crossed by axial growth lines, both forming a rather indistinct reticulated surface. There are generally three rows of blunt spines or tubercles, the first formed at the shoulder of the whorl, the other two rows developed at the mid area of the whorl. The topmost tubercle or spine of the first row is generally the largest. No periostracum. Operculum about 1/5 the length of the aperture, narrow, more or less rounded at both ends and sculptured with rather coarse growth lines.

	length	width	
(large)	216	162 mm.	Jamaica
(average)	162	133	Alicetown, North Bimini Id., Bahamas
(small)	115	106	Settlement Pt., Grand Bahama Id., Bahamas

*Types.* The type figure is that of Kiener here selected (1835, Coquilles Vivantes 8, pl. 2, fig. 2) as given by Lamarck in the second edition of his Animaux sans Vertèbres (see above). As the original locality of Madagascar was in error, Beaufort, North Carolina can be accepted on the basis of Stimpson's record.

*Remarks.* *Cassis madagascariensis* is mainly characterized by its cream colored exterior and having the parietal shield colored a rather deep salmon. (See also under *C. tuberosa*.)

*Range.* North Carolina (Stimpson 1860) south to the Lesser Antilles.

*Records.* FLORIDA: Lake Worth, Boynton (P. McGinty). BAHAMAS: Settlement Point, Grand Bahama Id., North Bimini Id. (both MCZ). JAMAICA: (MCZ).

### ***Cassis madagascariensis spinella*, new subspecies, Plate 8**

*Description.* Shell similar in all respects to *C. madagascariensis* except in the formation of the tubercles on the outer surface of the shell. In this new subspecies the tubercles occur generally in three spiral rows, are much smaller, almost uniform in size and far more numerous than the tubercles that exist on *C. madagascariensis*. To judge by the few specimens of this subspecies in our possession, the adults probably reach a much larger size than the typical form. Young specimens have rather faint brownish marks which are crescent shaped and form four rather indistinct spiral bands on the body whorl. On the spire these color marks are disposed more irregularly.

	length	width	
(large)	280	210 mm.	Florida Keys
(average)	200	190	Sand Key, Florida
(small)	125	81	off Key Largo, Florida

*Types.* Holotype from Tortugas, Florida, Museum of Comparative Zoölogy, no. 140761 (Sister Marie Caroline). Paratypes from Sand Key, off Key West, Florida, (James Miller); Pelican Shoals, Key West (J. Schwengel); 5½ miles off The Elbow, Key Largo, Florida in 92–100 fathoms (L. A. Burry).

*Remarks.* This new subspecies differs from typical *C. madagascariensis* in its larger size and in the possession of smaller, more regular and far more numerous tubercles. It appears to be a geographical race of the far more wide-spread typical form.

*Range and Records.* Known only from the Lower Florida Keys. (See under types.)



Plate 8. *Cassis madagascariensis spinella* Clench, Tortugas, Florida (Holotype) (reduced one-half).

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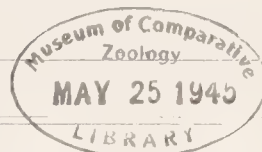
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MURICIDAE



NUMBER 17

## THE GENUS MUREX IN THE WESTERN ATLANTIC

BY

W. J. CLENCH AND I. PÉREZ FARFANTE<sup>1</sup>

This genus includes some of the most beautiful of our marine shells. Though moderately colored, their beauty is mainly invested in the structure of the spines, which in some species have become exceedingly elaborate in their modification.

There are about 400 known species of *Murex*, commonly called Rock Shells, which are found in portions of temperate and in all tropical seas. All are probably carnivorous, feeding mainly on other gastropods and bivalves. In the Western Atlantic certain species are known to occur in depths up to 435 fathoms. Both *Murex brandaris* Linné and *M. trunculus* Linné of the Mediterranean Sea produce a dye called Tyrian Purple which was held in high esteem by the Romans. It is not, however, produced by all species of *Murex*, but appears to be limited to only a very few. On the other hand, it is also produced by certain species of *Thais*.

The number of genera, subgenera and sections proposed for the many species is exceedingly large and more than ordinarily confusing. Unfortunately, differential characteristics are not at all parallel. One character will place a species in a subgenus while another of its characters will fit it into another group, its final disposition depending upon the character regarded as the more important.

One of the most unfortunate classifications was that proposed by Jousseume in *Le Naturaliste* under the title "Division Méthodique de la Famille des Purpuridés." Some 47 genera were listed, mostly named by Jousseume, type selections were made, but no descriptions were given for the different genera. This type of publication imposes a tremendous amount of work upon all subsequent students and limits the studies of many others if they do not have access to a large collection or library.

In this present study, some well known names have had to fall by the way, but this was completely unavoidable if a rigid policy of adhering to the rules was to be followed. When any reasonable doubt existed, the better known name was always retained.

The characters that are generally considered for subgeneric differentiation are the number of varices, production and type of spines, shape, size and sculpture of the nuclear whorls, the length and width of the siphonal canal and the type of operculum. All of these several characters appear to be quite independent of each other and all possible combinations seem to exist in the vast species complex contained in this genus. Extremes in the various species are, of course, easily recognized as to their proper subgenus, but there are many intermediate species that are difficult to assign properly and in many cases their placement is entirely arbitrary. From the standpoint of shell morphology, we be-

<sup>1</sup>Guggenheim Fellow, Cuba, 1942-44.

lieve that the number of varices is the most important single character: the development of spines, shape of siphonal canal and opercula differences are secondary. In this we appear to be in agreement with most other students of this genus.

A varix is not only an indication of the "rest period" in shell development, during which the edge of the shell is thickened by depositing shell material, but is probably a device to render additional strength to the shell structure. Secondary structures in the form of spines and folds add protection against predators. Few specimens of *Murex* are found with the shell developed mid-way between two varices. This may indicate that the animal secretes itself in the sand or among the rocks during this period of growth and remains quite inactive. Again, their rarity may be caused by a very short time period in this growth stage and a comparatively long period during the time the varix is developed and strengthened.

The spines are first developed as pointed outgrowths from the varix and, as growth proceeds, enfold their sides until they meet in front. All stages of spines exist for different species, from those that are completely closed to those that are broadly open. In addition, the spines may branch one or more times. In some species there may exist a shell webbing between the spines, which consists of a simple undulating plate as in *M. beautii* Crosse or a somewhat thickened and deeply fluted plate as in *M. hidalgoi* Crosse.

As new whorls are formed, the animal absorbs the spines and varices that are in front of the aperture. In the same way, the apertural side of the siphonal canal is absorbed during a growth period and again rebuilt at the time the varix is produced. However, when the canal is recurved, an entirely new canal is built, sealing off the old canal and leaving only the distal end as a scale-like spine. Species of *Murex* that possess more than three varices have a succession of canals that remain in a short spiral, the center of which is the false umbilicus.

The siphonal canal is a structure to encompass and protect the extended siphon. The length and breadth of this structure is an aid in characterizing the subgenera and species.

The nuclear whorls are of importance in determination as considerable variation is found in these structures among the several species. The first whorl may be larger than the second, or smaller, carinated or rounded, all depending upon the species in question. The carination may show some individual variation, depending much upon how high up on the whorls the succeeding whorls may be produced.

The operculum may be unguiculate or concentric, depending upon the species. One is only a modification of the other. The unguiculate or claw-shaped operculum possesses a subapical nucleus; the concentric operculum possesses a subcentral nucleus. The differences appear to be due to a change in the shape of the aperture and the breadth of the opening that extends along the ventral face of the siphonal canal.

### Genus *Murex* Linné

*Murex* Linné 1758, Syst. Nat. ed. 10, 1, p. 746.

Genotype, *Murex tribulus* Linné (subsequent designation, Denys de Montfort, 1810).

Shells varying in size from a few millimeters to 250 mm. (10 inches) in length, generally solid and strong with most of the species being spinose. Spire moderately extended. Aperture subcircular to oval, ending below in a siphonal canal which may be greatly extended. Spines generally produced on a varix, the spines being either closed or open, single or branched, depending upon the species. Operculum unguiculate (claw-like) with an apical or subapical nucleus or concentric with a subcentral nucleus.



Subgenus *Murex* Linné

*Murex* Linné 1758, Syst. Nat. ed. 10, 1, p. 746.

*Aranea* Perry 1810, Arcana or The Museum of Natural History, pl. 47 (Genotype, *Aranea gracilis* Perry, monotypic. [This species was later described by Lamarek as *Murex tenuispina*]).<sup>1</sup>

*Tubicauda* Jousseaume 1880, Le Naturaliste, 1, no. 42, p. 335 (Genotype, *M. brevispina* Lamarek).

*Acupurpura* 'Bayle' Jousseaume 1880, Le Naturaliste, 1, no. 42, p. 335 (Genotype, *M. tenuispina* Lamarek).

Subgenotype, *Murex tribulus* Linné (subsequent designation, Denys de Montfort 1810).

Shell possessing three varices (including the lip) on each whorl, each new varix formed more or less evenly and in the same or nearly the same plane with the varix on the whorl above. Spines usually present and developed on the varices. Rarely, as in *M. beaultii*, there is a webbing consisting of a thin axial plate of shell material that connects the spines along the varix. Siphonal canal narrow, generally long and may be straight or curved moderately upward.

Operculum corneous, generally unguiculate, the nucleus sub-apical, or concentric with the nucleus sub-central; the outer surface rather strongly sculptured with irregular concentric growth lines.

***Murex (Murex) cabritii* Bernardi, Plate 1, fig. 1-2**

*Murex cabritii* Bernardi 1858, Journ. de Conchy., 7, p. 301, pl. 10, fig. 3 (locality unknown).

*Murex cabritii* Bernardi, Dall 1889 (in part), Bull. Mus. Comp. Zoöl., 13, p. 196.

*Murex cabritii* 'Bernardi' M. Smith 1939, An Illust. Cat. of the Recent Species of the Rock Shells, Lantana, Florida, p. 2, pl. 1, fig. 3.

*Description.* Shell medium in size, from 40 to 78 mm. (about 1½ to 3 inches) in length.

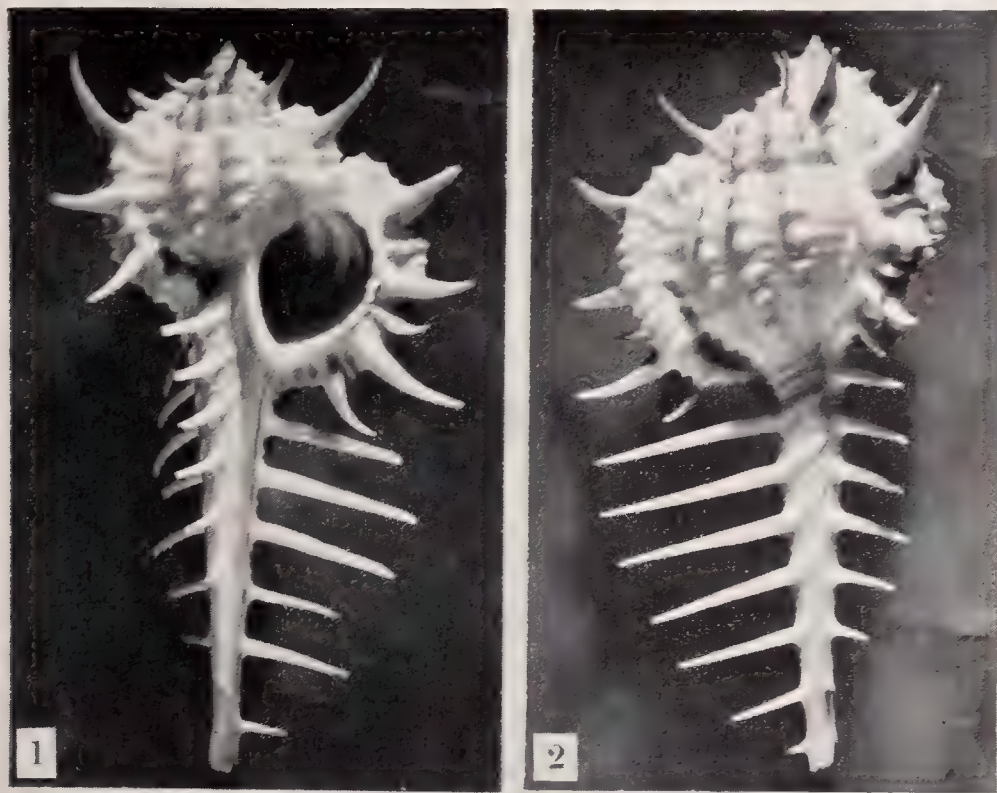


Plate 1. *Murex cabritii* Bernardi

Fig. 1. Tarpon Springs, Florida. Fig. 2. Cedar Keys, Florida.  
(both natural size)

<sup>1</sup> We have not seen Perry's Arcana but obtained our data from a report on this publication by Mathews and Iredale (1912, The Victorian Naturalist, 29, pp. 9-13).

solid and strongly spinose. Whorls seven, strongly convex. Color white to variegated pink with the varices and intervarical ridges white or pale yellowish pink. There are no color bands. Spire moderately extended. Suture irregular, indented, interrupted by the varices that buttress the whorl above. Aperture oval and porcellaneous white. Parietal lip adhering above, free and slightly recurved below. A single strong tooth is developed at the upper end of the parietal area and slightly below the margin. The palatal or outer lip is erect along its entire length and strongly crenulated with the crenulations usually grouped in pairs. Siphonal canal long, generally as long as the whorls above. This canal is very straight, so much so that it leaves behind no trace of the older canals as growth advances. This is done by absorbing the spines on the left margin of the canal. As growth proceeds, the forward-growing margin is simply added on. The apertural opening of the siphonal canal consists of a long narrow slit. Axial sculpture consists of three very prominent rounded and strongly spinose varices which are pinched in on the backward edge. Each varix produces at the growing margin a series of three rather large spines with a small spine in between each two of the large spines and at both ends of the varices. The spines found on the siphonal canal following the varical series renders this a very spinose species. Between the varices there are generally four, sometimes three, axial ridges. A series of long and closely set spines follow down the siphonal canal as a continuation of the varices. These spines are remarkably regular and they diminish more or less regularly in height toward the distal end of the canal. In addition, they are curved forward. Intervarical ridges are three or four in number and are strongly rugose. These rugosities are produced by spiral cords as they pass over the ridges. There are fine spiral threads in between these stronger cords. On the back of the canal there are small spiral ridges connecting the spines in each axial series. Nuclear whorls one and one half, very small, rounded, polished and of a light brown coloration. They are followed by about three whorls, finely sculptured with numerous, equal axial ribs and four revolving threads. Perry (1940, Bull. 95, Paleontological Research Institution, Ithaca, N.Y., p. 140) reports the periostracum to be thin and smooth. Operculum unguiculate, suboval and rather strongly sculptured with concentric ridges.

	length	width (without counting the spines)	
(large)	77	34 mm.	Cedar Keys, Florida
(average)	62	29	Tarpon Springs, Florida

*Types.* The whereabouts of the type specimen of this species is unknown to us. The type figure is that given above in the original citation. The type locality was unknown to Bernardi, though Hidalgo noted that this species occurred in the Lesser Antilles (Tryon 1880, Man. of Conch. (1) 2, p. 134). We limit the type locality to Barbados, based on a specimen collected by the *Blake* in 76 fathoms.

*Common name.* Cabriti's Rock Shell.

*Remarks.* This species is quite different from all others in *Murex* s.s. in the Western Atlantic. The most outstanding character is that of the three long rows of spines that are produced on the siphonal canal. Young specimens, however, can be confused with *M. recurvirostris rubidus*, particularly if the spines have become broken, but their attachment points are readily detected with a low power lens. It is known to occur in depths up to 76 fathoms. Dall's records (1889, p. 196) included those of *M. tryoni* as he considered both these species to be the same.

*Range.* Florida and south through the West Indies to Barbados.

*Records.* FLORIDA: Pompano (L. C. Smith); 5 miles S. E. of Sombrero Key, Lower Florida Keys in 33-66 fathoms (L. A. Burry); Marco Pass; Captiva Id. (both MCZ); Tarpon Springs (T. Van Hyning); Cedar Keys (J. S. Schwengel); off Fort Walton in 18 to 20 fathoms (L. A. Burry). LESSER ANTILLES: off Barbados, *Blake*, station 272, in 76 fathoms (MCZ).

***Murex (Murex) tryoni* Hidalgo, Plate 2**

*Murex (Tribulus) tryoni* Hidalgo 1880, [in] *Man. of Conch.* (1) 2, p. 134 (Lesser Antilles).

*Description.* Shell thin, small, from 25 to 43 mm. (about 1 to 1.75 inches) in length. Whorls six to seven. Color white to gray, without dots or other color markings. Spire acute and moderately extended. Suture deeply indented, interrupted by the varices that buttress the whorls above. Aperture small, oval and a glossy white. Parietal lip thin, sharp and extended, lightly attached on its upper margin to the body whorl; no denticulations present on the specimens examined. Palatal lip thin, erect and rather finely crenulated. Siphonal canal long and varying in length from about two thirds to equal the length of the whorls above. It is straight to slightly recurved backwards. The previous siphonal canals remain as scale-like processes about midway on the new canal. Apertural opening of the latter consisting of a long narrow slit. Axial sculpture consists of three prominent and acute varices. These varices support alternating long and short spines which are closed in front and generally somewhat curved, the spines being all evolved in a single plane and not built forward as in most other species in this group. They are flat on their forward side and rather sharply keeled on their backward side. At the proximal end of the siphonal canal there are two or three spines at the base of each varix. The intervarical ridges are low, four or five in number and rather finely nodulose, the nodules occurring more or less regularly on the spiral threads that connect the spines of



Plate 2. *Murex tryoni* Hidalgo  
Off Grenada Island, Lesser Antilles (2X).

one varix to those on another. The nuclear whorls large, number one and three-quarters, the first rounded, the second generally developing a carina. One and one-half post nuclear whorls sculptured with twelve equal axial ribs crossed by rather strong spiral threads. Remaining whorls as described above. Periostracum and operculum unknown.

	length	width (without counting the spines)	
(large)	43	17 mm.	off Grenada, Lesser Antilles
(average)	35	15	off Montserrat, Lesser Antilles

*Types.* Holotype, Academy of Natural Sciences of Philadelphia, from Hidalgo. As Hidalgo did not restrict the type locality, we here select the island of Grenada, Lesser Antilles, a station from which the *Blake* obtained several specimens of this species.

*Remarks.* *Murex tryoni* is closely related to *M. cabritii*, a species with which it has been confused and synonymized by several authors. In general *M. tryoni* is much smaller, thinner and possesses a more extended spire than that of *M. cabritii*. In addition, both the spiral cords and axial ridges are much finer in *M. tryoni*; the varices are nearly acute and not rounded and the spines on their forward side are flat, while they are more or less angular in *M. cabritii*. The nuclear whorls are much larger in *M. tryoni*, the second whorl being carinated. The most significant difference, however, is the lack of the strong comb-like spines on the siphonal canal. The possession of these spines differentiates *M. cabritii* from all other known species in the Western Atlantic. *M. tryoni* does have two or three spur-like spines on each of the three rows in line with the varices below the base of the aperture.

*Range.* Florida, probably the Greater Antilles and south to Grenada, Lesser Antilles.

*Records.* FLORIDA: off Destin in 18 fathoms; off Elbow Reef, Key Largo in 66 fathoms (both L. A. Burry); off Sombrero Key, *Blake*, in 54 fathoms; off Sand Key in 25 fathoms (both MCZ). VIRGIN ISLANDS: off St. Croix, *Blake*, station 132, in 115 fathoms. LESSER ANTILLES: off Montserrat, *Blake*, station 155, in 88 fathoms; off Barbados, *Blake*, station 273, in 103 fathoms; off Grenada, *Blake*, station 253, in 92 fathoms (all MCZ).

### **Murex (Murex) recurvirostris rubidus** *F. C. Baker*, Plate 3, fig. 1-7

*Murex recurvirostris* of authors, not of Broderip 1833.

*Murex messorius* of authors, not of Sowerby 1841.

*Murex messorius* var. *rubidum* 'Dall' *F. C. Baker* 1897, *Trans. Acad. Sci. St. Louis*, **7**, no. 16, p. 377, (Cedar Keys, Florida).

*Murex marcoensis* Sowerby 1900, *Journ. of Malacology*, **7**, p. 162, text fig. (Marco Pass, Florida).

*Murex narcoensis* Sowerby 1900, *Journ. of Malacology*, **7**, p. 162 [typ. error in caption of text figure].

*Murex anniae* M. Smith 1940, *Nautilus*, **54**, p. 45, pl. 2, fig. 1 (Ortona Locks, Florida; Pliocene. [Data given in letter]).

*Murex recurvirostris delicatus* M. Smith 1940, *Nautilus*, **54**, p. 45 (Lake Worth, Florida).

*Murex recurvirostris citrinus* M. Smith 1940, *Nautilus*, **54**, p. 45 (off Key Largo, Florida).

*Description.* Shell medium in size, from 30 to 50 mm. (about 1 to 2 inches) in length, rather solid and with a short body whorl and extended siphonal canal. Whorls seven or eight, strongly convex. Color variable; it may be cream, pink, pale orange, salmon, or even red. Occasionally, on the shoulder of the last two whorls, there may be developed a band of color, generally of a much darker shade than the ground color. A few specimens possess an irregular band either narrow or broad, of the same color at the base of the whorl. When broad, this band extends part way down the canal. Spire acute and

extending but little above the body whorl. Suture deeply indented and interrupted by the varices. Aperture rather small, oval, polished and colored a milk or oyster white, the color bands of the outside showing through when present. The lower half of the parietal lip is erect with the edge slightly recurved; the remaining upper half adheres to the body whorl. On the inner wall of this lip there is a series of small flattened denticulations and at the upper part there is produced a low ridge which extends backward into the whorl.

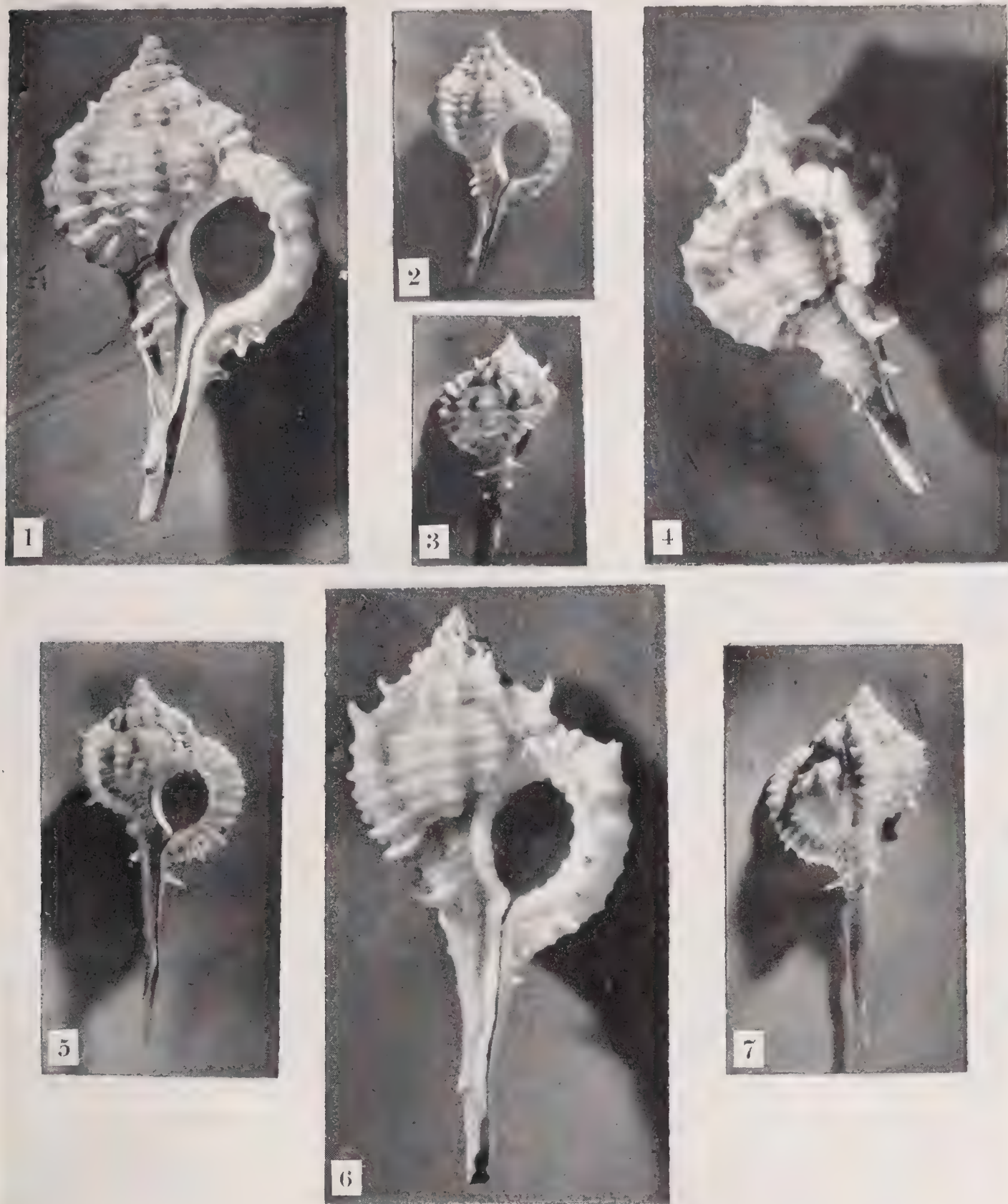


Plate 3. *Murex recurvirostris rubidus* F. C. Baker

Fig. 1-2. Holotype, Cedar Keys, Florida (fig. 1,  $2\times$ ; fig. 2, natural size). Fig. 3-4. Off Boynton, Florida (fig. 3, natural size; fig. 4,  $2\times$ ). Fig. 5 and 7. Off Fort Walton, Florida (natural size). Fig. 6. Off Key Largo, Florida (Holotype of *Murex recurvirostris citrinus* M. Smith,  $3\times$ ).

The palatal or outer lip is erect along its entire length, the thin forward edge finely crenulated, the crenulations being the forward extensions of the denticulations that margin the inner surface of the lip below the edge. Siphonal canal varying in length from a little less than the length of the whorls above to about equal their length. The siphonal canal gradually tapers slightly towards the distal end. Old siphonal canals are merged smoothly with the newest formed, only the distal ends projecting slightly above. The apertural opening of the canal consists of a very narrow slit. At the base of the canal there may be one or two slightly recurved spines aligned with each varix which are longer than those found on the body whorl. Axial sculpture consists of three rounded varices and three intervarical ridges, two strong and one faint, which are crossed by from six to eight spiral and rather sharply keeled ridges and alternating raised threads. On the forward face of the varices short and open spines are sometimes formed by extensions of the ridges. Nuclear whorls one and one half, polished, rounded and colored cream to brownish. They are followed by three whorls axially sculptured with fine costae crossed by very fine spiral threads. On these whorls the varices can not be distinguished from the other axial ribs. Periostracum very thin, finely rugose and limited to small patches. Operculum unguiculate, the surface crossed by numerous and irregular growth lines.

	length	width	
(large)	55	24 mm.	off Fort Walton, Florida
(average)	42	21	Biscayne Bay, Florida

*Types.* As no types were selected or indicated by F. C. Baker, we here select a specimen from Cedar Keys, Florida, the type locality, to be the holotype (Mus. of Comp. Zoöl., no. 147272). Through the kindness of Maxwell Smith we have seen the types of both *M. recurvirostris delicatus* and *M. recurvirostris citrinus*. These in addition to *M. recurvirostris anniae* are contained in his collection.

*Common name.* Red Rock Shell.

*Remarks.* This species has long been known under the names of *M. recurvirostris* Broderip and *M. messorius* Sowerby; the disposition of the two names has been considered in the synonymy above. *M. recurvirostris rubidus* is the first available name for the Western Atlantic subspecies. The name *rubidus* in the original description by Baker was applied only to the deep pink or reddish specimens. However, in a study of a large series of shells we have been unable satisfactorily to separate the many existing transitional forms. Later writers have included under *rubidus* the specimens possessing a short canal, a form which was named *marcoensis* by Sowerby. The color, the length of the canal and even the extended whorls which this form exhibits, intergrade smoothly with darker and more lightly colored shells, those having a shortened series of whorls as well as those possessing a more lengthened canal. The several forms are not even limited geographically as they appear throughout the range as known to us, even in the same region and dredged haul. As a consequence it seems best to use the name *rubidus* Baker as a subspecies of *recurvirostris* to include this complex in the Western Atlantic. This species has been known under the several names given in the synonymy above.

The names *anniae* Smith, *delicatus* Smith and *citrinus* Smith are all synonyms of *rubidus*. In our opinion *M. recurvirostris anniae* appears to be a typical *rubidus* with the canal broken. *M. recurvirostris delicatus* was only a substituted name to distinguish *M. recurvirostris* of the Western Atlantic; the name *rubidus*, however, is earlier. *M. recurvirostris citrinus* is one of the several color forms that exist in this subspecies. Typical

*M. recurvirostris* Broderip is here restricted to include the chocolate brown form that occurs on the west coast of Central America and possibly along the eastern side of Central and South America. We possess a single and badly worn specimen from Santa Marta, Colombia which is exceedingly dark in color and may be true *recurvirostris*. Its worn condition prevents exact determination. *M. recurvirostris rubidus*, however, is consistent in being much lighter in coloration, even though the colors are very variable.

The record of *M. recurvirostris nigrescens* Sby. by M. Smith from Colón, Panama comes from the Calvert Collection and is open to question as to locality (Nautilus, 54, p. 45, 1940). *Murex nigrescens* Sby. is an absolute synonym of *M. recurvirostris*. We possess cotypes of both *recurvirostris* and *nigrescens* from H. Cuming.

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.

*Range.* East and West Florida and the Bahamas.

*Records.* FLORIDA: Lake Worth (B. R. Bales); off Lantana in 85 fms. (J. S. Schwengel); off Boynton in 10 fathoms; off Delray in 80 fathoms (both T. van Hyning); Miami Beach (A. H. Patterson); Looe Key, Lower Florida Keys in 25 to 39 fathoms; off Key Largo (both L. A. Burry); Bonefish Key (B. R. Bales); off Pelican Shoals in 25 to 30 fathoms (J. S. Schwengel); Stock Island (B. R. Bales); off Marco Island in 6 to 7 fathoms; Naples (both MCZ); Bonita Springs (B. R. Bales); Sanibel Island (R. Humes); Pass-a-Grille (MCZ); Tarpon Springs (J. S. Schwengel); off Cedar Keys (MCZ); off Fort Walton (L. A. Burry). BAHAMAS: Governor's Harbour, Eleuthera; Arhurstown, Cat Id. (both MCZ).

***Murex (Murex) woodringi*, new species, Plate 4, fig. 1-3**

*Description.* Shell medium in size, from 50 to 72 mm. (2 to 2 $\frac{3}{4}$  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.

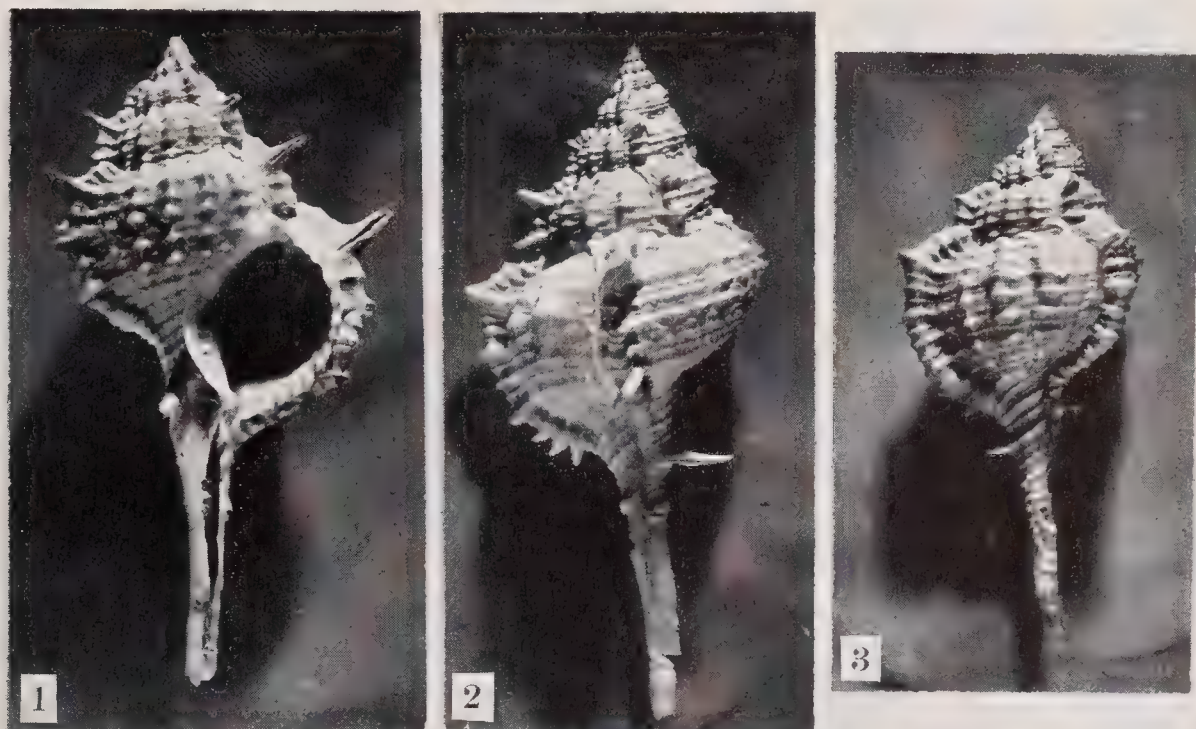


Plate 4. *Murex woodringi* Clench and Pérez Farfante  
Fig. 1 and 3. Jamaica. Fig. 2. West Indies (both natural size).

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.

	length	width (without counting the spines)	
(large)	72	30 mm.	Holotype
(average)	55	24	Jamaica

*Types.* Holotype, Museum of Comparative Zoölogy, no. 156087, from Jamaica, C. B. Adams collector. Paratypes from the same locality and from Cartagena, Colombia.

*Remarks.* This species is very close in its relationship to both *M. antillarum* and *M. recurvirostris rubidus*. From *M. antillarum* it differs by being less spinose, having a much longer and straighter siphonal canal and much coarser post-nuclear whorl-ridges. In addition the nuclear whorls are a little larger. From *M. recurvirostris rubidus* it differs in possessing a more extended spire and longer siphonal canal in the adult and in having more intervarical ridges. Young specimens, however, of this new species have a much shorter spire, but as the shell grows larger, the proportional length of the spire increases materially.

Woodring has published as *Murex recurvirostris* Brod. two figures from the Miocene of Bowden, Jamaica, which may possibly be this species of ours (Carnegie Institution of Washington, Publication no. 385, p. 288, pl. 17, fig. 7 to 8). Only the figures and the description refer to this new species, not his synonymy, which is for *M. recurvirostris*.

Named for Wendell P. Woodring as a tribute to his excellent studies on the Tertiary fauna.

*Range.* Jamaica and northern South America.

*Records.* See Types.

### **Murex (Murex) chrysostoma** Sowerby, Plate 5, fig. 1-2

*Murex chrysostoma* 'Gray' Sowerby 1834, Conch. Illust., **Murex**, pt. 58, fig. 1, with name in the cat. of species, p. 1, no. 8 (locality not given).

*Murex bellus* Reeve 1845, Conch. Icon., **3**, **Murex**, pl. 21, fig. 84 (locality unknown).



*Description.* 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.

	length	width	
(large)	70	40 mm.	Tobago Id., Lesser Antilles
(average)	62	36	Tobago Id., Lesser Antilles

*Types.* The type figure is that in the Conchological Illustrations, pl. 58, fig. 1. As no

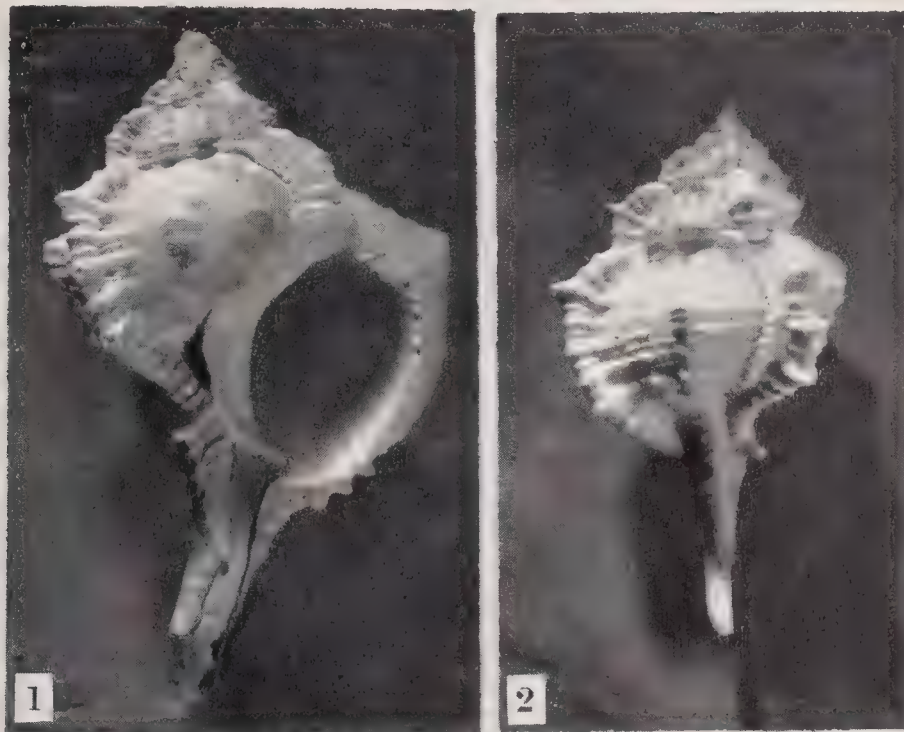


Plate 5. *Murex chrysostoma* Gray

Fig. 1. Tobago Island, Lesser Antilles. Fig. 2. West Indies  
(both natural size).

locality was given, we here select Tobago Island, Lesser Antilles, to be the type locality.

*Common name.* Golden-Mouth Rock Shell.

*Remarks.* We have but little data on this species. Our records below show a very limited distribution, but we believe that it exists probably as far south as Brasil. *M. chrysostruma* appears to be closely related to *M. recurvirostris rubidus*. *M. chrysostruma* reaches a much larger size, is proportionately wider, and possesses the yellow patches of color on the parietal lip. In addition, it has the varices of each whorl built just behind the varices of the whorl above, while in *M. recurvirostris rubidus* the corresponding varices generally form a continuous ridge from apex to base or are built ahead of the varix of the whorl above. The intervarical ridges in *M. chrysostruma* may be reduced to one in the last whorls, while in *M. recurvirostris rubidus* there are generally two or more.

*Range.* Tobago and south probably to Brasil.

*Records.* LESSER ANTILLES: Tobago Id. (MCZ); Chaguaramas, Carenage Bay, and Harts Cut, Trinidad (all H. G. Kugler). VENEZUELA: Cumaná (MCZ).

### **Murex (Murex) antillarum** Hinds, Plate 6

*Murex motacilla* var. Sowerby 1841, Conch. Illust., **Murex**, pt. 189, fig. 69, with name in explanation of plates (Indian Ocean).

*Murex antillarum* Hinds 1844, Proc. Zool. Soc. London, **11**, p. 126 (Tortola, Virgin Islands). Refers to Sowerby's Conch. Illust., 1841, pt. 189, fig. 69.

*Murex nodatus* Reeve 1845, Conch. Icon., **3**, **Murex**, pl. 15, fig. 107. Refers to Sowerby's Conch. Illust. 1841, pt. 189, fig. 69.

*Murex articulatus* Reeve 1845, Conch. Icon., **3**, **Murex**, note under species 88. Based on Sowerby's Conch. Illust. 1841, pt. 169, fig. 69.

*Murex gundlachi* Dunker 1883, Malak. Blätt. (n.s.) **6**, p. 35, pl. 1, figs. 1-3 (Matanzas, Cuba).

*Description.* 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 in 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.

	length	width (without counting the spines)	
(large)	95	38 mm.	off Cienfuegos Bay, Cuba
(average)	67	28	Bull Bay, Jamaica

*Types.* The type specimen is probably in the British Museum as it was described from the Cuming collection which is now in their possession. The type locality is Tortola, Virgin Islands.

*Common name.* Antillean Rock Shell.

*Remarks.* *M. antillarum* is closely allied to *M. beaultii* and appears to be somewhat near to *M. aguayoi*. See remarks under both of these species for the differences that exist between them.

This well known species is fairly abundant throughout the West Indies in moderate to fairly deep water. Specimens obtained from deep water appear to be more spinose. Those sent by Alcalde Ledón are the finest that we have seen. They were obtained from a submerged cable at 200 meters (about 100 fathoms) in depth (Plate 6).

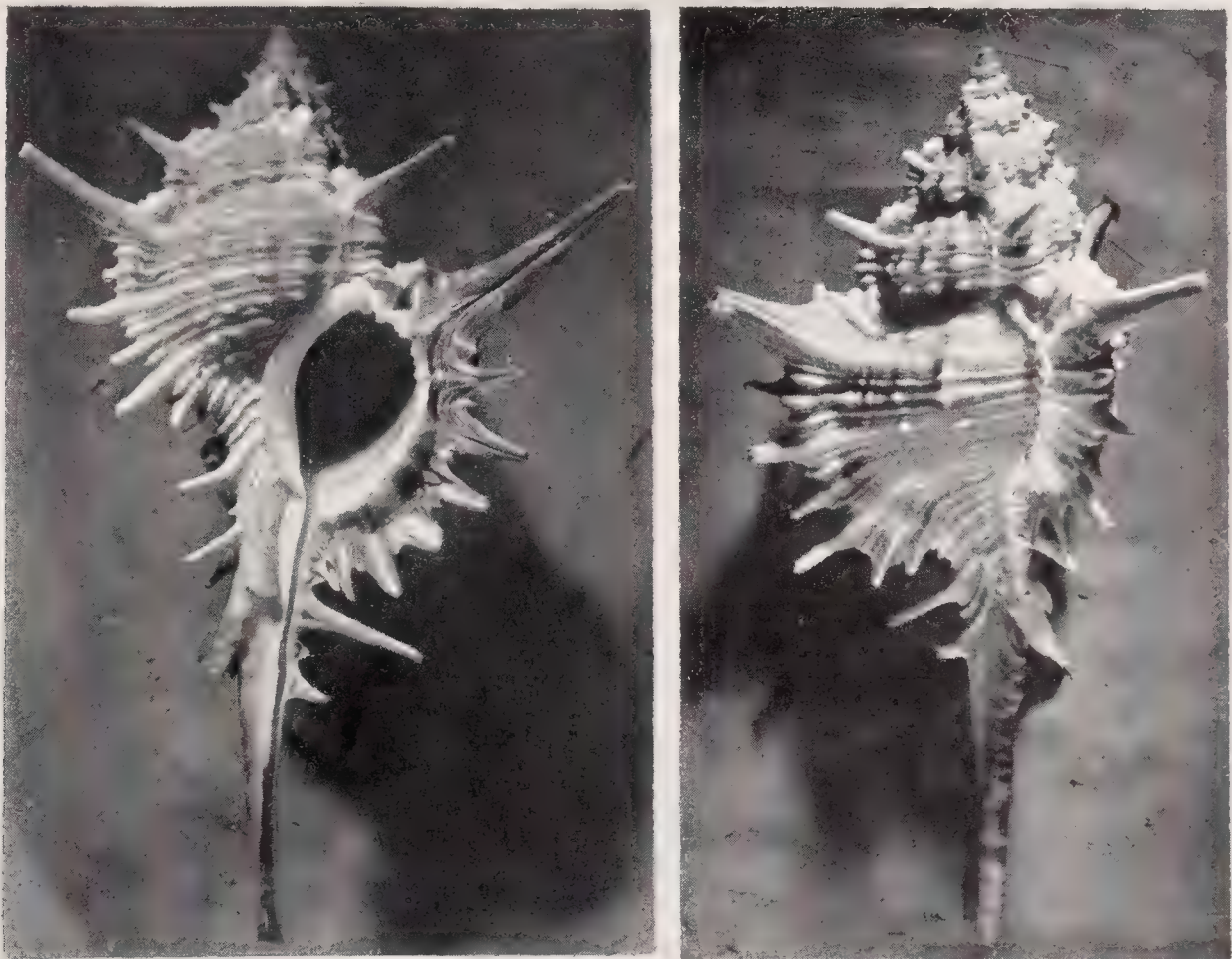


Plate 6. *Murex antillarum* Hinds  
Cienfuegos Bay, Cuba (natural size).

Both *M. antillarum* and *M. nodatus* are based on the same figure in Sowerby's Conchological Illustrations.

*Range.* Southern Florida and south through the Lesser Antilles.

*Records.* FLORIDA: Tortugas (MCZ). CUBA: off Matanzas, *Atlantis*, station 3482 (N. Lat. 23°09'; W. Long. 81°27'30'') in 190 fathoms (MCZ); Casilda, Trinidad (C.G. Aguayo); off Cienfuegos Bay in 100 fathoms (Alcalde Ledón); off Bahía de Cochinos, *Atlantis*, station 2963 (N. Lat. 22°07'; W. Long. 81°08') in 155 to 190 fathoms (MCZ). HISPANIOLA: Puerto Plata; Monte Christi; Jérémie (all MCZ). JAMAICA: Port Royal, *Blake*, in 100 fathoms; Port Antonio (both MCZ); Bull Bay (P. D. Ford). VIRGIN ISLANDS: Flannegan Passage, off St. John, *Blake*, station 142, in 27 fathoms (MCZ). LESSER ANTILLES: Barbados (A. H. Patterson); off Grenada, *Blake*, station 247 in 170 fathoms (MCZ).

**Murex (Murex) beauii** Fischer and Bernardi, Plate 7, fig. 1-2

*Murex beauii* Fischer and Bernardi 1857, Journ. de Conchy., 5, p. 295, pl. 3, fig. 1 (Marie Galante [Lesser Antilles]); Dall 1889, Bull. Mus. Comp. Zoöl. 18, p. 195.

*Description.* Shell medium in size, from 70 to 120 mm. (about 3 to 5 inches) in length, thin, rather delicately constructed. Whorls eight and strongly convex. Color cream to pale brownish without developing bands of color. There are faint indications of spiral lines of rusty brown that are on the spiral cords. Spire extended. Suture irregular and deeply indented. Aperture subcircular to oval, glazed porcellaneous white. Parietal lip slightly reflected, adherent almost its whole length to the body whorl and possessing a few fine submarginal denticulations. Outer lip thin, erect and slightly reflected, its margin being finely irregular rather than crenulated. Siphonal canal somewhat long and

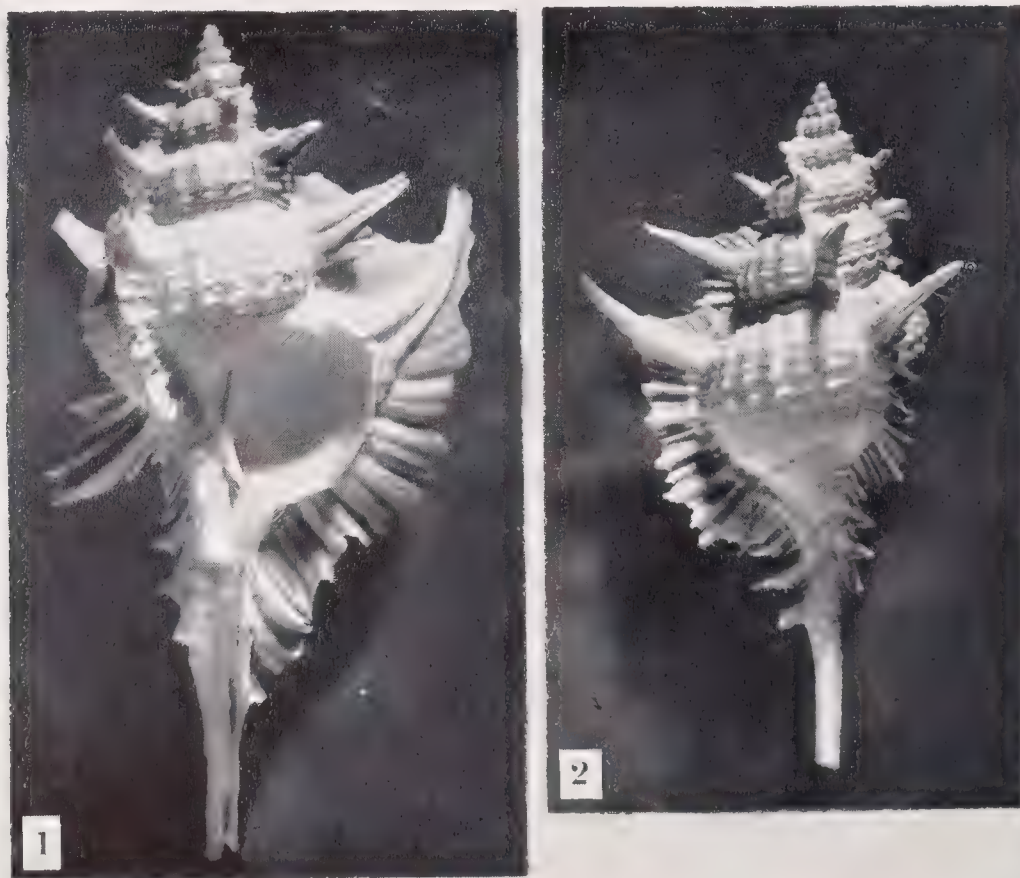


Plate 7. *Murex beauii* Crosse

Fig. 1. Off Guadeloupe Island, Lesser Antilles. Fig. 2. Off St. Vincent Island, Lesser Antilles (both natural size).

moderately recurved, two previous canals remaining as scale-like spines near the base of the aperture. Varices three on each whorl, moderately spinose. The spines developed at the shoulder of the whorls are long and generally open on their forward side. Remaining spines may be differentiated, but generally they have opened up and become connected with each other, forming a web-like structure that extends from above the shoulder spines to the base of the varix at the siphonal canal. The two or three spines generally found below the aperture exist in this species as high points in the webbing. Early webbing is generally broken away leaving only the shoulder spine behind. Axial sculpture consists of five or six nodulose ridges crossed by fine spiral cords. Axial growth lines very fine and slightly irregular. Nuclear whorls one and one-half, small, rounded and glass-like. Two following whorls sculptured with equal and very strong axial ridges and fine spiral threads. Periostracum absent. Operculum unguiculate with rather strongly developed concentric ridges.

	length	width	
(large)	120	51 mm.	(including spines) Holotype
(average)	88	30	(not including spines) off Guadeloupe, Lesser Antilles

*Types.* Holotype in the collection of the Journal de Conchyliologie from the Island of Marie Galante in the Lesser Antilles, from Commander Beau.

*Remarks.* This species is readily differentiated from all others of this group in the Western Atlantic. The possession of the webbing along the varices is unique. In relationship it appears near *M. antillarum* with which it agrees in nearly all of its other characters. Even in *M. antillarum* there is an indication of the webbing in the widely open spines which are connected at their bases. The spire is a little more elevated and the suture more deeply indented in *M. beauii* than in *M. antillarum*. In addition, there is a tendency to develop color bands in *M. antillarum*, which are absent in the few specimens of *M. beauii* we have seen, while the latter species possesses fine spiral threads of color. This species has been recorded in depths ranging from 95 to 245 fathoms:

*Range.* From Gulf of Mexico and south through the Lesser Antilles.

*Records.* FLORIDA: off the Lower Florida Keys in 100 to 120 fathoms (MCZ); about 65 miles south of Cape San Blas, *Albatross*, station 2402 in 111 fathoms (USNM). CUBA: off Santiago de Cuba, *Albatross*, station 2134 in 254 fathoms (USNM). LESSER ANTILLES: off Guadeloupe, *Blake*, station 171 in 183 fathoms; off St. Vincent, *Blake*, station 231 in 95 fathoms (both MCZ).

### **Murex (Murex) aguayoi**, *new species*, Plate 8, fig. 1-3

*Description.* Shell medium in size, from 35 to 60 mm. ( $1\frac{1}{2}$  to  $2\frac{1}{2}$  inches) in length, rather thin and strongly spinose. Whorls from seven to nine, rather strongly convex with occasional specimens moderately carinated. Color uniformly milky white or light gray. Spire extended. Suture irregular and rather deeply impressed. Aperture obliquely ovate and porcellaneous white. Parietal lip slightly reflected, rigidly attached above, erect and free below. Generally it is smooth within though occasionally two or three very weak denticles may be formed near the lower part. Palatal lip thin, erect, somewhat irregular and not crenulated; opposite the large shoulder spine it is slightly drawn out to form a tooth-like process. The siphonal canal is extended, narrow throughout its length and rather abruptly turned upward at its base, forming a pronounced angle at the base of the

aperture. In addition, occasional specimens have the canal turned slightly to the right in an apertural view. Two previous stages of the siphonal canal remain as scale-like spines at the lower left of the aperture. Axial sculpture formed by three prominent equidistant varices. The varices of each whorl are aligned with those of the previous whorl, each varix supporting a series of recurved spines, the largest being developed at the shoulder of the whorl. The remaining spines are quite irregular and on a few specimens, they are alternately large and very small. The spines are closed on the aperture side, though occasionally there is a narrow slit remaining. In between the varices there are two to four nodulose axial ridges, the nodules being in both axial and spiral arrangement. Growth lines consist of very fine axial threads. Spiral sculpture consists of numerous fine cords. It is on these cords that the nodules are generally developed forming the axial ridges. Nuclear whorls two, bulbous, without a carina, smooth, with the first whorl larger. This whorl develops in a vertical plane, then turns at the beginning of the second whorl to a horizontal plane. The following whorl has spiral and axial ridges, the varices beginning at the end of this whorl.



Plate 8. *Murex aguayoi* Clench and Pérez Farfante

Fig. 1. Holotype, off Punta Alegre, Camagüey, Cuba. Fig. 2. Off Punta Alegre, Camagüey, Cuba (both natural size). Fig. 3. Off Caibarién, Cuba (2×).

	length	width (without the spines)	
(large)	65	24 mm.	Holotype
(average)	60	21	Off Punta Alegre, Camagüey, Cuba

*Types.* Holotype, Museum of Comparative Zoölogy, no. 147286, *Atlantis*, station no. 3415 (N. Lat.  $22^{\circ}51'30''$ ; W. Long.  $78^{\circ}55'30''$ ) off Punta Alegre, Camagüey Prov., Cuba, in 210 fathoms, Feb. 3, 1938. The following paratypes are all from the *Atlantis* dredgings: station 2951 (N. Lat.  $26^{\circ}14'$ ; W. Long.  $78^{\circ}43'$ ) off South West Point, Grand Bahama Island, Bahamas, in 285 fathoms; station 3422 (N. Lat.  $22^{\circ}48'$ ; W. Long.  $79^{\circ}09'$ ) off Caibarién, Cuba, in 235 fathoms; station 3414 (N. Lat.  $22^{\circ}50'30''$ ; W. Long.  $78^{\circ}52'$ ) off Punta Alegre, Camagüey Prov., Cuba in 230 fathoms; station 3320 (N. Lat.  $22^{\circ}13'$ ; W. Long.  $81^{\circ}11'$ ) Bahía de Cochinos, Santa Clara Prov., Cuba, in 185 fathoms.

*Remarks.* *M. aguayoi* appears to be nearest in its relationship to *M. antillarum* but it differs by possessing a narrower and a more recurved siphonal canal, a more extended spire and having the spines on the varices far more strongly recurved. Both the parietal and palatal lips in *M. aguayoi* are much smoother, the parietal denticles being relatively insignificant and the crenulations on the outer lip almost obsolete. The most significant difference is that of the nuclear whorls: *M. aguayoi* possesses a bulbous and twisted first whorl which is larger than the second whorl; in *M. antillarum*, the first nuclear whorl is smaller than the second and is not at all bulbous or twisted in a horizontal plane.

Our specimens of *M. aguayoi* were obtained in depths ranging from 185 to 285 fathoms.

Named for Carlos G. Aguayo, Professor of Zoology at the University of Habana, who has contributed much to our knowledge of Cuban malacology.

*Range.* In deep water, the Bahamas and south to Cuba.

*Records.* See Types.

### **Murex (Murex) cailleti** Petit, Plate 9, fig. 3-6

*Murex motacilla* Lamarck 1822, An. s. Vert., 7, p. 160 [description only, not the reference to Chemnitz] (l'Océan des grandes Indes [Indian Ocean]); non *M. motacilla* Gmelin 1790.

*Murex elegans* 'Beck' Sowerby 1841, Proc. Zool. Soc. London, 8, p. 140 (locality unknown); Sowerby 1841, Conch. Illust., **Murex**, fig. 84 (locality unknown); non *M. elegans* Donovan 1804; non *M. elegans* Wood 1828.

*Murex trilineatus* Reeve 1845, Conch. Icon., 3, **Murex**, pl. 25, fig. 103 (Gulf of Mexico); non *M. trilineatus* J. Sowerby 1813.

*Murex cailleti* Petit de la Saussaye 1856, Journ. de Conchy., 5, p. 87, pl. 2, fig. 1-2 (Guadeloupe, Lesser Antilles).

*Murex motacilla* var. *cailleti* 'Petit' Tryon 1880, Man. of Conch. (1), 2, p. 82, pl. 12, fig. 131; pl. 13, fig. 132 (Guadeloupe, Lesser Antilles).

*Description.* Shell medium in size, from 35 to 60 mm. (about 1 to  $1\frac{1}{2}$  inches) in length and rather solid. Whorls eight or nine, convex but generally slightly angulated at the shoulder. Ground color from white to dark cream with numerous, spiral and equidistant chestnut brown lines. Many examples show in addition two indistinct brownish bands on the last whorl. The spiral lines may be reduced to a very few and these few are usually superimposed over the broader brownish bands. Spire moderately extended. Suture irregular and rather deeply indented. Aperture oblique and oval, porcellaneous white with the parietal lip reflected and, adherent above and erect below. Beneath the margin of this lip there is generally a series of three or four denticles on the inner wall near the siphonal

canal and one at the upper portion. In addition, there may be another denticle below the first which is placed well within the aperture. The palatal or outer lip is rather thick, erect and strongly crenulated. Siphonal canal moderately long, never as long as the whorls above, narrow, recurved upward and slightly inclined toward the right. Two previous stages of the siphonal canal exist on the apertural face as two scale-like spines at the proximal end of the siphonal canal. Sculpture consists of three thick varices on each whorl which are aligned with the varices of the whorl above. Occasional specimens are without spines but frequently the varices give rise to a short and pointed spine on the shoulder of the whorls. In addition the varices may possess several small and open spines on the forward side. At the base of the siphonal canal and at the lower end of each varix there is generally a strongly developed spur-like spine. In between the varices there are generally two, sometimes three, axial ridges which in addition are somewhat nodulose. Spiral sculpture consists of numerous and irregularly spaced cords which are frequently indicated by the brownish lines mentioned above under coloration. Nuclear whorls one and one-half, smooth, rounded, and brownish in coloration; the next two following whorls are sculptured with numerous close-set axial ridges which are crossed by spiral

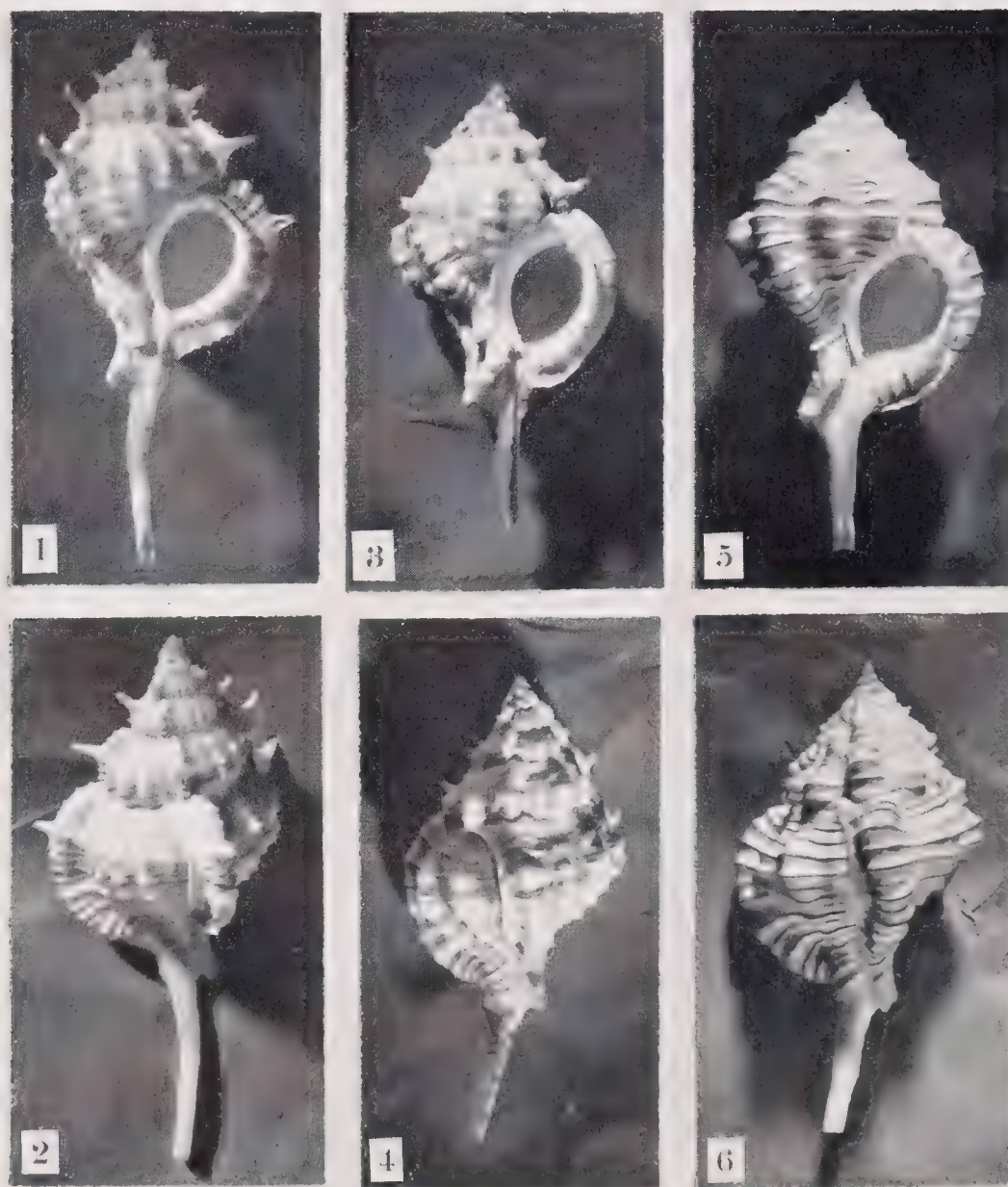


Plate 9. Fig. 1-2. *Murex cailleti kugleri* Clench and Pérez Farfante, Banes, Oriente, Cuba. Fig. 3-4. *Murex cailleti* Petit, Barbados, Lesser Antilles. Fig. 5-6. *Murex cailleti* Petit, Hispaniola (all natural size).



raised cords. The remaining whorls are as described above. Operculum unguiculate, ovate in shape with the surface having rather strongly developed concentric lines.

	length	width	
(large)	55	25 mm.	Barbados, Lesser Antilles
(average)	50	21	Barbados, Lesser Antilles

*Types.* The type specimen is probably in the collection of the Journal de Conchyliologie and was collected by Caillet. The type locality is Guadeloupe, Lesser Antilles.

*Remarks.* As far as we can now determine, the names in the above synonymy all refer to this species. The name *M. cailleti* is used here as it is the first available name among the several synonyms. This species shows considerable variation. Perhaps one of the most outstanding characteristics is that brown spiral lines are always present, either complete or only on the varices. These lines may be numerous and more or less regularly disposed over the surface of the shell as in Sowerby's *elegans*, or reduced to three that are rather widely spaced as in Reeve's *trilineatus*.

*Range.* Southern Florida, Bahamas, and south through the Lesser Antilles.

*Records.* FLORIDA: off Sombrero Key, *Blake*, in 54 fathoms (MCZ). BAHAMAS: off South West Point, Grand Bahama Id., *Atlantis*, station 2951 in 155 fathoms (MCZ). CUBA: Matanzas (C. G. Aguayo); off Matanzas, *Atlantis*, station 3465, in 175 fathoms and station 2480, in 200 fathoms (MCZ). HISPANIOLA: (J. S. Schwengel). LESSER ANTILLES: off Montserrat, *Blake*, station 155, in 88 fathoms (MCZ); off Barbados, *Blake*, station 290, in 73 fathoms (MCZ); Barbados (Mrs. Kellett).

***Murex (Murex) cailleti* var. *kugleri*, new name, Plate 9, fig. 1-2**

*Murex similis* Sowerby 1841, Proc. Zool. Soc. London, **8**, p. 140 (locality unknown); Sowerby 1841, Conch. Illust., *Murex*, fig. 70; non *M. similis* Schroeter 1805.

*Description.* This variety is very similar to the typical species but differs in having the spire slightly more extended and particularly in possessing more numerous and finer intervarical ridges. In addition, it is somewhat more spinous and has the siphonal canal longer. The differences exhibited by the figures on plate 9 are more apparent than is generally found by studying a large series of specimens, as certain examples appear to be intermediate in many of their characters.

As the name *similis* Sowerby is a homonym, a new name had to be selected. Many authors have considered this variety to be a synonym of *M. cailleti*, but in our opinion there are sufficient differences to warrant its retention as a variety.

	length	width	
(large)	60	25 mm.	Banes, Oriente, Cuba
(average)	46	19	Banes, Oriente, Cuba

*Types.* The type specimen is that of *M. similis* Sowerby as figured in his Conchological Illustrations (figure 70). This was originally contained in the Saul collection which is now in the British Museum. Since the locality was unknown to Sowerby, we here select that of Banes, Oriente Province, Cuba, to be the type locality.

Named for H. G. Kugler who has provided us with much critical material.

*Range.* Florida, Cuba and the Virgin Islands.

*Records.* FLORIDA: off Sand Key in 25 fathoms. CUBA: *Atlantis*, station 3419 (N. Lat. 22°46'30"; W. Long. 79°00'), off Punta Alegre, Camagüey, in 180 fathoms; Banes, Oriente. VIRGIN ISLANDS: *Blake*, station 132, off St. Croix in 115 fathoms (all MCZ).

**Murex (Murex) ciboney**, *new species*, Plate 10, fig. 1-3

*Description.* Shell medium in size, from 40 to 60 mm. ( $1\frac{1}{2}$  to  $2\frac{1}{2}$  inches) in length, solid and strongly sculptured. Whorls nine, uniformly convex. Color oyster white with an occasional specimen showing very faint and rather widely spaced brownish lines. Spire extended. Suture irregular and deeply indented. Aperture subcircular to oval, both lips flaring, porcellaneous white, the parietal lip reflected over the body whorl. The upper half of this lip adheres completely to the body whorl; the lower half is suberect from the mid area to the base of the siphonal canal; on the inner wall there is a series of four denticles at the base and a single denticle at the extreme upper margin. Palatal lip erect, strongly crenulated and built forward from the last varix and similar in appearance to the visor of a cap. Denticles formed well within the aperture, their forward ends giving rise to the crenulations on the lip. Siphonal canal medium in length, strongly recurved dorsally and with a very narrow slit which is placed close to the right margin. Terminations of the previous siphonal canals exist as two prominent scale-like spines near the base of the present siphonal canal. Axial sculpture consists of three equidistant and rounded varices which bear a series of short open spines. These spines are rather irregular in size, number from five to seven, are sharply pointed and built on the forward face of each varix. One or two spines are to be found at the base of the siphonal canal. Intervarical axial ridges, numbering two to five on the different whorls, are more or less smooth, though an occasional specimen will have these ridges strongly nodulose. Spiral sculpture consists of numerous close-set cords with fine threads between them. Nuclear whorls one and one half, rounded, smooth and grayish white. Next two whorls sculptured with strong axial ridges and three spiral raised threads. Remaining whorls with the varices more prominent than the intervarical ridges. No periostracum. Operculum oval with strong concentric ridges and possessing an apical nucleus.

	length	width	
(large)	59	25 mm.	off Punta Alegre, Camagüey, Cuba
(average)	52	23	Bahía de Cochinos, Cuba

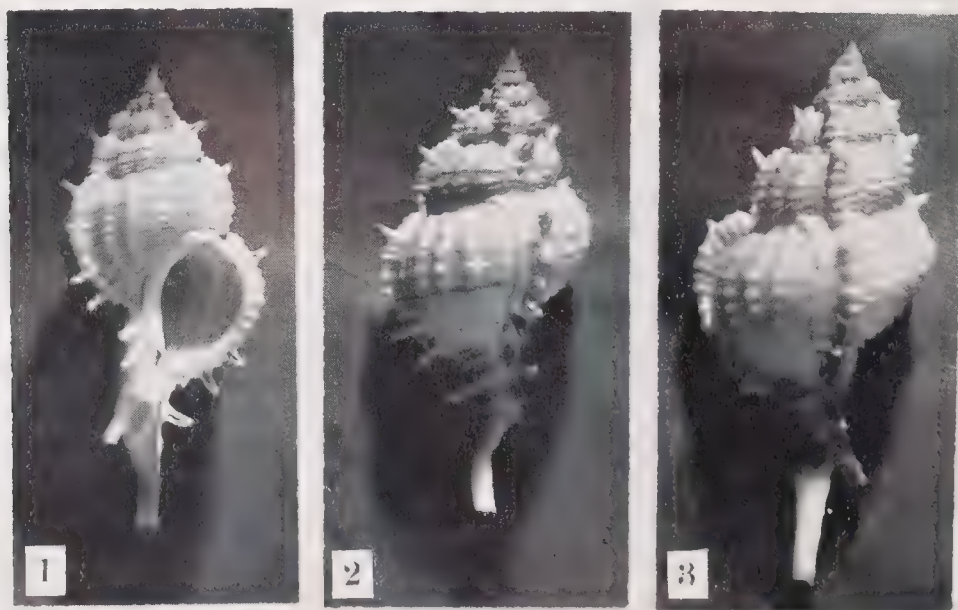


Plate 10. *Murex ciboney* Clench and Pérez Farfante  
 Fig. 1-2. Off Matanzas, Cuba. Fig. 3. Off Punta Alegre, Camagüey,  
 Cuba (both natural size).

*Types.* Holotype, Museum of Comparative Zoölogy, no. 147315, *Atlantis*, station no. 3482 (N. Lat.  $23^{\circ}09'$ ; W. Long.  $81^{\circ}27'30''$ ) off Matanzas, Cuba, in 190 fathoms. Paratypes from the *Atlantis* dredgings off Cuba as follows: station no. 3418 (N. Lat.  $22^{\circ}49'$ ; W. Long.  $79^{\circ}00'$ ) off Punta Alegre, Camagüey, in 195 fathoms; station no. 3375 (N. Lat.  $22^{\circ}12'$ ; W. Long.  $81^{\circ}11'$ ) off Puerto Tánamo, Oriente; station no. 3335, Bahía de Cochinos, Santa Clara, in 200 fathoms.

*Remarks.* This species is nearest in its relationship to *M. cailleti*, but differs in having a more extended spire, having stronger axial ridges on the earlier whorls, with more numerous spines and proportionately smaller varices. In general the spiral cords and threads are finer and more regularly disposed. Previous terminations of the siphonal canal in *M. ciboney* are far more prominent owing to their greater outward curvature.

This rather rare species is known from off Cuba, the Virgin Islands and the northern Lesser Antilles. The range and depth so far known is from 180 to 248 fathoms.

The name *ciboney* is taken from a group of Indians of the same name that once lived in Cuba.

*Range.* Cuba and east to the Virgin Islands and northern Lesser Antilles, in deep water.

*Records.* See under types. CUBA: Cayo Mégano Grande, Camagüey Prov. (P.J. Bermúdez). VIRGIN ISLANDS: off St. Croix, *Blake*, station 134, in 248 fathoms (MCZ). LESSER ANTILLES: off St. Kitts, *Blake*, station 149, in 60–150 fathoms (MCZ).

### **Murex (Murex) motacilla Gmelin, Plate 11**

*Murex motacilla* Gmelin 1790, Syst. Nat. 13 ed., 1, pt. 6, p. 3530 (Indian Ocean). [Refers to Chemnitz, Conchy. Cat. (1), 10, pl. 163, fig. 1563]; Kiener 1843, Coquilles Vivantes, 7, p. 18, pl. 12, fig. 1; Reeve 1845, Conch. Icon., 3, **Murex**, pl. 22, fig. 88 (Senegal).

*Murex motacilla* Lamarck 1822, An. s. Vert., 7, p. 160 (reference to Chemnitz only, not the description which is for *M. cailleti*).

*Murex motacilla* var. *b* Lamarck 1822, An. s. Vert., 7, p. 160.

*Description.* Shell medium in size, from 50 to 60 mm. (about 2 to  $2\frac{1}{2}$  inches) in length, rather solid and moderately spinose. Whorls eight or nine, strongly convex. Color cream to brownish orange, which is rather irregularly disposed and is generally more intensely

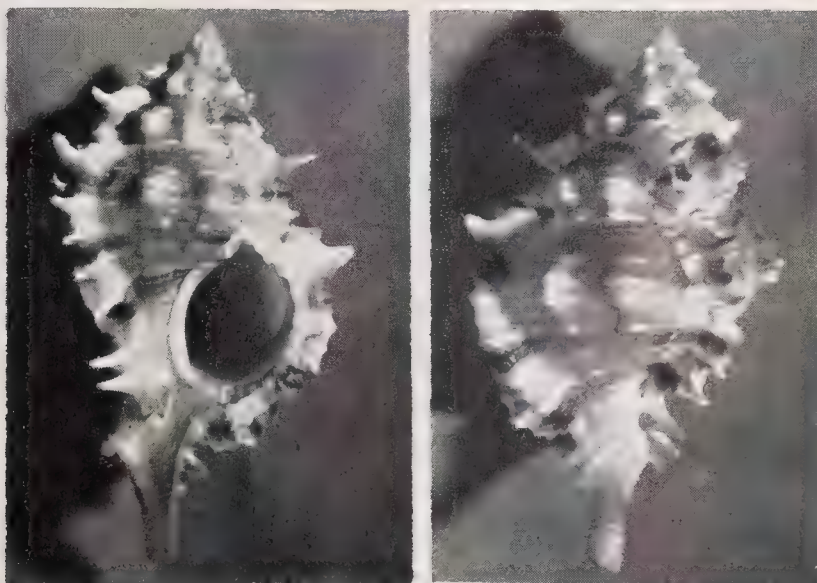


Plate 11. *Murex motacilla* Gmelin  
St. Lawrence, Barbados, Lesser Antilles (natural size).

developed in between the varices along the upper part of the whorls. In live material these take on a faint purplish cast. In addition there are three rusty brown bands on each whorl which are more or less faint in between the varices but exceedingly dark as they pass over each varix. Spire acute and moderately extended. Suture irregular and somewhat indented. Aperture oval and porcellaneous white inside. Parietal lip reflected and adherent almost its entire length to the body whorl; near its lower end there are three or four denticles below the margin and one or two fairly large denticles at the upper end. Palatal lip erect, moderately thin and rather strongly crenulated. These crenulations are due to the forward extension of the denticles, which in this species appear to be quite long and arranged in pairs. Siphonal canal moderately extended and recurved upwardly and to the right. The canal is broad at its union with the aperture and constricts suddenly to form the narrow distal end. The two previous canals exist as well developed scale-like spines near the base of the aperture. Axial sculpture consisting of three varices which support a series of sharp but low spines which may, in places, be joined and ruffled. At the point of the whorl shoulder on the varix there is generally developed a spine somewhat larger than the remainder. In addition there may be two sharp and open spines at the base of each varix. Intervarical ridges two or three, rather prominent and strongly nodulose. Minute sculpture consisting of small and very low axial scales. There are numerous spiral alternating threads and cords; the latter give rise to the nodules, which are in axial arrangement, as well as the spines where they pass over the varices. Nuclear whorls two, rounded, glass-like and amber in coloration. Following two whorls are strongly sculptured with both spiral and axial ridges which are about equal in development. Remaining whorls as described above. No periostracum observed. Operculum unguiculate with rather strongly developed concentric ridges.

length	width	
58	28 mm.	St. Lawrence, Barbados
50	25	St. Lawrence, Barbados

*Types.* The type figure is that of Chemnitz 1788, Conchy.-Cab. (1), 10, pl. 163, fig. 1563. This is the only reference given by Gmelin. Both the Indian Ocean and Senegal, as stated by Reeve above, are apparently in error as to the original locality from which this species came. Our only specific records are from the West Indies. We here select Barbados, Lesser Antilles, to be the type locality.

*Common name.* Frog Shell (Barbados).

*Remarks.* The specimen that we have figured is almost an exact duplicate of the original wood-cut by Chemnitz, the only difference being that our specimen is a little smaller. In relationship *M. motacilla* appears to be nearest to *M. cailleti*. It differs from this latter species in being much more spinose, possessing the mottled brown coloration as well as the three dark bands, and in lacking the spiral chestnut threads which are possessed by *M. cailleti*. The proximal end of the siphonal canal is broader and the size of the shell is generally larger than that of *M. cailleti*. The two specimens from Barbados were collected on the beach and from a fish trap; the specimen from St. Vincent was dredged by the *Blake* in 95 fathoms.

*Range.* Lesser Antilles.

*Records.* LESSER ANTILLES: off St. Vincent, *Blake*, station 231, in 95 fathoms (MCZ); St. Lawrence and Oistin Bay, Barbados (Mrs. Kellett).

**Murex (Murex) pulcher** A. Adams, Plate 12, fig. 1-4

*Murex trigonulus* Reeve 1845, Conch. Icon., **3**, **Murex**, pl. 22, fig. 87 [not species 97 as listed] (Red Sea); *non* Lamarck 1816.

*Murex pulcher* A. Adams 1853, Proc. Zool. Soc. London, **19**, p. 270 (St. Croix, [Virgin Islands] in 60 fathoms); Sowerby 1879, Thes. Conchy., **4**, **Murex**, p. 10, pl. 12, fig. 119.

**Description.** Shell rather small, from 34 to 60 mm. (about 1½ to 2½ inches) in length, rather solid and very moderately spinose. Whorls eight, slightly convex. Ground color cream to yellow and variegated with reddish brown. There are three darker bands of color which are generally irregular, one at the shoulder of the whorl, the second near the base of the whorl and the third at the narrowing point on the siphonal canal. The remaining distal portion of the canal is white in color. Spire moderately extended and acute. Suture irregular and somewhat indented. Aperture oval, porcellaneous white with the outside color showing through. Parietal lip reflected, adherent to the body whorl with almost no free margin. There is a series of denticles along the inner wall for its entire length. Outer lip thin, erect, finely crenulated and with a series of low and thin denticles extending well within the aperture; the crenulations are the forward extensions of these denticles. Siphonal canal long, rather broad at its proximal end and having the greater portion of its distal end narrow, recurved upwardly and outwardly. The two previous siphonal canals exist as scale-like spines near the base of the aperture. Sculpture consisting of three rounded varices which support, on the forward side, a ruffle-like series of spines which are usually rather low. At the base of the siphonal canal along the line of the varices there are generally two or three of these spines that are quite extended and widely opened. A few specimens have an open spine located at the shoulder. Elsewhere on each varix there are rather strong ridges which are part of the spiral sculpture. There are two to four nodulose intervarical ridges. Spiral sculpture consists of alternating fine threads and rather strong cords; these cords develop the nodules which are also in axial arrangement. Nuclear whorls one and one half, smooth, rounded, and of a dull reddish color. Next two whorls strongly spirally ridged and crossed by rather low axial ridges. Remaining whorls as described above. No periostracum. Operculum unknown.

	length	width	
(large)	51	20 mm.	Barbados
(average)	45	19	St. Lawrence, Barbados

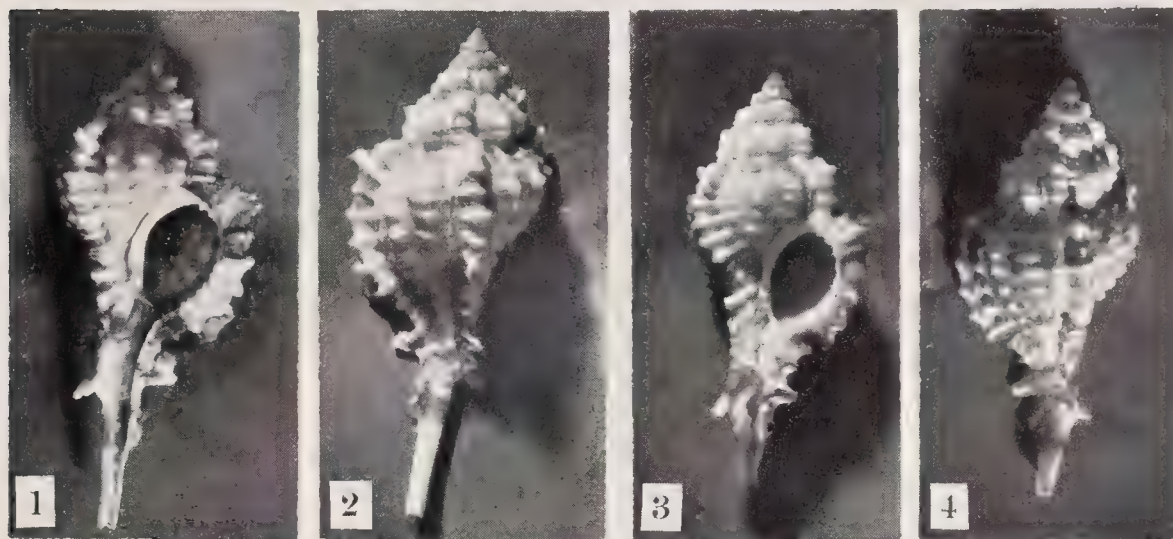


Plate 12. *Murex pulcher* A. Adams

Fig. 1-2. Barbados, Lesser Antilles. Fig. 3-4. St. Lawrence, Barbados, Lesser Antilles (both natural size).

*Types.* The type specimens are in the British Museum, originally contained in the Cuming collection. The type locality is St. Croix, Virgin Islands.

*Remarks.* This species is best characterized by its overall mottled coloration except at the distal end of the siphonal canal which is white. In addition, it has fewer spines than any other species in the subgenus represented in the Western Atlantic. The lower part of the body whorl in this species is not as sharply constricted as in other closely allied forms. The base of the siphonal canal is broad, which makes it appear much shorter when seen from the dorsal side. The extension of the canal places it in *Murex* s.s. Without this extension, the broadening of the lower part of the body whorl and the expansion of the proximal end of the canal would make it a member of the subgenus *Naquetia* Jousseaume. Though this shell was originally reported from fairly deep water (60 fathoms), it has been found on the beach in Barbados. It appears to be quite a rare shell. The references to Red Sea by Reeve and Sowerby for this species are probably in error.

*Range.* Virgin Islands and Lesser Antilles.

*Records.* VIRGIN ISLANDS: St. Croix in 60 fathoms (A. Adams 1853). LESSER ANTILLES: St. Lawrence, Barbados (MCZ).

#### Subgenus *Siratus* Jousseaume

*Siratus* Jousseaume 1880, Le Naturaliste, 1, no. 42, p. 335 (subgenotype, *Pupura sirat* Adanson [= *Murex sirat* d'Orbigny, = *M. senegalensis* Gmelin]).

Genotype, *Pupura sirat* Adanson = *M. senegalensis* Gmelin (monotypic).

Shell possessing three varices on each whorl. Spines on the varices are few with the shoulder spines generally quite large. The siphonal canal is comparatively short and rather broad and is slightly recurved upward.

This subgenus differs but slightly from *Murex* s.s., the main difference being in the shortened and broader siphonal canal. The opercula are the same and the remaining characters, such as spines, spiral and axial sculpture are very similar.

#### *Murex* (*Siratus*) *senegalensis* Gmelin, Plate 13, fig. 1-2

*Murex senegalensis* Gmelin 1790, Syst. Nat. ed. 13, 1, pt. 6, p. 3537 (Senegal).

*Murex costatus* Gmelin 1790, Syst. Nat. ed. 13, 1, pt. 6, p. 3549 (Senegal); *non M. costatus* Pennant 1777; Born 1778; Meuschen 1787; Gmelin 1790, p. 3543; [Gmelin refers to the same plate and figure in Adanson as he did for *M. senegalensis*].

*Murex brasiliensis* Sowerby 1834, Conchological Illust. **Murex**, (Catalogue, p. 2, sp. 24) fig. 55 (Senegal).

*Murex sirat* d'Orbigny 1841, Voyage L'Amérique Méridionale, p. 453 (Senegal and Rio de Janeiro, Brasil). [Refers to Adanson 1757, pl. 8, fig. 19].

*Description.* Shell medium in size, 50 to 71 mm. (2 to 3 inches) in length, strong and with only a few spines. Whorls eight, convex, though somewhat angulate at the shoulder. Ground color cream or buff. Three pale and somewhat interrupted rusty or reddish brown bands occur in spiral arrangement. This coloration is not present on all specimens and, when it occurs, it is faint and difficult to follow. Spire moderately extended. Suture irregular and rather deeply impressed. Aperture relatively large, oval, polished and colored white to brownish. Parietal lip slightly reflected over the body whorl, generally smooth but sometimes with a series of fine denticles below the margin and along its entire length. Palatal lip erect and crenulated, with a series of strong denticles within, generally arranged in pairs, the terminal ends of the denticles producing the crenulations. On the margin of the lip opposite the large shoulder spine the lip is drawn out to form a small spout-like notch. Siphonal canal rather short and fairly broad with the opening along the

ventral side moderately wide and slightly curved. The two previous siphonal canals existing as large scale-like spines. Axial sculpture consists of three prominent rounded and equidistant varices on each whorl. Each varix is formed by the production of a half rounded arch, at which time one very large shoulder spine and one or two shorter, open spines are developed at the siphonal canal. Then growth starts anew from within; the growth of the varix continues down to the contour of the body whorl, infolding the large shoulder spine and closing it to a narrow slit in front. The animal fills in the hollow varix, then growth continues ahead to form another third of the body whorl and another new varix. There are two or three strong intervarical ridges. Spiral sculpture consists of numerous irregular, raised cords between which there are one or more fine threads. Both cords and threads are finely granulose. The cords connecting the shoulder spines and those at the siphonal canal are larger. Nuclear whorls, one to two, rounded, smooth, and of a brownish color. The three following whorls sculptured with numerous and equal axial ridges and fine spiral threads. Operculum unguiculate with the surface roughened by a few, low, growth lines.

	length	width	
(large)	71	38 mm.	Victoria, Espirito Santo, Brasil
(average)	62	34	Rat Id., Río de Janeiro, Brasil

*Types.* The type figure is that of Adanson (1757, Hist. Nat. Sénégal, pl. 8, fig. 19). This reference is the only one given by Gmelin. The type locality is Senegal, French West Africa.

*Common name.* Senegal Rock Shell.

*Remarks.* This is quite a distinctive species; the possession of three varices on each whorl, the large and backwardly curved shoulder spines and the broad and shortened siphonal canal differentiate it from all other species in the Western Atlantic.

We can add but little to the knowledge of this species. It probably occurs on rocks in shallow water to judge by a fair series of live material collected by the *Hassler* in 1872 on Rat Island, Río de Janeiro Harbor.



Plate 13. *Murex senegalensis* Gmelin  
Fig. 1-2. Victoria, Espirito Santo, Brasil (both natural size).

*Range.* Senegal and probably elsewhere along the northwestern coast of Africa and the coast of Brasil.

*Records.* BRASIL: Victoria, Espirito Santo; Rat Island, R o de Janeiro, *Hassler* voyage, 1872 (both MCZ); Praia de Copacabana and Ilha de Paquet , Bah a de Guanabara, both Federal District; Ilha Grande, Enseada do Abrah o, Estado R o de Janeiro; Ilha de S o Sebasti o, Estado S o Paulo (all P. de Oliveira).

### Subgenus *Phyllonotus* Swainson

*Phyllonotus* Swainson 1833, *Zoological Illustrations* [2], 3, p. 100; J. E. Gray 1847, *Proc. Zool. Soc. London*, 15, p. 133.

Subgenotype, *Murex imperialis* (= *M. pomum* Gmelin) (subsequent designation, J. E. Gray, 1847).

This subgenus is characterized by possessing three varices; low and generally broad and somewhat fluted spines and a short, broad siphonal canal which is generally sharply recurved upward at its distal end. The operculum is unguiculate.

### *Murex (Phyllonotus) pomum* Gmelin, Plate 14, fig. 1-3

*Murex pomum* Gmelin 1790, *Syst. Nat.* ed. 13, 1, pt. 6, p. 3527 (West Coast of Africa).

*Murex asperrimus* Lamarck 1822, *Anim. s. Vert.*, 7, p. 164 (Atlantic Ocean); Deshayes 1845 [in] Lamarck. *Anim. s. Vert.*, 9, p. 576 [both refer to Lister's figure that we have selected as the type figure]; d'Orbigny 1841, *Voy. l'Am rique Merid.*, 5, pt. 3, *Mollusca*, p. 452 (Brasil and Cuba).

*Murex imperialis* Swainson 1831, *Zoological Illustrations* (2), 2, p. 67, and plate (locality unknown); *non M. imperialis* Fischer 1807; *non M. imperialis* Swainson 1833.

*Murex oculatus* Reeve 1845, *Conch. Icon.*, 3, **Murex**, pl. 9, fig. 36 (locality unknown).

*Murex mexicanus* Petit 1852, *Journ. de Conchy.*, 3, p. 51, pl. 2, fig. 9 (Gulf of Mexico).

*Murex pomiformis* 'Martini' M rch 1852, *Cat. Conchy. Comes de Yoldi*, p. 96 (Antilles).

*Murex globosa* Emmons 1858, *Geol. North Carolina*, p. 247, fig. 105a (fossil: Miocene).

*Description.* Shell 50 to 115 mm. (2 to 4.5 inches) in length, thick, strong and rugose. Whorls convex, from seven to nine. Color irregular, from brownish yellow to brown with many specimens showing one to three dark brown, solid or interrupted, spiral bands. These bands are often reduced to color spots on the varices and the lower band may be wide and color the entire base of the shell. Spire extended. Suture not clearly indicated. Aperture rather large, oval to subcircular. Interior of aperture below lip polished and colored ivory, buff, yellow, orange and even pink. Parietal lip reflected over and adherent to the body whorl, except for the distal edge which is erect. Color the same as on the inside and in addition, there is generally a dark brown spot at the upper part which sometimes extends along the parietal wall to the siphonal canal. On the parietal wall there is a series of irregular elongated denticles which extends the entire length. Outer lip strongly toothed, with three dark brown spots, the last one extending down along the siphonal canal. The siphonal canal short, broad and curved back from the aperture, flat on the columellar side and with the right portion deeply fluted along the open margin. Previous canals extending obliquely downward and forming the left margin beyond the flattened area. Axial sculpture consisting of three prominent, equidistant varices on each whorl. Each varix possesses a series of low and open spines after which is developed a fluted edge on the forward margin. In addition there are one to three irregular, intervarical ridges which may be almost as high as the varices. Along the suture there may be developed small, buttressing scales which are cemented to the whorl above. Spiral sculpture consists of a series of very strong cords, generally scaly, which give rise to



nodules on the intervarical ridges. Between these cords there are several threads which are also scaly. Periostracum absent or exceedingly limited. Nuclear whorls two, very small, rounded, smooth and colored white to amber. They are generally missing in adult shells. Next four whorls sculptured with strong axial ridges which are crossed by well-developed spiral cords. Remaining whorls as described above. Operculum unguiculate, heavy and having very strong growth lines.

	length	width	
(large)	115	68 mm.	St. Thomas, Virgin Islands
(average)	87	53	Puerto Plata, Hispaniola

*Types.* The type figure of *M. pomum* here selected is that of Lister (1688, *Historiae Conchyliorum*, pl. 944, fig. 39a). The figures in the other references that we have examined are exceedingly poor. As far as we know Gmelin's locality of West Africa is an error. We here limit the type locality to St. Thomas, Virgin Islands, where large specimens approximating in size the figure of Lister have been found.

*Remarks.* This species is quite variable and under favorable conditions may reach a fairly large size. The brown spots both on outer lip and parietal wall may be absent although this condition appears to be very rare. The spot on the parietal wall may become a broad band extending around the callus. On specimens found in protected habitats where wave action is reduced to a minimum, the sculpture is generally a little more delicate and, in fact, becomes more rugose than on those found in exposed situations. Specimens found on grass-covered flats may have the siphonal canal considerably lengthened and more recurved than those occurring in other habitats. This is a shallow water species. In Trinidad, specimens have a decidedly pinkish cast in the aperture; elsewhere the coloration is generally whitish to orange. Dall (1899, *Blake Report*, p. 199) has noted that young shells are quite hispid.

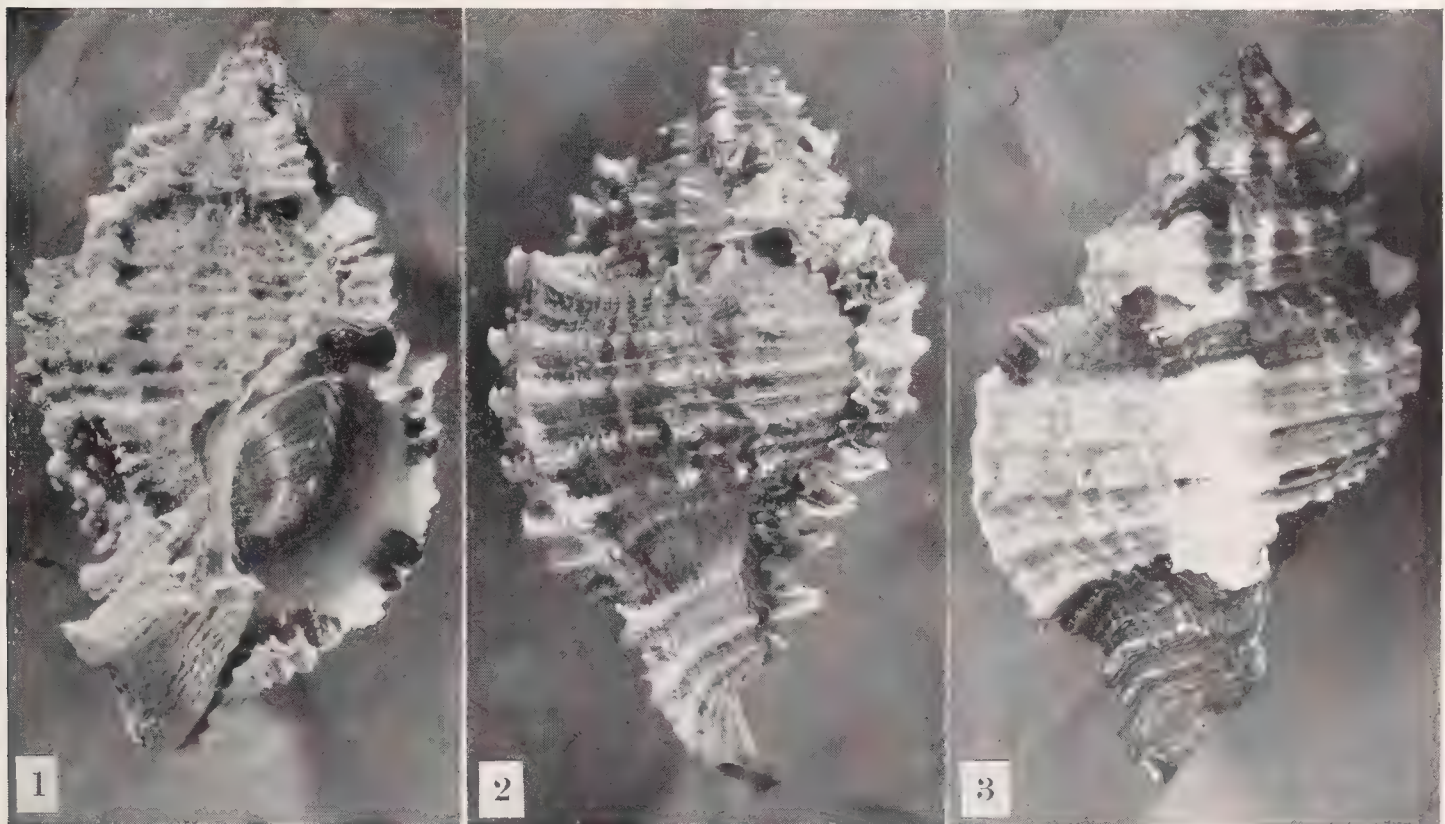


Plate 14. *Murex pomum* Gmelin  
Fig. 1-3. Off Miami Beach, Florida (all natural size).

*Range.* Beaufort, North Carolina (Dall, 1889, p. 120), south through the West Indies, to Brasil (d'Orbigny 1841).

*Records.* SOUTH CAROLINA: Pawley Id.; Folly Beach (both Charleston Mus.). FLORIDA: Lake Worth (MCZ); Biscayne Bay (R. Humes); Pavilion Key (MCZ); Marco Id. (A. H. Patterson); Naples; Bonita Springs; Sanibel Id.; Captiva Id.; Boca Grande; Lemon Bay; Pass-a-Grille; Tampa Bay; St. Petersburg; Boca Chica Key; Key West; Sand Key (all MCZ); Bonefish Key (B. R. Bales); off the Elbow, Key Largo (L. A. Burry). BAHAMAS: Cherokee Sound, Great Abaco; Alicetown, Bimini Ids. (both MCZ); Whale Cay, Berry Ids.; Lowe Sound, Andros Id. (both A. H. Patterson); Nassau, New Providence (P. D. Ford); Harbour Id.; Savannah Sound, Eleuthera (both MCZ). CUBA: Canimar, Matanzas (H. Sarasúa); Cayo Francés, Caibarién (P. J. Bermúdez); Guantánamo Bay; Cayo Alcatraz, Cienfuegos (both MCZ); Punta del Este, Isla de Pinos (L. Howell). HISPANIOLA: Santa Bárbara de Samaná; Puerto Plata; San Lorenzo Bay, Samaná Bay; Jérémie; Gonave Id. (all MCZ). JAMAICA: (MCZ). PUERTO RICO: Mayagüez; Ponce (both MCZ). VIRGIN ISLANDS: St. Thomas; Flannegan Passage, St. John, *Blake*, Station 142 in 27 fathoms (young specimen); St. Croix (all MCZ). LESSER ANTILLES: Martinique (MCZ); Barbados (Mrs. Kellett); Magueripe Bay and Pointe à Pierre, Trinidad (H. G. Kugler). COLOMBIA: Cartagena (MCZ).

### Subgenus **Chicoreus** *Denys de Montfort*

*Chicoreus* Denys de Montfort 1810, Conchyliologie Systématique, **2**, p. 611 and plate.<sup>1</sup>

*Triplex* Perry 1810 (June), Arcana or The Museum of Natural History, pl. 23 (Genotype, *Triplex foliatus* Perry).

*Chicoreus* Agassiz 1846, Nomen. Zool. Index Universalis, p. 85 (emendation for *Chicoreus* Denys de Montfort).

*Torvamurex* Iredale 1936, Rec. Australian Mus., **19**, p. 323 (Genotype, *Murex denudatus* Perry).

Subgenotype, *Chicoreus ramosus* Denys de Montfort (= *Murex brevifrons* Lamarck) (monotypic); *non Murex ramosus* Linné.

Shells possess three strongly spinose varices on each whorl with the spines foliated and sometimes squamulose; siphonal canal generally rather short but broad and curved upward. Opercula unguiculate or concentric.

Species in this subgenus have evolved some of the most intricate spines. The large spines not only possess smaller spines or foliations on their margins, but there may be several open layers of shell material forming these spines. Occasional specimens may produce fine imbricated scales on the spines and spiral ridges or cords.

### **Murex (Chicoreus) brevifrons** Lamarck, Plate 15, fig. 1-2; Plate 16, fig. 1-2

*Murex ramosus* Denys de Montfort 1810, Conchy. Syst., **2**, p. 611 and plate; *non Murex ramosus* Linné 1758.

*Murex brevifrons* Lamarck 1822, An. s. Vert., **7**, p. 161 (American Ocean).

*Murex calcitrata* Lamarck 1822, An. s. Vert., **7**, p. 162 (locality not given).

*Murex megacerus* 'Sowerby' Reeve 1845, Conch. Icon., **3**, **Murex**, pl. 6, fig. 24 (West Indies); *non M. megacerus* Sowerby 1841.

<sup>1</sup> We have been unable to determine the exact date of Montfort's work other than the year as given above. Perry's name *Triplex*, appeared in June, 1810, and it is possible that this may eventually prove to be an earlier name.

*Murex elongatus* 'Lamarck' Reeve 1845, Conch. Icon., **3**, **Murex**, pl. 6, fig. 26 (Gulf of Mexico); *non M. elongatus* Lamarck 1822.

*Murex crassivaricosa* Reeve 1845, Conch. Icon., **3**, **Murex**, pl. 9, fig. 33 (locality unknown).

*Murex pudoricolor* Reeve 1845, Conch. Icon., **3**, **Murex**, pl. 33, fig. 171 (St. Thomas [Virgin Islands] West Indies).

*Murex purpuratus* Reeve 1846, Conch. Icon., **3**, **Murex**, pl. 35, fig. 183, (locality unknown).

*Murex microphyllus* 'Lamarck' d'Orbigny 1853 ?, [in] R. de la Sagra, Hist. Phys. Pol. Nat. Cuba, Moll., **2**, p. 159; *non M. microphyllus* Lamarck 1822.

*Murex toupiollei* Bernardi 1860, Journ. de Conchy., **8**, p. 211, pl. 4, fig. 5 (locality unknown).

*Murex alabastrum* A. Adams 1863 [1864], Proc. Zool. Soc. London, p. 508 (Martinique); Sowerby 1879, Thes. Conchy., **4**, **Murex**, p. 20, pl. 21, fig. 191; *non M. alabaster* Reeve 1845.

*Murex adamsii* Kobelt 1877, Jahrbücher Deut. Malak. Gesell., **4**, p. 154 [new name for *alabastrum* A. Adams, *non alabaster* Reeve].

*Murex approximatus* Sowerby 1879, Thes. Conchy., **4**, **Murex**, p. 13, pl. 7, fig. 62 (locality unknown).

*Description.* Shell large, from 90 to 150 mm. ( $3\frac{1}{2}$  to 6 inches) in length, solid and frondosely spined. Whorls convex, eight or nine. Color very variable; it may be cream or from pinkish or rusty brown to a dark purplish brown. Generally there are dark brown bands, which are spirally arranged and are found mainly between the ridges. Spire extended. Suture irregular and impressed. Aperture suboval with the interior porcellaneous white. Parietal lip reflected over the body whorl, adherent, smooth and heavily glazed, sometimes showing irregular brown patches. At the upper portion of the parietal wall there is a low ridge which follows back into the aperture. Palatal lip strongly crenulated and possessing a series of paired and elongated denticles between each two of the large spines. Axial sculpture consisting of three rounded varices that are strongly armed, generally with five thickened and rather long spines, the uppermost spine being the largest, the next, large to small, and the lower three being smaller and more or less equal in



Plate 15. *Murex brevifrons* Lamarck

Fig. 1-2. Bargo Cove, Guantánamo Bay, Cuba (both natural size).

size. They are opened toward the aperture and have their edges foliated. The spines are fully developed before the animal attempts to fill in the varix canal; when this is done, a new set of smaller spines are formed from the base of those first developed. The animal then makes a third start, forming a part of the new body whorl beneath this second set of spines. In addition to the varices there are one or two intervarical knob-like ridges. Spiral sculpture consists of rounded and flattened ribs, generally of a lighter color than the areas between them. In addition, there are numerous spiral threads which cover the ribs, the interspaces and the backs of the spines. Siphonal canal broad and slightly curved backward at its distal end; the palatal side provided with three spines, the lowest one being very small; the columellar side is flattened, previous siphonal canals remaining as lengthened scale-like spines. Nuclear whorls two and one half, rounded, smooth and from light to purplish brown in coloration. First whorl somewhat twisted; remaining one and one half whorls regular and of equal size. Postnuclear whorl sculptured with numerous, strong, axial ridges crossed by equally strong spiral cords. Remaining whorls as described above. Periostracum absent. Operculum unguiculate, and with numerous concentric growth lines. It is colored a dull, dark brown.

	length	width (without counting the spines)	
(large)	155	70 mm.	St. Thomas, Virgin Islands
(average)	120	53	Guanta, Venezuela

*Types.* We select Martini's figure (1777, Conchy.-Cab. (1) 3, pl. 103, fig. 983) referred to by Lamarck, to be the type figure. The figure 982 in the same work is the type of *M. calcitrata* which unquestionably is the same as *M. brevifrons*. As Lamarck gave only

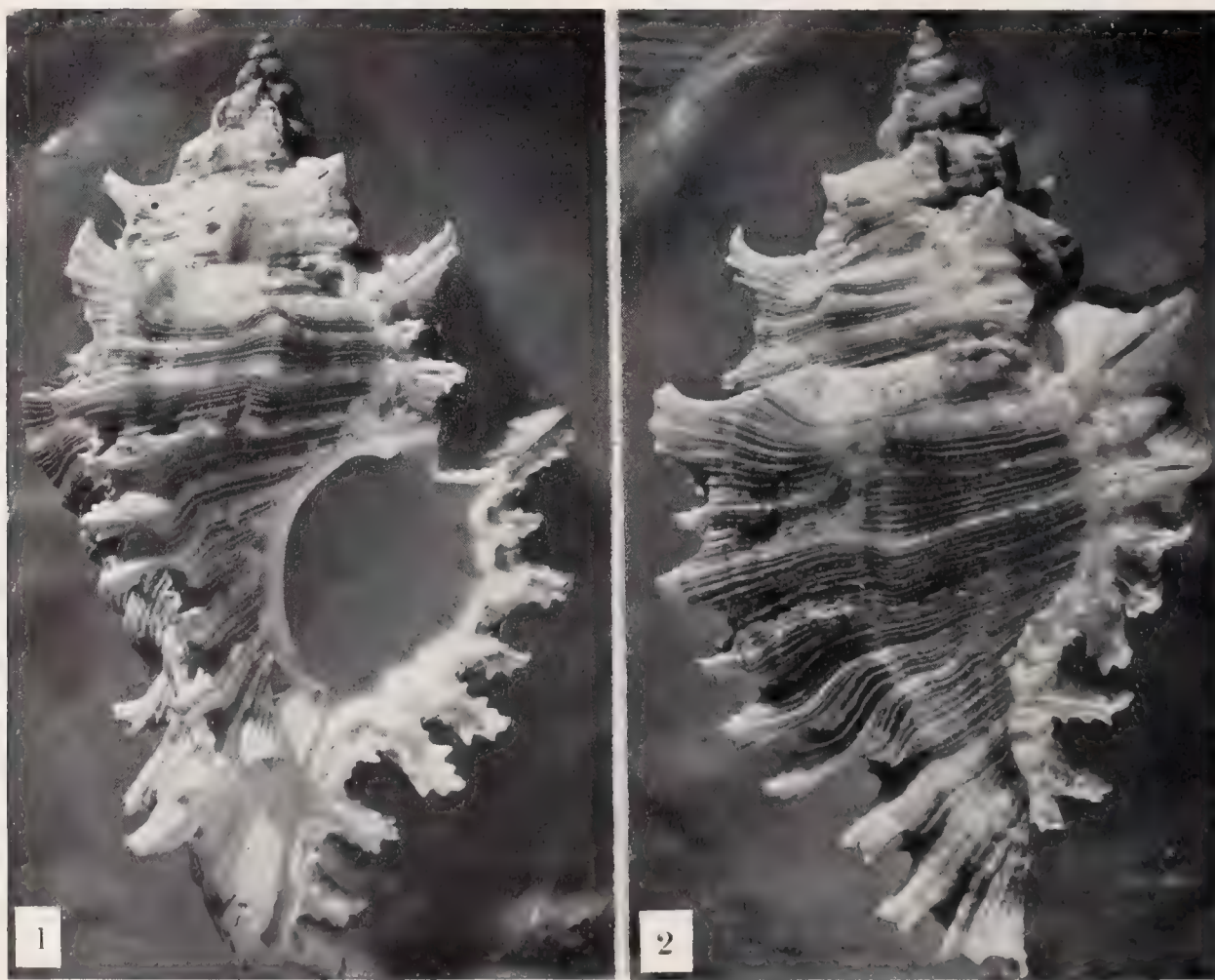


Plate 16. *Murex brevifrons* Lamarek  
Fig. 1-2. Kingston Harbour, Jamaica (both natural size).

the "American Ocean," we here limit the type locality to St. Thomas, Virgin Islands.

*Remarks.* This species, although rare in Florida, is quite common throughout the West Indies. Adult specimens are readily differentiated from *M. florifer* to which it appears to be rather closely related. See *Remarks* under *M. florifer* and *M. imbricatus*.

*M. megacerus* Reeve is unquestionably a synonym of *M. brevifrons*. It possesses but three varices as the illustration clearly shows and not four as stated by Reeve and though his specimen possesses more spines than generally occur, we have seen occasional specimens exhibiting more than the usual number.

*Murex alabastrum* A. Adams is a very young shell of *M. brevifrons* with very poorly developed spines; we have a specimen exactly like that figured in Sowerby's Thesaurus.

*Range.* Southern Florida, West Indies and south to British Guiana.

*Records.* FLORIDA: West Crawfish Key; Pelican Shoals; Tortugas (all MCZ). CUBA: Gibara (C. G. Aguayo); Guantánamo Bay; Santiago de Cuba (both MCZ). HISPANIOLA: San Lorenzo Bay; Puerto Plata (both MCZ). JAMAICA: Port Henderson; Kingston Harbor (both P.D.Ford). PUERTO RICO: Ponce; Mayagüez (both MCZ). VIRGIN ISLANDS: St. Thomas; St. John (both MCZ). LESSER ANTILLES: Fort James, Antigua; Guadeloupe; Grenada (all MCZ); Barbados (F.S.Kellett); Ortoise River and Carenage, Trinidad (both H.G.Kugler). CARIBBEAN ISLANDS: Curaçao (MCZ). COLOMBIA: Cartagena (MCZ). VENEZUELA: Guanta (MCZ); Tucacas Bay, Falcón (H. G. Kugler). DUTCH GUIANA: Corentyne River (H. G. Kugler).

### ***Murex (Chicoreus) argo*, new name, Plate 17**

*Murex imbricatus* Higgins and Marrat 1877, Proc. Literary and Philosophical Soc. Liverpool, no. 31, p. 413, pl. 1, fig. 2 (Carinage, Grenada, Lesser Antilles); *non Murex imbricatus* Brocchi 1814; *non* Risso, 1826; *non* Nardo 1847.

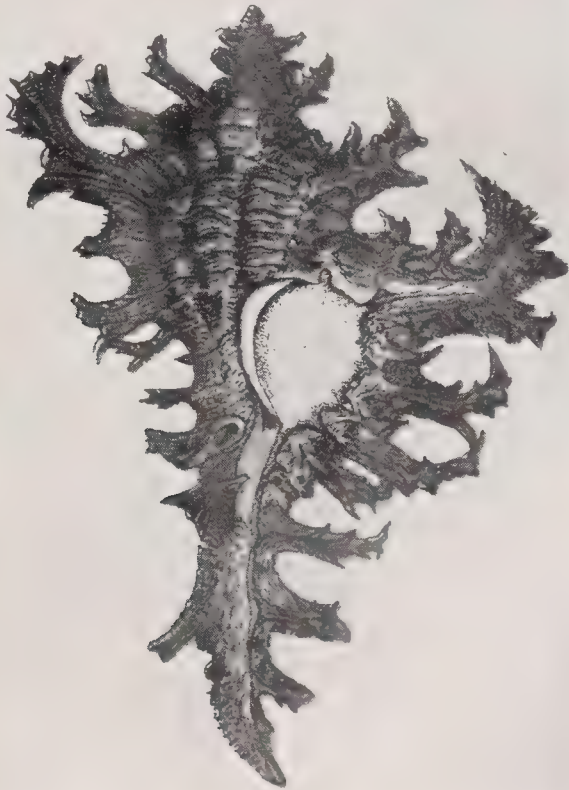


Plate 17. *Murex argo* Clench and Pérez Farfante Grenada (after Higgins and Marrat; natural size).

We are not familiar with this species and have seen no examples. The figure by Higgins and Marrat, here reproduced, plate 17, is well drawn and would indicate a species quite different from any other in the subgenus *Chicoreus* known to us from the Western Atlantic. *M. argo* differs from *M. brevifrons* by having a much smaller aperture, a longer and narrower siphonal canal and fewer spines on the varix. From *M. florifer*, it differs in the longer siphonal canal and in possessing fewer and more widely spaced spines. It differs from both in having more intervarical ridges.

length	width (without counting the spines)
82	34 mm. Holotype

*Types.* Holotype in the Liverpool Museum, the type locality being Carinage, Grenada Island, Lesser Antilles.

*Range and Records.* Known only from the Island of Grenada.

### **Murex (Chicoreus) florifer** Reeve, Plate 18, fig. 1-5

*Murex rufus* Lamarek 1822, An. s. Vert., 7, p. 162 (locality unknown); *non M. rufus* Montagu 1803.

*Murex florifer* Reeve 1846, Conch. Icon., 3, **Murex**, pl. 36, fig. 188 (Honduras).

*Murex salleanus* A. Adams 1854, Proc. Zool. Soc. London, 21, p. 70 (Saint Domingo, West Indies, ex Cuming); Sowerby 1879, Thes. Conchy., 4, **Murex**, p. 19, pl. 388, fig. 73 (Gulf of Mexico).

*Murex despectus* A. Adams 1854, Proc. Zool. Soc. London, 21, p. 72 (West Indies, ex Cuming); *non M. despectus* Sowerby 1879.

*Description.* Shell medium in size, from 40 to 85 mm. ( $1\frac{1}{2}$  to  $3\frac{1}{2}$  inches) in length, solid, heavy and with three prominent varices which from above form a triangle in outline. Whorls convex, about seven in number. Ground color cream, buff or light brown, the spines and varices being of a rusty or chocolate brown. This dark coloration may exist, too, on the spiral ridges on the body whorl. Spire moderately extended. Suture distinct, slightly indented and irregular. Aperture small, oval and with the stronger spiral ridges of the outside showing through in the form of shallow grooves. Both inner and outer lips are margined within by a narrow band of buff; the remaining inner areas porcellaneous white. Parietal lip smooth, slightly reflected over the body whorl and possessing a non-crenulated edge. Palatal lip erect and both broadly and finely crenulated, the broad crenulations being the forward extensions of the grooves inside the aperture. On the upper margin of the outer lip there is produced a shallow sinus and in addition a small ridge is formed along its base which follows back inside the whorls. Siphonal canal broad and flattened; the parietal side occupies the greater part of its width while the palatal side is very narrow and bears four foliated spines, the lowest being the smallest. Previous canals extend obliquely downward and form the left margin beyond the flattened area. Axial sculpture consists of three prominent equidistant varices on each whorl. Each varix produces at the growing margin a series of six large spines on the body whorl and four along the siphonal canal; the uppermost spine is generally larger than all of the others. The forward side of the spines remains open in a narrow slit. The larger spines bear several smaller ones which give them their foliated appearance. There is a prominent knob-like ridge between each pair of varices. Spiral sculpture consists of a series of angular dark brown ridges which connect the corresponding spines. In addition there are numerous spiral threads which are formed on the ridges, between the ridges and on the back of the spines. On many specimens there is an additional sculpture of imbricated scales on the ends and back of the spines. Periostracum absent. Nuclear whorls one and one half, rounded, without carina, and of a reddish-brown coloration. The following three whorls

are sculptured with numerous equal longitudinal ribs and four spiral threads, both becoming stronger from the end of the nuclear whorls to the first varix. Operculum concentric, with a subcentral nucleus which is surrounded by a few coarse, concentric ridges.

	length	width (without counting the spines)	
(large)	84	32 mm.	Savannah Sound, Eleuthera, Bahamas
(average)	72	27	Nassau, New Providence, Bahamas

*Types.* The exact location of Lamarck's types is not known to us. However, Kiener credits the specimens used in his description both to Lamarck and to the Museum of Natural History in Paris. They may possibly be in this latter institution. As the locality was unknown to Lamarck, we here designate Honduras, where Reeve obtained *M. florifer*, to be the type locality. Reeve's types are in the British Museum.

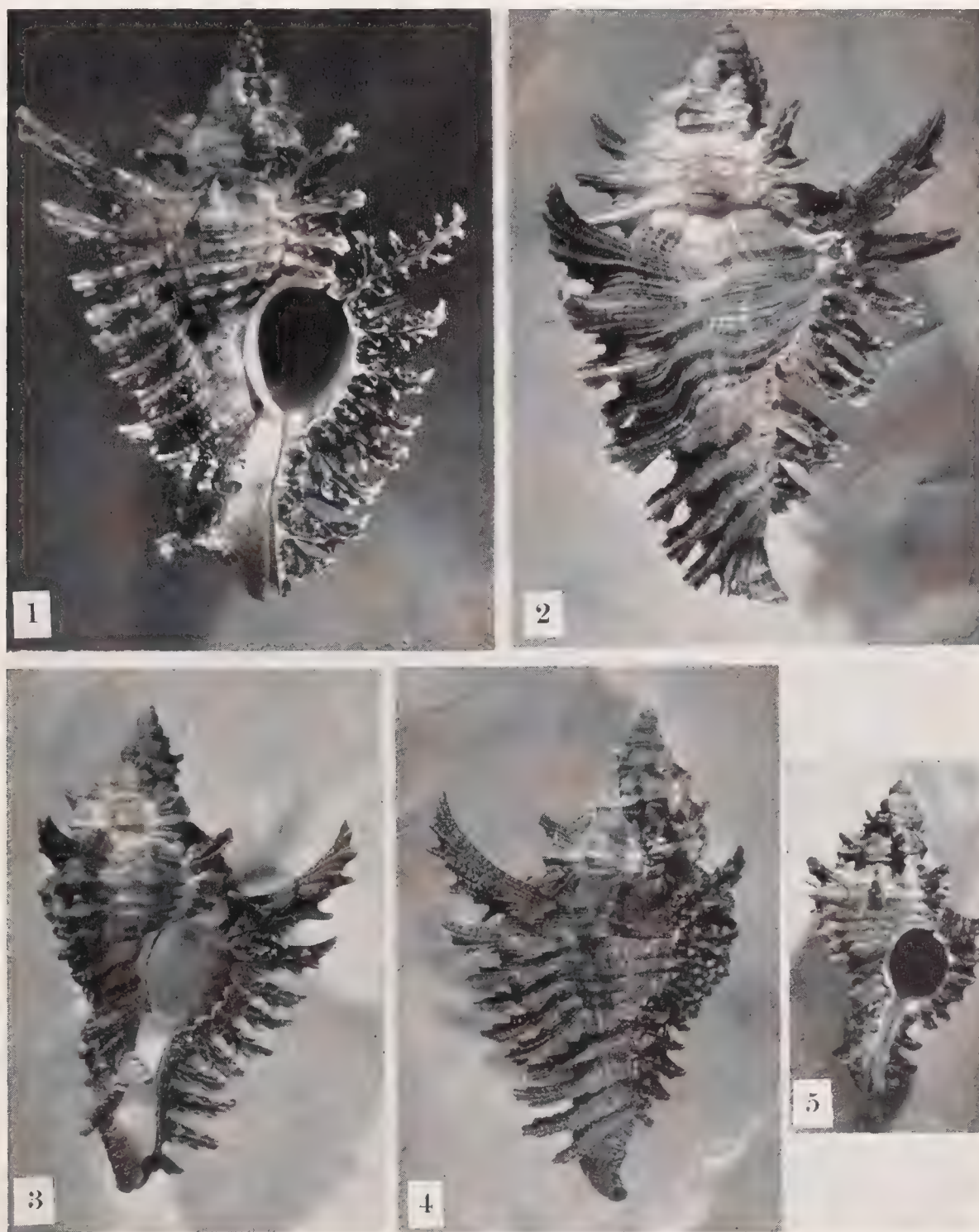


Plate 18. *Murex florifer* Reeve. Fig. 1-2. Fort Montague, Nassau, New Providence Island, Bahamas. Fig. 3-4. Guana Key, Bahamas. Fig. 5. (Beachworn specimen), Tice Island, Caxambas, Florida (all natural size).

*Common name.* The Burnt Rock Shell.

*Remarks.* This species is only superficially close to *M. brevifrons*. The latter reaches a larger size, possesses a proportionally larger aperture and has longer and more open spines. The spiral bands of dark brown are between the spiral ridges in *M. brevifrons* while in *M. florifer* these bands are on the ridges. *M. florifer* possesses one and one-half nuclear whorls while *M. brevifrons* has two and one-half; this makes the differentiation of young specimens very easy. The opercula are quite different in appearance in these two species: *M. brevifrons* possesses an unguiculate operculum, while in *M. florifer* the operculum is nearly round and concentric with a subcentral nucleus. This is a case in point, as mentioned before, where two species have certain of their characters in common and rather sharp differences in other of their characters. See also under *M. florifer arenarius*.

Reeve's figure of *M. florifer* has exceptionally long spines and has been considered different from the typical form; however, we possess specimens in which the spines are normal in size on one varix and particularly long on another. This character appears to be but an individual variation.

*M. despectus* A. Adams seems to be an absolute synonym of *M. florifer* Reeve. Adams' statement that the aperture was white and that the original locality was West Indies, would connect it with *M. florifer* and not with *M. adustus* Lamarck, the Indo-Pacific analogue of *M. florifer*. The aperture in *M. adustus* Lamarck is generally of a deep pink, particularly along the margin of the parietal wall. Subsequent writers have placed *despectus* as a synonym of *adustus*.

*Murex florifer* is a fairly abundant species, at least in the northern West Indies. It accepts a wide variety of habitats, living in sand, on rocks and even in mangrove swamps if the latter is not too brackish. It appears to be more abundant at low-water line.

*Range.* Southern Florida, the Bahamas, Greater Antilles and along the coast of Central America.

*Records.* FLORIDA: Palm Beach; Lake Worth (both MCZ); Biscayne Bay (A. H. Patterson); Tarpon Springs (T. Van Hyning); Cedar Keys (MCZ). BAHAMAS: Bimini Ids. (MCZ); Nassau, New Providence (A. H. Patterson); Savannah Sound, Eleuthera; Arthurstown, Cat Id.; Simms, Long Id. (all MCZ). CUBA: La Chorrera, Habana; Varadero (both R. de la Torre); Cayo Francés, Caibarién (C. G. Aguayo). HISPANIOLA: Puerto Plata; Monte Cristi (both MCZ).

### ***Murex florifer arenarius*, new subspecies, Plate 19, fig. 1-3**

*Murex salleanus* of authors, not of A. Adams.

*Description.* Shell medium in size, from 40 to 85 mm. ( $1\frac{1}{2}$  to  $3\frac{1}{2}$  inches) in length. In general the characters are similar to *M. florifer* but there are a few differences that distinguish this geographic subspecies. The uppermost spine on each varix is about the same size as the remaining varical spines and it recurves somewhat toward the spire. The color is generally a uniform cream or white with the early whorls pinkish. A secondary color of pale brown exists as lines on the spiral cords and as irregular patches. Intervarical sculpture consists of a prominent knob with one or more small axial ridges.

	length	width (without counting the spines)
(large)	85	25 mm. Sanibel Island, Florida
(average)	66	21 Cedar Keys, Florida



*Types.* Holotype, Museum of Comparative Zoölogy, no. 149854, Sanibel Island, Florida, collected by A. H. Patterson. Paratypes, from the same locality and from Cedar Keys, Marco Island and Naples, all on the west coast of Florida.

*Common name.* The Sand Rock Shell.

*Remarks.* *M. florifer arenarius* possesses constant differences from typical *M. florifer*. It is proportionally narrower; the varices with their associated spines are light in color; and the upper three or four whorls are generally pinkish. Between the varices there are, besides the pronounced knob found in *M. florifer*, one or more axial ridges. Generally, the uppermost spine that borders the outer lip of the aperture is so recurved that it comes in contact with the spines on the varix of the whorl above, which more or less hides the small sinus in the upper palatal wall.

This beautiful subspecies is limited to Florida so far as our present series would indicate.

*Range.* Florida along the southeast coast, the Keys and Gulf coast.

*Records.* FLORIDA: Palm Beach (MCZ); Marco Id. (A. H. Patterson); Naples; Bonita Springs; Sanibel Id. (all MCZ); off Captiva Id. (T. Van Hyning); Lemon Bay; Sarasota; Gulf Port (all MCZ); off Cedar Keys (J. S. Schwengel); 15-18 miles off Fort Walton in 13 to 19 fathoms; Key Largo (both L. A. Burry); Bonefish Key (B. R. Bales); Tortugas (MCZ).



Plate 19. *Murex florifer arenarius* Clench and Pérez Farfante  
Fig. 1. Holotype. Fig. 2-3. Paratypes (all Sanibel Island, Florida; all natural size).

### Subgenus *Pterynotus* Swainson

*Pterynotus* Swainson 1833, Zoological Illustrations (2) 3, p. 100.

*Pteronotus* Swainson 1833, Zoological Illustrations (2) 3, page and plate 122; *non Pteronotus* Rafinesque 1815; Gray 1838; Ranzani 1839; Swainson 1839.

Subgenotype, *Murex (Pteronotus) pinnatus* Swainson (monotypic).

Shells in this subgenus are usually about three inches or less in size, have three wing or blade-like varices which are generally laminated and have the spines very much reduced or absent. The siphonal canal is moderately long and usually quite narrow.

Swainson proposed and described the subgenus *Pterynotus* in the *Zoological Illustrations* without a type designation. Later, in the same volume, he changed the spelling to *Pteronotus* and figured *M. pinnatus* Swainson as its type. The name *Pterynotus*, however, will have to be used for this subgenus, not only because it has page precedence, but because the later name, *Pteronotus*, is a homonym.

### **Murex (Pterynotus) tristichus** Dall, Plate 20, fig. 1-4

*Murex (Pteronotus) tristichus* Dall 1889, Bull. Mus. Comp. Zoöl., **18**, p. 202, pl. 15, fig. 2 (off Habana, Cuba).

*Description.* Shell about 15 mm. in length, very thin and delicate. Whorls six and one-half, strongly convex. Shell surface brightly polished and of a uniform cream color. Spire greatly extended and acute. Suture deeply impressed. Aperture very small, tear-shaped, with the parietal wall smooth, glossy, and adherent to the body whorl along its entire length. Siphonal canal moderately long, very narrow and turned upward and to the right. Previous siphonal canal exists as a long, scale-like spine. Axial sculpture consists of three well-developed, blade-like varices. Each varix is formed of a rather wide and thin lamina which has a denticulated edge. The denticles are due to the spiral ridges which extend upward on the backward side of each varix; on the forward side, these ridges appear as very shallow grooves. Each varix is widest at the shoulder area of the whorl. Spiral sculpture consists of four low ridges, inconspicuous in the intervarical areas, but fairly strong on the varices. Nuclear whorls one and one-half, large, rounded and glass-like in appearance. The first whorl is upturned in relation to the second. Post-nuclear whorls similar to the later whorls. Periostracum absent. Operculum unknown.

length	width	
15.5	10 mm.	Holotype

*Types.* Holotype, Museum of Comparative Zoölogy, no. 7308 from *Blake* station 51, off Havana, in 400 fathoms, and a single paratype from the same station.

*Remarks.* This species is exceedingly delicate and highly lustrous: the blade-like varices are composed of only one or two thin lamellae, which makes the shell very fragile. It is still a very rare species as only two records, both by Dall, have been reported. *M. tristichus* is closely related to *M. pygmaeus*, the following species.

*Range and Records.* See under Types.

### **Murex (Pterynotus) pygmaeus** Bush, Plate 20, fig. 7-8

*Murex (Pteronotus) pygmaeus* Bush 1893, Bull. Mus. Comp. Zoöl., **23**, p. 213, pl. 1, fig. 3-4 (off Charleston, South Carolina).

*Description.* Shell small, about 16 mm. in length, thin and ornamented with three blade-like varices. Whorls six to seven, moderately convex. Color a uniform cream. Spire extended and acute. Suture regular and deeply impressed. Aperture oval with a lustrous interior. The parietal lip is smooth, brightly polished, reflected and adherent to the body whorl. The palatal lip possesses a slightly thickened and finely crenulated margin; at the shoulder of the whorl there is a small notch which is directed toward the shoulder expansion of the varix. Siphonal canal narrow, moderately long and slightly turned upward and to the right. The two previous siphonal canals remain as scale-like

projections on the parietal margin. Axial sculpture consists of three equidistant, well-developed, blade-like varices, each formed in front of the corresponding varix of the whorl above. The outer edge of the varices is rather finely crenulated, the crenulations being produced by the spiral ridges which cross the shell and extend upward on their backward sides and terminate at the margin. The front side of the varices is very lustrous and covered with numerous, low and wavy lamellae which are but the free edges of the successive layers and on this side, the spiral ridges, which are seven or eight in number, appear as shallow grooves. Nuclear whorls large, two in number, rounded and glass-like. The first one is decidedly upturned. Postnuclear whorls similar to the later whorls. Operculum unguiculate with an apical nucleus and colored a yellowish brown.

length      width  
16          9.5 mm.    Holotype

*Types.* Holotype, Museum of Comparative Zoölogy no. 6918, (N. Lat.  $32^{\circ}25'$ ; W. Long.  $77^{\circ}42'30''$ ) from *Blake* station 319, off Charleston, South Carolina, in 262 fathoms.

*Remarks.* *M. pygmaeus* is closely related to *M. tristichus*, having the same general characters, differing only slightly in degree. *M. pygmaeus*, though possessing blade-like varices, has them composed of several lamellae; while on *M. tristichus*, the varices are composed of only one lamella or two at the most. In addition, there are more spiral ridges present in *M. pygmaeus* and its aperture is a little larger and more circular. However, more material may show this species to be a subspecies of *M. tristichus*.

*Range and Records.* See under Types.

### **Murex (Pterynotus) phaneus Dall**

*Murex (Pteronotus) phaneus* Dall 1889, Bull. Mus. Comp. Zoöl., **18**, p. 201 (off St. Augustine, Florida); M. Smith 1939, Illustrated Catalog of the Recent Species of the Rock Shells, Lantana, Florida, p. 5, pl. 11, fig. 10.

*Description.* "Shell ashy white, elongated, thin, six-whorled. Nucleus translucent, smooth, polished, of about one and a half whorls; whorls slightly convex, appressed to the suture behind them, connected by three continuous fin-like varices which in descending the spire make about half a revolution around it; these varices on the upper whorls were extended backward into a little wing-like point with dentate edges; on the last whorl the lines of growth indicate that the thin margin was rounded, parallel with the whorl. Transverse sculpture of fine growth lines, and on the last two whorls at the periphery three short little narrow pinched-up riblets between the varices; spiral sculpture of fine rather faint striae and wider undulations, hardly visible except on the varices; of these there are nine or ten on the last varix. Aperture elongate-oval, internally white, thickened, smooth canal rather long, open, bent back."

length      width  
17          8 mm.    Holotype

*Types.* The type specimen is in the United States National Museum. The type locality is *Albatross* station 2662, off St. Augustine, Florida, in 434 fathoms (N. Lat.  $29^{\circ}24'30''$ ; W. Long.  $79^{\circ}43'$ ).

*Remarks.* We have not seen this species. To judge by Dall's description, which is copied above, and the figure in Smith's catalogue, *M. phaneus* is quite different from all other species in *Pterynotus* so far as the Western Atlantic species are concerned. The

blade-like varices are rather short in proportion to the total length of the shell and the presence of three, small intervarical ridges differentiates this species from *M. tristichus* and *M. pygmaeus*, the two to which it appears to be most closely allied.

*Range and Records.* See under Types.

**Murex (Pterynotus) abyssicola** Crosse, Plate 20, fig. 9-10

*Murex abyssicola* Crosse 1865, Jour. de Conchy., **13**, p. 30, pl. 1, fig. 4-5 (Guadeloupe [Lesser Antilles]).

*Description.* Shell about 11 mm. in length, rather thin and somewhat translucent. Whorls six and convex. Color a brownish gray, with a band of light brown at the base of the body whorl. Spire somewhat extended. Suture impressed. Aperture small and nearly oval. Siphonal canal broad, short and slightly recurved upward. Axial sculpture consists of three well-developed, blade-like varices. There is a single intervarical knob-like ridge. Spiral sculpture consists of numerous, fine threads which are crossed by finer, axial threads. The fine axial and spiral sculpture is more accentuated on the varices and on the siphonal canal. Nuclear whorls one and one-half, smooth and whitish. Postnuclear whorls similar to the later whorls. Operculum unknown.

length      width  
11            6 mm.      Holotype

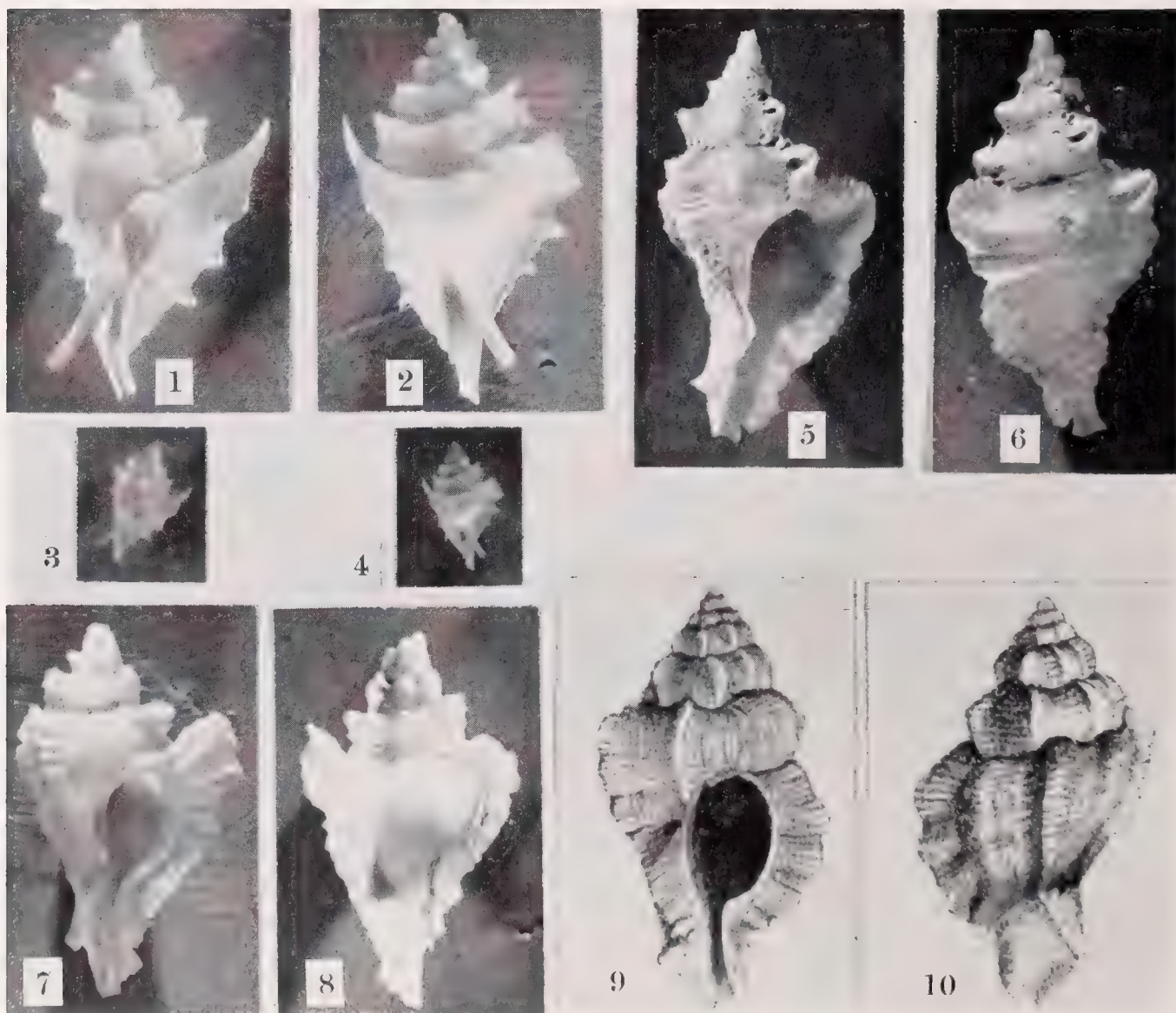


Plate 20. Fig. 1-4. *Murex tristichus* Dall, Holotype, off Havana, Cuba (fig. 1-2, 3×; fig. 3-4, natural size). Fig. 5-6. *Murex ariomus* Clench and Pérez Farfante, Holotype, off Hollywood, Florida (2×). Fig. 7-8. *Murex pygmaeus* Bush, Holotype, off Charleston, South Carolina (3×). Fig. 9-10. *Murex abyssicola* Crosse, Guadeloupe (after Crosse; 4×).

*Types.* According to Sherborn, the collection of H. Caillet is now in the École des Mines, Paris. Crosse had described the specimen of *M. abyssicola* from the collection of H. Caillet who had furnished him with many specimens from the Island of Guadeloupe, the type locality of this present species.

*Remarks.* We have not seen this species. Our description has been derived from the description of Crosse and his excellent figures. Our figures are copied from his plate in the *Journal de Conchyliologie*.

This species is included in *Pterynotus* with some uncertainty. Though having only three varices, their general structural formation is not clear in Crosse's figure or understandable in his description. All other characters would indicate a place in this subgenus.

*Range and Records.* Known only from Guadeloupe, Lesser Antilles, in 270 fathoms.

**Murex (Pterynotus) ariomus**, *new species*, Plate 20, fig. 5-6

*Description.* Shell about 25 mm. (1 inch) in length, rather solid and non-spinose. Whorls six and one-half and moderately globose. Color a dull white. Spire extended. Suture rather deeply impressed. Aperture oblique and oval, porcellaneous white within. Parietal lip adnate above, free and erect below. Palatal lip non-denticulated below. Siphonal canal broad and short, recurved upward at its distal end. Axial sculpture consists of three low and rather thin, laminated varices with a prominent angle rather than a spine at the shoulder area. The laminations are numerous, quite irregular and rather compact. There is a single knob-like ridge in between the varices. Spiral sculpture consists of numerous and rather fine ribs which turn up to sculpture the back side of the varices. The entire surface of the shell is covered with very small scale-like processes other than on the forward or the front side of the varices. At the suture these scales buttress the whorl above. Nuclear whorls one and one-half, small, rounded, smooth, the first whorl slightly twisted. Postnuclear whorls similar to later whorls. Operculum unguiculate and having an apical nucleus. No periostracum.

length	width	
24	12.5 mm.	Holotype

*Types.* Holotype, Museum of Comparative Zoölogy, no. 164734, from off Hollywood, Florida, in 50 to 60 fathoms. Collected by L. A. Burry.

Named for the strong shoulder angle that is developed on each varix.

*Remarks.* This species is not closely related to any other Western Atlantic *Pterynotus*. It does appear to approximate *M. angasi* Crosse from South Australia and Tasmania, in its general characters, particularly in its shape, though it is smaller and has a more reduced shoulder angle.

*Range and Records.* See under Types.

Subgenus **Pteropurpura** *Jousseaume*

*Pteropurpura* Jousseaume 1880, *Le Naturaliste*, 1, no. 42, p. 335.

Subgenotype, *Murex macropterus* Deshayes (original designation).

Shells generally under two and one-half inches in length and possessing three varices. The varices are webbed, blade-like and composed of numerous laminae. The siphonal canal is closed on the ventral side and not slit-like as in other subgenera. The canal becomes a tube which opens at the base of the aperture. Operculum unguiculate, with an apical nucleus.

**Murex (Pteropurpura) bequaerti**, *new species*, Plate 21, fig. 1-2

*Murex (Pteronotus) macropterus* 'Deshayes' Dall 1889, Bull. Mus. Comp. Zoöl., **18**, p. 201 (22 miles off Cape Hatteras, North Carolina); M. Smith 1939, Illustrated Catalog of the Recent Species of the Rock Shells, Lantana, Florida, p. 5, pl. 11, fig. 8 (Key West, Florida); *non M. macropterus* Deshayes 1841.

*Description.* Shell from 17 to 37 mm. (about three-fourths to one and one-half inches) in length, solid and provided with three strong, wing-like varices. Whorls about seven and rather strongly convex. Color a dull white with irregular areas of cream on the base of the varices and on the intervarical ridges. Spire extended. Suture rather deeply impressed. Aperture small, oval and entire, notched slightly above the opening to the siphonal canal. Both parietal and palatal lips are thin and erect. Siphonal canal short, broad and completely inclosed, with the distal end turned slightly toward the right. Previous siphonal canals exist as very short scales. Axial sculpture consists of three wing-like varices which are broad at the base and knife-like at the outer edge. The front surface of the varices consists of many very low laminae, which are built forward in overlapping layers. There is a single knot-like ridge between the varices. Spiral sculpture consists of numerous, large and small alternating threads. This sculpture passes over the intervarical ridges and up on the back surface of the varices. Postnuclear whorls similar to the later whorls. Periostracum absent.

length      width  
25      15.5 mm.      Holotype

*Types.* Holotype in the Florida State Museum, collected by F. B. Lyman in 80 fathoms off Delray, Palm Beach Co., Florida.

*Remarks.* This species has been considered to be *M. macropterus* Deshayes, but although they are somewhat similar, they are really distinct. The wing-like varices are much higher and thinner in *M. macropterus*, and in addition, are divided into four lobes while in *M. bequaerti* the outer margin is continuous. *M. bequaerti* is smaller, has at least one more whorl and is colored white and not brown as *M. macropterus* was described and figured by Deshayes.



Plate 21. Fig. 1-2. *Murex bequaerti* Clench and Pérez Farfante, Holotype, off Delray, Florida (2×).  
Fig. 3-5. *Murex atlantis* Clench and Pérez Farfante, Holotype, off Bahia de Cochinos, Santa Clara Province, Cuba (fig. 3, 2½×; fig. 4-5, 2×).

Named for Joseph C. Bequaert.

*Range.* North Carolina and south to the Florida Keys.

*Records.* NORTH CAROLINA: 22 miles off Cape Hatteras, *Albatross*, station 2595, in 63 fathoms (Dall 1889). FLORIDA: off Delray, in 80 fathoms (T. Van Hyning); off Key West (M. Smith 1939).

Subgenus **Bathymurex**, *new subgenus*

Shell small, with six spinose varices. Each varix supports one proportionately long and open spine at the whorl shoulder. The single shoulder spine is formed very much the same way as it is produced in the subgenus *Siratus* (*Murex senegalensis* Gmelin). All other characters, however, would place *Bathymurex* among the groups possessing many varices and fairly close to *Poirieria*. The siphonal canal is relatively long and narrow. The operculum is unknown.

Subgenotype, *Murex* (*Bathymurex*) *atlantis*.

**Murex** (**Bathymurex**) **atlantis**, *new species*, Plate 21, fig. 3-5

*Description.* Shell small, about 23 mm. (about one inch) in length, rather thin and spinose. Whorls seven and strongly convex. Color a dull white. Spire well extended. Suture deeply impressed. Aperture subcircular, small and porcellaneous white within. Parietal lip smooth, adnate above and very slightly free below. Palatal lip smooth but possessing a series of small denticles below the margin on the lower half of the lip. Siphonal canal narrow, long, recurved upward and angled toward the right near the base. Previous siphonal canals remain as spur-like spines, the last one almost as long as the present canal, making it appear bifurcated. Axial sculpture consists of six low varices, each of which supports a rather long, slightly recurved, single, open spine at the shoulder of the whorl. Below this spine there are a few small knobs where the spiral ribs cross. Spiral sculpture consists of numerous fine and coarse ribs, the coarse ribs forming the little knobs as they pass over the varices. Nuclear whorls one and one-half, small, smooth and rounded, the first whorl moderately twisted. Post nuclear whorls similar to the later whorls but having the shoulder spine relatively smaller. Operculum unknown. No periostracum.

length	width (without counting spines)
23.5	10.5 mm. Holotype

*Types.* Holotype, Museum of Comparative Zoölogy, no. 164684, *Atlantis*, station 3333, Bahía de Cochinos, Santa Clara Province, Cuba (N. Lat. 22°13': W. Long. 81°11') in 190 to 200 fathoms. Collected April 6, 1939.

Named for the ketch *Atlantis*.

*Remarks.* This little species is based upon a single specimen. It is very distinct and is not closely related to any other species in the Western Atlantic. Superficially, at least, *M. atlantis*, appears to be nearest to members of the subgenus *Poirieria*, namely *pazi*, *burryi* and *hystricinus*, but differs in its smaller size, proportionately shorter spines, and in having these spines limited to a single one on the shoulder area of each varix. The specimen was collected dead but in very good condition.

*Range and Records.* See under Types.

### Subgenus *Muricanthus* Swainson

*Centronotus* Swainson 1833, Zool. Illust., (2) 3, p. 100 (genotype, *Murex eurystomus* Swainson); non *Centronotus* Schneider 1801; Lacépède 1802.

*Muricanthus* Swainson 1840, Treatise on Malacology, p. 296.

*Muricantha* 'Swainson' Suter 1913, Man. New Zealand Mollusca, Wellington, New Zealand, p. 400.

Subgenotype, *Murex radix* Linnè (subsequent designation, Hermannsen 1847).

Shells large and possessing numerous spinose varices. The spines are rather broad, open and very heavy in structure and may be simple or rather finely foliated. The siphonal canal is short and generally broad and margined on the parietal side with the previous siphonal canals which form a nested spiral. The operculum is oval, concentric and with a submarginal nucleus.

### *Murex* (*Muricanthus*) *fulvescens* Sowerby, Plate 22

*Murex turbinatus* Sowerby 1834, Conchological Illustrations, **Murex**, fig. 30, Catalogue, p. 7, sp. 94 (locality not given); non *M. turbinatus* Lamarck 1822; non *M. turbinatus* Brocchi 1814.

*Murex fulvescens* Sowerby 1834, Conchological Illustrations, **Murex**, fig. 30, Catalogue, p. 7, sp. 94 (locality unknown).

*Murex spinicosta* 'Valenciennes' Kiener 1843, Coquilles Vivantes, 7, p. 49, pl. 41, fig. 4 (South Carolina) [*spinicosta* on plate] [refers directly to Sowerby's figure 30 in the Conchological Illustrations].

*Murex spinicostata* 'Valenciennes' Reeve 1845, Conch. Icon., 3, **Murex**, pl. 4, fig. 18 (Gulf of Mexico); Tryon 1880, Man. of Conch. (1), 2, p. 107, pl. 23, fig. 207; pl. 28, fig. 251 (Beaufort, North Carolina).

*Description.* Shell large, reaching about 180 mm. (7 inches) in length, strong, heavy, and highly spinose. Whorls six to seven, early whorls slightly convex, later whorls strongly so. Color generally milky white to dirty gray on the exterior. Interior of aperture and of siphonal canal porcellaneous white. On the external surface there are numer-



Plate 22. *Murex fulvescens* Sowerby  
Off Sand Key, Florida (natural size).



ous spiral threads of brown or brownish purple which on larger specimens may be weak or absent. The earlier whorls are cream and generally have more brownish threads showing, which impart a pronounced coloration to this part of the spire. Base of canal may be stained brownish. Spire rather short and nearly straight sided. Suture distinct and quite irregular. Aperture oval to subcircular. Parietal lip calloused and supporting a low ridge at the upper part. Palatal lip margined by a series of strong crenulations. Siphonal canal short and broad. Previous siphonal canals existing as a series of flutings which are in spiral arrangement and give rise to the false umbilicus. Axial sculpture consisting of six to ten highly spinous varices. The spines are erect, opened toward the outer lip and irregular in size and height, the largest being at the shoulder of the whorls. In addition, there are numerous and fine growth lines. Spiral sculpture consists of strong cords, usually brown in coloration, which connect the spines on one varix with the corresponding spines on the next varix. Between the cords there are numerous raised threads. Nuclear whorls one and one-half, rounded and smooth; two following whorls developing strong axial ridges crossed by numerous spiral cords. Remaining whorls as described above. Periostracum absent. Operculum unguiculate, thick, with numerous concentric growth lines which give rise to a very rough outer surface. Inner surface with a smooth and shiny ridge above the nucleus. Below the nucleus the surface is dull and possesses ridges or threads more or less concentric.

	length	width (without counting the spines)	
(large)	185	115 mm.	Fernandina Beach, Florida
(average)	135	80	off Breton Island, Louisiana

*Types.* Probably in the British Museum. The type locality is here restricted to off Charleston, South Carolina. Kiener was the first to give an American locality for this species, namely South Carolina.

*Remarks.* This very remarkable species is the largest in the Western Atlantic and one of the largest in the world in the family Muricidae. It apparently is quite rare and probably exists fairly well below low water line. We have a specimen which was collected on an oyster bed in Bastian Bay, Louisiana, which may indicate that it was feeding on oysters. *M. hoplites* Fischer from West Africa is very close to this species and may possibly be only a subspecies of our Western Atlantic form.

*Range.* North Carolina (Tryon 1880, p. 107) south to Florida and west to Texas.

*Records.* SOUTH CAROLINA: Isle of Palms: Sullivan's Id. and Dewees Inlet, Charleston (all Charleston Museum). FLORIDA: off Daytona (F.S. Webber); Fernandina (A.H. Patterson); Cape Canaveral; Cocoa Beach (both MCZ); off Sand Key in 25 fathoms (MCZ); Fort Jefferson, Dry Tortugas (T. Van Hyning); off Cedar Keys (J.S. Schwengel). LOUISIANA: off Breton Id.; Bastian Bay (both MCZ).

#### Subgenus **Poirieria** *Jousseaume*

*Poirieria* Jousseaume 1880, Le Naturaliste, **1**, no. 42, p. 335 [Genotype, *Murex zelandicus* Q. and G.].

*Paziella* Jousseaume 1880, Le Naturaliste, **1**, no. 42, p. 335 [Genotype, *Murex pazi* Crosse].

Subgenotype, *Murex zelandicus* Q. and G. (monotypic, Jousseaume 1880).

Shell medium in size to small and characterized by possessing five to nine varices on the later whorls with elongated spines: these spines may remain open or closed: both types of spine may exist in the same species and even on the same specimen. Nuclear whorls one and one-half, the first whorl formed obliquely. Siphonal canal short to mod-

erately long and moderately narrow. Pigment is produced, at least in *M. zelandicus* Q. and G. and may possibly occur in other species in this subgenus. Operculum unguiculate and possessing an apical nucleus.

**Murex (Poirieria) pazi** Crosse, Plate 23, fig. 1-3

*Murex pazi* Crosse 1869, Journ. de Conchy., **17**, p. 183 (Seas of the Antilles); Crosse 1870, Journ. de Conchy., **18**, p. 99, pl. 1, fig. 4.

*Murex (Phyllonotus) pazi* Crosse, Dall 1889, Bull. Mus. Comp. Zoöl., **18**, p. 199, pl. 15, fig. 1.

*Description.* Shell rather small, from 30 to 47 mm. (1 to 2 inches) in length, somewhat translucent and provided with numerous long spines. Whorls seven to eight and one-half, the first whorls being angular and the last two less so. Color milky to oyster white, the first whorls generally being of a dark gray. Spire extended. Suture deeply impressed, rather irregular and interrupted by the small spines at the varices of the whorls above. Aperture ovate to subcircular, porcellaneous white. Parietal lip reflected over the body whorl, smooth and thick. Palatal lip with a smooth margin but possessing within, a series of fine and regular denticles on adult specimens. Siphonal canal rather short and narrow and slightly curved back from the aperture. The palatal side has a long recurved spine; the columellar side is flattened and smooth, but supports the previous siphonal canals which remain in spiral arrangement. Axial sculpture consists of five or six low varices on each whorl, armed with a very long, open and backwardly recurved spine on the shoulder and two or three much smaller scale-like spines below. The shoulder spine, when first formed opens into the aperture, but when growth is resumed, the opening is closed and grown over. In addition, there are numerous and exceedingly fine growth lines. On the siphonal canal, there is a long recurved open spine following each varix.



Plate 23. *Murex pazi* Crosse

Fig. 1-3. Off Punta Alegre, Camagüey, Cuba (fig. 1, 2×; fig. 2-3, natural size).

Spiral sculpture consists of fine ridges which connect the spines on one varix with the corresponding spines on the next varix. Periostracum absent. Operculum of a light yellowish brown, unguiculate, pointed below and possessing an apical nucleus. Growth lines numerous and fine. Nuclear whorls one and one-half, rounded, glass-like, the first whorl developing in a plane oblique to that of the second, that is to say, it is distinctly bent to one side. The postnuclear whorls are not sculptured differently from the later whorls, possessing only more varices.

	length	width (without counting the spines)	
(large)	47	22 mm.	off Punta Alegre, Camagüey, Cuba
(average)	39	17	off Punta Alegre, Camagüey, Cuba

*Types.* The type of this species is probably in the collection of the Journal de Conchyliologie. The original locality was given as Seas of the Antilles. Tryon (1880, p. 134) reports on the authority of Hidalgo that this species was dredged in the Lesser Antilles.

*Remarks.* This beautiful species appears to be quite unique in the Western Atlantic. In relationship, it is very close to *M. zelandicus* Q. and G. from New Zealand. *M. pazi* differs, however, in being smaller, heavier and possessing fewer spines on the varices, while possessing, in addition, a simple spur-like spine on the siphonal canal, corresponding to each varix. This last character is not found in *M. zelandicus*. In depth, this has been found in 200 to 338 fathoms. The *Atlantis* records for this species were most numerous in the dredgings north of Cuba.

*Records.* BAHAMAS: *Albatross*, station 2655 (N. Lat. 27°22'; W. Long. 78°07'30'') off Strangers Cay, Little Abaco Id. in 338 fathoms (USNM); *Atlantis*, station 2951 (N. Lat. 26°14'; W. Long. 78°43') off Southwest Point, Grand Bahama Id., in 285 fathoms. CUBA: *Blake*, station 20 (N. Lat. 23°02'; W. Long. 83°11') off Bahía Honda in 220 fathoms (MCZ); *Atlantis*, station 3480 (N. Lat. 23°10'; W. Long. 81°28') off Matanzas in 200 fathoms; *Atlantis*, station 3424 (N. Lat. 22°53'; W. Long. 79°08') off Caibarién in 250 fathoms; *Atlantis*, station 3411 (N. Lat. 22°47'; W. Long. 78°43') off Punta Alegre in 260 fathoms; *Atlantis*, station 3401 (N. Lat. 22°36'; W. Long. 78°19') off Cayo Coco, Camagüey in 235 fathoms; *Atlantis*, station 3388 (N. Lat. 22°32'; W. Long. 78°09') off Cayo Romano, Camagüey, in 255 fathoms (all *Atlantis* records in MCZ and Museo Poey).

*Range.* Deep water from the Bahamas south through the Lesser Antilles.

### **Murex (Poirieria) hystricinus** Dall, Plate 24, fig. 4-7

*Murex (Phyllonotus) hystricinus* Dall 1889, Bull. Mus. Comp. Zoöl., 18, p. 200, (*hystricina* on plate caption) pl. 15, fig. 4 (off Montserrat [Lesser Antilles]).

*Murex (Phyllonotus) hystricinus* Dall, Smith 1939, Illustrated Catalog of the Recent Species of the Rock Shells, Lantana, Florida, p. 9, pl. 9, fig. 7; pl. 12, fig. 5.

*Description.* Shell small, about 20 mm. (four-fifths of an inch) in length, highly ornamented with numerous spinous varices. Whorls nine, strongly angulated at the shoulder which gives rise to a turreted spire. Color a uniform white. Spire extended and acute. Suture deeply impressed. Aperture subcircular and porcellaneous white. Parietal lip smooth, reflected over the body whorl, adherent above and suberect below. Palatal lip very finely crenulated and with four emarginate, rounded, denticles. Siphonal canal short, narrow, oblique and recurved upwardly from near its base. Previous siphonal canals remaining as rather long, scale-like spines. Axial sculpture consisting of nine var-

ices on the body whorl of an adult specimen. Each varix possesses six recurved spines, the one at the shoulder of the whorls being the longest, remaining spines decreasing in size to the last one which is very small. The last four varices produced are laminated and all of them flare upward in their forward margin. There are no spines on the siphonal canal. Spiral sculpture consists of smooth rounded ribs which extend upward at each varix to produce the spines. Nuclear whorls one and one-half, rounded, smooth, glass-like and exceedingly small. Periostracum absent. Operculum "muricoid" according to Dall.

length      width (without counting the spines)  
20          10 mm. Holotype

*Types.* Holotype, Museum of Comparative Zoölogy, no. 7307, off Martinique, Lesser Antilles, *Blake*, station 206, in 170 fathoms.

*Remarks.* This remarkable species presents an interesting character in that there is a great reduction in the number of varices as the animal reaches maturity. The development of the large shoulder spine and the regularity of increase in size of all the spines produce an even turreted appearance of the spire.

This seems to be a very rare, deep-water species, occurring in depths from 148 to 254 fathoms.

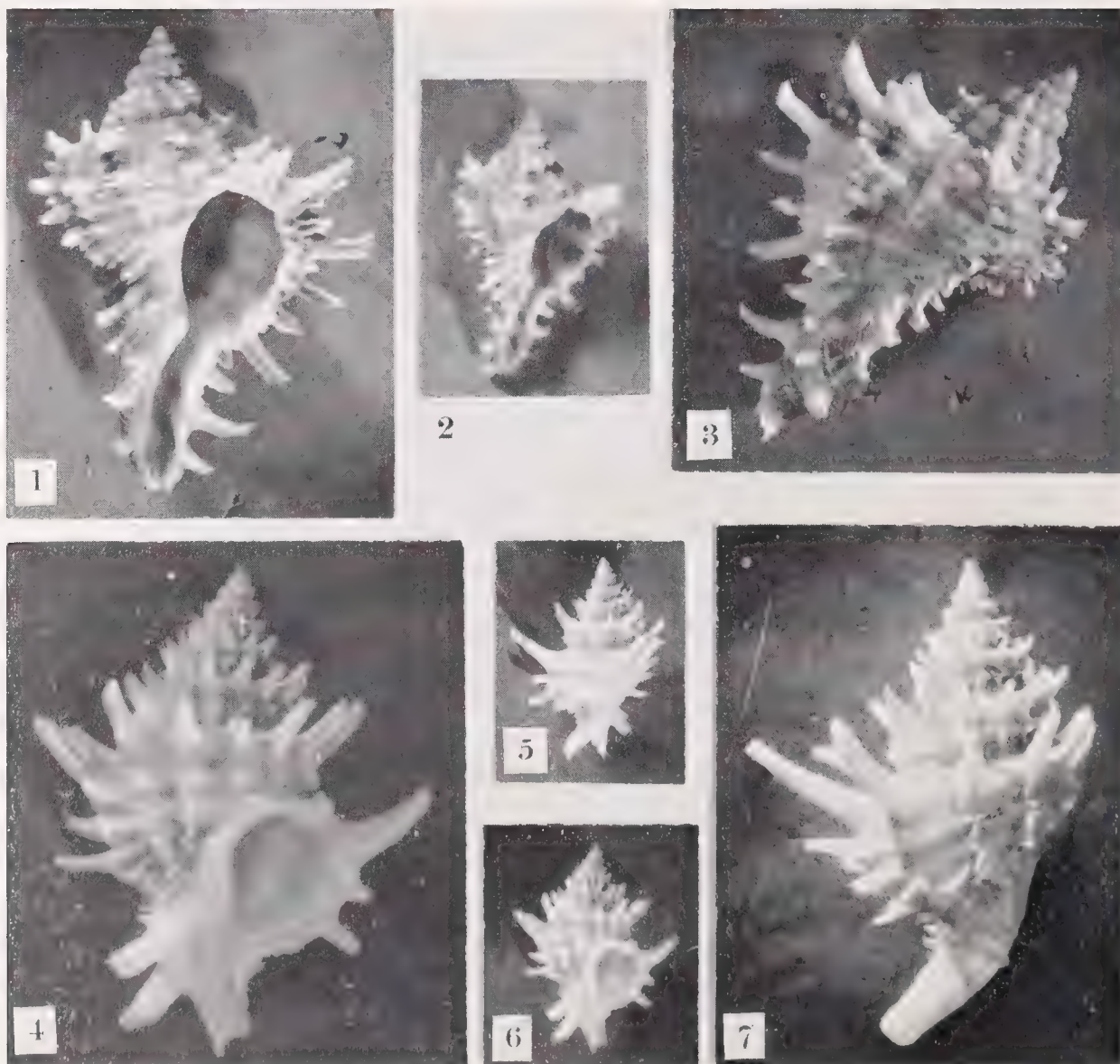


Plate 24. Fig. 1-3. *Murex burryi* Clench and Pérez Farfante, Holotype, off Fort Walton, Florida (fig. 1 and 3, 2 $\times$ ; fig. 2, natural size). Fig. 4-7, *Murex hystricinus* Dall, Holotype, off Martinique (fig. 1 and 4, 3 $\times$ ; fig. 2-3, natural size).

*Range.* Off Cuba and south through the Lesser Antilles.

*Records.* CUBA: off Santiago, *Albatross*, station 2134 (N. Lat.  $19^{\circ}56'66''$ ; W. Long.  $75^{\circ}47'30''$ ) in 254 fathoms (USNM). LESSER ANTILLES: off Montserrat, *Blake*, station 158, in 148 fathoms (USNM); off Martinique, *Blake*, station 206, in 170 fathoms (MCZ).

***Murex (Poirieria) burryi*, new species, Plate 24, fig. 1-3**

*Description.* Shell small and having five varices with moderately long and foliated spines. Whorls convex, about eight. Color a more or less uniform brownish-cream with two or three dark brown spots on each varix. Spire moderately extended and acute. Suture irregular and slightly impressed. Aperture oval, about one-third the length of the shell. Parietal wall thinly glazed. Palatal lip finely crenulated, the crenulations due to the ends of the spiral ribs. Siphonal canal moderately long and rather narrow: previous siphonal canals remaining as scale-like spines along the parietal margin. Axial sculpture consisting of five prominent varices possessing five to seven minutely foliated open spines which are rather low and irregular in height. There are three more spines corresponding to each varix that are developed on the siphonal canal. Numerous fine axial lamellae give rise to scale-like processes particularly in between the spiral ribs. The latter are equal to the number of spines, each rib passing from the spine of one varix to the corresponding spine of the next varix. Nuclear whorls two and one-half, rounded, smooth and pale amber in color; the first whorl is exceptionally small. Post-nuclear whorls four, strongly axially ribbed and crossed by rather fine spiral threads. No periostracum. Operculum unguiculate, with a subapical nucleus.

length	width (without counting the spines)
26.5	14 mm. Holotype

*Types.* Holotype, Museum of Comparative Zoölogy, no. 164567, from off Fort Walton, Florida, in 13 to 19 fathoms. Only a single specimen of this new species is known: it was collected by Mr. L. A. Burry.

*Remarks.* *M. burryi* is a very distinct species. Its characters place it in the subgenus *Poirieria*, though it is not closely related to either *M. pazi* or *M. hystericinus*. It differs from both by lacking the well-developed shoulder spine, having its spines irregular but not showing much difference in size. The spines on *M. burryi* are minutely foliated, a character not possessed by the others. In addition, *M. burryi* has smaller nuclear whorls and the postnuclear whorls sculptured with axial ribs rather than with true varices.

Named for Mr. L. A. Burry of Pompano, Florida.

*Range and Records.* See types.

**Subgenus *Murexsul* Iredale**

*Murexsul* Iredale 1915, Trans. Proc. New Zealand Institute, 47, p. 471.

Subgenotype, *Murex octogonus* Quoy and Guimard (original designation, Iredale 1915).

Shells possessing six to nine varices which support rather small to medium-long, open, spines, the spines on the shoulder of the whorls and those occurring on the siphonal canal being the largest. The most important differential character is that of the laminated varices. These consist of several layers, the first and topmost layer producing the largest spines; each succeeding layer is built within and forward of the last layer or lamina produced. The completed varix appears as a series of nested and overlapping laminae.

**Murex (Murexsul) carnicolor**, *new species*, Plate 25, fig. 1-4

*Murex pazi* 'Crosse' Sowerby 1879, Thes. Conchy. 4, **Murex**, p. 39, pl. 22, fig. 208 (West Indies); *non* *M. pazi* Crosse 1869.

*Murex (Phyllonotus) interserratus* 'Sowerby' Dall 1889, Bull. Mus. Comp. Zoöl., 18, p. 199 (off Barbados, *Blake*, station 273; off Monserratt, *Blake*, station 156); *non* *M. interserratus* Sowerby 1879.

*Description.* Shell small, about 20 mm. in length, highly spinose and rather thin. Whorls seven to eight, angulated at the shoulder, which gives rise to a turreted spire. The entire shell has a uniform flesh color. Spire extended. Suture irregular and not distinct, owing to small scale-like lamellae that overgrow it. Aperture ovate and colored similarly but paler than the outside. Parietal lip smooth, adhering above and slightly erect below. Palatal lip finely crenulated and with a few emarginate denticles. Siphonal canal rather short, narrow and slightly recurved upward at the distal end. Previous canals remain only as short overlapping scales. Axial sculpture consists of six to seven rounded varices. Each varix consists of a series of overlapping laminae, the first lamina giving rise to the first series of spines. Successive laminae are produced slightly forward of each other and following the general shape of the previous one formed. The spines are open, scale-like and rather short, except those developed at the shoulder of the whorls. These shoulder spines are rather low, sharply pointed and recurved upward. On the siphonal canal there is a large, spur-like spine corresponding to each varix. Additional axial sculpture consists of numerous low and irregular lamellae. Spiral sculpture consists of strong cords which connect the spines on one varix with the corresponding spines on the next. Nuclear whorls one and one-half, small, rounded, smooth and colored white. Postnuclear whorls sculptured the same as all of the later whorls but having more varices. Periostracum absent. Operculum unknown.

length            width (without counting the spines)  
20                10 mm.    off Barbados, Lesser Antilles

*Types.* Holotype, Museum of Comparative Zoölogy, no. 7305, from off Barbados, Lesser Antilles, collected by the *Blake*, station 273, in 103 fathoms.

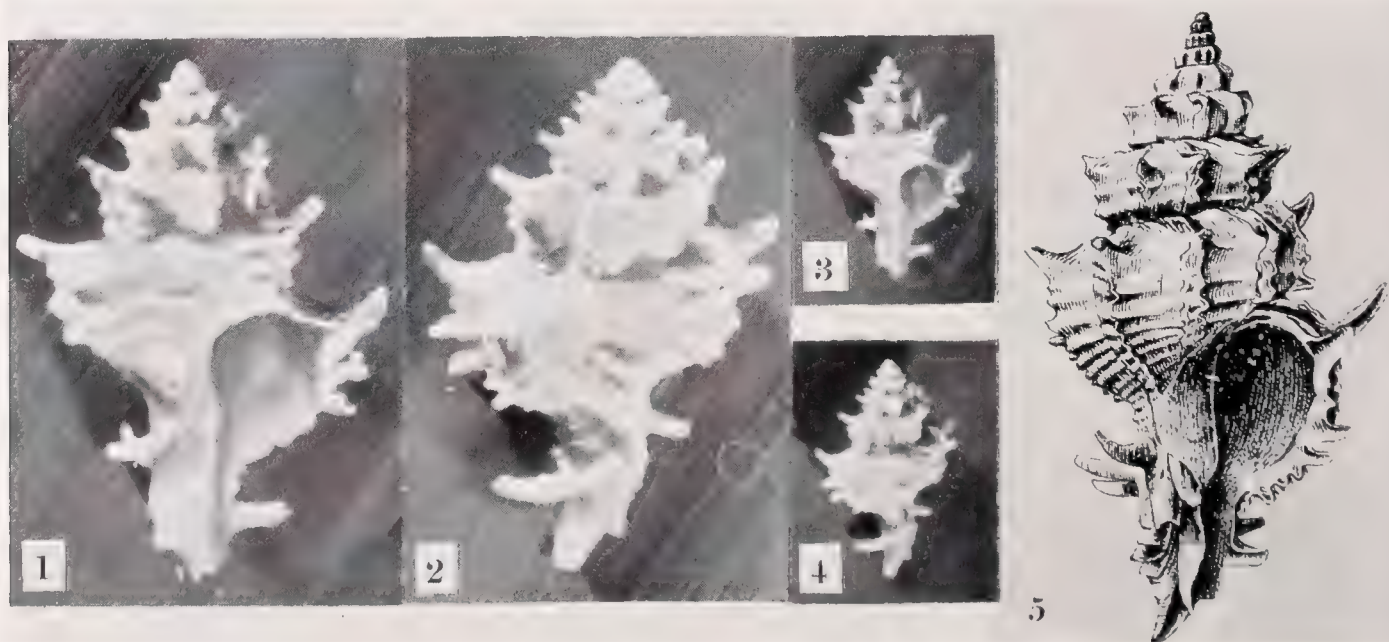


Plate 25. Fig. 1-4. *Murex carnicolor* Clench and Pérez Farfante, Holotype, off Barbados (fig. 1-2, 3×; fig. 3-4, natural size). Fig. 5. *Murex nuttingi* Dall, Holotype, off Sand Key, Florida (after Dall; about 2×).

*Remarks.* The specimen here described is the one that was listed by Dall in the *Blake Report* as *M. (Phyllonotus) interserratus* Sowerby, but it does not agree with Sowerby's original figure or description (1879, *Thesaurus Conchyliorum*, 4, **Murex**, p. 39, pl. 29, fig. 204). *M. carnicolor* is close in its general characters to that species, but differs rather sharply by the possession of long, spur-like spines on the siphonal canal which are absent in *M. interserratus*. In addition, all of the spines are more strongly developed in *M. carnicolor*, especially those at the shoulder of the whorls.

*M. carnicolor* is close to *M. nuttingi* Dall, both possessing laminated varices and well-developed spines on the siphonal canal. Our present species differs in being flesh-colored, not white, much smaller and having proportionately longer spines.

*Range.* Lesser Antilles.

*Records.* LESSER ANTILLES: off Montserrat, *Blake*, station 156 in 88 fathoms (USNM); off Barbados, *Blake*, station 273, in 103 fathoms (MCZ).

### **Murex (Murexsul) nuttingi** Dall, Plate 25, fig. 5

*Murex nuttingi* Dall 1896, Bull. Lab. Nat. Hist. University of Iowa, 4, p. 13, pl. 1, fig. 1 (eight miles east of Sand Key, Florida).

*Description.* "Shell white with a pale straw-colored epidermis and eight whorls exclusive of the (lost) nucleus; suture deep, whorls rounded (the last) crossed by eight varices, each bearing a rather long grooved spine at the shoulder and anteriorly about six smaller and less conspicuous spinules, each of which corresponds to a more or less distinct revolving thread; at the shoulder and behind it there is no revolving sculpture or only faint traces of it; the apical three or four whorls show angular points, rather than spines, which are partly the result of wear; canal rather long, shorter than the spire, with a wreath midway of long recurved spines, each corresponding to a varix; the siphonal fasciole imbricated by the canal-ends of successive resting-stages; pillar white, moderately callous; canal open; outer lip modified by the sculpture, not lirate; operculum pale-brown, kite-shaped, the nucleus at the acute end which is nearly straight; height of shell 40, major diameter exclusive of spines 21 mm."

*Types.* The types are now in the United States National Museum, Washington, D.C. These were collected eight miles east of Sand Key, Florida (near Key West) in 15 fathoms by the Bahama Expedition of the State University of Iowa.

*Remarks.* We have not seen this species and have given above a full quotation of Dall's diagnosis and a copy of his figure. The numerous laminated varices, so well executed in Dall's figure, characterized this species as a member of the subgenus *Murexsul*. (See under *M. carnicolor*.)

*Range and Records.* See under Types.

#### Subgenus **Murexiella**, *new subgenus*

Shell possessing four to six varices with foliated spines. The spines are connected on each varix by a complex laminated webbing. This webbing is not formed of a single plate of material, but of several layers, the front margins separated and produced more or less horizontally to the vertical back. The forward side of this web appears as a series of layers between the foliated spines. Siphonal canal moderately broad and somewhat extended. Operculum unguiculate, with a subapical nucleus.

This subgenus would appear to be related to the subgenus *Chicoreus* by possessing well

developed foliated spines, relatively small apertures and the development in certain species of the fine scale-like spiral sculpture. *Murexiella* differs from *Chicoreus* in the possession of more than three varices and having the spines on each varix connected by a fluted webbing. *Murexiella* is probably more closely related to *Favartia* through similarity in the structure of the varices. *Murexiella* differs, however, by having the spines greatly developed and foliated and having the webbing elaborated to an extreme degree.

Subgenotype, *Murex hidalgoi* Crosse.

**Murex (Murexiella) hidalgoi** Crosse, Plate 26, fig. 1-4

*Murex hidalgoi* Crosse 1869, Journ. de Conchy., **17**, p. 408 (Antilles); Crosse 1871, Journ. de Conchy., **19**, p. 68, pl. 1, fig. 4.

*Murex (Chicoreus) hidalgoi* Crosse, Dall 1889, Bull. Mus. Comp. Zoöl., **18**, p. 198, pl. 16, fig. 3.

*Description.* Shell 28 to 35 mm. (one to one and one-half inches) in length, highly sculptured and somewhat translucent. Whorls convex, six or seven. Color grayish white or cream. Spire somewhat extended. Suture irregular and deeply impressed. Aperture small, subovate and porcellaneous white. The lips are rather thin, erect and extend outward, the parietal lip being smooth while the palatal lip is minutely crenulated. Axial sculpture consists of generally five, sometimes four, varices on the body whorl which possess five, long, slightly flattened and hollow spines; the uppermost spine being the long-

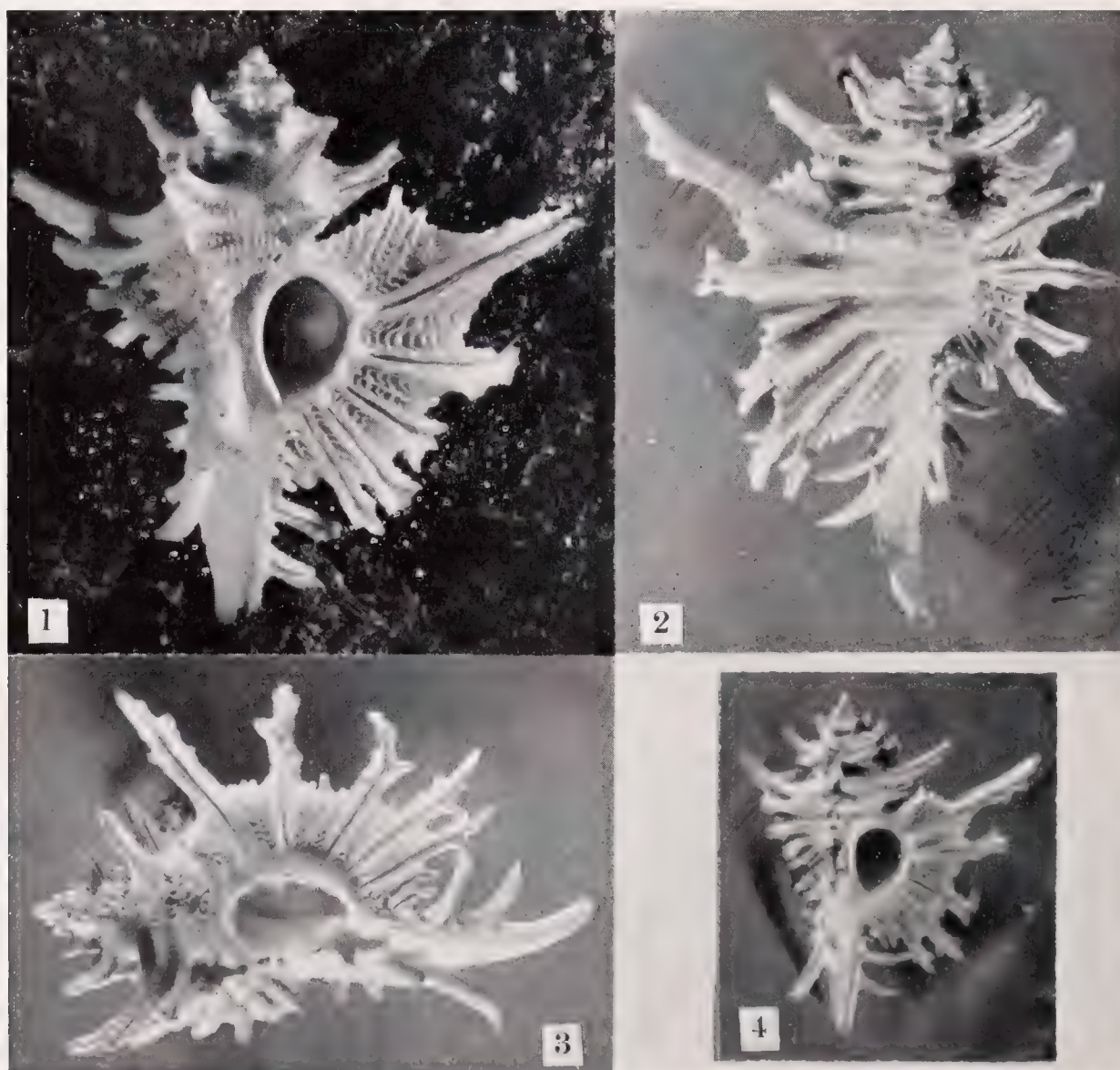


Plate 26. *Murex hidalgoi* Crosse

Fig. 1-4. Off Guadeloupe (fig. 1-3, 2×; fig. 4, natural size).



est, the spines below being smaller and equal to each other. All the spines along each varix are connected by a lamina which appears in front as cloth in loosely draped layers, while behind, this lamina has a series of small ridges which are clearly indicated in between the larger ridges that form the spines. On the siphonal canal, there are two rather long and narrow, pointed spines which are produced in line with each varix. Spiral sculpture consists of five strong, rounded ridges which extend upward at each varix to form the spines. At the base of each spine these ridges are built forward until they again form the new spines on the next varix. In addition, all of the ridges and sometimes the spaces in between are covered with numerous, minute scales. Siphonal canal moderately long, rather broad and slightly curved upward at its distal end. Previous siphonal canals form a depressed spiral around the false umbilicus. Periostracum nearly obsolete. Operculum unknown.

	length	width (without counting the spines)	
(large)	35	14 mm.	off Guadeloupe, Lesser Antilles
(small)	30	11	off Montserrat, Lesser Antilles

*Types.* The type of this species was in the collection of Patricio Paz of Madrid, according to H. Crosse. As Crosse gave only the Antilles, we here restrict the type locality to off Guadeloupe from which we have two records.

*Remarks.* *M. hidalgoi* is a very distinct species. It is related to *M. macgintyi*, though this relationship is not at all close. (See remarks under *M. macgintyi*). We can add but little to what is known regarding this species. It is a deep water form, having been dredged in depths ranging from 76 to 196 fathoms.

*Range.* Lesser Antilles in deep water.

*Records.* LESSER ANTILLES: off Montserrat, *Blake*, station 157 in 120 fathoms and station 158 in 148 fathoms; off Guadeloupe, *Blake*, station 159 in 196 fathoms and station 166 in 150 fathoms; off Barbados, *Blake*, station 272 in 76 fathoms (all MCZ).

### Subgenus *Favartia* Jousseaume

*Favartia* Jousseaume 1880, Le Naturaliste, 1, no. 42, p. 335.

Subgenotype, *Murex breviculus* Sowerby (original designation, Jousseaume 1880).

Species composing this subgenus are small and possess five to seven low varices which support only small spines or no spines at all. The varices consist of a series of low and fluted laminae which are developed nearly in a vertical plane. At the varix the spiral ribs turn sharply upward and form the first layer of the varix. Below this layer there follow many others, all appearing as little truncated troughs. Each trough is connected on both sides by a depressed lamina to the corresponding troughs of the next two ribs, thus forming a webbing between them. The spiral sculpture is generally marked by rather strong ridges or ribs. Siphonal canal short and moderately broad. The operculum is unguiculate and has an apical nucleus.

Nothing is known so far as we have been able to determine regarding the kind of operculum possessed by *Murex breviculus* Sby., the type of *Favartia*. Until this is known, the position of this subgenus will have to remain in abeyance. It has been considered a subgenus of *Tritonalia*, but this latter genus has a purpuroid operculum, that is, one which is subtriangular in shape with the nucleus at the outer margin, and not the concentric or unguiculate operculum possessed by members of the genus *Murex*. Our Western Atlantic species, *M. macgintyi* and *M. cellulosus* are very similar in general structure

to *M. breviculus*, the subgenotype: both possess the fluted varices, the strong spiral ribs and general globose shape of *M. breviculus*. These two species have a muricoid operculum which would indicate that *Favartia* is a member of *Murex* and not of *Tritonalia*. It would also appear that *M. humilis* Broderip of the Panamic area should be placed in *Favartia*.

**Murex (Favartia) macgintyi** Smith, Plate 27, fig. 1-4

*Murex macgintyi* Smith 1938, Nautilus **51**, p. 88, pl. 6, fig. 11 (Pliocene: Clewiston, Florida).

*Tritonalia macgintyi* Smith 1939, Illustrated Catalog of the Recent Species of the Rock Shells, Lantana, Florida, p. 16, no. 215, pl. 12, fig. 20.

*Description.* Shell small, from 20 to 30 mm. (a little under to a little over one inch) in length and possessing varices with low and upward curved spines. Whorls six, strongly convex. Ground color oyster white or pale straw with an interrupted band of dark mahogany-brown along the superior margin of the whorls. Occasionally there are brownish patches at the varices on the mid area as well. Spire somewhat extended. Suture depressed. Aperture small, porcellaneous white, subcircular to ovate in shape. Parietal lip smooth, erect, adnate only at its extreme upper margin. Palatal lip finely crenulated, the crenulations formed at the forward extensions of the spiral ridges. Axial sculpture consists of six or seven spinose varices. The spines are short, finely foliated, more or less uniform in height and recurved upward toward the spire, there being six spines on each varix and three or four along the siphonal canal. They are connected on each varix by a fluted webbing which is almost as high as the spines and consists of horizontal layers built at right angles to the back. A continuation of each layer forms smaller spines in front of the first series of primary spines. Spiral sculpture consists of numerous, narrow and rounded ridges on the whorls and three on the siphonal canal which extend upward at each varix to form the spines. The ridges and the areas in between them are generally covered with very fine scales. Siphonal canal short and fairly broad. Previous siphonal canals remaining as scale-like spines on the parietal margin of the new canal. Nuclear whorls one and one half, rounded, smooth and very small. Post-nuclear whorls similar to the later whorls. No periostracum. Operculum unguiculate with an apical nucleus, the surface of the operculum crossed by rather coarse and concentric growth lines.

	length	width	
(large)	29	17.5 mm.	New Providence, Bahamas
(average)	22.5	15	New Providence, Bahamas

*Types.* Holotype in the collection of Paul McGinty of Lantana, Florida. The type locality is the Pliocene beds along the canal banks at Clewiston, Florida.

*Remarks.* *M. macgintyi* Smith is very close to *M. humilis* Broderip from the Panamic region. This latter species is larger and possesses much more color than is known to occur in *M. macgintyi*. All other characters appear to be the same to judge by Reeve's excellent figure (Reeve 1845, Conch. Icon., **3**, *Murex*, pl. 13, fig. 58a-b).

Recent specimens of this species agree exactly with Smith's description and figure which were based on a fossil specimen. The original type specimen was obtained from the spoil banks along the canal at Clewiston, Florida.

*Range.* Found fossil in the Pliocene of southern Florida and recent off the Lower Keys, Gulf coast of Florida and in the Bahamas.

*Records.* FLORIDA: off Port Everglade, Broward Co., in 50 fathoms (T. Van Hyning); off Carysfort Reef, Key Largo in 65 to 100 fathoms; off The Elbow, Key Largo, in 38

to 100 fathoms; off Molasses Reef, Key Largo, in 66 fathoms; off Fort Walton in 13 to 19 fathoms; (all L. A. Burry). BAHAMAS: Alicetown, Bimini Islands (MCZ): Nassau, New Providence (P. D. Ford; R. Humes and A. H. Patterson).

**Murex (Favartia) cellulosa** Conrad, Plate 27, fig. 5-8

*Murex cellulosa* Conrad 1846, Proc. Acad. Nat. Sci. Philadelphia, 3, p. 25 (Tampa Bay [Florida]).

*Ocenebra (Favartia) cellulosa* Conrad, Dall 1889, Bull. Mus. Comp. Zoöl., 18, p. 210, pl. 16, fig. 1.

*Description.* Shell small, from 20 to 25 mm. (about one inch) in length and possessing five to seven low and fluted varices. Whorls seven to eight and moderately convex. Color generally a dull grayish white. Spire extended. Suture depressed and difficult to trace owing to the irregular sculpture. Aperture small, oval in shape and stained with brown within. Parietal lip smooth, erect, and adherent or adnate above, somewhat free below. Palatal lip finely denticulated and evenly crenulated, the crenulations produced by the terminations of the spiral ridges. Axial sculpture consists of five to seven, slightly oblique,

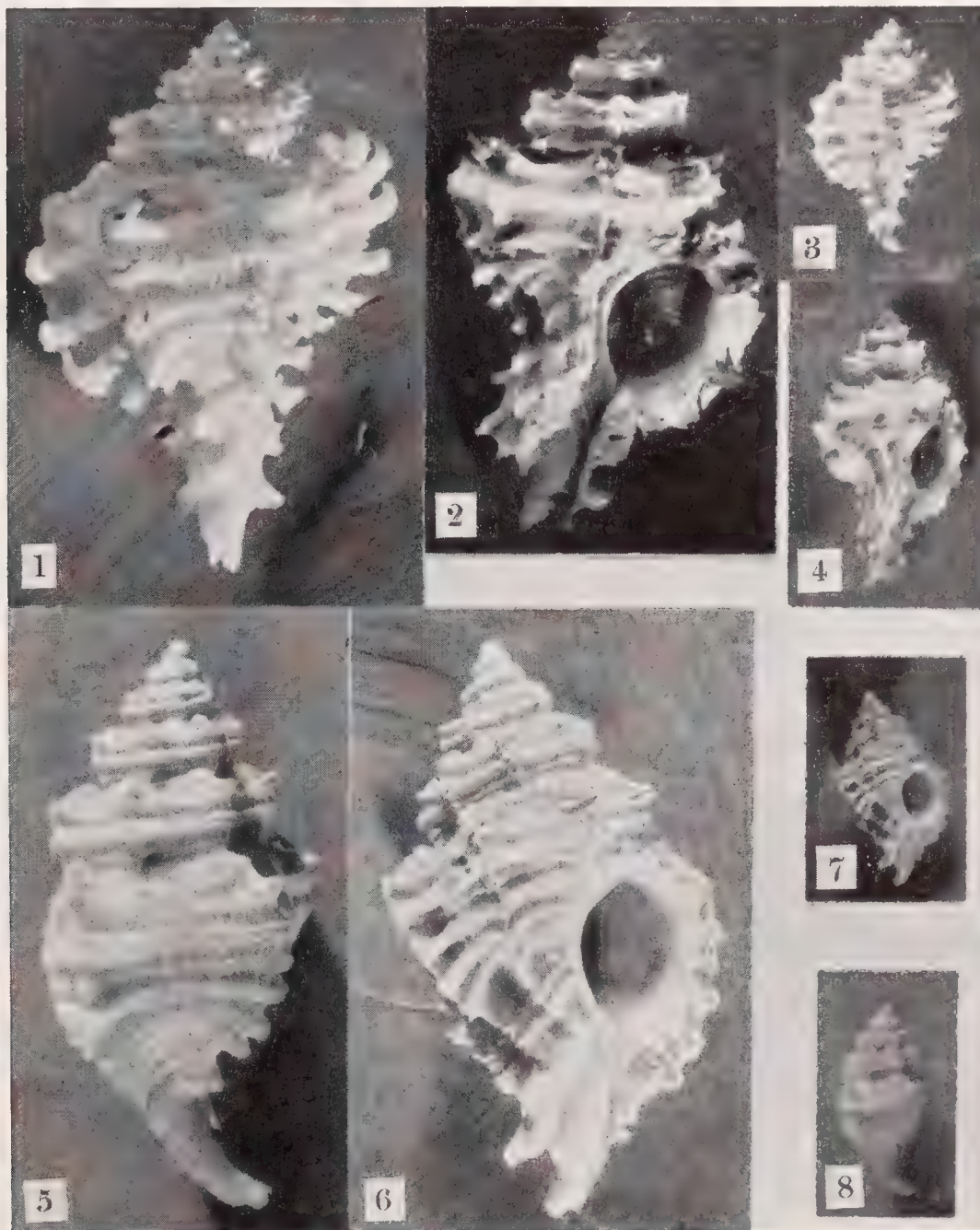


Plate 27. Fig. 1-4. *Murex macgintyi* Smith. Fig. 1 and 3. Montague Pier, Nassau, New Providence Island, Bahamas (fig. 1,  $3\times$ ; fig. 3, about natural size); fig. 2 and 4, Lyford Key, New Providence Island, Bahamas (fig. 2,  $2\times$ ; fig. 4, natural size). Fig. 5-8, *Murex cellulosa* Conrad, Gulfport, Florida (fig. 5-6,  $3\times$ ; fig. 7-8, natural size).

low varices. The varices may be finely spinose and consist of a series of nearly vertically developed laminae. The ends of the spiral ribs are truncated and each rib is followed within and below by many more, thus producing a fluted appearance in frontal view. Each of these individual rib terminations is connected to the terminations of the ribs on both sides by a depressed lamina which creates the webbing between the ribs of the varices. Spiral sculpture consists of seven or more strong ridges or ribs which extend upward at each varix to form the low spines. Siphonal canal generally long and rather broad near the base. The extension of the canal is narrow and thin and is usually broken off. Previous siphonal canals remaining as scale-like spines along the parietal margin of the new canal. Nuclear whorls one and one-half, rounded, smooth and very small. Post-nuclear whorls similar to the later whorls. No periostracum. Operculum unguiculate, possessing an apical nucleus.

	length	width	
(large)	29	15 mm.	Gulfport, Florida
(average)	22.5	12.5	Bermuda
(small)	20	11	Gulfport, Florida

*Types.* The type specimens may be in the Academy of Natural Sciences, Philadelphia. Many, though not all, of Conrad's types are in the Academy; others have never been located. The type locality is Tampa Bay, Florida, and according to Conrad, this species occurs on oyster bars.

*Remarks.* This is a small and rather ornate little species which appears to be common only along the west coast of Florida. Perfect specimens have a rather long and upturned siphonal canal but this is quite frequently broken off near its base. It occurs on oyster bars and very probably drills the young oysters.

*M. cellulosis* differs from *M. macgintyi* by being of a much finer structure. The spines are far less developed, the spiral ribs not nearly as strong; it has a less convex shell and a more produced spire. In addition, *M. macgintyi* does not have the lengthened and upturned distal end to the siphonal canal.

*Range.* Bermuda, North Carolina (Dall 1889, p. 210), Gulf of Mexico and south through the Greater Antilles.

*Records.* BERMUDA: Agar's Island (MCZ). FLORIDA: off The Elbow, Key Largo in 75 to 100 fathoms (L. A. Burry); Carysfort Reef, Key Largo; Little Duck Key (both A. H. Patterson); Bonefish Key (B. R. Bales); Key West; off Shark River, in 2 fathoms (both J. S. Schwengel); Bonita Beach; Sanibel Island; Sarasota Bay; Gulfport; Indian Pass, Pinellas Co.; Cedar Keys (all MCZ); Boca Grande (H. Dodge); off Fort Walton in 13 to 19 fathoms (L. A. Burry).

### **Murex cellulosis nuceus** Mörch, Plate 28, fig. 4-6

*Murex nuceus* Mörch 1850, Catalogus Conchyliorum C. P. Kierulf, Hafnia, p. 31, pl. 1, fig. 9 (Antilles).

*Murex jamaicensis* Sowerby 1879, Thesaurus Conchyliorum, 4, **Murex**, p. 39, pl. 23, fig. 223 (Jamaica):  
non *M. jamaicensis* Petiver, Mörch 1877, *nomen nudum*.

*Description.* Shell small, from 20 to 25 mm. in length and possessing five to six low, slightly oblique and fluted varices. Varices a little wider and heavier structurally than in *M. cellulosis*. In general, the shell is heavier and a little more globose than the typical species. All specimens so far examined have a somewhat shorter siphonal canal, but this character may equal in length that occurring in the typical species in live specimens.

	length	width	
(large)	23	14.5 mm.	St. Thomas, Virgin Islands
(average)	21	12	Holotype
(small)	15	10.5	off Fort Walton, Florida

*Types.* Mörch described *M. nuceus* from the collection of Dr. C. P. Kierulf which was offered for sale at public auction in 1850. The whereabouts of these types today is not known. We restrict the type locality to St. Thomas, Virgin Islands.

*Remarks.* Extreme forms of this subspecies appear to be quite distinct. However, innumerable specimens exist which merge smoothly in shape and general sculpture with typical *M. cellulosus*, at least in the region of the Lower Florida Keys. One form may well be a geographical subspecies of the other, the two merging their characters in Florida where both occur. Our records are still too limited, both in number and in distribution, even to be sure that we are dealing with geographical subspecies. More material may prove them to be close but distinct species.

The type of *M. jamaicensis* Sowerby is a slightly more elongate specimen than the type of *M. nuceus* as figured by Mörch. It could be considered a synonym of *M. cellulosus* equally as well.

*Range.* Gulf of Mexico and south through the Greater Antilles.

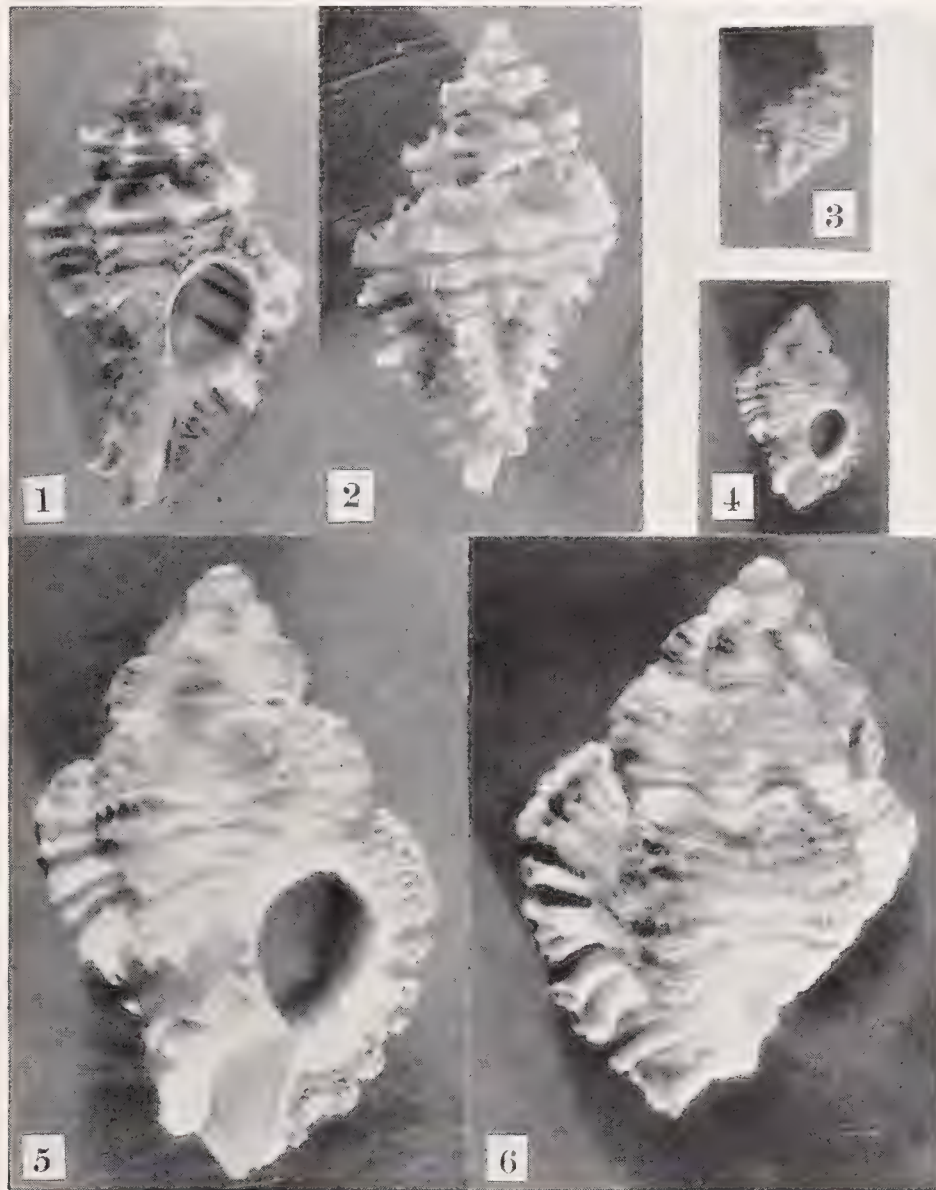


Plate 28. Fig. 1-3. *Murex cellulosus leviculus* Dall. Fig. 1, Sanibel Island, Florida (3×); fig. 2-3, off Destin, Florida (fig. 2, 3×; fig. 3, natural size). Fig. 4-6, *Murex cellulosus nuceus* Mörch, Topotype, St. Thomas, Virgin Islands (fig. 4, natural size; fig. 5-6, 3×).

*Records.* FLORIDA: off Fort Walton (L. A. Burry); Teatable Key (J. S. Schwengel). VIRGIN ISLANDS: St. Thomas (MCZ, ex T. Bland collection).

**Murex cellulosus leviculus** Dall, Plate 28, fig. 1-3

*Ocenebra (Favartia) (cellulosa, var.?) levicula* Dall 1889, Bull. Mus. Comp. Zoöl., **18**, p. 211 (off Cape Lookout, North Carolina).

*Tritonalia cellulosa levicula* Dall, Smith 1939, Illustrated Catalog of the Recent Species of Rock Shells, Lantana, Florida, p. 16, pl. 13, fig. 8.

*Description.* Shell a little smaller than *M. cellulosus* and little higher proportionately. The varices are a little more acute and the shells colored a yellowish brown with a few scattered and irregular patches of dark brown.

	length	width	
(large)	18	11.2 mm.	off Sanibel Island, Florida
(average)	15.5	8.5	off Fort Walton, Florida

*Types.* Cotypes of this species are in the United States National Museum. The type locality is: *Albatross* station 2609 (N. Lat. 34°26': W. Long. 76°12') from off Cape Lookout, North Carolina, in 25 to 40 fathoms.

*Remarks.* This subspecies is exceedingly close to *M. cellulosus* and may be only a form of the typical species. Specimens occur that intergrade completely. Actually, *leviculus* is the narrow form and *nuceus* the globose form, *cellulosus* having characters just about in between these two extremes. Much more material is needed from a wide area before a better understanding can be had of all three forms.

*Range.* North Carolina and Gulf of Mexico.

*Records.* NORTH CAROLINA: off Cape Lookout, *Albatross*, station 2609, in 25 to 40 fathoms (USNM). FLORIDA: off Yamato, in 80 fathoms (T. Van Hyning); off Carysfort Light in 75 fathoms; and off Molasses Reef in 96 to 100 fathoms, Key Largo (both L. A. Burry); off Sanibel Island in 4 to 6 fathoms; off Dentin in 14 fathoms (both J. S. Schwengel); off Fort Walton in 13 to 19 fathoms (L. A. Burry).

### Notes

*Murex bilineatus* 'Reeve' Beau 1858, Revue Coloniale [for] 1857, p. 9, *nomem nudum*; Krebs 1864, The West Indian Marine Shells, p. 18, Nykjobing, Denmark, *nomen nudum*.

This name was first introduced by Beau and credited to Reeve, probably in error for *M. trilineatus* Reeve. It was later used by Krebs on the basis of Beau's list as he cites the locality and name of Beau.

We have seen the specimen of *M. concinnus* Reeve mentioned by Dall in the Blake report (1889, Bull. Mus. Comp. Zoöl., **18**, p. 197) as from the Antilles. It appears to be unquestionably *M. ternispina* Lamarek of the Indo-Pacific region.

*Murex (Jaton) gaza* M. Smith 1940, Nautilus, **54**, p. 44, pl. 2, fig. 3 (off Key West, Florida).

This species does not appear to belong to any of the various subgenera now included in *Murex*.

*Murex microphyllus* Lamarek 1816, Ency. Méth., **3**, pl. 415, fig. 5 (locality unknown); Lamarek 1822, An. s. Vert., **7**, pl. 163; *non* Kiener 1843.

This species is not known to occur in the Western Atlantic.

*Murex pudicus* Reeve 1845, Conch. Icon., **3**, *Murex*, pl. 29, fig. 137 (Island of St. Domingo).

This species is wholly unknown to us. It appears to be a young shell, possibly beach-worn, and not recognizable as a young specimen of any known Western Atlantic species.

*Murex spectrum* Reeve 1846, Conch. Icon., **3**, *Murex*, pl. 36, fig. 187 (locality unknown).

This species does not appear to us to be from the Western Atlantic. It is close to *M. brevifrons* in general appearance and has probably been misidentified for this species. It is possibly equal to or affiliated with *M. elongatus* Lamarek from the Indo-Pacific.

### Growth of the Operculum in *Murex*<sup>1</sup>

The operculum has its origin upon the embryo while still in the egg; it is above the foot and at the posterior end of the body. It is developed upon a restricted area which is distinguished by its denser texture, the operculigerous lobe.

The "nucleus" of the operculum is the first or one of the early layers of chitin to be produced. Succeeding chitinous layers grow from below and each layer *may* be produced at the time a varix is formed. As horizontal growth is unequal, the growth on the inner or parietal margin being much greater, the first or nuclear layers remain close to the outer or palatal margin. Thus the relative position of these earlier layers gives rise to the terms concentric and unguiculate, as they pertain to *Murex*. This unequal growth of each succeeding layer is best appreciated when it is considered that the increase in the size of the aperture of the shell is on the outer or palatal margin, while the inner or parietal region remains about the same. The under or attached side of the operculum also shows an unequal rate of growth. The palatal margin is greatly thickened by continuous deposition while the parietal margin is narrow and thin, owing to a continuous lateral growth in that direction. It appears then, that the initial point of growth, the "nucleus," remains fixed or nearly so; and as this point is on the lower and outer palatal margin, the growth in size of the animal carries this fixed point along and results in the new operculum growth being built along the parietal or inner margin. There is variation in the position of the nucleus, depending upon the species examined, but it would appear, that the more circular and regular the aperture, the more nearly the nucleus remains close to

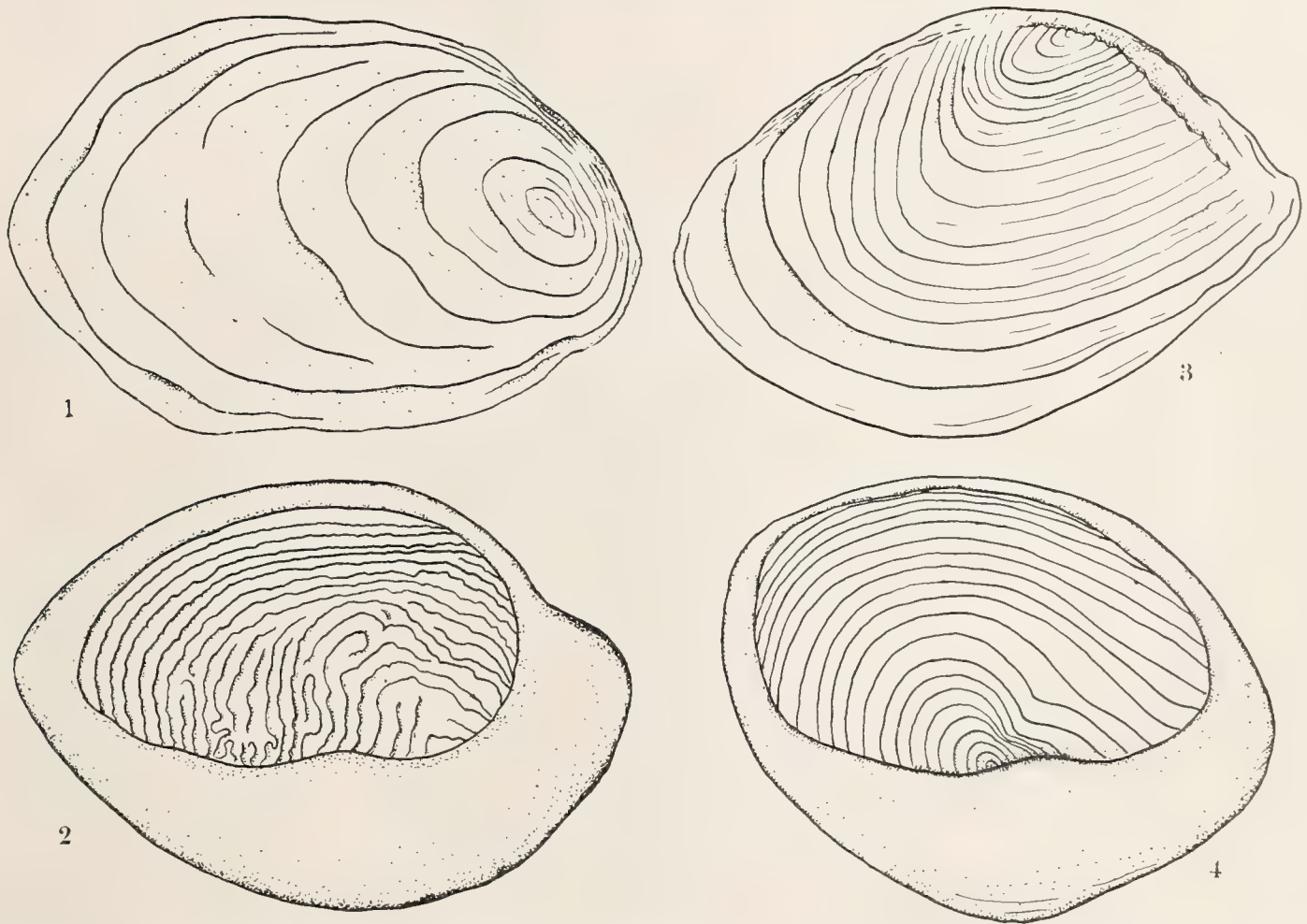


Plate 29. Opercula of *Murex* (fig. 1 and 3, outer surface; fig. 2 and 4, inner surface). Fig. 1-2. *Murex pomum* Gmelin (3 $\times$ ). Fig. 3-4. *Murex florifer arenarius* Clench and Pérez Farfante (3 $\times$ ).

<sup>1</sup> Pages 57 and 58 published November 23, 1945.

the center. This condition is observed in the subgenus *Haustellum* Bruguière, which does not occur in the Western Atlantic, in which the aperture is nearly circular and the operculum grows a little more equally around the entire margin. As a consequence, the nucleus is nearly central and not apical or submarginal.

The concentric growth lines that are generally observed on nearly all non-calcareous opercula are but the old margins that have been thrust vertically from the horizontal axis. This is brought about by pressure against the walls of the aperture during the time the animal has retracted and brought the operculum within the shell aperture and when, of course, these "growth lines" formed the margin of the basal plate or layer of the operculum.

\* \* \* \*

All shell photographs of *Murex* were made by Marion A. Bills. Copies of previously published figures (plate 20, fig. 9-10; plate 25, fig. 5) by F. P. Orchard.

\* \* \* \*

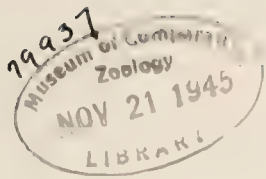
### Review of the Genera completed for the Western Atlantic<sup>1</sup>

The plan of the following review is to give additional data about the various genera that have been covered so far in Johnsonia. New information regarding records, extension of ranges, and species newly described will be added and, in addition, synonyms overlooked or not considered for our previously published species are also included. It is planned to have a number of this sort at the end of each volume so that we can keep up to date, at least on the genera and species so far published.

Earlier numbers did not include deep-water species, as we had set an arbitrary depth of 25 fathoms as a limit. Species only known to occur beyond this depth were not to be considered. However, such a policy was soon found to be unsound and too limited in scope. Interest in dredging is increasing, particularly in Florida and the West Indies, and to exclude such species would limit the value of Johnsonia in a very material way. Again, our knowledge of most species that occur a few fathoms beyond low water line is exceedingly fragmentary and more dredging and exploration will certainly show that many species possess a greater or lesser depth range than is now known.—W. J. CLENCH

<sup>1</sup>The length of Johnsonia no. 18, has to be curtailed owing to the unavailability at the moment of heavy grade paper. As a consequence, a few species will be limited to a reference only and will be included, in detail, in the final number of Volume 2.





# JOHNSONIA

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REVIEW NUMBER

NUMBER 18

## THE GENUS STROMBUS IN THE WESTERN ATLANTIC

BY

WILLIAM J. CLENCH AND R. T. ABBOTT

### *Strombus raninus nanus* Bales

*Strombus raninus nanus* Bales 1942, *Nautilus* **56**, p. 19, pl. 4, fig. a-b (Southern end of Lake Worth, Palm Beach Co., Florida).

## THE GENUS FICUS IN THE WESTERN ATLANTIC

BY

WILLIAM J. CLENCH

### *Ficus Röding*

*Ficus* Röding 1798, *Museum Boltenianum*, p. 148 [Refers to Gmelin 1790, *Syst. Nat.* ed. 13, p. 3426. Gmelin gives a long list of references as does Linné 1767 in the 12 ed. of the *Syst. Nat.*, the original citation of *Bulla ficus*. Reference by both Linné and Gmelin is made to Gualtieri 1742, pl. 26, fig. I and M. Figure I in Gualtieri is here selected to be the type figure of *Bulla ficus* Linné].

*Pyrula* Lamarck 1799, *Mém. Soc. Nat. Hist.*, Paris, p. 73 [Genotype, *Bulla ficus* Linné, monotypic].

*Pirula* Denys de Montfort 1810, *Conchyliologie Systématique* **2**, p. 486; *non Pirula* Wood 1835.

*Otus* Risso 1826, *Hist. Nat. L'Europe Méridionale*, **1**, p. 122; *non Otus* Pennant 1769; Cuvier 1800; Huebner 1819; Bates 1862; Gray 1871.

*Ficula* Swainson 1835, *Elements of Conchology*, p. 21.

*Sycotypus* Gray 1847, *Proc. Zool. Soc. London*, **15**, p. 135 (Genotype, *Bulla ficus* Linné).

*Sycotopus* Conrad 1856 [error for *Sycotypus* Gray].

*Syctyphus* Gabb 1861 [error for *Sycotypus* Gray].

Genotype, *Bulla ficus* Gmelin (= *B. ficus* Linné) (by subsequent designation, Dall 1906).

### *Ficus howelli* Clench and Aguayo, Plate 1, fig. 1-2

*Ficus howelli* Clench and Aguayo 1940, *Mem. Sociedad Cubana Hist. Nat.*, **14**, p. 85, pl. 14, fig. 2 (Bahía de Cochinos, Santa Clara Province, Cuba).

*Description.* Shell imperforate, thin and rather small in size for this genus. Color a yellowish straw, with a series of small, dark reddish-brown dots arranged in six spiral rows. Whorls  $4\frac{3}{4}$ , regularly enlarging. Aperture sub-elliptical in shape with a somewhat extended canal below. Spire slightly elevated. Outer or palatal lip thin. Columella extended, slightly twisted, narrowly truncated and somewhat inwardly arched. Sculpture consisting of a reticulated pattern, produced by flattened axial and spiral threads, the alternate spiral threads being slightly stronger, particularly above the mid region of the body whorl. Nuclear whorl glass-like and smooth, the second whorl developing faint axial threads which cross with spiral ridges producing the reticulated pattern, which becomes enlarged and much stronger on the body whorl.

length	width	aperture
36.5	19.3	34.2×11.4 mm. Holotype

*Types.* Holotype, Museum of Comparative Zoölogy, no. 135140. *Atlantis*, station no. 3332 (N. Lat.  $22^{\circ}09'30''$ ; W. Long.  $81^{\circ}11'$ ) Bahía de Cochinos, Santa Clara Province, Cuba, in 175–225 fathoms (1939).

*Remarks.* See under *F. carolae* Clench.

This species differs from *F. atlanticus* Cl. and Ag. by having much smaller and fewer brownish spots and in possessing a very fine sculpture. *F. atlanticus* Cl. and Ag. possesses a very straight columella, not arched or arcuate as it is in most other species in this genus.

*Range and Records.* Known only from Cuba (see under *Types*).

### ***Ficus atlanticus* Clench and Aguayo, Plate 1, fig. 3–4**

*Ficus atlanticus* Clench and Aguayo 1940, Mem. Sociedad Cubana Hist. Nat. 14, p. 85, plate 14, fig. 1 (off Sao Salvador, Estado Bahía, Brasil).

*Description.* Shell imperforate and very small for the genus. Color a dull (?) yellowish-brown, with a series of 11 rows of small reddish brown dots definitely arranged in spiral rows and somewhat off-set axially on the earlier portion of the body whorl. Whorls  $4\frac{3}{4}$  regularly increasing in size. Aperture sub-elliptical with a shortened canal. Spire slightly elevated. Outer lip very thin. Columella slightly extended, faintly twisted, narrowly truncated and straight. Sculpture of a fine reticulated pattern produced by raised axial and spiral threads, the spiral threads being stronger. Nuclear whorl smooth, the second whorl showing the start of the fine reticulated pattern.

length	width	aperture	
28 <sup>1</sup>	15.8	24.7 × 9 mm.	Holotype

*Types.* Museum of Comparative Zoölogy no. 104657, *Hassler* Voyage (S. Lat.  $11^{\circ}49'$ ; W. Long.  $37^{\circ}10'$ ) off São Salvador, Estado Bahía, Brasil in 450 fathoms (1872).

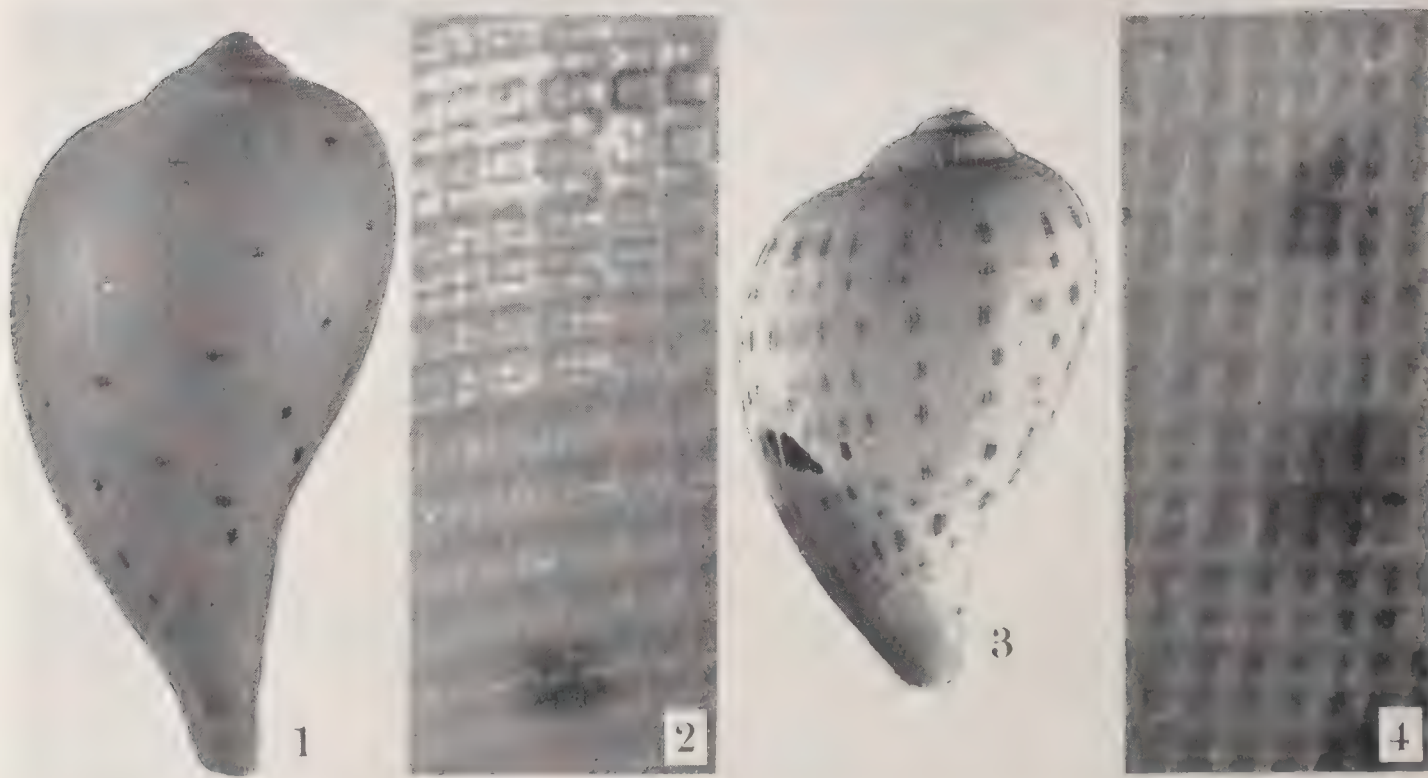


Plate 1. Fig. 1–2. *Ficus howelli* Clench and Aguayo, Holotype, off Bahía de Cochinos, Cuba. Fig. 3–4. *Ficus atlanticus* Clench and Aguayo, Holotype, off Sao Salvador, Estado da Bahía, Brasil. Fig. 1, 3; 2×; Fig. 2, 4, sculpture 12×).

<sup>1</sup>This measure was given in error as 38 mm. in the original description.

*Remarks.* See under *Ficus carolae* Clench and *F. howelli* Clench and Aguayo.

*Range and Records.* Known only from Brasil (see under Types).

***Ficus carolae*, new species, Plate 2, fig. 1-3**

*Description.* Shell rather elongated, imperforate and rather small for the genus, the holotype measuring about two and one-half inches in length. Whorls three and one-half, rapidly increasing in size and strongly convex. Interior of aperture glazed with the spots showing through. Outer lip very thin. Aperture long, nearly as long as the shell and extending below into a rather wide siphonal canal. Spire greatly depressed though the first two whorls do show above the body whorl. Nuclear whorls (one and one-half) smooth and opaque. Sculpture of remaining whorls finely reticulated with the spiral threads alternating strong and fine, the axial threads fine and somewhat irregular as to spacing.

length	width	aperture	
61.5	30	58×15.6 mm.	Holotype

*Types.* Holotype, Museum of Comparative Zoölogy, no. 157501, 5½ miles S.E. of The Elbow, Key Largo, Florida in 92-100 fathoms. L. A. Burry, Richard and Carol Foster collectors, July 1944. Paratypes from 4 miles N.E. of The Elbow in 66 fathoms; 5 mi. E. of Carysfort Light in 96-107 fathoms; 6 mi. S.S.E. of The Elbow in 66 fathoms. These localities are all off Key Largo, Florida.

Named for Carol Foster (Mrs. Richard W. Foster).

*Remarks.* *Ficus carolae* Clench is the first deep-water member of this genus known to occur in North America. It differs from *F. papyratus* Say by being proportionately smaller, but having the sculpture of about the same coarseness, having a wider aperture, being a little more extended and having a higher spire. In addition, the shell is somewhat thinner and the small brownish spots more irregular in their arrangement. From both *F. howelli* and *F. atlanticus* it differs in being much larger and having much coarser sculpture. The small spots are irregular in *F. carolae*, regular and in spiral arrangement in both *F. howelli* and *F. atlanticus*.

*Range and Records.* Known only from southern Florida (see under Types).



Plate 2. *Ficus carolae* Clench, Holotype, 5½ mi. S.E. of The Elbow, Key Largo, Florida (fig. 1-2, natural size; fig. 3, 8×).

## THE GENUS CONUS IN THE WESTERN ATLANTIC

BY  
WILLIAM J. CLENCH**Conus clenchi** *Martins*

*Conus clenchi* Martins 1943, Boletim do Museu Nacional Brasil, (N.S.) Zoologia, No. 12, p. 2, text figures 1-3 (Barra do Furado, Município de Campos, Est. do Rio de Janeiro, Brasil).

**Conus lorenzianus** *Dillwyn*, Plate 7, fig. 5<sup>1</sup>

*Conus lorenzianus* 'Chemnitz' Dillwyn 1817, Descriptive Catalogue of Recent Shells, London, 1, p. 370 (East Indian Seas and Africa).

*Conus flammeus* Lamarck 1810, Ann. Mus. d'Hist. Nat. (Paris) 15, p. 279 (Seas of Africa). Refers to plate 336, fig. 1, Encyclopédique Méthodique 1798, pt. 21 (*non Conus flammeus* Solander 1786, *non* Link 1807).

*Conus largillierti* Kiener [in part], Clench 1942, Johnsonia No. 6, p. 16, pl. 7, fig. 5 only.

**Conus verrucosus** *Hwass*

*Conus verrucosus vanhyningi* Rehder 1944, Nautilus 57, p. 105 (off Pompano, Broward Co., Florida).

THE GENERA LUCAPINA AND DIODORA IN THE  
WESTERN ATLANTICBY  
ISABEL PÉREZ FARFANTE  
Guggenheim Fellow, Cuba, 1942-44**Lucapina eolis**, *new species*, Plate 3, fig. 1-3

*Description.* Shell medium in size, from 12 to 20 mm. in length, rather thin and depressedly conical. Anterior slope straight or concave, about half the length of the posterior slope, which is straight or convex. Orifice located between the first and second third; it is narrow and with a mid-horizontal widening. Sculpture consists of about 30 primary ribs between each pair of which there is intercalated one riblet. The shell is crossed by concentric laminae which form small scales where they intercept the radiating ribs. Between these laminae there are from five to seven strong cords. It is unicolorous milky white. Margin finely crenulated. Interior polished white with the sculpture of the outside showing through in the form of concentric and radiating white lines. Internal callus of the orifice sharply truncated behind and rounded anteriorly.

	length	width	height	orifice length	
(large)	21	11	6	2.5 mm.	off Sand Key, Florida
(average)	13	7	4	1.5	off Key West, Florida

*Types.* Holotype Mus. Comp. Zoöl. no. 146436, 3 miles southwest of Sombbrero Light, Florida, in 41 fathoms. L. A. Burry collector. Paratypes from the same locality and from off Key West, Florida, *Eolis*, station 44, in 50 fathoms, and off Sand Key, Florida, *Eolis*, station 2, in 27-30 fathoms, all at the United States National Museum.

*Range and Records.* Known only from the type localities.

*Remarks.* This species is related to *L. aegis* Reeve from which it differs in many ways. The orifice in *L. eolis* is smaller, narrower, excavated in the middle and much more anteriorly placed. The sculpture is heavier, having many more and stronger cords between

<sup>1</sup> Figured in Johnsonia No. 6, p. 12, pl. 7, fig. 5 as *C. largillierti*.

the laminae. The color is always unicolored white; the shape is much narrower. The internal callus of the orifice is sharply rather than roundly truncated behind. Anteriorly it is rounded, quite unlike the triangular effect of *L. aegis*. *Lucapina colis* is a moderately deep water species and very rare.

Named for J. B. Henderson's yacht, *Eolis*, which dredged off the Lower Florida Keys.

***Lucapina suffusa tobagoensis*, new subspecies, Plate 3, fig. 4-7**

*Description.* Shell about 20 mm. in length, conical, slightly elevated and attenuated in front. Base oblong-ovate. Anterior slope straight; posterior slope somewhat convex. Orifice ovate, contracted in the middle and sometimes stained with bluish black, its length being from one-sixth to one-eighth the length of the shell. Sculpture consists of numerous rounded, radiating ribs, alternately larger and smaller, beginning as fine threads at the orifice and broadening toward the margin. Concentric raised threads cross the shell forming elongated nodules where they intercept the ribs. The growth lines are visible between the threads. Color a pale mauve with nine or ten dotted rays of a darker shade. Margin strongly crenulated with paired and sharply pointed denticles. Inside of shell polished gray, the darker color pattern of the outside showing through. Internal callus of the orifice thin, narrow and roundly truncated behind, colored the same as the rest of the interior. Sometimes it is encircled by a bluish black streak. Ribs of the outer surface are visible as radiating white lines. Muscle impression distinct, lying very near the border.

	length	width	height	orifice length	
(large)	24	14	11	4 mm.	Tobago Id., Lesser Antilles
(small)	19	10	6	3	Tobago Id., Lesser Antilles

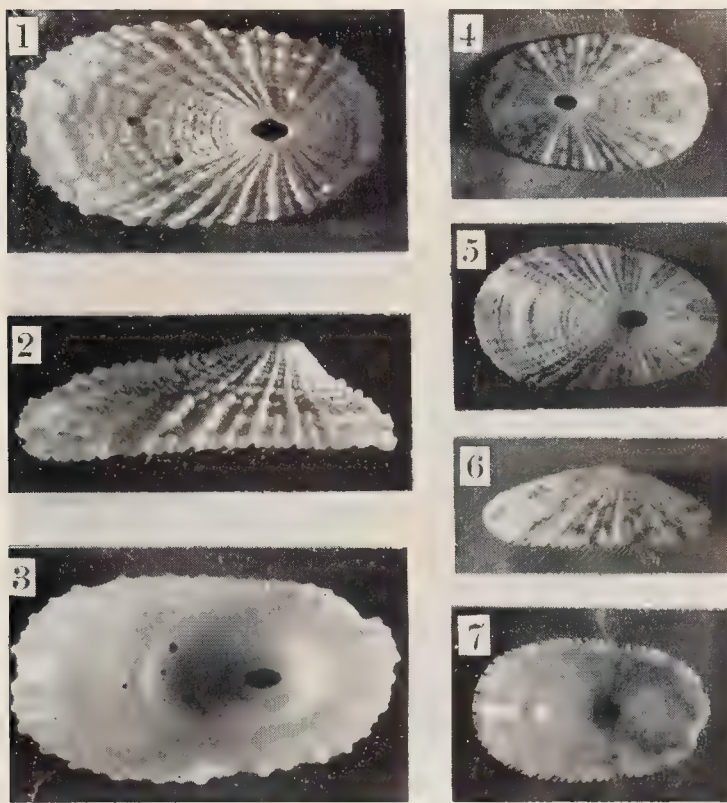


Plate 3. Fig. 1-3. *Lucapina eolis* Pérez Farfante, Paratype, off Key West, Florida (3×). Fig. 4-7. *Lucapina suffusa tobagoensis* Pérez Farfante, Tobago, Lesser Antilles (natural size; fig. 4, 6, 7, Holotype).

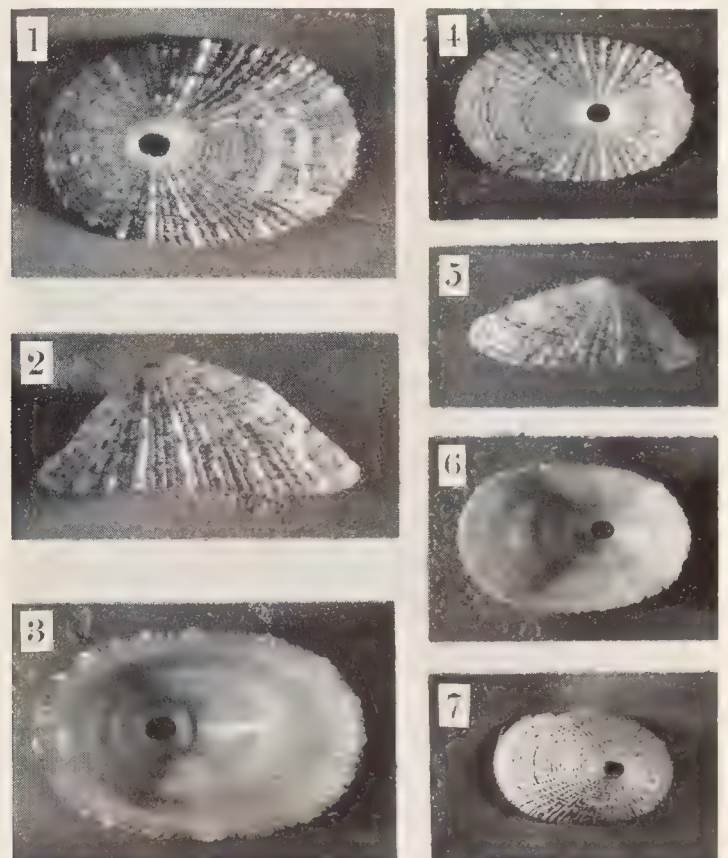


Plate 4. *Diodora wetmorei* Pérez Farfante. Fig. 1-3. Off Tortugas, Florida (3×). Fig. 4-6, Holotype, off Key West, Florida (3×). Fig. 7. Off St. Lucia, Lesser Antilles (natural size).

*Types.* Holotype, Mus. Comp. Zoöl. no. 144831, Tobago Id., Lesser Antilles: H.L. Clark collector, 1916. Paratypes from the same locality.

*Range and Records.* Known only from Tobago Id.

*Remarks.* This subspecies is similar in shape and sculpture to *L. suffusa*. It differs in being thinner, having a narrower orifice which is contracted in the middle and always having present very definite broken, never solid, color rays, a character not present in any specimens of *L. suffusa* which I have examined.

**Diodora wetmorei**, *new species*, Plate 4, fig. 1-7

*Description.* Shell rather small from 15 to 25 mm. in length, conical, slightly elevated and moderately strong. Base oblong-ovate. Front slope straight or slightly concave; posterior slope convex. Summit decidedly anterior to shell center, pierced by the orifice which is elliptical, sometimes contracted in the middle and small, its length being from one-ninth to one-twelfth that of the shell. Surface sculptured with numerous close-set, rounded, nearly equal radiating ribs. Many concentric threads cross the shell forming small nodules where they intercept the ribs, thus producing a typical granulose surface. Shell irregularly colored reddish brown with about nineteen white ribs over which reddish brown spots are intermittently dispersed. These ribs divide the ground color into rays. Margin finely crenulated, the color pattern of the outside presenting a series of brown teeth interrupted at the intervals by a single white one. Interior colored oyster white, the ribs of the outside showing through in the form of white radiating lines. Internal callus also white, narrow and roundly truncated behind. Muscle impression distinct.

	length	width	height	orifice length	
(large)	24	16	7	3 mm.	off Barbados (100 fathoms) Lesser Antilles
(average)	18	11.5	6	2	off St. Lucia (116-220 fathoms) " "

*Types.* Holotype, United States Nat. Mus. no. 94044, off Key West, Florida, in 50 fathoms, *Albatross*, 1885. Paratype from off Tortugas, Florida.

*Remarks.* This new species appears to be quite different from any so far described from the Western Atlantic. It is related to *D. aguayoi* from which it differs in its shape, the lateral and posterior slopes being convex, while in *D. aguayoi* these slopes are concave. The orifice of *D. wetmorei*, seen in profile, is in one plane while in *D. aguayoi* it is in two planes, one portion on top, the anterior portion on the front slope. In addition, *D. wetmorei* possesses equal radiating ribs while *D. aguayoi* has large and small ribs alternating.

*D. wetmorei* is a moderately deep water species and exceedingly rare, since among the large series of material examined by us only a very few specimens have been found.

Named for Dr. Alexander Wetmore, Secretary of the Smithsonian Institution.

*Range.* Southern Florida and south through the Greater and Lesser Antilles.

*Records.* FLORIDA: off Key Largo (66 fathoms) (L. A. Burry); off Sand Key, *Eolis*, station 100 (65 fathoms); off Key West, *Albatross*, station 2316 (50 fathoms); off Tortugas (all USNM). CUBA: off Bahía Honda, *Blake*, station 22 (100 fathoms). PUERTO RICO: off Boca Juana, Johnson-Smithsonian Expedition, station 104 (50 fathoms) (USNM). LESSER ANTILLES: off St. Lucia, *Blake*, station 220 (116 fathoms); off Barbados, *Hassler*, 100 fathoms (both MCZ). CARIBBEAN IDS.: off Curaçao Id. (USNM).

## INDEX

BY

MERRILL E. CHAMPION

Figures in *italics* refer to *Johnsonia* numbers. The main page reference comes first; others are in numerical order. Subspecies are treated as species in this index. See Table of Contents for references to new genera and species; bibliographies; book reviews; collecting grounds; expeditions and voyages.

- 
- abacoensis*, *Plagioptycha*, 14: 8  
 Abbott, R. T., 1: 1; 4: 1; 9: 1;  
     12: 1, 11; 14: 1; 18: 1  
*abbotti*, *Conus*, 6: 6  
 Abbott's Cone, 6: 6  
*abbreviata*, *Cassis*, 16: 6, 7, 8  
*abbreviatum*, *Buccinum*, 16: 8  
*abbreviatum*, *Cassis*, 16: 6  
*abyssicola*, *Murex*, 17: 38  
*abyssicola*, *Pterynotus*, 17: 38  
*accipitrinus*, *Strombus*, 1: 9, 10  
*Acrosterigma*, 13: 5  
*aculeata*, *Fissurella*, 10: 19  
*Acupurpura*, 17: 3  
*acutimarginatus*, *Conus*, 6: 10  
*adamsii*, *Littorina*, 7: 3  
*adamsii*, *Murex*, 17: 29  
*adansonii*, *Conus*, 6: 32  
*adpersa*, *Fissurella*, 10: 15  
*adpersa*, *Lucapina*, 10: 14  
*adustus*, *Murex*, 17: 34  
*aegis*, *Fissurella*, 10: 15  
*aegis*, *Lucapina*, 10: 15, 18; 18:  
     4, 5  
*agassizii*, *Conus*, 6: 25, 26, 27, 34,  
     35  
*alabaster*, *Murex*, 17: 29  
*alabastrum*, *Murex*, 17: 29, 31  
*alba*, *Cassis*, 16: 12  
*Angled Modulus*, 14: 5  
*Aguayo*, 8: 1  
*aguayoi*, *Diodora*, 11: 11, 3; 18: 6  
*aguayoi*, *Murex*, 17: 15, 13  
*ahenea*, *Littorina*, 7: 23  
*ala avis*, *Paphia*, 3: 5  
*alatus*, *Strombus*, 1: 7, 1, 5  
*albocooportum*, *Cerithium*, 5: 8  
*albovittatum*, *Cerithium*, 5: 8  
*Algaroda*, 7: 1  
*Alphabet*, Florida Chinese, 6: 20  
*alternata*, *Fissurella*, 11: 5, 8, 9  
*alticola*, *Littorina*, 7: 8  
*ambigua*, *Cerithidea*, 5: 3, 4  
*ambiguum*, *Cerithium*, 5: 2, 3, 4  
*Americardia*, 13: 19, 21  
*Amiantis*, 5: 11  
*ammiralis*, *Conus*, 6: 7, 38  
*amphiurgus*, *Conus*, 6: 30  
*Anadonta*, 13: 1  
*anaglypticus*, *Conus*, 6: 13  
*anaglyptus*, *Conus*, 6: 13  
*angasi*, *Murex*, 17: 39  
*angulata*, *Monodonta*, 14: 5  
*angulifera*, *Littorina*, 7: 23, 3, 25,  
     26, 27  
*angulifera*, *Phasianella*, 7: 3, 23  
*angusta*, *Cremides*, 10: 7  
*angusta*, *Fissurella*, 10: 7, 9; 11: 2  
*angustior*, *Littorina*, 7: 15, 17  
*anniae*, *Murex*, 17: 6, 8  
*antillarum*, *Cucullus*, 6: 38  
*antillarum*, *Murex*, 17: 12, 10, 15,  
     17  
*Antillian Cone*, 6: 7  
*antillarum*, *Cardium*, 13: 19  
*antillarum*, *Fissurella*, 10: 6  
*antillarum*, *Trigoniocardia*, 13: 19  
*antoni*, *Littorina*, 4: 4  
*apertum*, *Cardium*, 13: 31  
*apertura*, *Patella Fissurella*, 11: 1  
*Aphrodita*, 13: 28  
*Aphrodite*, 13: 28  
*Aplodon*, 14: 1, 2  
*approximatus*, *Murex*, 17: 29  
*Aranea*, 17: 3  
*arausiensis*, *Conus*, 6: 21  
*archetypus*, *Conus*, 6: 38  
*arctica*, *Littorina*, 7: 18  
*arcticum*, *Cardium*, 13: 15  
*arcuata*, *Diodora*, 11: 17, 3  
*arcuata*, *Fissurella*, 11, 17  
*arenarius*, *Murex*, 17: 34  
*Argo*, 12: 12  
*argo*, *Chicoreus*, 17: 31  
*argo*, *Murex*, 17: 31  
*ariomus*, *Murex*, 17: 39  
*ariomus*, *Pterynotus*, 17: 39  
*armillatus*, *Conus*, 6: 3, 5  
*Artemis*, 3: 4  
*articulatus*, *Murex*, 17: 12  
*aspera*, *Littorina*, 7: 3, 8  
*asperrimus*, *Murex*, 17: 26  
*atlantica*, *Casmaria*, 16: 2  
*atlanticus*, *Ficus*, 18: 2, 3; 2: 2  
*atlanticus*, *Conus*, 6: 20, 2, 16  
*atlantis*, *Bathymurex*, 17: 41  
*atlantis*, *Murex*, 17: 41  
*atlantis*, *Columbarium*, 15: 2  
*aurea*, *Littorina*, 7: 23  
*australis*, *Conus*, 6: 39  
*Bacalia*, 7: 1  
*Bahama Cone*, 6: 23  
*balanoides*, *Fissurella*, 10: 2, 3  
*Balboaina*, 10: 2  
*barathrum*, *Cucullus*, 6: 32  
*barbadensis*, *Conus*, 6: 7  
*barbadensis*, *Cremides*, 10: 6, 2  
*barbadensis*, *Fissurella*, 10: 6, 1,  
     2, 3, 8, 9; 11: 2  
*barbadensis*, *Patella*, 10: 6  
*Barbour*, Thomas, 14: 7  
*barbouri*, *Cremides*, 10: 9  
*barbouri*, *Fissurella*, 10: 9; 11: 2  
*barbudensis*, *Sconsia*, 9: 6; 12: 12  
*bartletti*, *Columbarium*, 15: 3  
*basterotii*, *Littorina*, 7: 2  
*Bathymurex*, 17: 41  
*Batillaria*, 5: 7, 1  
*bavayi*, *Chlamys*, 12: 12  
*beattyi*, *Cerithidea*, 5: 3  
*beauii*, *Murex*, 17: 14, 2, 3  
*beddomei*, *Conus*, 6: 10  
*bellus*, *Murex*, 17: 10  
*Bequaert*, Joseph C., 5: 1; 7: 1  
*bequaerti*, *Murex*, 17: 40  
*bequaerti*, *Pteropurpura*, 17: 40  
*Bermuda Cone*, 6: 35  
*bermudensis*, *Conus*, 6: 34  
*bermudensis*, *Diodora*, 11: 10, 2  
*bermudensis*, *Fissurella*, 10: 4, 6  
*bermudensis*, *Fissuridea*, 11: 10  
*bermudezi*, *Columbarium*, 15: 2  
*Bezoardica*, 16: 5  
*bicincta*, *Cassis*, 9: 3  
*bicolor*, *Fissurella*, 11: 14  
*bilineatus*, *Murex*, 17: 56  
*biradiatum*, *Laevicardium*, 13: 23  
*Bite (of Conus)*, 6: 2

- bituberculata, Strombus, 1: 2, 3  
 boreale, Cardium, 13: 15, 28  
 borsoni, Phorus, 8: 5  
 boubeae, Conus, 6: 10  
 brandaris, Murex, 17: 1  
 brasiliana var.  $\beta$ , Venus, 3: 7  
 brasilianum, Cardium, 13: 22, 24  
 brasilianum, Laevicardium, 13: 24  
 brasiliensis, Conus, 6: 24  
 brasiliensis, Murex, 17: 24  
 breviculus, Conus, 6: 38  
 breviculus, Murex, 17: 51, 52  
 brevifrons, Chicoreus, 17: 28  
 brevifrons, Murex, 17: 28, 32, 34, 56  
 brevispina, Murex, 17: 3  
 bullatum, Solen, 13: 17  
 Burnt Rock Shell, 17: 34  
 burryae, Conus, 6: 29  
 burryi, Murex, 17: 47, 41  
 burryi, Poirieria, 17: 47  
 Burry's Cone, 6: 29  
 cabritti, Murex, 17: 3  
 cabritii, Murex, 17: 3, 6  
 Cabriti's Rock Shell, 17: 4  
 caerulans Conus, 6: 32  
 cailleti, Murex, 17: 17, 21, 22  
 calcitrapa, Murex, 17: 28, 30  
 Callogaza, 12: 5  
 callomarginata, Lucapinella, 10: 18, 20  
 callosa, Amiantis, 5: 11  
 callosa, Cytherea, 5: 11  
 cameo, Cassis, 16: 14  
 campechiense, Cardium, 13: 7  
 canaliculatus, Modulus, 14: 2  
 cancellata, Fissurella, 10: 14, 17  
 cancellata, Lucapina, 10: 15  
 candidus, Conus, 6: 39  
 Capiluna, 11: 1  
 caracanus, Conus, 6: 3  
 carchedonicus, Modulus, 14: 5  
 carchedonius, Modulus, 14: 5, 4  
 carchedonius, Monodonta, 14: 5  
 Cardiidae, 13: 1  
 Cardinal Cone, 6: 6  
 cardinalis, Conus, 6: 5, 37  
 Cardium, 13: 1, 2, 20  
 caribaea, Xenophora, 8: 3  
 caribaeum, Tugurium, 8: 3, 1, 2, 6  
 caribbaeus, Conus, 6: 23, 24  
 carinata, Littorina, 7: 15, 17  
 carinatus, Turbo, 7: 15  
 carinifera, Littorina, 7: 25  
 carnicolor, Murex, 17: 48  
 carnicolor, Murexsul, 17: 48  
 carolae, Ficus, 18: 3, 2  
 carolinensis, Cardium, 13: 9  
 carolinensis, Littorina, 7: 6  
 Carrier Shell, Atlantic, 8: 2  
 Carrier Shell, Caribbean, 8: 3  
 Carrier Shell, Longley's, 8: 6  
 Carrot Cone, 6: 22  
 Casmaria, 16: 1, 2, 5  
 Cassida, 16: 10  
 Cassidaria, 16: 3, 4  
 Cassidea, 16: 2, 5, 10  
 Cassididae, 9: 1, 8  
 Cassids, 16: 1  
 Cassinia, 16: 10  
 Cassis, 16: 10, 1; 12: 11; 14: 8  
 Cassisoma, 16: 10  
 castanea, Littorina, 7: 8, 10  
 catenulatus, Modulus, 14: 6  
 cayenensis, Diodora, 11: 5, 7, 3, 4, 8, 9, 10, 11  
 cayenensis, Fissurella, 11: 5  
 cedonulli, Conus, 6: 6, 7, 39  
 cellulosa, Favartia, 17: 53, 56  
 cellulosa, Murex, 17: 53  
 cellulosa, Ocinebra, 17: 53, 56  
 cellulosus, Favartia, 17: 53  
 cellulosus, Murex, 17: 53, 51, 54, 55, 56  
 Cenchritis, 4: 2  
 centiquadrata, Phalium, 16: 10  
 Centronotus, 17: 42  
 centurio, Conus, 6: 24  
 Centurion Cone, 6: 24  
 ceramidum, Cardium, 13: 20  
 ceramidum, Trigoniocardia, 13: 20  
 Cerastoderma, 13: 12, 1  
 Cerithidea, 5: 1  
 Cerithideopsis, 5: 1  
 Cerithium, 14: 2  
 Challenger, Voyage of, 8: 7, 8; 15: 1  
 characteristicus, Conus, 6: 19  
 Chazalie, 12: 12  
 chazaliei, Drillia, 12: 12  
 chazaliei, Leda, 12: 12  
 chazaliei, Pecten, 12: 12  
 chazaliei, Phos, 12: 12  
 Chicoreus, 17: 28, 32, 49, 50  
 Chinese Alphabet, 6: 19  
 Chinese Hat, 10: 1  
 Chiton, 12: 10  
 ciboney, Murex, 17: 20  
 chrysostoma, Murex, 17: 10  
 cicatricosa, Cassis, 16: 8  
 cicatricosum, Buccinum, 16: 8  
 cicatricosum, Cassis, 16: 9  
 cicatricosum, Phalium, 16: 8, 2  
 cidaris, Conus, 6: 39  
 Cienfuegos, Cuba, 7: 28  
 ciliatum, Cardium, 13: 15  
 ciliatum, Clinocardium, 13: 15, 13  
 cingulata, Littorina, 7: 15  
 cingulifera, Littorina, 7: 27  
 citrinum, Cardium, 13: 22, 23  
 citrinus, Conus, 6: 7, 39; 12: 10  
 citrinus, Murex, 17: 6, 7, 8  
 Cittarium, 12: 6  
 clathratum, Cerithium, 5: 8  
 claudoni, Drillia, 12: 12  
 Clench, William J., 1: 1; 2: 1; 3: 1; 4: 1; 5: 12; 6: 1; 7: 28; 8: 1; 9: 1; 12: 1, 9; 13: 1; 14: 6, 7, 8; 15: 1; 16: 1; 17: 1; 18: 1, 4  
 clenchi, Conus, 18: 4  
 clenchi, Cremides, 10: 11  
 clenchi, Fissurella, 10: 11; 11: 2  
 clerii, Conus, 6: 21  
 Clery's Cone, 6: 21  
 Clinocardium, 13: 1, 15  
 Clypidella, 10: 12  
 Cockle Shells, 13: 1  
 Cockle, Spiny Paper, 13: 17  
 coeruleescens, Conus, 6: 32  
 columba, Aphrodite, 13: 28  
 columba, Hemicardium, 13: 21  
 columba, Conus, 6: 39  
 Columbariidae, 15: 1  
 Columbarium, 15: 1  
 columellaris, Littorina, 7: 11, 12  
 columna, Litorina, 7: 15, 17  
 communis, Littorina, 7: 3  
 concentrica, Dosinia, 3: 2, 4  
 concentrica, Venus, 3: 2  
 concharum, Polydora, 7: 3  
 conchyliophora, Xenophora, 8: 2  
 conchylophorus, Trochus, 8: 1, 2  
 concinnus, Murex, 17: 56  
 Conidae, 6: 1; 15: 1  
 conoidea, Cypraea, 9: 4  
 consors, Trachycardium, 13: 31  
 Conus, 6: 3; 18: 4  
 Conus, Key to, 6: 36, 37, 38  
 convexior, Modulus, 14: 2  
 Coralliophora, 12: 10  
 cornutum, Buccinum, 16: 10  
 coronacivica, Cucullus, 6: 3  
 coronadoi, Cassis, 16: 4  
 coronadoi, Galeodea, 16: 4



- coronatus, Tectarius, 4: 1  
 coronarius, Monodonta, 4: 1  
 corrugatus, Modulus, 14: 2  
 costata, Cerithidea, 5: 2, 3, 4, 5  
 costatum, Cardium, 13: 2  
 costatus, Murex, 17: 24  
 costatus, Strombiformis, 5: 2  
 costatus, Strombus, 1: 9, 11, 12, 15  
 costulata, Littorina, 7: 8  
 crassior, Litorina, 7: 15, 17  
 crassivaricosa, Murex, 17: 29  
 Cremides, 10: 3  
 croceus, Conus, 6: 39  
 Crown Cone, 6: 4  
 crumena, Cassidea, 9: 3  
 crumena, Cypraecassis, 9: 3  
 crusoe, Fissurella, 10: 5  
 cubana, Gaza, 12: 3  
 cubana, Littorina, 7: 15  
 cumingii, Echininus, 4: 4  
 cumingii, Trochus, 4: 3  
 curassaviensis, Conus, 6: 3  
 Cypraea, 12: 10  
 Cypraecassis, 9: 1; 12: 10  
 daedala, Gaza, 12: 2  
 Dalium, 9: 1, 8  
 dalli, Cardium, 13: 5  
 Dallocardia, 13: 7  
 dalmasi, Nuclula, 12: 12  
 danieli, Littorina, 7: 8  
 daucus, Conus, 6: 21, 23, 38, 39;  
 12: 10  
 davidis, Turbo, 7: 8  
 dawsoni, Cardium, 13: 15  
 debilis, Littorina, 7: 15, 17  
 degenerata, Batillaria, 5: 10  
 degeneratum, Cerithium, 5: 10  
 delessertii, Conus, 6: 30, 31  
 delicatus, Murex, 17: 6, 8  
 dennisoni, Morum, 9: 5  
 dennisoni, Oniscia, 9: 5  
 denudatus, Murex, 17: 28  
 despectus, Murex, 17: 32, 34  
 diadema, Fusus, 15: 4  
 Dinocardium, 13: 9, 1  
 Diodora, 11: 1, 2, 20; 18: 4  
 dilatata, Littorina, 4: 2  
 discus, Dosinia, 3: 4, 2  
 dispar, Turbo, 7: 15, 17, 26  
 dominicanus, Conus, 6: 6  
 d'orbignyana, Litorina, 7: 15, 17  
 Dosinia, 3: 1  
 Duck Clam, 13: 27  
 duvali, Conus, 6: 10  
 dysoni, Diodora, 11: 7, 3  
 dysoni, Fissurella, 11: 7  
 eburniferum, Cardium, 13: 3  
 Echinella, 4: 1  
 Echinellopsis, 4: 1  
 Echininus, 4: 3  
 echinophora, Galeodea, 16: 4  
 Echinophoria, 16: 5  
 echinophorum, Buccinum, 16: 3, 4  
 Echinora, 16: 3  
 echinulatus, Conus, 6: 13  
 edentula, Cardium, 13: 28  
 edititia, Fissurella, 10: 6  
 edule, Cardium, 13: 12, 15  
 edule, Cerastoderma, 13: 1, 2  
 Egg Shell Heart Clam, 13: 24  
 egmontianum, Cardium, 13: 4  
 egmontianum, Trachycardium, 13:  
 4, 3  
 elegans, Dosinia, 3: 1, 4  
 elegans, Lucapina, 10: 14, 15  
 elegans, Murex, 17: 17, 19  
 elegantulum, Cardium, 13: 14  
 elegantulum, Cerastoderma, 13:  
 14, 12, 16  
 elongata, Fissurella, 10: 16; 11:  
 15, 16  
 elongata, Lucapina, 10: 16  
 elongatum, Cardium, 13: 5  
 elongatum, Trachycardium, 13: 7  
 elongatus, Murex, 17: 29, 56  
 eolis, Lucapina, 18: 4  
 eques, Conus, 6: 3  
 eriense, Cerithium, 5: 8  
 Ersina, 9: 3  
 Eucallista, 5: 11  
 eurystomus, Murex, 17: 42  
 exarata, Litorina, 7: 11, 12  
 exquisita, Fissurella, 10: 20  
 exutum, Tugurium, 8: 1, 3  
 exutus, Phorus, 8: 3  
 fabricii, Cardium, 13: 28  
 Farfante, Isabel Pérez, 10: 1; 11:  
 1; 17: 1; 18: 4  
 fasciata, Lucapina, 10: 14  
 fascicularis, Clypidella, 10: 13  
 fascicularis, Fissurella, 10: 13;  
 11: 2, 20  
 Fasciculariidae, 15: 1  
 Faurotis, 16: 5  
 Favartia, 17: 51, 50  
 ferrugineum, Cerithium, 5: 9  
 ferugineus, Cucullus, 6: 19  
 Ficula, 18: 1  
 Ficus, 2: 1, 2; 18: 1  
 ficus, Bulla, 18: 1  
 filogyra, Margarita, 12: 5  
 filosus, Trochus, 14: 2  
 Fimbriola, 16: 10  
 fischeri, Gaza, 12: 4  
 Fish Hawk, 14: 6  
 Fissurella, 10: 1, 2; 11: 1, 2, 6, 20  
 Fissurellidae, 10: 1; 11: 1  
 Fissurellus, 10: 1  
 Fissuridea, 11: 1  
 Flame Helmet, 16: 14  
 flammea, Cassidea, 16: 12  
 flammea, Cassis, 16: 12, 1  
 flammea, Littorina, 7: 25  
 flammeum, Buccinum, 16: 12  
 flammeus, Conus, 18: 4  
 flammeus, Cucullus, 6: 32  
 flava, Littorina, 7: 13, 14, 12, 26  
 flavescens, Conus, 6: 22, 15, 25  
 flavescens, Litorina, 7: 23  
 floccosa, Littorina, 7: 15, 17  
 Florida Cone, 6: 27  
 floridana, Dosinia, 3: 2, 3  
 floridanum, Cardium, 13: 4  
 floridanus, Conus, 6: 27, 29, 31, 39  
 floridanus complex, Conus, 6: 25,  
 26  
 floridanus, Modulus, 14: 2, 4  
 floridensis, Conus, 6: 28, 16, 29  
 florifer, Chicoreus, 17: 32  
 florifer, Murex, 17: 32, 34, 31, 35  
 fluviana, Diodora, 11: 18, 3  
 fluviana, Glyphis, 11: 18  
 formosissimum, Columbarium, 15: 4  
 fortior, Pyrula, 2: 2  
 fosteri, Conus, 6: 34  
 Frog Shell (Barbados), 17: 22  
 fulgurans, Nerita, 12: 11  
 fulvescens, Murex, 17: 42  
 fulvescens, Muricanthus, 17: 42  
 fumata, Fissurella, 11: 5  
 furvoides, Conus, 6: 34  
 fusca, Littorina, 7: 21, 22  
 Galeodea, 16: 1, 3, 4  
 Galeodocassis, 16: 10  
 gallus, Strombus, 1: 4, 3, 15  
 Gaza, 12: 1, 2  
 gaza, Jatón, 17: 56  
 gaza, Murex, 17: 56  
 gemmulata, Fissurella, 11: 15  
 gibbum, Buccinum, 16: 6  
 gigantea, Callista, 3: 5  
 gigantea, Macrocallista, 3: 5  
 gigantea, Venus, 3: 5  
 gigas, Strombus, 1: 12, 1, 2, 11,  
 15; 16: 1

- glabrata, Melarapne, 7: 2  
 glabratum, Cardium, 13: 22, 24  
 glaucocincta, Littorina, 7: 15, 17  
 glaucum, Buccinum, 16: 5  
 globosa, Murex, 17: 26  
 globulus, Cassis, 16: 6  
 Glyphis, 11: 1  
 goliath, Strombus, 1: 13, 15  
 Goniogalea, 16: 10  
 gossei, Cardium, 13: 7  
 gracilis, Aranea, 17: 3  
 gracilis, Conus, 6: 39  
 graeca, Diodora, 10: 13; 11: 1  
 graniferum, Cardium, 13: 18  
 Granulated Cone, 6: 18  
 granulatum, Buccinum, 16: 6  
 granulatum, Phalium, 16: 6, 9, 10  
 granulatum, Semicassis, 16: 6  
 granulatus, Conus, 6: 18; 12: 10  
 granulosa, Cassis, 16: 6  
 granulosum, Phalium, 16: 5, 6  
 grayi, Scensia, 9: 6  
 greenwayae, Oliva, 14: 8  
 grenadensis, Conus, 6: 3  
 groenlandica, Litorina, 7: 8, 10  
 groenlandicum, Cardium, 13: 28  
 groenlandicus, Serripes, 13: 28  
 Gualtieri, Nicholas, 12: 11  
 Guantánamo Bay, 12: 10  
 gundlachi, Litorina, 7: 21, 22  
 gundlachi, Murex, 17: 12  
 guppyi, Cardium, 13: 19  
 guttata, Litorina, 7: 19, 20, 21  
 Haliphoebus, 8: 1  
 hanleyana, Cerithidea, 5: 6  
 hanleyi, Cerithium, 5: 5, 6  
 Haplodon, 14: 1  
 harrassowitzi, Diodora, 11: 9, 3  
 harrassowitzi, Lucapina, 11: 9  
 hassleri, Lucapinella, 10: 20  
 Haustellum, 17: 58  
 hayesii, Cardium, 13: 15  
 Heart Clams, 13: 1, 24  
 hedleyi, Columbarium, 15: 4  
 Helmet Shells, 9: 2; 16: 6, 9, 12,  
 14  
 henseli, Fissurella, 10: 20  
 henseli, Lucapinella, 10: 20  
 heteroclytes, Cerithium, 5: 8  
 hiatus, Cardium, 13: 16, 17  
 hiatus, Papyridea, 13: 17, 16  
 hidalgoi, Chicoreus, 17: 50  
 hidalgoi, Littorina, 7: 19, 21  
 hidalgoi, Murex, 17: 50, 2  
 hidalgoi, Murexiella, 17: 50  
 hiulcum, Cardium, 13: 17  
 hondurasensis, Fissurella, 10: 17  
 hoplites, Murex, 17: 43  
 horridus, Strombus, 1: 12, 13  
 howelli, Ficus, 2: 2; 18: 1, 3  
 hystricina, Murex, 17: 45  
 hystricinus, Murex, 17: 45, 47, 41  
 hystricinus, Phyllonotus, 17: 45  
 hystricinus, Poirieria, 17: 45  
 humilis, Murex, 17: 52  
 imbricatus, Chicoreus, 12: 12  
 imbricatus, Murex, 12: 12; 17: 31  
 imperialis, Murex, 17: 26  
 incarnata, Litorina, 7: 8  
 inermis, Strombus, 1: 9, 10  
 inflata, Cassis, 16: 7  
 inflatum, Buccinum, 16: 6  
 informis, Conus, 6: 32  
 insularis, Conus, 6: 3  
 intensa, Fissurella, 10: 6  
 interrupta, Litorina, 7: 15  
 iostomus, Potamides, 5: 1, 4  
 irrorata, Littorina, 7: 6, 2, 11, 13,  
 14, 25, 26  
 irroratus, Turbo, 7: 6, 7  
 islandica, Venus, 13: 28  
 islandicum, Cardium, 13: 15  
 isocardia, Cardium, 13: 2, 3, 4  
 isocardia, Trachycardium, 13: 3,  
 5, 6, 31  
 Isonema, 7: 1  
 itapema, Lucapina, 10: 9  
 jamaicensis, Conus, 6: 7  
 jamaicensis, Littorina, 7: 15  
 jamaicensis, Murex, 17: 54, 55  
 jamaicensis, Patella, 10: 4  
 japonica, Cassis, 16: 5  
 japonicus, Conus, 6: 16  
 Jasper Cone, 6: 11  
 jaspideus, Conus, 6: 10, 14  
 jaumei, Diodora, 11: 11, 3  
 Johnsonia, Description of, 1: 16  
 jousseamei, Drillia, 12: 12  
 jugosus, Turbo, 7: 8, 10  
 juliae, Conus, 6: 26  
 Key to Conus, 6: 36  
 Key to Diodora, 11: 2  
 Key to Fissurella, 11: 2  
 Key to Gaza, 12: 6  
 Key to Littorina, 7: 25  
 Key to Phalium, 16: 5  
 Key to Strombus, 1: 15  
 Key to Xenophoridae, 8: 1  
 krebsii, Modulus, 14: 2  
 kugleri, Murex, 17: 19  
 lactea, Cassis, 16: 8, 9  
 Lacuna, 7: 3  
 Laevicardium, 13: 22, 1  
 laevigata, Cassis, 16: 6  
 laevigata, Xenophora, 8: 2  
 laevigatum, Cardium, 13: 22, 23  
 laevigatum, Laevicardium, 13: 22,  
 26, 27, 32  
 lafondii, Cerithium, 5: 2  
 lamarekii, Cardium, 13: 22  
 lamarekii, Morum, 9: 5  
 lamarekii, Oniscis, 9: 5  
 Lambidium, 9: 3  
 Lampanella, 5: 7  
 Lampania, 5: 7  
 largillardii, Conus, 6: 16  
 largillierti, Conus, 6: 16; 18: 4  
 Largilliert's Cone, 6: 16  
 larva, Fissurella, 11: 5  
 latissimus, Strombus, 1: 14  
 latuca, Ulva, 7: 5  
 lavalleanum, Cerithium, 5: 4  
 lenticularis, Trochus, 14: 2  
 lentiginosa, Fissurella, 10: 14  
 leoninus, Conus, 6: 19  
 leucostictus, Conus, 6: 3, 5  
 leucosticus, Conus, 6: 3, 5  
 leucostomum, Cardium, 13: 5  
 levicula, Favartia, 17: 56  
 levicula, Ocinebra, 17: 56  
 levicula, Tritonalia, 17: 56  
 leviculus, Murex, 17: 56  
 Liguus, 12: 11  
 Lima, 12: 10  
 limatula, Fissurella, 10: 19  
 limatula, Fissurellidea, 10: 19  
 limatula, Lucapinella, 10: 19, 20  
 Limpets, Keyhole, 10: 1; 11: 1  
 lineata, Litorina, 7: 23  
 lineata, Littorina, 7: 15  
 lineata, Phasianella, 7: 13, 15  
 lineatum, Buccinum, 7: 13, 15  
 lineatum, Cardium, 13: 22  
 lineolata, Littorina, 7: 15, 17  
 lineolata, Melania, 5: 1  
 lineolatus, Strombus, 5: 1  
 Liocardium, 13: 22  
 listeri, Diodora, 11: 3, 2, 13  
 listeri, Fissurella, 11: 3  
 lithophorus, Trochus, 8: 2  
 Lithorina, 7: 2  
 litorea, Litorina, 7: 3  
 Litorina, 7: 1, 14  
 Litorinna, 7: 2  
 Litormia, 7: 2

- litterata, *Littorina*, 7: 3  
 litteratus, *Conus*, 6: 3  
 Little Frog Cone, 6: 33  
 littoralis, *Littorina*, 7: 19  
 littoralis, *Nerita*, 7: 2, 18, 19  
 littoralis, *Neritoides*, 7: 2  
 Littoraria, 7: 3  
 littorea, *Littorina*, 7: 3, 2, 5, 25, 26, 27  
 littoreus, *Littorina*, 7: 1  
 littoreus, *Turbo*, 7: 2, 3  
*Littorina*, Key to, 7: 25  
*Littorina*, 7: 1, 2  
 Littorine, 7: 1  
 Littorinidae, 7: 1  
 Littorinopsis, 7: 3  
 Littorivaga, 7: 2  
 Littornia, 7: 2  
 Littorrina, 7: 2  
 Livona, 12: 1, 6, 8  
 Livonia, 12: 6  
 longleyi, *Trochotugurium*, 8: 5  
 longleyi, *Tugurium*, 8: 5, 1, 2, 3  
 longleyi, *Xenophora*, 8: 5  
 lorenzianus, *Conus*, 18: 4  
 lubeckianus, *Conus*, 6: 7  
 Lucapina, 10: 1, 14, 17; 11: 6; 18: 4  
 Lucapinella, 10: 1, 18  
 lucrativa, *Xenophora*, 16: 8, 9  
 lunata, *Littorina*, 7: 6, 7  
 luteus, *Conus*, 6: 21  
 lymani, *Conus*, 6: 35  
 macerwinii, *Littorina*, 7: 8  
 macgintyi, *Favartia*, 17: 52  
 macgintyi, *Murex*, 17: 52, 51, 54  
 macgintyi, *Tritonalia*, 17: 52  
 Macrocallista, 3: 5, 6; 5: 11  
 macropterus, *Murex*, 17: 39, 40  
 macropterus, *Pteronotus*, 17: 40  
 maculata, *Macrocallista*, 3: 6  
 maculata, *Venus*, 3: 6  
 maculatum, *Cardium*, 13: 9  
 maculiferus, *Conus*, 6: 5, 39  
 madagascariensis, *Cassis*, 16: 14, 12, 15, 16  
 magellanicus, *Conus*, 6: 7  
 magnum, *Acrosterigma*, 13: 5  
 magnum, *Cardium*, 13: 5, 9, 11  
 magnum, *Trachycardium*, 13: 5, 8, 10  
 malum, *Cassis*, 16: 6  
 mamillaris, *Conus*, 6: 21  
 marcoensis, *Murex*, 17: 6, 8  
 marmoreum, *Cardium*, 13: 5  
 martinicanus, *Conus*, 6: 3  
 mauritiana, *Littorina*, 7: 15, 27  
 mazei, *Conus*, 6: 17, 35  
 Maze's Cone, 6: 17  
 medium, *Americardia*, 13: 21  
 medium, *Cardium*, 13: 21  
 medium, *Trigoniocardia*, 13: 21  
 megacerus, *Murex*, 17: 28, 31  
 Melanoraphe, 7: 2  
 Melarapha, 7: 2  
 Melaraphe, 7: 2  
 Melaraphis, 7: 2  
 Melarophe, 7: 2  
 Melarpha, 7: 2  
 Melarraphe, 7: 2  
 Meleagris, 12: 6  
 meleagris, *Littorina*, 7: 19, 2, 25, 26  
 meleagris, *Phasianella*, 7: 19, 21  
 meleagus, *Littorina*, 7: 19  
 Melongena, 12: 11  
 melvilli, *Conus*, 6: 31, 32  
 mespillum, *Helix*, 7: 21  
 mespillum, *Littorina*, 7: 21, 3, 25, 26  
 mespilum, *Littorina*, 7: 21  
 messorius, *Murex*, 17: 6, 8  
 meta, *Diodora*, 11: 13, 2  
 meta, *Lucapina*, 11: 13  
 metcalfi, *Diodora*, 11: 8  
 mexicanus, *Murex*, 17: 26  
 Microcardium, 13: 1, 29  
 microphyllus, *Murex*, 17: 29, 56  
 microsticta, *Diodora*, 11: 7  
 minima, *Batillaria*, 5: 7  
 minima, *Littorina*, 7: 21, 22  
 minimus, *Murex*, 5: 7  
 minimus, *Turbo*, 7: 21  
 minor, *Drillia*, 12: 12  
 minor, *Littorina*, 7: 11  
 minuta, *Diodora*, 11: 15, 2, 16, 17  
 minuta, *Fissurella*, 11: 15  
 minutus, *Conus*, 6: 7  
 Modolus, 14: 2  
 Modulidae, 14: 1  
 Modulus, 14: 1, 2, 4, 6  
 modulus, *Modulus*, 14: 2  
 modulus, *Monodonta*, 14: 2  
 modulus, *Trochus*, 14: 2  
 Morio, 16: 3  
 mortoni, *Cardium*, 13: 27  
 mortoni, *Laevicardium*, 13: 27, 22  
 Morum, 9: 1, 3  
 motacilla, *Murex*, 17: 21, 12, 17  
 Mouse Cone, 6: 8  
 multilineatum, *Cardium*, 13: 22, 24  
 multiradiata, *Venus*, 3: 5  
 Murex, 12: 11; 17: 1, 2, 3, 24, 52, 56  
 Murexiella, 17: 49, 50  
 Murexsul, 17: 47, 49  
 Muricantha, 17: 42  
 Muricanthus, 17: 42  
 muricatum, *Cardium*, 13: 7  
 muricatum, *Dallocardia*, 13: 7  
 muricatum, *Trachycardium*, 13: 7, 6  
 muricatus, *Littorina*, 7: 1  
 muricatus, *Tectarius*, 4: 1  
 muricatus, *Trochus*, 4: 1  
 Muricidae, 17: 1; 15: 1  
 mus, *Conus*, 6: 7  
 mutabile, *Cerithium*, 5: 10  
 nanus, *Strombus*, 18: 1  
 Naquetia, 17: 24  
 narcissus, *Conus*, 6: 32  
 narcoensis, *Murex*, 17: 6  
 natalense, *Columbarium*, 15: 4  
 naticoides, *Littorina*, 7: 21, 22  
 nebulosa, *Littorina*, 7: 11, 2, 13, 14, 15, 25, 26, 27  
 nebulosa, *Phasianella*, 7: 11  
 nebulosus, *Conus*, 6: 3, 4  
 Nerita, 12: 10  
 Neritoides, 7: 2  
 neritoides, *Littorina*, 7: 18  
 neritoides, *Turbo*, 7: 2, 18  
 Neritrema, 7: 2  
 Neritrotrema, 7: 2  
 nicaraguensis, *Strombus*, 1: 8, 2, 6, 15  
 nigrescens, *Cerithium*, 5: 8  
 nigrescens, *Murex*, 17: 9  
 nigrolineata, *Littorina*, 7: 8  
 niloticus, *Trochus*, 12: 1  
 nimbosa, *Fissurella*, 10: 2; 11: 2  
 nimbosa, *Macrocallista*, 3: 5  
 nimbosa, *Patella*, 10: 2  
 nimbosa, *Venus*, 3: 5  
 Nina, 4: 3  
 nodatus, *Murex*, 17: 12, 14  
 nodiferus, *Conus*, 6: 13  
 Nodilittorina, 4: 3  
 nodosa, *Cremides*, 10: 3, 2  
 nodosa, *Fissurella*, 10: 3, 2; 11: 2  
 nodosum, *Aplodon*, 14: 1, 2  
 nodulosus, *Echininus*, 4: 4, 3  
 nodulosa, *Littorina*, 4: 4  
 nodulosus, *Trochus*, 4: 2

- nuceus, Murex, 17: 54, 56  
 nuttallii, Cardium, 13: 15  
 nuttingi, Murex, 17: 49  
 nuttingi, Murexsul, 17: 49  
 obligatus, Turbo, 7: 8, 10  
 oblongum, Cardium, 13: 22  
 obtusata, Littorina, 7: 18, 3, 25, 26, 27  
 obtusatus, Littorina, 7: 1  
 obtusatus, Turbo, 7: 2, 18, 19  
 obtusum, Cerithium, 5: 1  
 ochraceus, Conus, 6: 19  
 octogonus, Murex, 17: 47  
 oculatus, Murex, 17: 26  
 Oniscia, 9: 3  
 Oniscidia, 9: 3  
 oniscus, Morum, 9: 4, 1  
 oniscus, Strombus, 9: 3, 4  
 Onustus, 8: 1  
 onustus, Phorus, 8: 2  
 Operculum in Murex, 17: 57  
 orbignyana, Littorina, 7: 15  
 orbignyi, Conus, 6: 17  
 ornatus, Conus, 6: 5  
 Otus, 18: 1  
 oviputamen, Cardium, 13: 22  
 pagoda, Columbarium, 15: 4  
 pagoda, Fusus, 15: 4  
 pagodoides, Columbarium, 15: 4  
 pagodoïdes, Colus, 15: 4  
 pagodoïdes, Fusus, 15: 4  
 pagodoides, Fusus, 15: 4  
 pagodus, Fusus, 15: 1  
 palliata, Littorina, 7: 19  
 palliatus, Turbo, 7: 18, 19  
 Paludina, 7: 1  
 Paludinae, 7: 1  
 Panope, 13: 1  
 papilionaceus, Conus, 6: 38  
 papillosum, Cardium, 13: 31  
 papillosus, Conus, 6: 13  
 papyratia, Pyrula, 2: 2  
 papyratus, Ficus, 2: 2; 18: 3  
 Papyridea, 13: 1, 16  
 patagonica, Cytherea, 3: 2, 3  
 patagonica, Diodora, 11: 8, 2  
 patagonica, Fissurella, 11: 8  
 pazi, Murex, 17: 44, 41, 43, 47  
 pazi, Phyllonotus, 17: 44  
 pazi, Poirieria, 17: 44  
 Paziella, 17: 43  
 pealii, Conus, 6: 10, 11, 39  
 peconica, Littorina, 7: 18, 19  
 peculiaris, Strombus, 1: 5, 7  
 peloritanum, Cerithium, 5: 8  
 peramabile, Cardium, 13: 29  
 peramabile, Microcardium, 13: 29  
 peramabilis, Cardium, 13: 29  
 peramabilis, Fulvia, 13: 29  
 peristephes, Semicassis, 16: 8, 9  
 Periwinkle, 7: 1  
 periwinkle, Mangrove, 7: 24  
 periwinkle, Spiny, 4: 1, 2  
 perlatus, Trochus, 14: 2  
 perryae, Conus, 6: 31  
 Perry's Cone, 6: 32  
 pertusus, Conus, 6: 38  
 petitianum, Cardium, 13: 18  
 petitii, Cerithium, 5: 2  
 pfeifferianus, Litorina, 4: 4  
 pfeifferianus, Tectarius, 4: 4  
 Phalium, 16: 5, 1, 2  
 phaneus, Murex, 17: 37  
 phaneus, Pteronotus, 17: 37  
 phaneus, Pterynotus, 17: 37  
 philippi, Venus, 3: 2  
 philippiana, Diodora, 10: 16  
 philippiana, Lucapina, 10: 16, 18  
 Phoenicopterus, 5: 9  
 Phorus, 8: 1  
 Phyllonotus, 17: 26  
 pica, Cittarium, 12: 6  
 pica, Livona, 12: 6, 8  
 pica, Trochus, 12: 8  
 pica, Turbo, 12: 6  
 picoides, Livona, 12: 6  
 picoides, Trochus, 12: 6, 9  
 picta, Fissurella, 10: 2  
 pictum, Cardium, 13: 25, 31  
 pictum, Laevicardium, 13: 25, 22, 26  
 pictum, Liocardium, 13: 25  
 picus, Meleagris, 12: 6  
 Pigmy Cone, 6: 12  
 pinnatus, Murex, 17: 35  
 pinnatus, Pteronotus, 17: 35  
 pinnulatum, Cardium, 13: 12  
 pinnulatum, Cerastoderma, 13: 12, 15, 16  
 Pirate Cone, 6: 14  
 piraticus, Conus, 6: 14  
 Pirula, 2: 1; 18: 1  
 pisum, Modulus, 14: 2  
 Planaxis, 12: 10  
 Plesioniscia, 9: 3  
 plicatum, Buccinum, 9: 3  
 pliculosa, Cerithidea, 5: 4  
 pliculosum, Cerithium, 5: 4  
 Poirieria, 17: 43, 41, 47  
 pomiformis, Murex, 17: 26  
 pomum, Murex, 17: 26  
 pomum, Phyllonotus, 17: 26  
 porphyrozonias, Patella, 10: 6  
 portoricanus, Conus, 6: 32  
 Potamididae, 5: 1, 11  
 praefectus, Conus, 6: 39  
 Prickly Cardium, 13: 3, 5  
 Prickly-winkle, Common, 4: 3  
 Prickly-winkle, False, 4: 4  
 proteus, Conus, 6: 20  
 proteus var.  $\beta$ , Conus, 6: 19  
 protractus, Serripes, 13, 28  
 Pseudotrochus, 14: 2  
 Pteronotus, 17: 35, 36  
 Pteropurpura, 17: 39  
 Pterynotus, 17: 35, 36, 37  
 pubescens, Cardium, 13: 15  
 pudicus, Murex, 17: 56  
 pudoricolor, Murex, 17: 29  
 puertoricanus, Conus, 6: 32  
 pugilis, Strombus, 1: 5, 1, 15  
 pulhella, Littorina, 7: 3  
 pulcher, Murex, 17: 23  
 pulhira, Littorina, 7: 3  
 pulhira, Littoraria, 7: 3  
 pulicarius, Conus, 6: 1  
 punctata, Clypidella, 10: 12  
 punctata, Fissurella, 10: 12; 11: 2, 20  
 punctata, Littorina, 7: 19, 20, 21, 23  
 punctata, Phasianella, 7: 19  
 punctatus, Turbo, 7: 19, 23  
 puncticulatus, Conus, 6: 13  
 pupoidea, Cerithidea, 5: 2  
 Purple, Tyrian, 17: 1  
 purpurascens, Chione, 3: 7  
 purpurata, Amiantis, 3: 7; 5: 11  
 purpurata, Cytherea, 3: 7  
 purpuratus, Murex, 17: 29  
 purpureum, Morum, 9: 3, 4  
 pusilla, Litorina, 7: 15, 16, 17  
 pusilla, Littorina, 7: 15  
 pusio, Conus, 6: 10  
 pustula, Clypidella, 10: 12  
 pustula, Fissurella, 10: 12  
 pustula, Fissurellidea, 10: 12  
 pustula, Patella, 10: 12, 13  
 pustulata, Clypidella, 10: 12  
 pustulata, Fissurella, 10: 12  
 pygmaeus, Conus, 6: 12  
 pygmaeus, Murex, 17: 36, 38  
 pygmaeus, Pteronotus, 17: 36  
 pygmaeus, Pterynotus, 17: 36  
 Pyrula, 2: 1; 18: 1

- quadratus, *Cucullus*, 6: 19  
 quercinus, *Conus*, 6: 1  
 radiale, *Columbarium*, 15: 4  
 radialis, *Fusus*, 15: 4  
 radiata, *Fissurella*, 10: 9, 11  
 radiata, *Maetra*, 13: 28  
 radiatum, *Cardium*, 13: 28  
 radix, *Murex*, 17: 42  
 ramosus, *Chicoreus*, 17: 28  
 ramosus, *Murex*, 17: 28  
 raninus, *Strombus*, 1: 2, 15  
 ranunculus, *Conus*, 6: 32; 12: 10  
 rattus, *Conus*, 6: 39  
 rawsoni, *Batillaria*, 5: 10  
 rawsoni, *Cerithium*, 5: 10  
 rawsoni, *Pyrazus*, 5: 10  
 recurvirostris, *Murex*, 17: 6, 8, 9, 10  
 recurvirostrum, *Buccinum*, 16: 8, 9  
 recurvirostrum, *Cassis*, 16: 8, 9  
 regius, *Conus*, 6: 3, 5, 6, 38, 39; 12: 10  
 regulare, *Cardium*, 13: 31  
 reticulata, *Pyruca*, 2: 2  
 Review Number, 18: 1  
 Rhizophora Mangle, 7: 25  
 riisei, *Littorina*, 7: 15, 17  
 ringiculum, *Cardium*, 13: 18  
 robustum, *Cardium*, 13: 9  
 robustum, *Dinocardium*, 13: 9  
 Rock Shells, 17: 1, 4, 8, 12, 13, 25, 34, 35  
 rodochroa, *Drillia*, 12: 12  
 rosea, *Cremides*, 10: 9  
 rosea, *Fissurella*, 10: 9; 11: 2  
 rosea, *Patella*, 10: 9  
 roseo-tinctus, *Conus*, 6: 30  
 roseus, *Conus*, 6: 5  
 rotundata, *Cassis*, 16: 11  
 rubidum, *Murex*, 17: 6  
 rubidus, *Murex*, 17: 6, 4, 10, 12  
 rubra, *Litorina*, 7: 23  
 rubra, *Littorina*, 7: 23  
 rudis, *Turbo*, 7: 8, 10  
 rufus, *Murex*, 17: 32  
 rugatum, *Cardium*, 13: 31  
 salleanus, *Murex*, 17: 32, 34  
 salmacidum, *Cerithium*, 5: 2  
 samba, *Strombus*, 1: 10, 15; 14: 8  
 sanguinolentus, *Conus*, 6: 39  
 Santa Barbara de Samaná, Santo Domingo, 5: 12  
 sarissophorum, *Columbarium*, 15: 1, 2  
 sarissophorus, *Fusus*, 15: 1  
 sayii, *Monodonta*, 14: 5  
 saxatilis, *Littorina*, 7: 8, 2, 4, 25, 26, 27  
 saxatilis, *Turbo*, 7: 8  
 sayi, *Diodora*, 11: 8, 2  
 sayi, *Littorina*, 7: 6, 11, 12  
 scabra, *Helix*, 7: 23  
 scabra, *Litorina*, 4: 4  
 scabra, *Littorina*, 7: 3, 11, 15, 23, 24, 25  
 scalariformis, *Cerithidea*, 5: 6  
 scalariformis, *Pirena*, 5: 6  
 schramnii, *Fissurella*, 10: 7, 8  
 Seonsia, 9: 1, 6; 16: 4  
 Scotch Bonnet (Florida), 16: 6  
 sculpta, *Fissurella*, 10: 9, 11  
 Semicassis, 16: 5, 6  
 semisulcatum, *Cardium*, 13: 18  
 semisulcatum, *Papyridea*, 13: 18, 16  
 senegalensis, *Murex*, 17: 24, 41  
 senegalensis, *Siratus*, 17: 24  
 sepa, *Cassis*, 16: 6  
 septemstriatum, *Cerithium*, 5: 8  
 septemstriata, *Nassa*, 5: 8  
 serratum, *Laevicardium*, 13: 22, 23  
 Serripes, 13: 1, 28  
 similis, *Murex*, 17: 19  
 simplex, *Acmaea*, 12: 8  
 simplex, *Littorina*, 7: 8  
 sirat, *Murex*, 17: 24  
 sirat, *Purpura*, 17: 24  
 Siratus, 17: 24, 41  
 sitchana, *Litorina*, 7: 2, 10, 27  
 sitkana, *Littorina*, 7: 2  
 Smith, Lillian Cassett, 13: 1  
 solaris *Haliphoebus*, 8: 1  
 soleniforme, *Cardium*, 13: 16, 17  
 solidum, *Dalium*, 9: 8, 1  
 sombrerito, *Chino*, 10: 1  
 sowerbii, *Foraminella*, 10: 14  
 sowerbii, *Lucapina*, 10: 14, 16, 18  
 sozoni, *Conus*, 6: 30, 28, 29  
 Sozon's Cone, 6: 31  
 speciosissimus, *Conus*, 6: 5  
 spectrum, *Murex*, 17: 56  
 spinella, *Cassis*, 16: 15, 1  
 spinicincta, *Columbarium*, 15: 1, 4  
 spinicincta, *Pleurotoma*, 15: 1, 4  
 spinicinctum, *Columbarium*, 15: 4  
 spinicosta, *Murex*, 17: 42  
 spinicostata, *Murex*, 17: 42  
 spinosa, *Patella*, 10: 4  
 spinosum, *Cardium*, 13: 17  
 spurius, *Conus*, 6: 19, 20  
 squalida, *Littorina*, 7: 5  
 squamosum, *Cardium*, 13: 31  
 Stearns' Cone, 6: 9  
 stearnsii, *Conus*, 6: 9, 11  
 sticticus, *Conus*, 6: 13  
 stimpsoni, *Conus*, 6: 15  
 Stimpson's Cone, 6: 15  
 striata, *Cassidaria*, 9: 6; 16: 3  
 striata, *Seonsia*, 9: 6; 16: 2  
 striatum, *Buccinum*, 16: 11  
 striatum, *Cricostoma*, 14: 2  
 striatus, *Conus*, 6: 2  
 striatus, *Turbo*, 7: 23  
 strigata, *Litorina*, 7: 23  
 strigata, *Littorina*, 7: 23  
 Striped Florida Cone, 6: 29  
 strombiformis, *Oniscia*, 9: 5  
 Strombus, 1: 1; 12: 11; 14: 8; 18: 1  
 subangulata, *Littorina*, 7: 23  
 subangulata, *Phasianella*, 7: 3  
 subcarinatus, *Conus*, 6: 30  
 subelongatum, *Cardium*, 13: 5  
 subrostrata, *Fissurella*, 11: 20  
 suffusa, *Fissurella*, 10: 17  
 suffusa, *Lucapina*, 10: 17, 15, 18; 18: 6  
 sulcata, *Phasianella*, 7: 6, 7  
 superba, *Callogaza*, 12: 2  
 superba, *Gaza*, 12: 2  
 surinamensis, *Conus*, 6: 6  
 sybariticum, *Laevicardium*, 13: 26, 22  
 Sycotypus, 18: 1  
 Syctopus, 18: 1  
 Syctyphus, 18: 1  
 syriacus, *Cucullus*, 6: 19  
 tanneri, *Diodora*, 11: 19, 2  
 tasmanica, *Ethalia*, 14: 2  
 Tectarius, 4: 1, 4; 12: 10  
 Tectininus, 4: 4  
 Tegula, 12: 10  
 tenebrosus, *Turbo*, 7: 8, 10  
 tenuis, *Potamides*, 5: 6, 7  
 tenuispina, *Murex*, 17: 3  
 ternispina, *Murex*, 17: 56  
 tessellata, *Cassis*, 16: 6  
 tessellata, *Litorina*, 7: 13  
 tessellata, *Littorina*, 7: 13, 8, 15  
 tessellatum, *Cassis*, 16: 6  
 testiculus, *Buccinum*, 9: 1  
 testiculus, *Cassis*, 9: 3  
 testiculus, *Cypraecassis*, 9: 1  
 testudinarius, *Conus*, 6: 32, 33  
 Thais, 12: 10; 17: 1

- thiarella, Litorina, 4: 2  
 tigrina, Littorina, 7: 11, 12  
 tinctum, Cardium, 13: 30  
 tinctum, Microcardium, 13: 30  
 tobagoensis, Lucapina, 18: 5  
 Top-Shell, West Indian, 12: 8  
 Torvamurex, 17: 28  
 toupiollei, Murex, 17: 29  
 trabeatum, Columbarium, 15: 4  
 Trachycardium, 13: 1, 2, 5  
 tribulus, Murex, 17: 2, 3  
 Trigonocardia, 13: 1, 18, 19  
 trigonulus, Murex, 17: 23  
 trilineatus, Murex, 17: 17, 19, 56  
 trinitarius, Conus, 6: 3  
 Triplex, 17: 28  
 triseriata, Oniscis, 9: 4  
 tristichus, Murex, 17: 36, 37, 38  
 tristichus, Pteronotus, 17: 36  
 tristichus, Pterynotus, 17: 36  
 Tritonalia, 17: 51, 52  
 Trochidae, 12: 1  
 trochiformis, Modulus, 14: 6  
 trochiformis, Turbo, 4: 2; 8: 2  
 trochiformis, Xenophora, 8: 2, 1  
 Trochotugurium, 8: 5  
 Trochus, 7: 1  
 trunculus, Murex, 17: 1  
 tryoni, Murex, 17: 5, 4  
 tryoni, Tribulus, 17: 5  
 tuberculata, Litorina, 4: 2  
 tuberculatus, Tectarius, 4: 2  
 tuberculatus, Turbo, 4: 2  
 tuberculosa, Echinora, 16: 3  
 tuberculosa, Oniscia, 9: 5  
 tuberculosum, Morum, 9: 5  
 tuberosa, Cassidea, 16: 11  
 tuberosa, Cassis, 16: 11, 1  
 tuberosum, Buccinum, 16: 11  
 Tubicauda, 17: 3  
 Tugurium, 8: 1, 3  
 turbinatus, Murex, 17: 42  
 Turbinopsis, 14: 1  
 turneri, Aquilonaria, 7: 3  
 turrita, Cerithidea, 5: 3  
 Turtle Cone, 6: 33  
 Tylocassis, 16: 6, 5, 9  
 Tyrian Purple, 17: 1  
 undulata, Littorina, 7: 13  
 undulatum, Buccinum, 16: 10  
 unidens, Trochilus, 14: 2  
 vanhyningi, Conus, 18: 4  
 vanhyningi, Dinocardium, 13: 11, 2, 10  
 variabile, Cerithium, 5: 9  
 varicosa, Cerithidea, 5: 4  
 varicosum, Cerithium, 5: 4  
 variegata, Diodora, 11: 16, 17  
 variegata, Fissurella, 11: 16  
 Vasum, 12: 11  
 ventricosum, Cardium, 13: 9, 11  
 venustum, Cardium, 13: 21, 32  
 venulatus, Conus, 6: 39  
 veracruzensis, Cerithidea, 5: 5  
 verrucosus, Conus, 6: 13, 11; 18: 4  
 verulosus, Conus, 6: 18  
 versicolor, Polymita, 12: 11  
 versluysi, Tellina, 12: 12  
 vestita, Turbo, 7: 8, 10  
 vetellinum, Cardium, 13: 22  
 vibex, Buccinum, 16: 2  
 vibex, Casmaria, 16: 2  
 villepini, Conus, 6: 25, 21, 34, 35  
 Villepin's Cone, 6: 25  
 viminea, Fissurella, 11: 5  
 viridula, Diodora, 11: 14, 3  
 viridula, Fissurella, 11: 14  
 Warty Cone, 6: 14  
 watsoni, Callogaza, 12: 5, 6  
 watsoni, Gaza, 12: 5, 6  
 wetmorei, Diodora, 18: 6  
 Whiteaves, 12: 9  
 Wood-louse, Atlantic, 9: 5  
 woodringi, Murex, 17: 9  
 xanthostoma, Morum, 9: 5  
 Xenophora, 8: 1  
 Xenophoridae, 8: 1  
 zelandicus, Murex, 17: 43, 44, 45  
 ziczac, Littorina, 7: 14, 2, 13, 15, 17, 25, 26, 27  
 ziczac, Trochus, 7: 14, 17  
 zic-zak, Littorina, 7: 14  
 zigzag, Littorina, 7: 14  
 zigzag, Littorina, 7: 14  
 zonale, Cerithium, 5: 7  
 Zostera, 7: 5











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