

STUDIES ON THE FAUNA OF CURAÇAO AND OTHER  
CARIBBEAN ISLANDS: No. 68.

SYSTEMATICS AND DISTRIBUTION OF  
SIPHOCYPRAEA MUS AND  
PROPUSTULARIA SURINAMENSIS  
(Gastropoda, Cypraeidae)

by

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There are six living species of Cypraeidae in the West Indies. Three of them are common throughout the whole area: *Erosaria spurca acicularis* (Gmelin), *Luria cinerea* (Gmelin) and *Trona zebra* (Linné). *Trona cervus* (Linné) has been found only in the northern part of the Caribbean: Florida, Bermuda, the Greater Antilles and the Virgin Islands. (This distribution proves that it is unlikely that the species is only the female form of *Trona zebra*, as has been suggested by WARMKE & ABBOTT 1961, p. 92.) One species, *Siphocypraea mus* (Linné), is rare; it lives on the coast of Colombia and Venezuela, and is said to be found on the island of Curaçao. *Propustularia surinamensis* (Perry) is very rare, and was only known from nineteenth century records, from Dutch Guiana and some islands of the Lesser Antilles, including Curaçao. Recently one specimen was collected in Aruba.

SYSTEMATICS OF *Siphocypraea* (*Akleistostoma*) *mus*

Genus *Siphocypraea* Heilprin

*Siphocypraea* HEILPRIN 1886, p. 86

Type species by monotypy: *Siphocypraea problematica* (Heilprin), Pliocene of Florida (Plate I e-f).

*Cypraea* (*Siphocypraea*) *problematica* HEILPRIN 1886, p. 87.

Subgenus *Akleistostoma* Gardner

*Akleistostoma* GARDNER 1948, p. 213.

*Muracypraea* WOODRING 1957, p. 88.

Type species by original designation: *Siphocypraea* (*Akleistostoma*) *carolinensis* (Conrad), Upper Miocene of the Carolinas and Florida (Plate I c-d).

*Cypraea* (*Cypraeorbis* section *Akleistostoma*) *carolinensis* Conrad 1841, GARDNER 1948, p. 213.

***Siphocypraea* (*Akleistostoma*) *mus* (Linné) Plate I a-b**

Pleistocene-Recent; Gulf of Urabá, Colombia, to E. of Paraguaná, Venezuela (Fig. 12).

*Cypraea mus* LINNAEUS 1758, p. 721. [Carthagenam.]

*Porcellana simplex* MARTINI 1769, p. 324, pl. 23 fig. 222-223. [Carthage, Gulf of Maracaibo.]

*Cypraea trogiloides* MEUSCHEN 1781, p. 14.

*Cypraea vanelli* HUMPHREY 1797, p. 8. [Guinea.]

*Cypraea carthagenensis* ROEDING 1798, p. 22.

*Cypraea autumnalis* PERRY 1811, pl. 21 no. 2.

*Cypraea maculosa* "Hebenstreit" ORBIGNY 1853, p. 89. [Antilles, Cuba, Martinique.]

*Cypraea achates* "Argenville" ORBIGNY 1853, p. 89. [Antilles, Cuba, Martinique.]

*Arcia mus* (Linné), ROBERTS 1869, p. 202. [West Indies.]

*Gisortia mus* (Linné), JOUSSEAUME 1884, p. 89.

*Cypraea* (*Bernayia*) *mus* Linné, VREDENBURG 1920, p. 95.

*Cypraea fuscotecta* SULLIOTI 1924, p. 10.

*Cypraeorbis* (*Zoila*) *mus* (Linné), SCHILDER 1924, p. 195. [Cuba - Barbados.]

*Cypraeorbis* (*Siphocypraea*) *mus* (Linné), SCHILDER 1927, p. 98. [Antilles - Caracas.]

*Zoila* (*Protocypraea*) *mus* (Linné), THIELE 1931, p. 275.

*Siphocypraea* (*Siphocypraea*) *mus* (Linné), SCHILDER 1932, p. 118. [E. America, Antilles.]

*Siphocypraea mus* (Linné), SCHILDER & SCHILDER 1938-1939, p. 174. [Curaçao to Caracas and Cartagena.]

*Cypraea* (*Cypraeorbis* section *Akleistostoma*) *mus* Linné, GARDNER 1948, p. 213. [Venezuela.]

*Siphocypraea mus suta* COEN 1949, p. 17. [Antilles.]

*Cypraea* (*Muracypraea*) *mus* Linné, WOODRING 1957, p. 88. [South border of Caribbean Sea, Colombia - Venezuela.] Type of *Muracypraea*.

Juvenile or Bulla-stage. (Plate IIc.)

*Bulla ferruginosa* GMELIN 1791, p. 3432.

*Cypraea fuliginosa* ROEDING 1798, p. 22.

*Cypraea ovata* "Schreber" GRAY 1828, p. 83.

Forms with callosities. (Plate IIa-b.)

*Cypraea mus* var. *tuberculata* GRAY 1828, p. 83.

*Cypraea mus* var. *bicornis* SOWERBY 1870, p. 17, pl. 30 fig. 321. [Barbados.]

*Cypraea bicornis* Sowerby, ROBERTS (in TRYON) 1885, p. 177, pl. 10 fig. 43.

*Siphocypraea mus* was first reported and figured by RUMPHIUS (1705, p. 119, pl. 39 fig. S): "Die bij letter S, is een heel ongemeenen, ons van Cartagena toegezonden, waarom wij hem de *Cartageensche Kliphooorn* noemen." (Translated from the Dutch: The species of figure S, is very rare, sent to us from Cartagena, that is why we call it the *Cartagena Cowry*.)

The species was described by LINNAEUS (1758, p. 721, no. 301) as *Cypraea mus*, and most authors have accepted this name. *Porcellana simplex* MARTINI (1769, p. 324) is not valid, but *Cypraea simplex* was validated by ORBIGNY (1853, p. 89), who also validated several pre-Linnean names: *C. maculosa* (HEBENSTREIT 1743, p. 300) and *C. achates* (ARGENVILLE 1742, p. 307, pl. 21 fig. E).

HUMPHREY (1797, p. 8) described *S. mus* under the name of *Cypraea vanelli*, but this name had been preoccupied by LINNAEUS (1758, p. 720, no. 295). *C. vanelli* is now considered a subspecies of *Cypraea (Lycina) lynx*, HUMPHREY's locality, Guinea, is also incorrect. *C. vanelli* as a synonym for *mus* was validated by GRAY (1828, p. 83).

ROEDING (1798, p. 22) did honor to RUMPHIUS in describing *mus* as *Cypraea carthagenensis*, although he mentioned that the species was described by LINNAEUS as *Cypraea mus*. The name *carthagenensis* had been used by SCHROETER (1788, p. 83), but this work is not accepted. The name is misspelled by SCHILDER (1932, p. 118) as *carthaginiensis*. PERRY (1811, pl. 21 no. 2) gave an excellent figure of *mus*, under the name of *Cypraea autumnalis*.

*Siphocypraea mus* has been moved around from one genus to another, as will be seen here. ROBERTS (1869, p. 202) placed *mus* in the genus *Aricia*, together with several other recent species. In a subsequent paper ROBERTS (1885, p. 172 and 177) referred to the species as *Cypraea (Aricia) mus*, as also did HORST & SCHEPMAN (1899, p. 197). *Aricia* Gray 1837, however, is not valid, since this name had been used for a Polychaeta genus by SAVIGNY in 1822. According to JOUSSEAUME (1884, p. 89), *mus* belonged in the genus *Gisortia*.

SCHILDER (1924, p. 195) classified *mus*, along with four other species, as *Cypraeorbis (Zoila* group *Siphocypraea) mus*. Three years later SCHILDER (1927, p. 98) had changed his opinion, and *Zoila* had been removed as subgenus: *Cypraea (Siphocypraea) mus*. THIELE (1931, p. 275) used *Zoila* as a genus: *Zoila (Protocypraea) mus*. In the "Fossilium Catalogus" SCHILDER (1932, p. 118) gave *Siphocypraea* generic rank, with two subgenera: *Siphocypraea* s.str. and *Barycypraea*. Still later *Barycypraea* was removed from *Siphocypraea* (SCHILDER 1941, p. 80).

*Siphocypraea* was created as a subgenus by HEILPRIN (1886, p. 86), with the fossil *Cypraea problematica* Heilprin as a monotype (Plate Ie-f). The genus *Siphocypraea* contains sixteen extinct species (SCHILDER 1941, p. 82), *S. mus* being the only living representative. Therefore *S. mus* is sometimes, incorrectly, cited as genotype (STEADMAN & COTTON 1946, p. 512; ALLAN 1956, p. 29).

VREDENBURG (1920, p. 96) and INGRAM (1947a, p. 15) restricted *Siphocypraea* to only one species: *S. problematica*. Both authors put *mus* and allied species in the genus *Cypraea*; VREDENBURG (p. 95) placed it in the subgenus or section *Bernaya* (misspelled *Bernayia*).

GRIFFITHS (1962, p. 35) used only the genus *Cypraea* for all the species, as a large number of genera is too complicated for general use. KAY (1960, p. 278) did not want to use any generic or subgeneric name, but *Cypraea*, in the *Cypraeinae*, on anatomical grounds. She analyzed about fifty species and showed that they exhibit little ana-

tomical differentiation, except in the radular teeth and the female genitalia. These differences crossed the generic names of the existing systems of *Cypraeinae*. SCHILDER (1936, p. 75), however, had stated that the anatomical characters confirm the conchological classification.

GARDNER (1948, p. 213) erected a new section, *Akleistostoma*, in the subgenus *Cypraeorbis* of the genus *Cypraea*. She designated *Cypraea carolinensis* Conrad, from the Upper Miocene of the Carolinas and Florida (Plate Ic-d), as a type species. Miss GARDNER presumed that *Cypraea mus* also belonged in *Akleistostoma*; she considered the genus *Siphocypraea* to be different from *Akleistostoma*.

WOODRING (1957, p. 88) stated that *Cypraea (Siphocypraea) problematica* differed from all other *Cypraea* species, as the aperture has an astonishing posterior outlet which forms a deep comma-shaped channel, partly encircling the concealed apex (Plate I e-f). Hence, *Siphocypraea* is considered to be a monotypical subgenus.

For *Cypraea mus* and allied (extinct) species, WOODRING created a new subgenus: *Muracypraea*, with *Cypraea (Muracypraea) mus* as subgenotype. KEEN (1962, p. 161) was surprised that SCHILDER did not adopt WOODRING's new name, but while Miss KEEN's paper was in the press (December 1961) SCHILDER's explanation was published. SCHILDER (1961, p. 146) did not recognize *Akleistostoma*, for phylogenetical reasons: *Akleistostoma carolinensis* is an ancestor of *Siphocypraea problematica*, so both should belong to one genus, *Siphocypraea*, and *Akleistostoma* is not valid. Years ago SCHILDER (1926, p. 367) had stated that *S. problematica* is an abnormal descendant of *S. carolinensis*. SCHILDER (1961, p. 146) thought that *Muracypraea* could be considered a subgenus of *Siphocypraea*, or should be discarded. He thought that the descent of *S. problematica* from *S. carolinensis* is "zweifellos" (= without doubt), but there is no definite proof of it. In our opinion *S. mus* and *S. carolinensis* are more closely related to each other than *S. carolinensis* is to *S. problematica*, and this was also SCHILDER's idea at one time. SCHILDER (1927, p. 99) split the subgenus *Siphocypraea* into two groups, one group consisting only of *S. problematica*, the other group of more species, including *S. mus* and *S. carolinensis*. In an earlier paper SCHILDER (1924, p. 195) even stated that *carolinensis* was an ancestor of *mus*!

*S. problematica* differs from the other *Siphocypraea* species in shape, length, aperture, dentition and posterior outlet (cf. Plate I). As regards the shape, *problematica* has a convex ventral side, while the other species are flat. The maximum sizes of specimens of these three species in the collection of the American Museum of Natural History are: *S. mus* - 56 mm, *S. carolinensis* - 58 mm, *S. problematica* - 91 mm.

We suggest that *S. problematica* should be separated from the other species in a monotypical subgenus: *Siphocypraea* s.str. For the other species the subgenus *Akleistostoma* Gardner 1948 is available, with *S. (A.) carolinensis* as subgenotype. *Muracypraea* Woodring 1957 becomes a synonym of *Akleistostoma*. According to this

proposal, the name of *C. mus* is *Siphocypraea (Akleistostoma) mus* (Linné, 1758).

Table 2 shows the views of GARDNER (1948), WOODRING (1957), SCHILDER (1961), and the author's opinion.

TABLE 2

The systematical place of "*Cypraea*" *problematica*, *carolinensis* and *mus*, according to several modern authors.

	GARDNER, 1948	WOODRING, 1957	SCHILDER, 1961	COOMANS
<i>Siphocypraea</i>	<i>S. problematica</i> (type)	<i>C. (S.) problematica</i> (monotype)	<i>S. (S.) problematica</i> (type) <i>S. (S.) carolinensis</i>	<i>S. (S.) problematica</i> (monotype)
<i>Akleistostoma</i>	<i>C. (A.) carolinensis</i> (type) <i>C. (A.) mus</i>	(not mentioned)	= <i>Siphocypraea</i> s.s.	<i>S. (A.) carolinensis</i> (type) <i>S. (A.) mus</i>
<i>Muracypraea</i>	(not existing in 1948)	<i>C. (M.) mus</i> (type) <i>C. (M.) carolinensis</i>	<i>S. (M.) mus</i> (type)	= <i>Akleistostoma</i>

The name *mus* has been used several times for various *Cypraea* species. The pre-Linnean *Porcellana mus* ARGENVILLE (1742, p. 307 and 310, pl. 21 fig. C) was described by LINNAEUS as *Cypraea lurida*, recent, from the Mediterranean Sea. The fossil *C. mus* of LAMARCK (1822, p. 405), from the Pliocene of N. Italy, is *Zonaria porcellus cocconii* (Mayer). Another fossil *mus*, in GRATELOUP (1834, p. 307), from the Miocene of S.W. France, is *Schilderia maxima* (Grateloup). *C. mus* var? in GRAY (1837, fig. 157) is *Bernaya (Protocypraea) teulèrei* (Cazenavette), recent, from S. Arabia.

The juvenile or Bulla-stage of *S. mus* (Plate IIc) was described as an opisthobranch by MARTINI (1769, p. 296, pl. 22 fig. 209–210), as *Bulla ferruginosa*. This mistake was followed by SCHROETER (1783, p. 188) and validated by GMELIN (1791, p. 3432). ROEDING (1798, p. 22), however, placed the Bulla-stage of *mus* in the genus *Cypraea* as *C. fuliginosa*, and he mentioned *Bulla ferruginosa* Gmelin as a synonym. ROEDING did not recognize it as the juvenile of *mus*, which is described on the same page as *C. carthaginensis*.

DILLWYN (1817, p. 477) and WOOD (1818, p. 86, pl. 18 fig. 13) returned to the

wrong generic name: *Bulla ferruginosa*. MENKE (1830, p. 83) recognized *Bulla ferruginosa* as the juvenile of *C. mus*; this was also stated by CATLOW & REEVE (1845, p. 311). *Cypraea ovata* "Schreber" GRAY (1828, p. 83) is also a juvenile of *mus*; it is not *C. ovata* Gmelin 1791 (= *C. mauritiana* Linné).

None of the authors who described the juvenile of *S. mus* gave any locality for the species.

Since *S. mus* has a wide range of colour variety, we do not recognize *S. mus suta* COEN (1949, p. 17).

### VALIDITY OF THE "VARIETIES" *tuberculata* AND *bicornis*

GRAY (1828, p. 83) described a variety of *Cypraea mus* called *tuberculata* (Plate IIa), and he gave as explanation: "When full grown this shell has a large tubercle on the back just over the spire." From this description it is evident that *tuberculata*, with one tubercle, cannot be a synonym of the variety *bicornis* SOWERBY (1870, p. 17, pl. 30 fig. 321), which has two tubercles (Plate IIb). This synonymy was cited by SCHILDER (1924, p. 196), AGUAYO & JAUME (1947-1952, p. 329), and COOMANS (1958, p. 79).

ANTON (1839, p. 97) mentioned specimens of *C. mus* with one or two bumps, and he stated that the juveniles lacked bumps. ROBERTS (1885, p. 177) considered the bumped forms a full species *C. bicornis* Sowerby; but according to SCHILDER & SCHILDER (1938-1939, p. 174), it is an ecological variety of *S. mus*. DODGE (1953, p. 78) thought there was good reason for giving *bicornis* subspecific rank; but ALLAN (1956, p. 30) considered *S. bicornis* a synonym of *S. mus*. AGUAYO & JAUME (1947-1952, p. 329) gave a distinct distribution; *S. mus*: coast of South America, Colombia, Venezuela, Curaçao; forma *tuberculata*: Lesser Antilles. ABBOTT (1958, p. 181) considered the bumped specimens as deformations.

We have studied a number (about 30) of bumped specimens, and we observed: 1) the bumps are formed at the apical end at the back of the shell, just as far as the mantle reaches; 2) the bumps are formed only in full-grown specimens; 3) bumped forms are found together with smooth specimens in the same lot from one locality; 4) some specimens have only one bump (Plate IIa); 5) some have two (Plate IIb) or even three bumps; 6) the size of the bumps varies from almost nothing to a real tubercle; 7) some individuals show a large area of callus near the posterior outlet of the shell (Plate IIa); 8) when the bumps of several specimens were cut through, they showed a thickening of the last-formed shell layers (Plate IIId).

From these observations it can be concluded that: a) bumped specimens cannot be considered to be a variety, or an ecological form; b) there is no geographical separation between smooth and bumped forms; c) after the shell reaches maturity, the mantle still

produces shell material in some individuals, which makes the bump or callus area; *d*) there are different kinds of bump formation, so the names "*tuberculata*" or "*bicornis*" are not satisfactory; *e*) *Siphocypraea mus* forma *callosa* would be a suitable name, but it is senseless to create this name for *S. mus* only, as this extra formation of callus is often found in full-grown *Cypraeidae*.

SOWERBY (1850, p. 45, pl. 9 fig. 3), when describing a fossil *Cypraea* from the Tertiary of Santo Domingo (on the island of Hispaniola), *C. henikeri* (now in the genus *Siphocypraea*), added to the description: "This species bears a general resemblance to *Cypraea mus* and several others, which occasionally have irregular tubercles on the posterior part of the back." The specimen of SOWERBY's figure has two tubercles.

PILSBRY (1922, p. 365) also compared *C. henikeri* (= *henekeni*) to *C. mus*: "This species resembles the recent *C. mus*, and has parallel variations, both having smooth and bicornute or bituberculate forms. In *C. henekeni* the tuberculate form predominates, and the tubercles are larger, being thus more specialized than the modern race of the same stock."

A close relative of *mus*, *S. quagga* SCHILDER (1939, p. 25), from the Miocene of Venezuela, also has smooth and bumped individuals.

KENYON (1896, p. 26-27) described callosities in different species of *Cypraea* as "callused varieties": "I have lately come across several specimens of different species of *Cypraea* (*helvola*, *tabescens*, *miliaris*, *erosa*), which have the termino-dorsal arches adorned with callosities. Though these do not occur in every specimen, still finding it in several specimens of the genus, it proves that it is not an abnormal incident." Although KENYON does not mention the callosities of *S. mus*, the above proves that the formation of callus does occur often in the *Cypraeidae*. It will be shown later in this publication that *Propustularia surinamensis* (Perry), syn. *bicallosa* (Gray), also occurs in callused and smooth forms.

### DISTRIBUTION OF *Siphocypraea mus*

There has often been misunderstanding concerning the range of *S. mus* (INGRAM 1951, p. 29; CATE 1959, p. 4 and 36). Its earliest locality was Cartagena (RUMPHIUS 1705, p. 119). This locality, together with the species' rarity, are the reasons for the misconception regarding its range. There are two cities of Cartagena, one on the Mediterranean coast of Spain, the other on the Caribbean side of Colombia. Since Cartagena in Colombia lies within the range of *S. mus*, RUMPHIUS' shell undoubtedly came from the Caribbean.

LINNAEUS (1758, p. 721), when describing *Cypraea mus*, gave as locality "Carthagenam." KNORR (1768, p. 18) stated that this species came from the Gulf of Maracaibo, which is also within the range of *mus*. MARTINI (1769, p. 325) gave both these localities, but his text prompts the idea that he was thinking of Cartagena on the Mediterranean Sea. The first author to mention the Mediterranean as locality for

*mus* was GMELIN (1791, p. 3408): "Hab. in mare mediterraneo et americano." From that year until recently the Mediterranean Sea has been connected with *S. mus*, sometimes even as the type locality (STEADMAN & COTTON 1946, p. 512; ALLAN 1956, p. 29). In 1867, however, HIDALGO (p. 117) had stated that *Cypraea mus* was not to be found in Spain.

Table 3 indicates the distribution of *S. mus* according to many authors. PETIVER (1713, p. 4) named the species "Carthagena Coury", but gave as locality the island of Amboyna. The explanation for this mistake is simple: since PETIVER did not know Dutch, in which language RUMPHIUS' book is written, he thought that *S. mus* came from Amboyna. This mistake was repeated by WOOD (1818, p. 81); and KIENER (1844-1845, p. 121) cited the Indian Ocean.

HUMPHREY (1797, p. 8) aggravated the disorder by giving the locality Guinea in West Africa. This has been copied by several authors, but HIDALGO (1906-1907, p. 211) was doubtful about the localities in West Africa; he rejected the localities in the Mediterranean Sea and the Indian Ocean. BLAINVILLE (1826, p. 239) described *mus* from France. ORBIGNY (1853, p. 90) mentioned the species from the Antilles, Cuba and Martinique; his Cuba record is incorrect, but has often been copied by later authors. Records from the Lesser Antilles are also incorrect; SOWERBY (1870, p. 17) mentioned Barbados as type locality for the form *bicornis*. There is only one record from the Virgin Islands (HORST & SCHEPMAN 1899, p. 197).

SCHILDER & SCHILDER (1938-1939, p. 174) limited the range to between Curaçao, Caracas and Cartagena. Several authors did not give a distribution for the species: ROEDING (1798, p. 22), PERRY (1811, pl. 21 no. 2), and REEVE (1845, pl. 7 no. 24).

At the time of its first discovery the species was very rare. Later in the eighteenth century it was frequently brought to Europe, and it had many common names. Dutch: Cartageensche Kliphorn, Cartageensche Wit-rugge, Cartageensche Klip-kleeveer, Cartageensche Muis; English: Cartagena Courie, Mouse Cowry, Mouse; French: Porcelaine de Carthagène, Crapaud, Léopard, Bossue de Carthagène, Porcelaine saignante, Coup-de-Poignard; German: Carthagensische geflekte Kliphorn, Carthagensische Porcellanen, Klip-Horn, Kagenbauch, Maus, Kröte, Geflammte Ey (for the juvenile).

Although SCHILDER (1924, p. 195; 1956, p. 122) thought that *S. mus* is common nowadays, it must be rather rare. Not many definite locality records are known for this century. The species is seldom found for sale on the price lists of shell dealers, and the price ranges from \$ 5 to \$ 21.

### *Siphocypraea mus* ON THE COAST OF COLOMBIA AND VENEZUELA

The range of *S. mus*, as given by SCHILDER & SCHILDER (1938-1939, p. 174), between Curaçao, Caracas and Cartagena, must be extended more westward to the boundary between Colombia and Panamá, since there are locality records from Turbo on the Gulf of Urabá (INGRAM 1947, p. 32-33; 1951, p. 29; DANIEL 1941, p. 379), see Fig. 12. It seems that the species does not live on the Caribbean coast of Panamá, since there are no Panamá records in the literature.

To the east, Caracas should be the limit of distribution. In fact the species is not



mentioned in Venezuelan literature as occurring at the Gulf of Tacarigua (CARBONELL et al. 1949), Manicuaire (GINÉS et al. 1946) or the Gulf of Cariaco (GINÉS 1947). It is even doubtful if the range extends as far east as Caracas. This locality was reported for the first time by HIDALGO (1906–1907, p. 211). One objection is that Caracas is not on the sea. WEISBORD (1962) does not mention the species from Higuerote, Cabo Blanco (5 km west of La Guaira, the port of Caracas), or La Saliña de Guaiguaza (6 km west of Puerto Cabello).

The definite twentieth-century localities in Venezuela and Colombia are:

1) Gulf of Maracaibo, Venezuela (DAUTZENBERG 1900, p. 193), two specimens, now in Zoological Museum, Brussels (SCHILDER & SCHILDER 1952, p. 178).

2) El Cardón, Paraguaná, Venezuela (not Colombia, as stated by INGRAM 1946, p. 113). Many specimens, collected by J. O. NOMLAND in 1931. Specimens are now in the Museum of Paleontology, University of California, Berkeley, and in the American Museum of Natural History, New York.

3) Turbo, Gulf of Urabá, Colombia (INGRAM 1947, p. 32–33; 1951, p. 29). One specimen, collected by DANIEL in December 1932. Now in collection of United States National Museum, Washington.

4) Río Hacha, Colombia (COOMANS 1958, p. 79). Three specimens, collected by P. WAGENAAR HUMMELINCK in 1937. Specimens now in Zoological Museum, Amsterdam.

5) Carirubana, Paraguaná, Venezuela (VAN BENTHEM JUTTING 1945, p. 78). One specimen, from a Pleistocene shell bed only a few kilometers north of El Cardón, collected by P. WAGENAAR HUMMELINCK in 1937. Now in Zoological Museum, Amsterdam. This is the only fossil record of *S. mus*.

C. N. CATE gave us some informations concerning recently collected specimens of *S. mus*. The localities are: La Goajira, Zapara Island in the Gulf of Venezuela, Gulf of Maracaibo, Paraguaná, and Cumarebo. The last mentioned locality extends the distribution of *S. mus* more eastward than is indicated on fig. 12. Cumarebo is located just east of the Peninsula of Paraguaná, opposite Curaçao.

It is not clear, if the locality "Gulf of Maracaibo" refers to the Golfo de Venezuela or to the (for the greater part brackish) Lago de Maracaibo.

We suggest that the range of *S. mus* covers the Caribbean coast of Colombia, and the coast of Venezuela as far east as Cumarebo, E. of Paraguaná (Fig. 12). From Table 3 it can be seen that the localities of the early authors are within this range. As regards the modern authors, only INGRAM and WOODRING are correct.



*Siphocypraea mus* AND THE NETHERLANDS ANTILLES

*S. mus* is present in several collections with locality "Curaçao". This is known to us from the collections of the Zoological Museum in Amsterdam, the American Museum of Natural History in New York, the United States National Museum in Washington, and the Academy of Natural Sciences in Philadelphia. SCHILDER & SCHILDER (1952, p. 178) mentioned specimens from Curaçao and Curaçoa Bay in the Zoological Museum, Brussels (DAUTZENBERG collection). The Museum in Curaçao, which has a small collection containing most local shells, also has a number of specimens, but without any locality label. MÖRCH (1877, p. 46) mentioned *C. mus* from Bonaire.

These facts may lead to the conclusion that *S. mus* lives in the Netherlands Antilles. It is our opinion, however, that it does not live around Aruba, Curaçao or Bonaire, notwithstanding the short distance between these islands and Paraguaná in Venezuela (Aruba: 25 km, see Fig. 12).

We, therefore think the locality Curaçao given for *S. mus* in many museum collections is wrong. This is not surprising, since the locality data of old collections are often inaccurate, as has been proved by SCHILDER (1960) in case of the Cypraeidae.

The oldest record in literature that described *Cypraea mus* from Curaçao is JAY (1839, p. 96: lot number 3466, from "Curacoa"), in the third edition of the Catalogue of his shell collection. In the fourth edition of JAY's Catalogue (1850, p. 390) the same lot appeared under a different number (10.197), from "Curaçoa". JAY's collection is now part of the collection of the American Museum of Natural History; his lot number 10.197 bears the Museum collection number 13.464. This lot contains two adult specimens, the locality is "Curaçoa". One of the specimens is figured here (Plate I a-b).

However, in the second edition of JAY's Catalogue (1836, p. 67) lot number 3466, *Cypraea mus*, has the locality "West Indies"! So JAY changed the locality of lot 3466 between the years 1836 and 1839 from "West Indies" to "Curacoa". This makes it doubtful whether the specimens really did come from Curaçao.

A second record of Curaçao for *C. mus* is found in KREBS (1864, p. 41), but KREBS referred to R. SWIFT for this locality. We were not able to discover any publication of SWIFT concerning Curaçao (in 1863 he published a "List of Marine-Shells of the Virgin-Islands", see KREBS 1864, p. 95), so how SWIFT got this locality remains unknown.

MÖRCH (1877, p. 46) compiled the localities of *mus*; he mentioned "Curaçao (Swift)" and "Bonaire (Dietz)". MÖRCH is the only author to mention Bonaire; nothing is known about DIETZ.

Later authors who gave Curaçao as locality (Table 3) are not original. SOWERBY (1870, p. 17) has *C. mus* from "Curaçoa Bay", which is very doubtful, as there is no bay with this name on Curaçao or anywhere else. The DAUTZENBERG collection (SCHILDER & SCHILDER 1952, p. 178) contains two specimens with the same locality, which might have been copied from SOWERBY.

Naturalists have been collecting shells in the Netherlands Antilles of the Leeward Group since about 1880, and therefore if *S. mus* were living in these islands (Aruba, Curaçao and Bonaire), it should have been found. At the end of the nineteenth

century, mollusks were collected by A. J. VAN KOOLWIJK and C. EPP. Their shells are in the Rijksmuseum van Natuurlijke Historie in Leiden, but *S. mus* was not found by them (HORST & SCHEPMAN 1899, p. 197–198).

In 1905 J. BOEKE visited the West Indies to study the fisheries and shellfisheries of the Netherlands Antilles. C. J. VAN DER HORST made a zoological collecting trip to Curaçao in 1920; and G. J. H. MOLENGRAAFF, who was on Curaçao from 1921 until 1927, also collected mollusks. The results obtained by these three collectors were reported by VAN BENTHEM JUTTING (1927), but *S. mus* was not mentioned.

P. WAGENAAR HUMMELINCK visited the Netherlands Antilles four times: 1930, 1936–1937, 1948–1949, and 1955, and he collected shells on all his trips. The marine Gastropoda of these field trips, together with some other collections, were surveyed by COOMANS (1958). Neither HUMMELINCK nor the other collectors ever found *S. mus* on the islands.

We spent three years (1957–1960) in the Netherlands Antilles, and collected throughout on the islands (skin-diving, beach and shallow-water collecting), but no trace of *S. mus* was found. The Indian shell mounds on the islands do not contain this rare species, but three other species of *Cypraeidae*, *Luria cinerea*, *Erosaria spurca acicularis*, and *Trona zebra*, have been met by us in these special localities.

In addition, we know nearly all the collections of the shell collectors of Aruba and Curaçao (nobody was collecting on Bonaire), but they have never found *S. mus*.

*S. mus* is not known as a fossil from the Netherlands Antilles (LORIÉ 1887, p. 133–134; SCHEPMAN 1888, p. 125–127; SCHEPMAN 1915, p. 482). The geologist P. DE BUISSONJÉ, who collected Quaternary fossils on Curaçao, Aruba and Bonaire in 1956 and 1959–1960, informed me that he never found *S. mus*.

All these facts make it fairly conclusive that *S. mus* does not occur around these islands.

## SYSTEMATICS OF *Propustularia surinamensis*

### Genus *Propustularia* Schilder

*Propustularia* SCHILDER 1927, p. 103

Type species by original designation: *Propustularia surinamensis* (Perry).

*Pustularia* (*Propustularia*) *surinamensis* (Perry) 1811, SCHILDER 1927, p. 103. [Veracruz, Curaçao, Lesser Antilles, Surinam.]

### *Propustularia surinamensis* (Perry) Plate II e–f

Recent; Surinam and Lesser Antilles (Fig. 12).

*Cypraea surinamensis* PERRY 1811, pl. 20 no. 4. [Surinam.]

*Cypraea bicallosa* GRAY (in SOWERBY) 1832, p. 6, pl. 2 fig. 10.

*Cypraea aubryana* JOUSSEAUME 1869, p. 348, pl. 18 fig. 1–3. [Guadeloupe.]

*Luponia bicallosa* (Gray), ROBERTS 1869, p. 193. [St. Vincent.]

- Cypraea ingloria* CROSSE 1878, p. 166, pl. 3 fig. 2. ["Côtes de l'Afrique méridionale".]  
*Cypraea callosa* WEINKAUFF 1881, p. 119.  
*Zonaria bicollosa* ("Gray" JOUSSEAUME) 1884, p. 93.  
*Zonaria aubryana* (JOUSSEAUME) 1884, p. 93.  
*Cypraea (Erosaria) bicallosa* Gray, VREDENBURG 1920, p. 112.  
*Pustularia (Erosaria) bicallosa* (Gray), SCHILDER 1924, p. 210. [West Indies.]  
*Pustularia (Propustularia) surinamensis* (Perry), SCHILDER 1927 (1925), p. 103.  
 [Veracruz, Curaçao, Lesser Antilles, Surinam.]  
*Propustularia surinamensis* (Perry), SCHILDER & SCHILDER 1938-1939, p. 127.  
 [Lesser Antilles: St. Thomas to Surinam and Curaçao; ? Veracruz.]

This very rare West Indian species was described several times during the nineteenth century. PERRY (1811, pl. 20 no. 4) described *Cypraea surinamensis* from Surinam (Dutch Guiana). This species is better known as *Cypraea bicallosa* GRAY (1832, p. 6, pl. 2 fig. 10). It has two remarkable callus formations at the anterior and posterior ends of the back of the shell (Plate II e). No locality was given by GRAY. *Cypraea aubryana* was described from Guadeloupe by JOUSSEAUME (1869, p. 348, pl. 18 fig. 1-3); the author mentioned that this species resembled *bicallosa*, but lacked the callosities. Later authors often misspelled the name: *aubreyana* and *auberiana*. One year after JOUSSEAUME described *aubryana*, SOWERBY (1870, pl. 25) guessed that it was a juvenile of *bicallosa*; he stated that *surinamensis* should be a synonym for *C. nebulosa* Kiener. JOUSSEAUME (1884, p. 93) did not recognize *aubryana* as a juvenile of *bicallosa* (misspelled as *bicollosa*), and placed both species in the genus *Zonaria*.

MÖRCH (1877, p. 47) considered *surinamensis*, *bicallosa* and *aubryana* to be three distinct species.

A fourth synonym, *Cypraea ingloria*, was described from equatorial Africa by CROSSE (1878, p. 166). He stated that this species is related to *C. bicallosa*, but it lacked the callus formations.

WEINKAUFF (1881, p. 65) rejected SOWERBY's opinion that *surinamensis* (misspelled and wrong author on p. 227: *suraminensis* Sowerby) was a synonym of *C. nebulosa* Kiener, but he (p. 119) followed SOWERBY in calling *aubryana* a juvenile ("forma incompleta") of *bicallosa*; WEINKAUFF (p. 88) considered *C. ingloria* a distinct species. *C. callosa* WEINKAUFF (1881, p. 119) is only a misspelling of *bicallosa*.

ROBERTS (1885, p. 226) again synonymized *surinamensis* with *nebulosa* Kiener. He (p. 193) was the first author to place both *aubryana* and *ingloria* as varieties of *bicallosa*: "*C. ingloria*, CROSSE, credited to Africa, is a rather more inflated variety [of *C. bicallosa*], with extremities not quite so produced, and margins less pitted, but the general coloring of the shell is similar. The var. *Aubreyana*, JOUSSEAUME, is larger and still more inflated, the colors are paler, there is an absence of the pittings, and a partial obliteration of the callosities."

In an earlier paper ROBERTS (1869, p. 193) placed *bicallosa* in the genus *Luponia*, but later (1885, p. 193) he treated *Luponia* as a subgenus of *Cypraea*. PAETEL (1888, p. 316) also mentioned *aubryana* and *ingloria* as varieties of *bicallosa*. HIDALGO (1906-1907, p. 188) synonymized the three names; he thought (p. 331) that *surinamensis* was a distinct species, and not a synonym of *nebulosa*. SHAW (1909, p. 306) increased the confusion by stating that it was impossible to say, from description and figure, what shell PERRY intended to represent. Therefore *C. surinamensis* must

be unidentifiable. He showed that it cannot be *C. nebulosa* Kiener (= *gambiensis* Shaw), since *surinamensis* is a Caribbean species and *nebulosa* is from West Africa.

SCHILDER (1924, p. 195) originally placed *surinamensis*, with a question mark, in the synonymy of *C. mus*; and *bicallosa* (p. 210) was in *Pustularia* (*Erosaria*). However, three years later, SCHILDER (1927, p. 103) ended the confusion. He erected the subgenus *Propustularia* in the genus *Pustularia*. He declared *P. bicallosa* to be synonymous with *P. surinamensis*, and this species became the type species of *Propustularia*. SCHILDER (1927, p. 147) thought *C. surinamensis* of PERRY to be a beachworn *bicallosa*. Later, SCHILDER (1932, p. 158) gave *Propustularia* generic rank.

Most authors follow SCHILDER and consider *bicallosa* a synonym of *surinamensis*, but not all authors accept the genus *Propustularia*. AGUAYO & JAUME (1947-1952, p. 326) placed *surinamensis* in *Cypraea* (*Erosaria*), as VREDENBURG (1920, p. 112) had done earlier. INGRAM (1951, p. 37) stated that *bicallosa*, *aubryana*, and *ingloria* are synonyms of *surinamensis*, but he placed the species in the genus *Cypraea*, without mentioning *Propustularia*. A rather strange opinion concerning *surinamensis* is found in CATE (1958, p. 24): "It is true we have seen four specimens of this shell, all dead, but are still not thoroughly convinced of its validity." However, on our requesting elucidation, Mr. CATE informed us that he has studied more specimens of *surinamensis* since, and he is convinced that it is a perfectly good species. His own collection contains three specimens, two from St. Vincent, one from Martinique. We believe that Martinique is a new record, hitherto unknown in the literature.

The genus *Propustularia* has eight extinct species (SCHILDER 1941, p. 89), from which *P. barbadensis* Schilder has been cited as an ancestor of *P. surinamensis* (SCHILDER & SCHILDER 1938-1939, p. 127). It has sometimes (SCHILDER 1932, p. 159; 1939, p. 20; INGRAM 1947a, p. 13; 1951, p. 37) been considered to be a subspecies: *P. surinamensis barbadensis*.

#### DISTRIBUTION OF *Propustularia surinamensis*

The type locality of *Cypraea surinamensis* PERRY (1811, pl. 20 no. 4) is Surinam (Dutch Guiana). Its earliest synonym, *C. bicallosa* GRAY (1832, p. 6), has no type locality. *C. aubryana* JOUSSEAUME (1869, p. 350) was described from Guadeloupe. CROSSE (1878, p. 167) stated that, according to the testimony of B. THOMAS, *C. ingloria* came from the coast of equatorial Africa; but this locality must be incorrect.

KIENER (1844-1845, p. 111) did not give a locality for *C. bicallosa*; the first locality record for this species is to be found in REEVE (1845, pl. 16 no. 79): St. Vincent, West Indies. For this locality REEVE referred to GULDING; St. Vincent is often copied in literature. Table 4 shows the distribution of *P. surinamensis bicallosa*, *aubryana* and *ingloria* (included) according to a number of authors.

BEAU (1858) was the first author to mention *bicallosa* from Marie Galante. MÖRCH (1877, p. 48) referred to C. WESSEL for St. Thomas and Veracruz, Mexico. The Mexican locality is doubtful, according to SCHILDER & SCHILDER (1938-1939, p. 127).

USTICKE (1959, p. 53) doubted if *P. surinamensis* is to be found in the Virgin Islands, although it has been recorded from St. Thomas. One specimen was collected by C. EPP on Curaçao (HORST & SCHEPMAN 1899, p. 207). The SCHILDERS (1938-1939, p. 127) compiled the localities and gave the range: Lesser Antilles from St. Thomas to Surinam and Curaçao.

TABLE 4

Distribution of *Propustularia surinamensis* and *P. barbadensis*.

- × *Propustularia surinamensis*, included *bicallosa*, *aubryana* and *ingloria*, according to several authors.  
 ? Doubtful record.  
 + *Propustularia barbadensis*.

	Caribbean Sea or West Indies	Hispaniola (Haïti)	Lesser Antilles	St. Thomas	Guadeloupe	Marie Galante	St. Vincent	Barbados	Curaçao	Aruba	Surinam	Mexico (Veracruz)	Africa
PERRY, 1811, pl. 20, no. 4 . . .											×		
REEVE, 1845, pl. 16, no. 79 . . .							×						
JAY, 1850, p. 387 . . . . .							×						
MÖRCH, 1852, p. 116 . . . . .											×		
BEAU, 1858, p. 7 . . . . .						×							
KREBS, 1864, p. 41 . . . . .						×							
JOUSSEAUME, 1869, p. 350 . . .					×								
ROBERTS, 1869, p. 193 . . . . .							×						
SOWERBY, 1870, p. 39 . . . . .							×						
MÖRCH, 1877, p. 47-48 . . . . .				×	×	×	×				×		
CROSSE, 1878, p. 167 . . . . .													×
WEINKAUFF, 1881, p. 89, 119 . .			×	×	×		×					×	×
ROBERTS, 1885, p. 193 . . . . .							×						×
PAETEL, 1888, p. 316 . . . . .							×						
HORST & SCHEPMAN, 1899, p. 207			×	×	×				×				
HIDALGO, 1906-1907, p. 188, 224							×		×		×		
SCHILDER, 1924, p. 210 . . . . .	×												
SCHILDER, 1927, p. 104 . . . . .			×					+	×		×	×	
SCHILDER & SCHILDER, 1938-1939, p. 127 . . . . .			×	×					×		×	?	
SCHILDER, 1939, p. 20 . . . . .		+									×		
STEADMAN & COTTON, 1946, p. 511	×										×		
INGRAM, 1947a, p. 13 . . . . .		+		×				+	×		×		
AGUAYO & JAUME, 1947-1952, p. 326 . . . . .			×	×					×		×	?	
INGRAM, 1951, p. 37 . . . . .				×					×		×		
ALLAN, 1956, p. 18 . . . . .	×		×								×		
COOMANS, 1958, p. 79 . . . . .				×		×	×		×		×		
USTICKE, 1962, p. 7 . . . . .										×			

On Fig. 12 the localities of *P. surinamensis* are indicated, Veracruz and Africa being omitted.

The extinct species or subspecies *P. barbadensis* is reported from Barbados (Pleistocene) and Haiti (Pliocene).

*P. surinamensis* is very rare; all known localities date from the nineteenth century except one. USTICKE (1962, p. 7) collected one dead specimen in Aruba, from a dredging at Barcadera in about 7 m. The identification has been confirmed by us. Little can be stated about the exact range and habitat of this species.

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#### SUMMARY

The systematic place of "*Cypraea*" *mus* Linné is discussed, and it is concluded that the species belongs in *Siphocypraea* (*Akleistostoma*). The "varieties" *tuberculata* Gray and *bicornis* Sowerby should be withdrawn; they are only forms with callosities. Callus formations are often found in *Cypraeidae*. The distribution has been compiled from definite locality data; it covers the Caribbean coast of Colombia, and the coast of Venezuela as far as East of Paraguaná. *S. mus* does not occur around Curaçao or any other island of the West Indies.

"*Cypraea*" *surinamensis* Perry belongs in the genus *Propustularia*. It is a Caribbean species, localities in Africa being incorrect. The locality data are compiled from the literature, most records date from the nineteenth century. Since the species is very rare, its exact distribution remains uncertain.

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(Items marked with \* not seen.)

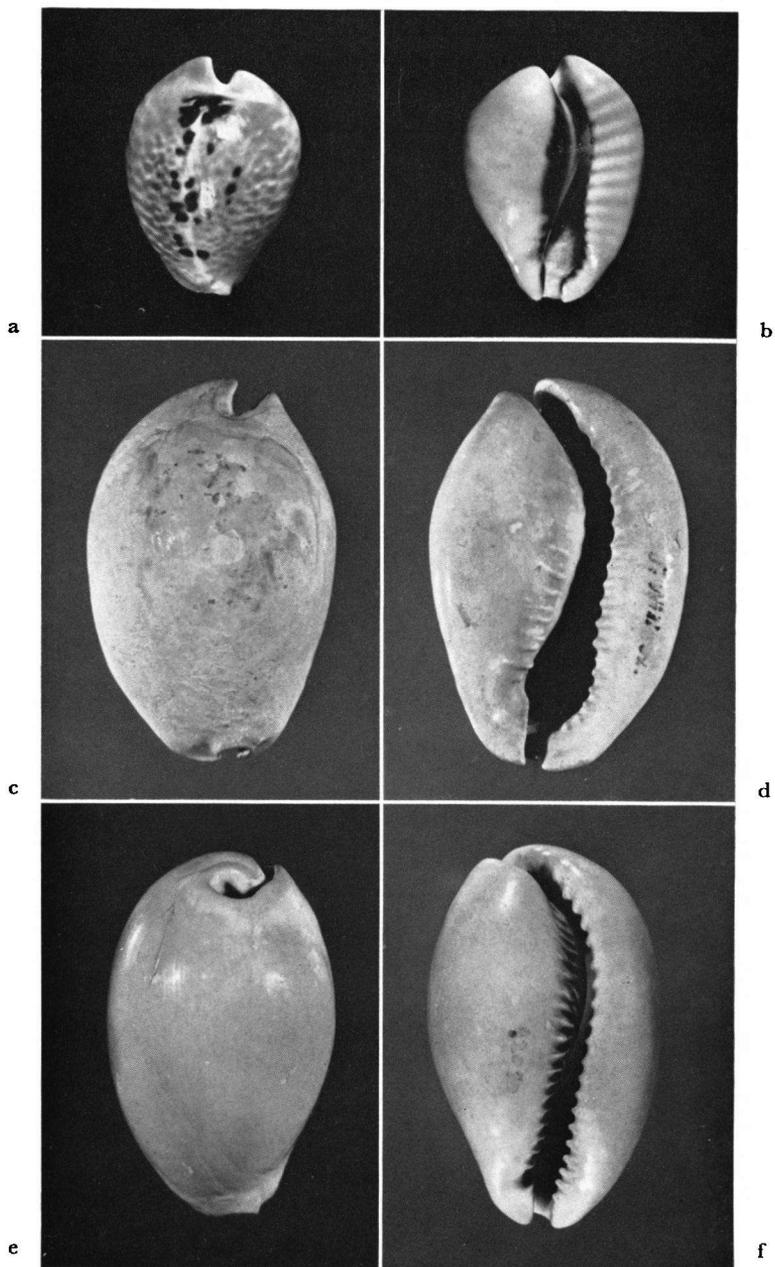
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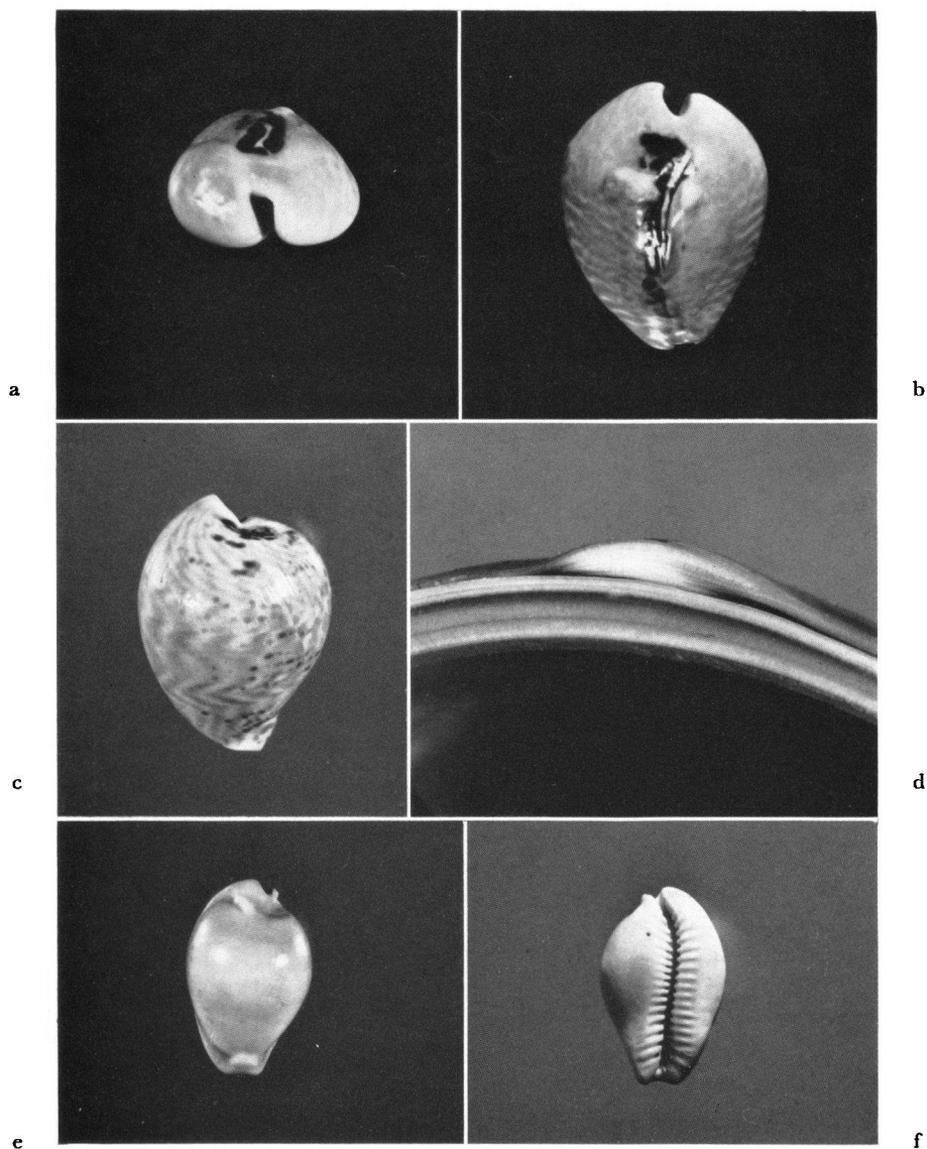
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PLATE I



- a-b. *Siphocypraea* (*Akleistostoma*) *mus* (Linné) ( $\times 1$ ). "Curaçao", from JAY-collection, in American Museum of Natural History.  
 c-d. *Siphocypraea* (*Akleistostoma*) *carolinensis* (Conrad) ( $\times 1$ ). Miocene; Duplin County, North Carolina.  
 e-f. *Siphocypraea* (*Siphocypraea*) *problematica* Heilprin ( $\times 1$ ). Pliocene; Glades County, Florida.

PLATE II



- a. *Siphocypraea mus* "variety" *tuberculata* (Gray) ( $\times 1$ ). There is also a callus area near the posterior outlet. Locality unknown.
- b. *Siphocypraea mus* "variety" *bicornis* (Sowerby) ( $\times 1$ ). "Barbados".
- c. *Siphocypraea mus* (Linné), juvenile ( $\times 1$ ). (= *Bulla ferruginosa* Gmelin) Locality unknown.
- d. Cross section through the bump of a callus form of *Siphocypraea mus* (Linné) ( $\times 10$ ).
- e-f. *Propustularia surinamensis* (Perry) ( $\times 1$ ). St. Vincent.