STUDIES ON THE FAUNA OF SURINAME
AND OTHER GUYANAS: No. 42.

# THE HOLOCENE AND RECENT MARINE BIVALVE MOLLUSCA OF SURINAM

by

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As the preparation of an annotated check list of the marine Mollusca of Surinam (Dutch Guiana) will take some more years, it was thought appropriate to publish a preliminary report on the bivalves. This report consists of a list of 126 species with a few notes containing, i.a., the description of seven new species, and a discussion of the local distribution of the marine bivalves.

Of the 126 species listed seven are described as new, viz., *Nucula surinamensis*, *Crenella abbotti*, *Periploma coquettae*, *Tivela geijskesi*, *Diplodonta* (*Sphaerella*) *rehderi*, *Lucina* (*Parvilucina*) *clenchi*, and *Mactra* (*Micromactra*) *surinamensis*.

All the bivalves found in the Holocene deposits belong to Recent species. The so-called shell-ridges are beach deposits containing mainly species belonging to the intertidal and inshore fauna and living within the 5 fathom line. There are indications that minor changes in the composition of the inshore fauna occurred during the Holocene. Well borings pierced deposits containing a fauna which presumably lived in slightly deeper water.

Within the 30 fathom line the Recent fauna lives in six different biotopes: the lower rivers, the intertidal zone, and four zones of increasing depth off the coast. These six biotopes appear to be characterized by the occurrence or abundance of particular species.

To the former Netherlands Foundation for the Advancement of Research in Surinam and the Netherlands Antilles (WOSUNA) I am indebted for enabling me to

visit Surinam and some museums in the United States of America in 1963. My study of Surinam Mollusca was also greatly furthered by several people whose co-operation will be fully acknowledged in the more elaborate paper now in preparation. To Mr. A. E. ELLIS I express my gratitude for linguistic help.

Figures 146–152 are drawn by W. BERGMANS; Fig. 145 is executed by W. C. G. GERTENAAR, both from the Leiden Museum.

## LIST OF SPECIES

### AND THEIR LOCAL DISTRIBUTION

The material on which this paper is based comes from a great number of localities which have been grouped in four categories. For every species the occurrence in one or more of these is indicated by letters in the four columns opposite the names of the species. The four categories are:

*1.* Holocene deposits pierced by well borings in the coastal region of Surinam, maximum depth 21.70 m. Column 1: b[orings].

*2.* The so-called shell-ridges, which are Holocene shell sands deposited in bars more or less parallel to the coast, up to about 35 km land inward. Column 2: r[idges].

*3.* The beaches of the sea coast and estuaries (much of the material examined had been washed ashore), and rivers as far as the influx of sea water controls the fauna. Column 3: c[oast].

*4.* The sea bottom off the Surinam coast where samples have been dredged by the "Coquette," mainly in 1957, when she was prospecting for the Surinam Government. Later the same ship has been employed by the Surinam Fisheries Service and dredged Mollusca have now and then been given to the Surinam Museum or to the writer. All these samples are from depths between 3 and 30 fathoms. Column 4: d[redgings].

The records of the species marked with an * are based on only one specimen. The !! with the letters c and d mean that at least part of the records are based on living specimens or very fresh shells (i.e., with the valves still connected and/or the periostracum present).

The bold type numbers refer to the notes in the next section.

| | | | | |
|---|---|---|---|---|
| Nuculidae | | | | |
| *Nucula venezuelana* Weisbord, 1964 | b | – | c! | d |
| **Nucula surinamensis* spec. nov. **1** | – | – | – | d |
| *Nucula* sp. (juv.?) | b | – | – | d! |
| *Nuculoma dalmasi* (Dautzenberg, 1900) | – | – | c | d |
| Nuculanidae | | | | |
| *Nuculana* (*Sacella*) *concentrica* (Say, 1824) | b | r | c | d |
| *Nuculana* (*Sacella*) *acuta* (Conrad, 1832) | – | – | – | d |
| *Yoldia* (*Orthoyoldia*) *crosbyana* (Guppy, 1882) | b | – | – | d |
| *Yoldia* (*Adrana*) *gloriosa* (A. Adams, 1855) **2** | – | r | – | d! |
| *Yoldia* (*Adrana*) *scaphoides* (Rehder, 1939) | b | – | c! | – |
| *Yoldia* (*Adrana*) *egregia* (Guppy, 1882) | – | r | – | d |
| Arcidae | | | | |
| **Arca zebra* (Swainson, 1883) | – | r | – | – |
| *Arca imbricata* Bruguière, 1789 | – | – | c | – |
| **Barbatia* (*Acar*) *domingensis* (Lamarck, 1819) | – | – | – | d |
| *Anadara* (*Diluvarca*) *notabilis* (Roeding, 1798) | – | – | – | d |
| *Anadara* (*Cunearca*) *brasiliana* (Lamarck, 1819) | – | r | c | – |
| *Anadara* (*Cunearca*) *chemnitzi* (Philippi, 1851) | b | r | c! | d! |
| *Lunarca ovalis* (Bruguière, 1789) | b | r | c! | – |
| *Noetia* (*Eontia*) *centrota* (Guppy, 1867) | b | r | c! | d! |
| Glycymeridae | | | | |
| *Glycymeris americana* (Defrance, 1826) | – | – | – | d |
| *Glycymeris pectinata* (Gmelin, 1791) | – | – | – | d! |
| Limopsidae | | | | |
| *Limopsis antillensis* Dall, 1881 | – | – | – | d |
| Pinnidae | | | | |
| *Atrina* (*Servatrina*) *seminuda* (Lamarck, 1819) | – | – | c! | d! |
| *Atrina* (*Servatrina*) *serrata* (Sowerby, 1825) | – | – | – | d! |
| Plicatulidae | | | | |
| *Plicatula gibbosa* Lamarck, 1801 | b | r | c | d |

| | | | | |
|---|---|---|---|---|
| Pectinidae | | | | |
| *Cyclopecten nanus* Verrill & Bush, 1897 | – | – | – | d |
| *Amusium papyraceum* (Gabb, 1873) | – | – | – | d! |
| *Chlamys* (*Mimachlamys*) *benedicti* Verrill & Bush, 1897 | – | – | – | d! |
| *Chlamys* (*Leptopecten*) *linki* (Dall, 1926) | b | r | c | d |
| *Aequipecten* (*Aequipecten*) *lineolaris* (Lamarck, 1819) | – | – | – | d! |
| *Aequipecten* (*Argopecten*) *gibba* (Linnaeus, 1758) | – | r | c | d! |
| *Lyropecten* (*Nodipecten*) *nodosus* (Linnaeus, 1758) | – | – | – | d! |
| *Pecten* (*Euvola*) *ziczac* (Linnaeus, 1758) | – | – | – | d |
| *Pecten* (*Euvola*) *chazaliei* Dautzenberg, 1900 | – | – | – | d! |
| Anomiidae | | | | |
| *Anomia simplex* d'Orbigny, 1842 | b | r | c | d! |
| Ostreidae | | | | |
| *Crassostrea rhizophorae* (Guilding, 1828) | b | r | c! | d! |
| *Ostrea* sp. | b | r | – | – |
| Mytilidae | | | | |
| *Mytella charruana* (d'Orbigny, 1846) | – | r | c! | – |
| *Modiolus americanus* (Leach, 1815) | – | – | – | d |
| *Gregariella chenui* (Récluz, 1842) | – | – | – | d! |
| *Crenella abbotti* spec. nov. **3** | – | – | – | d! |
| *Lithophaga* (*Diberus*) *bisulcata* (d'Orbigny, 1842) | – | – | – | d! |
| Lyonsiidae | | | | |
| *Anticorbula sinuosa* (Morrison, 1943) | – | – | c! | – |
| Laternulidae | | | | |
| *Periploma coquettae* spec. nov. **4** | – | – | – | d |
| Pholadidae | | | | |
| *Barnea* (*Anchomasa*) *truncata* (Say, 1822) | – | – | c! | – |
| *Cyrtopleura* (*Scobinopholas*) *costata* (Linnaeus, 1758) | – | r | c! | – |
| *Pholas* (*Thovanna*) *campechiensis* Gmelin, 1791 | b | r | c | – |
| *Pholadidea* (*Hatasia*) *melanura* (Sowerby, 1834) **5** | – | – | – | d! |

| | | | | |
|---|---|---|---|---|
| *Lignopholas clappi* Turner, 1955 **5** | – | – | c! | – |
| *Martesia striata* (Linnaeus, 1758) | – | – | c! | – |
| *Martesia fragilis* (Verrill & Bush, 1890) **5** | – | – | c! | – |
| *Diplothyra smithii* Tryon, 1862 **5** | – | – | c! | d! |
| Teredinidae | | | | |
| *Neoteredo reynei* (Bartsch, 1920) | – | ?r | c! | – |
| *Psiloteredo healdi* (Bartsch, 1931) **5** | – | – | c! | – |
| *Bankia carinata* (Gray, 1827) **5** | – | – | c! | – |
| Corbulidae | | | | |
| *Corbula caribaea* d'Orbigny, 1842 | b | r | c | d |
| *Corbula aequivalvis* Philippi, 1836 | b | – | – | – |
| **Corbula dietziana* C. B. Adams, 1852 | – | – | – | d! |
| Myidae | | | | |
| *Sphenia antillensis* Dall & Simpson, 1901 | – | – | c! | d! |
| Gastrochaenidae | | | | |
| *Gastrochaena hians* (Gmelin, 1791) | – | – | – | d! |
| Chamidae | | | | |
| *Arcinella arcinella* (Linnaeus, 1767) | – | – | – | d! |
| *Chama* sp. | – | – | c | d |
| **Pseudochama radians* (Lamarck, 1819) | – | r | – | – |
| Corbiculidae | | | | |
| *Polymesoda aequilatera* (Deshayes, 1855) | – | r | c! | – |
| *Cyanocyclas rotunda* (Prime, 1860) **6** | – | – | c! | – |
| Cyrenoididae | | | | |
| *Cyrenoida floridana* Dall, 1896 | – | – | c! | – |
| Veneridae | | | | |
| *Ventricola rigida* (Dillwyn, 1817) | – | – | – | d |
| *Gouldia cerina* (C. B. Adams, 1845) | – | – | – | d |
| *Tivela mactroides* (Born, 1778) | b | r | c | – |

| | | | | |
|---|---|---|---|---|
| *Tivela geijskesi* spec. nov. **7** | – | r | c | – |
| *Pitar* (*Pitar*) *fulminata* (Menke, 1828) | – | – | – | d |
| **Pitar* (*Lamelliconcha*) *circinata* (Born, 1778) | – | r | – | – |
| **Callista* (*Costocallista*) *eucymata* (Dall, 1889) | – | – | – | d |
| *Callocardia* (*Agriopoma*) *aresta* Dall & Simpson, 1901 | – | – | – | d! |
| *Dosinia concentrica* (Born, 1778) | – | r | – | d! |
| *Cyclinella tenuis* (Récluz, 1852) | – | – | – | d! |
| *Chione* (*Chione*) *subrostrata* (Lamarck, 1818) | b | r | c! | d! |
| *Chione* (*Chionopsis*) *pubera* (Bory, 1827) | – | – | – | d |
| *Chione* (*Lirophora*) *latilirata* (Conrad, 1841) | – | – | – | d |
| *Anomalocardia brasiliana* (Gmelin, 1791) | – | r | c | – |
| *Protothaca* (*Nioche*) *pectorina* (Lamarck, 1818) | – | r | c! | – |
| Petricolidae | | | | |
| *Petricola* (*Petricolaria*) aff. *parallela* Pilsbry & Lowe 1932 | – | r | c | – |
| Ungulinidae | | | | |
| **Diplodonta rehderi* spec. nov. **8** | – | – | – | d! |
| Lucinidae | | | | |
| *Lucina* (*Phacoides*) *pectinata* (Gmelin, 1791) | – | r | – | – |
| *Lucina* (*Lucinisca*) *muricata* (Spengler, 1798) | b | r | c | d |
| *Lucina* (*Parvilucina*) *clenchi* spec. nov. **9** | – | – | – | d! |
| Erycinidae | | | | |
| *Kellia suborbicularis* (Montagu, 1803) | – | – | – | d! |
| Montacutidae | | | | |
| *Rochefortia* (*Pythinella*) *cuneata* (Verrill & Bush, 1897) **10** | – | – | – | d! |
| Donacidae | | | | |
| *Donax* (*Chion*) *denticulatus* Linnaeus, 1758 | – | r | c! | – |
| *Donax* (*Chion*) *striatus* Linnaeus, 1767 | – | r | c! | – |
| *Iphigenia brasiliensis* (Lamarck, 1818) | – | r | c! | – |

| | | | | |
|---|---|---|---|---|
| Garidae | | | | |
| *Sanguinolaria* (*Psammotella*) *operculata* (Gmelin, 1791) | – | r | – | – |
| *Tagelus plebeius* (Lightfoot, 1786) | – | r | c! | – |
| Semelidae | | | | |
| *Semele* (*Semele*) *cancellata* (Sowerby, 1833) | – | – | – | d |
| *Semele* (*Semele*) *purpurascens* (Gmelin, 1791) | – | – | – | d |
| **Semele* (*Semelina*) *nuculoides* (Conrad, 1841) | – | – | – | d |
| *Cumingia antillarum* (d'Orbigny, 1842) | – | – | – | d! |
| *Abra aequalis* (Say, 1822) | b | r | c | d |
| Tellinidae | | | | |
| *Tellina* (*Phyllodina*) *persica* (Dall & Simpson, 1901) | – | – | – | d |
| *Tellina* (*Merisca*) *juttingae* (v. R. Altena, 1965) | – | – | – | d |
| *Tellina* (*Eurytellina*) *punicea* (Born, 1778) | – | r | c | – |
| *Tellina* (*Eurytellina*) *trinitatis* (Tomlin, 1929) | – | r | c! | d |
| *Tellina* (*Angulus*) *diantha* (Boss, 1964) | b | r | c! | d |
| *Strigilla gabbi* Olsson & McGinty, 1958 | – | – | c | – |
| *Strigilla pisiformis* (Linnaeus, 1758) | – | r | – | – |
| *Macoma* (*Macoma*) *constricta* (Bruguière, 1792) | – | r | c! | – |
| *Macoma* (*Psammacoma*) *tageliformis* Dall, 1900 | b | r | c | d |
| *Macoma* (*Psammacoma*) *cleryana* (d'Orbigny, 1846) | – | r | – | d |
| *Macoma* (*Temnoconcha*) *brasiliana* (Dall, 1921) | b | r | c | d |
| Solenidae | | | | |
| *Solen* sp. | – | – | – | d |
| Mactridae | | | | |
| *Mulinia cleryana* (d'Orbigny, 1846) **11** | b | r | c! | d |
| *Mactra* (*Mactra*) *petiti* d'Orbigny, 1846 **12** | – | r | c | – |
| *Mactra* (*Micromactra*) *surinamensis* spec. nov. **13** | b | r | c | d |
| *Mactra* (*Mactrotoma*) *fragilis* Gmelin, 1791 | – | – | – | d |
| *Mactra* (*Mactrellona*) *iheringi* (Dall, 1897) | – | r | c | d |
| *Labiosa* (*Raeta*) *plicatella* (Lamarck, 1818) | – | r | c | d |

| | | | | |
|---|---|---|---|---|
| Cardiidae | | | | |
| *Trachycardium* (*Trachycardium*) *isocardia* (Linnaeus, 1758) | – | – | – | d |
| *Trachycardium* (*Dallocardia*) *muricatum* (Linnaeus, 1758) | b | r | c | d! |
| *Trigoniocardia media* (Linnaeus, 1758) | – | – | – | d! |
| *Trigoniocardia antillarum* (d'Orbigny, 1842) **12** | – | r | c | d |
| **Microcardium tinctum* (Dall, 1881) | – | – | – | d! |
| *Laevicardium laevigatum* (Linnaeus, 1758) | – | – | – | d! |
| Crassatellidae | | | | |
| *Crassatella* (*Crassinella*) sp. | – | r | c | d |
| *Crassatella* (*Crassinella*) *guadelupensis* (d'Orbigny, 1842) | b | r | c | d |
| *Crassatella* (*Hybolophus*) *antillarum* Reeve, 1842 | – | – | – | d |
| Verticordiidae | | | | |
| **Verticordia* (*Trigonulina*) *ornata* (d'Orbigny, 1842) | – | – | – | d |
| Cuspidariidae | | | | |
| *Cuspidaria* (*Cardiomya*) sp. | – | – | – | d |

## NOTES ON SOME ITEMS IN THE LIST

### WITH THE DESCRIPTION OF SEVEN NEW SPECIES

In the notes the following abbreviations have been used:

ANSP: Academy of Natural Sciences of Philadelphia, Pennsylvania, U.S.A.

BM: British Museum (Natural History), London, England.

MCZ: Museum of Comparative Zoology, Cambridge, Mass., U.S.A.

RNHL: Rijksmuseum van Natuurlijke Historie, Leiden, Netherlands.

SM: Surinaams Museum, Paramaribo, Surinam.

USNM: United States National Museum, Washington, D.C., U.S.A.

## 1 **Nucula surinamensis** spec. nov. Fig. 145a, b

Holotype. – A right valve (Fig. 145) from a shell of *Murex brevifrons* Lamarck dredged off the coast of Surinam (exact locality unknown), Dienst van de Visserij, Paramaribo, leg. (RNHL).

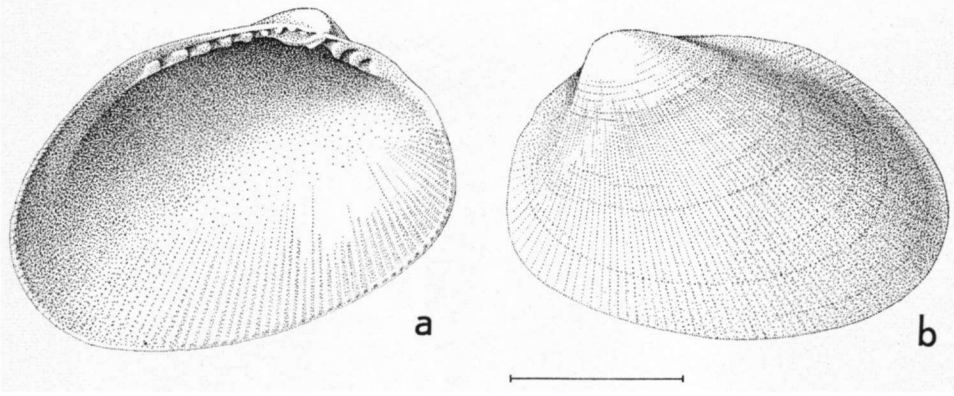


Fig. 145. *Nucula surinamensis* spec. nov., holotype. Scale: 1 mm.

Description. – Shell small, fairly thin for a *Nucula*, trapezoid, whitish and glossy; umbo at almost 1/3 of the length from the posterior end of the shell; anterior side broadened, posterior side subtruncate. Sculpture consisting of fine, flat radial ribs separated by narrow grooves and crossed by less pronounced lines of growth at irregular distances; on the ill-delimited escutcheon a more regular, very delicate, concentric schulpture is visible under proper illumination (not shown in the figure); no lunule. Anterior dorsal margin subangulate just in front of the foremost tooth of the hinge, anterior margin evenly rounded, ventral margin faintly curved, posterior margin subangulate at the junction with the sloping posterior dorsal margin, rounded at the junction with the ventral margin; anterior, ventral and posterior margins finely crenulated. Beak opisthogyrate. Hinge with 8 anterior and 3 posterior teeth; resilifer under the most central anterior teeth. Interior nacreous, muscular and pallial scars not or hardly showing.

Measurements. – Length 3.0 mm; height 2.0 mm; semidiameter about 0.7 mm.

Discussion. – By its trapezoid shape and thin shell this species is easily distinguished from other Caribbean species of *Nucula*. *Pronucula hedleyi* Pritchard & Gatliff (COTTON & GODFREY, 1938: 38, fig. 9, southern coasts of Australia) is the only species showing some similarity with *N. surinamensis* which I have found in the literature. The Surinam species is, however, longer in relation to its height, less truncate posteriorly, and has a longer and more oblique resilifer.

Derivatio nominis. – This new species is named after Surinam.

**2** *Adrana notabilis* Rehder, 1939, is a synonym.

**3** **Crenella abbotti** spec. nov. Fig. 146a, b

Holotype. – A right valve (Fig. 146) from Coquette "2 (138'–139')" [off the coast of Surinam at a depth of 138–139 feet] (RNHL).

Paratypes. – A left and three right valves from the 5th trip of the Coquette, NNW of the Marowijne River, ca. 30 miles off the coast, down to 20 fathoms (RNHL); one right valve from the type locality (RNHL); one shell (RNHL), four left and two right valves (SM) from a shell of *Murex brevifrons* Lamarck dredged off the coast of Surinam (exact locality unknown).

Description. – Valves minute, convex, rather thin, subcircular, the greatest height well behind the umbo; dorsal margin almost straight, the gently curved posterodorsal margin passing by a sharper curve into the also gently curved ventral margin, anterior mar-

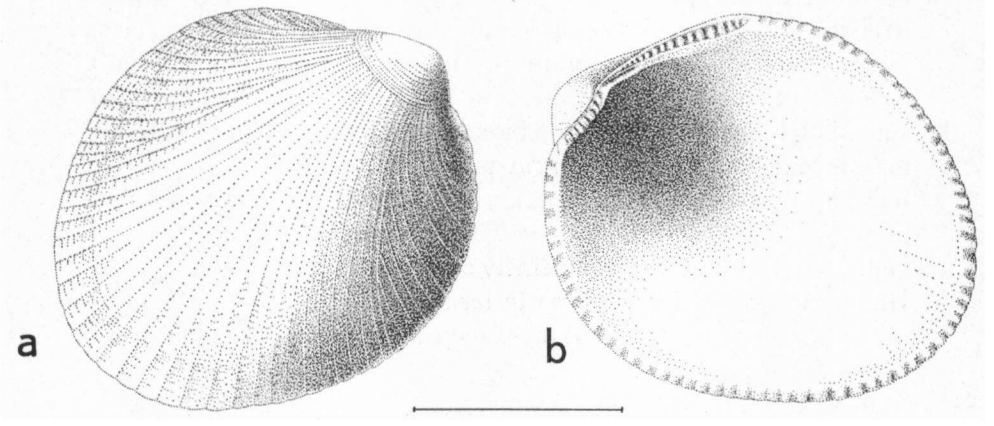


Fig. 146. *Crenella abbotti* spec. nov., holotype. Scale: 1 mm.

gin somewhat more curved and fairly short. Sculpture consisting of radial riblets, those of the lateral areas starting from the outer ones of the middle area, on which the riblets diverge in a reversed V pattern from each other.

Measurements. – Length 2.0 mm; height 2.1 mm; semidiameter about 1 mm (holotype).

Discussion. – This minute form does not agree with the young of any Atlantic *Crenella* I could compare. The nearest related species seems to be *Cr. minuta* THIELE & JAECKEL (1931: 171, pl. 6 Fig. 5, Agulhas Bank), of which I was enabled to examine the syntypes by the courtesy of Dr. R. KILIAS of the Berlin Museum. *Cr. minuta* reaches somewhat larger dimensions, has a still more circular outline owing to the relatively longer anterior margin, and differs especially in its much finer sculpture from the Surinam species.

Derivatio nominis. – This new species is dedicated to Dr. R. TUCKER ABBOTT of the Academy of Natural Sciences of Philadelphia.

**4 Periploma coquettae** spec. nov. Fig. 147a–d

Holotype. – A left valve (Fig. 147) dredged by the Coquette N. of the Suriname River, 20 miles off the coast, 15 fathoms, May 3, 1957 (RNHL).

Paratypes. – Two right valves (Fig. 147d) from the same locality and date (RNHL, SM).

Description. – Shell white all over, thin, moderately convex, suboval, subtruncate in front and behind, with the umbones well behind the middle at about 2/3 of the length, posterior side slightly twisted to the right. Antero-dorsal margin moderately convex, passing with a rounded angle into the short, nearly straight, anterior margin, which merges into the almost semicircular ventral margin; the hardly convex posterior margin is connected by rounded angles with the ventral and the postero-dorsal margins; the latter is subconcave. Outer surface of the shell with irregular lines of growth, some of which appear to be shallow grooves under a lens, and with concentric rows of minute pustules in a broad zone along the anterior and ventral margin, which continue on the rostrum as crowded, fine, wavy, concentric ridgelets. Inner surface of the valves nacreous as to a broad zone along the anterior, ventral and posterior margins; mantle sinus triangular, its blunt anterior angle reaching to about

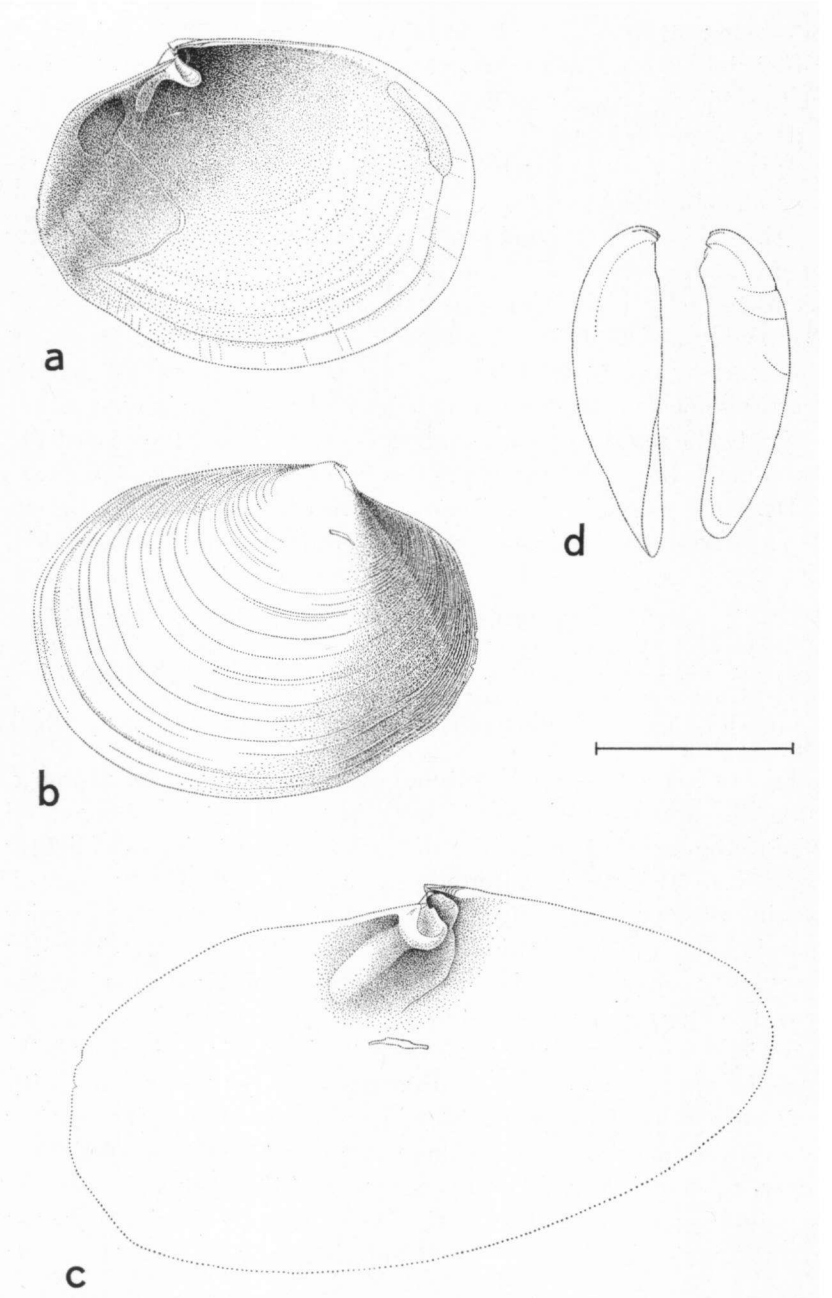


Fig. 147. *Periploma coquettae* spec. nov., a–c: holotype; d: holotype and paratype from behind. Scale for a, b and d: 10 mm.

1/3 of the length of the shell from behind. Chondrophore directed to the anteroventral angle in the holotype and paratype 2, more ventrally in paratype 1, with a short, blunt buttress directed to the postero-ventral angle.

| Measurements. – | Length | Height | Semi-diameter | |
|---|---|---|---|---|
| | 35 mm | 27 mm | 7 mm | (holotype) |
| | 42 mm | 35 mm | 10 mm | |
| | 32 mm | 25½ mm | 6 mm | |

Discussion. – This new species seems to be very near *P. venezuelana* H. K. Hodson (in HODSON & HODSON, 1931: 7, pl. 1 fig. 1, 2, 6, 8, Miocene of Venezuela). That species is, however, relatively less high, has a less convex ventral margin, a fold running from the umbo to the postero-ventral angle (most noticeable in the right valve), and a sharper postero-ventral angle. *P. coquettae* spec. nov. is easily distinguished from other Recent species of the genus.

Derivatio nominis. – This new species is named after the ship "Coquette," whose cruises provided me with so much important material.

**5** Dr. RUTH D. TURNER (M.C.Z.) det.

**6** *Corbicula surinamica* Clessin, 1879, is a synonym.

**7** **Tivela geijskesi** spec. nov. Fig. 148a, b

Holotype. – A right valve (Fig. 148) from the shell ridge at Munderweg, Paramaribo, 1956, W. A. Collier leg. (RNHL).

Paratypes. – 169 valves from the type locality, 1955 (49), 1956 (116) and without date (4), W. A. Collier leg.; two valves from the shell ridge at Charlesburgerweg, Paramaribo, 1957, W. A. Collier leg.; nine valves from the shell ridge at Jagtlust, district of Commewijne, 22.VIII.1955, D. C. Geijskes leg.; two young valves from the shell ridge at Blauwgrond near Paramaribo, Surinaams Museum leg.; one valve from Braamspunt, 5.IV.1957, D. C. Geijskes leg.; two valves from a beach at Olinda near Recife, province of Pernambuco, BRAZIL, 10.VI.1951, F. Kalff leg. (all RNHL).

Description. – Valves subtrigonal, convex, rather thin for a species of *Tivela*, inequilateral, the antero-dorsal margin hardly

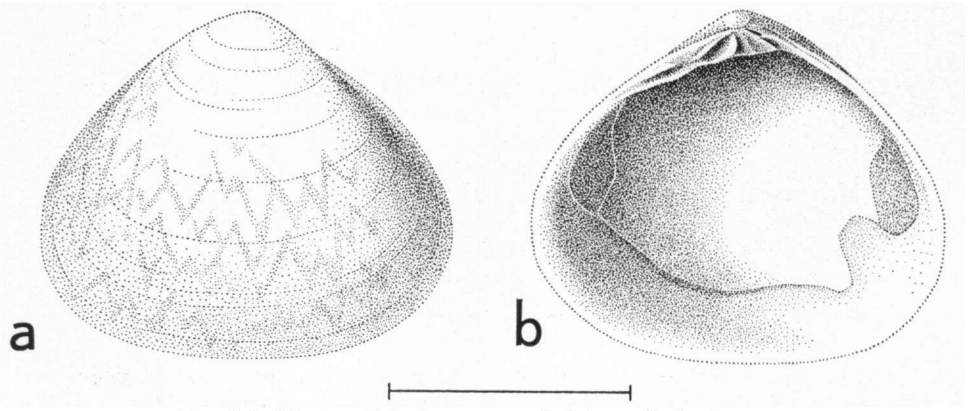


Fig. 148. *Tivela geijskesi* spec. nov., holotype. Scale: 5 mm.

convex, postero-dorsal and ventral margins moderately convex, posterior side rounded, anterior side slightly more pointed. Umbo in front of the middle of the length, prosogyrous. Lunule delimited by a ridge, moderately wide, long, extending almost to the most anterior point of the shell, no escutcheon. Outer surface smooth, but for irregular and fine lines of growth; in some specimens there are traces of irregular zigzag colour markings. Three cardinal teeth in both valves; in the left valve the anterior and central cardinals touch each other at the top, thus forming an inverted V; the anterior lateral in this valve parallel to and originating slightly in front of the ventral end of the anterior cardinal tooth. Pallial sinus very short, shorter than it is wide.

Young valves are relatively flatter and have a somewhat more ovate outline. In the adults there is some variation in the relative length of the valves, the relatively shortest valves being the most convex ones.

| Measurements. – Length | Height | Semidiameter | |
|---|---|---|---|
| 8½ | 7 | 2¼ mm | (holotype) |
| 8½ | 7½ | almost 3 mm | (left valve) |
| 8 | 7 | 3 mm | (left valve) |
| 7¾ | 6½ | 2¼ mm | (right valve) |
| 6½ | 6 | 2¼ mm | (left valve) |

Discussion. – *Tivela geijskesi* nov. spec. is a small species of the group of *T. trigonella* (Lamarck) and *T. floridana* Rehder. From both these species it differs in its smaller size and shallower pallial sinus. *T. abaconis* Dall is also a larger species and its hinge is different: the posterior cardinal tooth of the right valve is almost perpendicular to the long axis of the shell instead of pointing towards the posterior side, as in the present new species. Young shells of *Tivela mactroides* (Born), the only *Tivela* occurring in the same localities in Surinam, are thicker and differ in details of the hinge structure. For references to the other species of *Tivela* mentioned here, see: FISCHER-PIETTE & FISCHER, 1942.

Derivatio nominis. – This new species is dedicated to Dr. D. C. GEIJSKES, formerly Director of the Surinam Museum, Paramaribo.

Distribution. – *Tivela geijskesi* spec. nov. occurs in most of the shell ridges of Surinam and is locally abundant. In the Surinam Museum I saw specimens from the following ridges: District of Nickerie: Nickerie. District of Coronie: Coronieweg. District of Saramacca: Groningen. District of Suriname: Kwatta, Charlesburg. District of Commewijne: Lust en Rust. These specimens are no paratypes, because they were not available when the description of the species was made. The same obtains for an odd valve in the same collection dredged in the mouth of the Surinam River (Nijland leg.). This specimen and the paratype from Braamspunt are the only indications that the species might still belong to the Recent fauna of Surinam. The two paratypes from Olinda, Brazil, are somewhat beach-worn but look fresh and are presumably Recent.

## 8 **Diplodonta (Sphaerella) rehderi** spec. nov. Fig. 149a–c

Holotype: A fresh but empty shell (Fig. 149) from Coquette Sta. 337, 6°49′–6°47′ N, 55°21′–55°18′ W, 27–29 fathoms, 21.VII.1957 (USNM, No. 639008).

Description. – Shell subcircular and very convex, thin, white; umbones protruding over the hinge margin, prosogyrate; no lunule. Sculpture consisting of very fine and rather irregular concentric riblets crossed by a few indistinct radial lines over the disc of the shell. Ligament pit long and narrow; left valve with an anterior bifid cardinal and a long simple posterior cardinal tooth; right valve with the arms of the posterior cardinal strongly diverging, the posterior arm fairly long, the anterior cardinal tooth obsoletely (less pronounced than in the figure) bifid.

Measurements: Length 10; height 9; diameter 8 mm.

Unfortunately the left valve of the holotype was damaged after the figure of the hinge had been made.

Discussion. – *D. rehderi* is a smaller species than *D.* (*Sphaerella*) *verrilli* DALL (1899: 245, off Massachusetts to North Carolina; DALL, 1889, pl. 65 fig. 135, *D. turgida* V. & S. nec Conrad) from which species it also differs in details of the hinge structure. Young specimens of *D. verrilli* have a shape slightly different from that of *D. rehderi*: the junction of the dorsal and posterior margins is subangulate. The new species is also smaller than the Miocene type of *Sphaerella*, *D. subvexa* (Conrad), of which I failed to find a description or figure of the hinge.

Derivatio nominis. – This new species is dedicated to Dr. H. A. REHDER, curator of the Department of Mollusca of the United States National Museum.

Distribution. – This may be a rare but widely spread species. In the ANSP collection I saw a specimen from "108 ft., soft mud, NW of Tom Owens Cay (16°51′ N, 88°17′45″ W), BRITISH HONDURAS, Sta. 96, 23.VIII.1961, Robert Robertson leg." which probably belongs to this species. It is more transparent, which renders the concentric sculpture clearly visible on the inner side, and the concentric riblets are

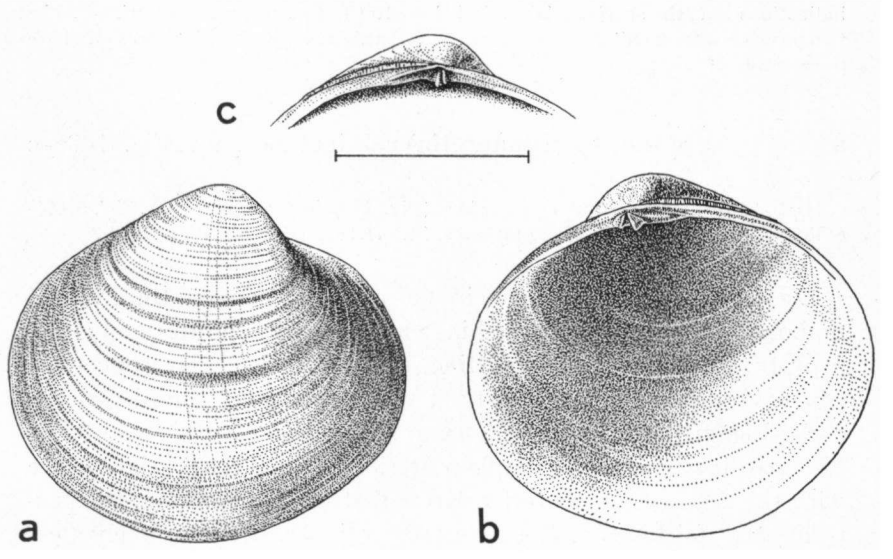


Fig. 149. *Diplodonta* (*Sphaerella*) *rehderi* spec. nov., holotype. Scale: 5 mm.

raised where they turn from the disc to the anterior side of the valve. In the USNM a valve from FLORIDA, s.n. *D. puncturella* Dall (No. 454206), is probably this species, while the MCZ may have it under *D. nucleiformis* Wagner from Matthew Town, GREAT INAGUA, Bahamas (No. 240564).

## 9 **Lucina (Parvilucina) clenchi** spec. nov. Fig. 150a–d

Holotype. – An empty shell (Fig. 150) from a shell of *Murex brevifrons* Lamarck dredged off the coast of Surinam (exact locality unknown), Dienst van de Visserij, Paramaribo, leg. (RNHL).

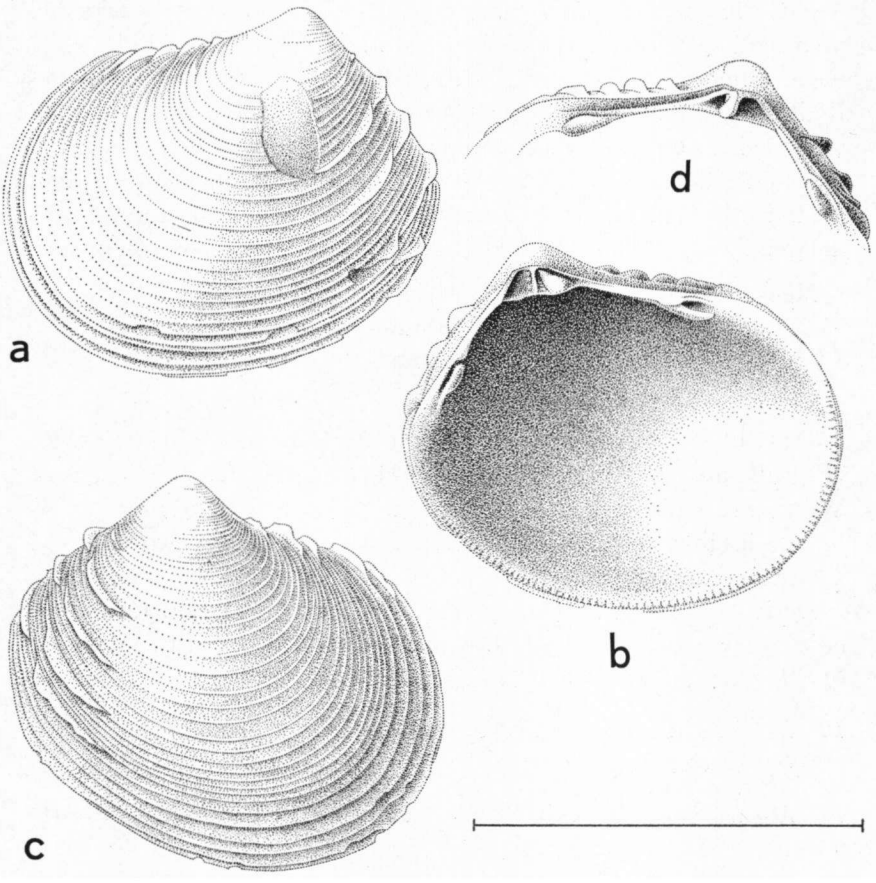


Fig. 150. *Lucina* (*Parvilucina*) *clenchi* spec. nov., holotype. Scale: 1 mm.

Paratypes. – One left valve from the 5th trip of the Coquette, 29.IV.–3.V.1957, NNW of the Marowijne River, ca. 30 miles off the coast, down to 20 fathoms (RNHL) one right valve from a tube of the polychaete *Diopatra cuprea* (Bosc) (Marian H. Pettibone det.), Coquette Sta. 197, 6°22.5′ N, 55°10′ W, 10.VI.1957, 11 fathoms (RNHL); one left valve from the same locality as the holotype (SM); one right valve from off the coast of Surinam (no exact locality) (SM).

Description. – Shell very small, ovate, moderately convex, solid, inequilateral, the umbones well behind the middle of the length, posterior side subtruncate, anterior side rounded. Prodissoconch smooth, on top of the submamillate umbones. Sculpture consisting of very fine concentric riblets, some of which (5 on the right, 4 on the left valve of the holotype) bear a scaly spine on the rounded angle between the disc and the posterior part of the valve, while some others of these riblets bear such a spine near the ridge delimiting the narrow and smooth escutcheon. There are also such scaly spines on some of the riblets near the ridge delimiting the lanceolate and smooth lunula. Radial sculpture lacking. One cardinal tooth in the right, two in the left valve, anterior and posterior laterals well developed in both valves. Ventral margin minutely crenulate.

| Measurements. – Length | Height | |
|---|---|---|
| 1.2 mm | 1.0 mm | (holotype) |
| 1¼ mm | 1⅛ mm | (paratype from Coquette Sta 197) |

Discussion. – This new species seems to be nearly related to *L.* (*P.*) *callosana* PILSBRY & OLSSON (1941: 57, pl. 18 fig. 6, Pliocene of Western Ecuador). *L. callosana* is, however, a larger and more circular species in which every other concentric riblet bears two spines at the posterior side.

Derivatio nominis. – This species is dedicated to Dr. W. J. CLENCH editor of Johnsonia and formerly curator of Mollusca at the Museum of Comparative Zoology, Cambridge (Mass.).

**10** Identification confirmed by G. HAMPSON (Woodshole Oceanographic Institution).

**11** *Mactra guadelupensis* Récluz, 1852, and *M. portoricensis* Shuttleworth, 1854, are synonyms.

**12** *Mactra richmondi* Dall, 1894, is a synonym.

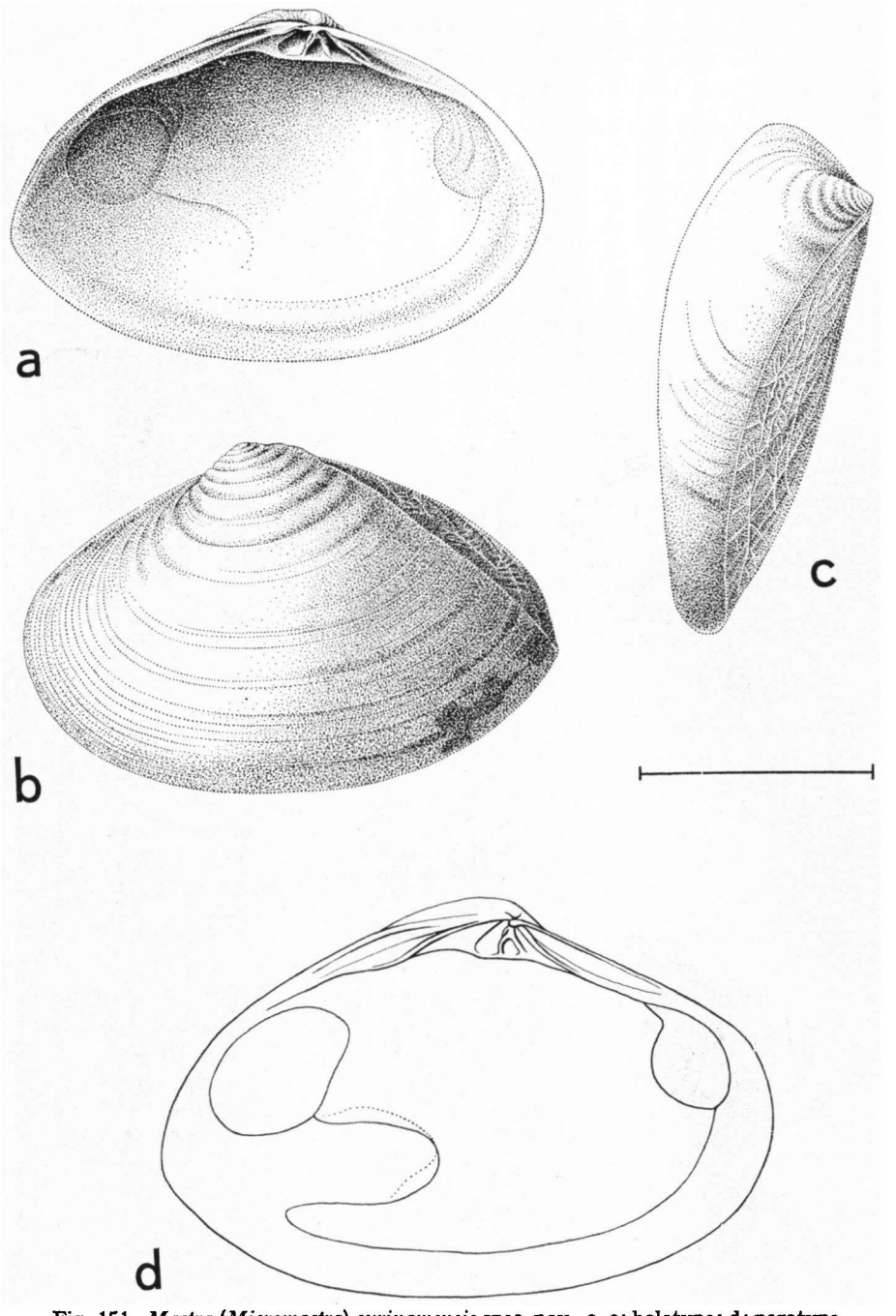


Fig. 151. *Mactra* (*Micromactra*) *surinamensis* spec. nov., a–c: holotype; d: paratype from Coronieweg km 117–118. Scale: 10 mm.

## 13 Mactra (Micromactra) surinamensis spec. nov.

Fig. 151a–d, 152a, b

Holotype. – A left valve (Fig. 151a–c) from Surinam (no exact locality, but the specimen is obviously Recent), June 1910, D. G. J. Bolten leg. (RNHL).

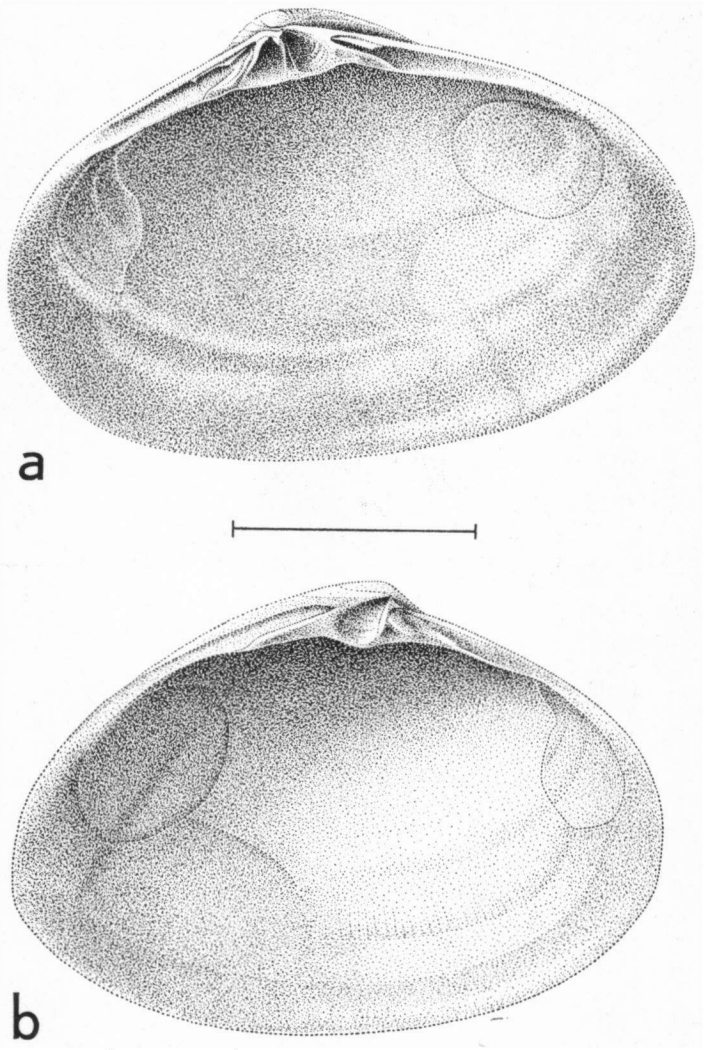


Fig. 152. *Mactra* (*Micromactra*) *surinamensis* spec. nov., paratypes from Coppename Punt. Scale: 10 mm.

Holocene paratypes. – Coronie district: one right valve from Coronieweg, picket 216, D. C. Geijskes leg. (SM); one left valve (Fig. 151d) from Coronieweg, km 117–118, 11.III.1963, C. O. v. R. Altena leg. (RNHL); Suriname district: one small right valve from Charlesburg, D. C. Geijskes leg. (RNHL).

Recent paratypes. – One left valve from Surinam (no exact locality, presumably Recent), D. C. Geijskes leg. (SM); Saramacca district: a right and a left valve (Fig. 152a, b) from Coppename Punt, 13.VIII.1948, D. C. Geijskes leg. (RNHL); a small right valve from the beach near Popogaimama Creek, D. C. Geijskes leg. (SM); one young right valve from Coquette Sta. 2, 6°23′ N, 55°05.5′ W, 15 fathoms, 5.XI.1957 (USNM, no. 638959).

Description. – Shell creamy white, glossy, fairly thin, suboval, the length about 1½ × the height, the sides flattened, umbones hardly to slightly in front of the middle. Anterodorsal margin gently curved, passing into the semicircular anterior margin, ventral margin nearly straight in the middle, curved on both sides, the junction with the posterior margin subangular at the end of the keel which delimits the escutcheon, posterior margin short and gently curved, passing by a rounded angle into the gently curved posterodorsal margin. Umbones prosogyrous, pointed, encircled by about ten rounded, gradually vanishing concentric ribs, the outer one or two of which are incomplete and well developed in front only. The escutcheon more or less clearly shows a peculiar sculpture of irregular wrinkles (fig. 151c). For the rest the sculpture consists of fine lines of growth only. Remains of the periostracum near the margins are brown in the holotype. Inner side glossy; hinge normal for the subgenus, pallial sinus rather deep, but ending well behind the middle of the shell, its exact shape not quite clear, the paratype from Coronieweg km 117–118 (fig. 151d) giving the best picture of it.

| Measurements.– Length | Height | Semi-diameter | |
|---|---|---|---|
| 22½ mm | 15 mm | 3.9 mm | (holotype) |
| 29 mm | 19 mm | 5.2 mm | (left valve, Coppename Punt) |
| 27½ mm | 19 mm | 4.7 mm | (right valve, id.) |
| 25½ mm | 16½ mm | 4.2 mm | (Coronieweg km 117–118) |
| 24 mm | 15½ mm | 4.1 mm | (Coronieweg) |
| 17 mm | 11 mm | 3.0 mm | (Popogaimama Creek) |

Discussion. – This new species is closely related to *Mactra janeiroensis* E. A. SMITH (1915: 102, pl. 2 fig. 20, Recent, off Rio de Janeiro, 40 fathoms), and to *Mactra californica maracaibensis* H. K. Hodson (in HODSON & HODSON, 1931: 20, pl. 9 fig. 6, 9, Miocene, Venezuela). It differs from the former, of which I could compare the syntypes (BM), in having a less convex shell in which the concentric ridges around the umbo vanish earlier, so as not to reach half the height of the shell in adult specimens. The mantle sinus has very much the same shape in both forms, but it is slightly shorter in the new species. The following are some measurements of syntypes of SMITH's species:

| Length | Height | Semi-diameter | Valve |
|---|---|---|---|
| 31½ mm | 20½ mm | 6.5 mm | left (marked 'Type,' the figured specimen) |
| 29 mm | 19 mm | 5.7 mm | right |
| 25 mm | 17 mm | 4.4 mm | right |
| 24 mm | 15½ mm | 4.2 mm | right |
| 22 mm | 15 mm | 4.3 mm | right |

I have not been able to examine specimens of the Miocene species from Venezuela, but from the description it appears to have a relatively longer shell with the umbones more in front of the middle and a stronger keel delimiting the escutcheon.

Admittedly the differences between *Mactra surinamensis* and these two related forms are small and future comparison of large series may show them to be of subspecific value only.

Distribution. – A small fragment of a left valve, recognizable by the peculiar sculpture of the escutcheon, was found at 16.25 m depth in the well boring "Alliance-28" (RNHL). The RNHL further possesses a damaged left valve with remains of a yellowish periostracum from the beach at Totness, Coronie district, 12.III.1963, C. O. v. R. Altena leg., and another damaged left valve from the shell ridge at Munderweg, Paramaribo, W. A. Collier leg. 1955. These specimens are too incomplete to be considered paratypes.

A. THE HOLOCENE FAUNA

All the bivalves found in the Holocene deposits belong to Recent species.

The great number of species, viz., 43 (79%) out of 54, which the bivalve fauna of the ridges has in common with that of the coast characterizes the former as a mixed intertidal and inshore fauna (see next section). Ridges are still formed (and sometimes also destroyed again) by the sea along the Surinam coast nowadays, and the most common bivalves of the ridges, viz., *Anomia simplex*, *Crassostrea rhizophorae*, *Chione subrostrata* and *Mulinia cleryana* are the same as those most abundantly washed ashore on the coast. Nevertheless there are some indications that changes in the fauna occurred since the first ridges were deposited.

From the six species restricted to the ridges three, *Arca zebra*, *Pseudochama radians*, and *Pitar circinata*, are represented by one valve each in our material and, therefore, need not concern us here. Two large species, however, *Lucina pectinata* and *Sanguinolaria operculata*, are represented by several odd valves, each from two localities, and the small *Strigilla pisiformis* occurs in at least six localities in the ridges. It should also be noted that *Tivela geijskesi* is not rare and even locally abundant in the ridges, while it has hardly been found on the coast. Hence it seems likely that during the Holocene the composition of the inshore bivalve fauna of Surinam underwent minor changes.

Far less material from boring cores could be examined than from the other categories. This is certainly the reason why only 27 species are referred to in category b. Of these 21 (78%) have also been found on the coast. Analysis of the mollusc fauna found at depths between 12.25 and 16.25 m in boring "Alliance-28" (v. R. ALTENA, in the press) showed that this fauna probably lived in shallow water at some distance off the coast, at a depth of circa 10 fathoms. An important argument for this conclusion was the total absence of species (both bivalves and gastropods) which are abundant in the intertidal zone. As these species are not lacking in the fauna of the ridges, it

seems likely that with growing knowledge of the fauna of category b this will prove more different from those of the categories r and c than the latter two are inter se.

## B. The Recent fauna

The species referred to by c in the third column opposite their name live in three different biotopes.

(1) The lower rivers. Here only few species are living, which penetrate to where the water is practically fresh, viz., in the Suriname River up to Jodensavanne before the closure of the Affobakka dam. They are true brackish water species: *Anticorbula sinuosa, Psiloteredo healdi,* and *Cyanocyclas rotunda.*

(2) The intertidal zone. Perhaps *Cyrenoida floridana* Dall, which species has not yet been found in situ in Surinam, is restricted to this zone. The zone is characterized by the abundant occurrence of: *Crassostrea rhizophorae, Mytella charruana* and *Neoteredo reynei.* The latter two species do not appear to go down far below low water level, while *Crassostrea rhizophorae* occurs also in dredged material, at least to a depth of 16 fathoms.

(3) The inshore zone along the coast. Presumably most of the shells washed ashore are of animals that lived in water shallower than 5 fathoms. Higman (1959) described this zone as follows:

> "The inshore waters, shallower than five fathoms, are irregularly obstructed by extensive soft 'sling' mud banks which extend from 2 to 12 miles offshore. These banks are subject to frequent shifting by tides and strong westerly currents, and their presence makes trawling inside 5 fathoms extremely hazardous. ... The water in the inshore zone is colour of creamed coffee due to considerable material in suspension."

So it is clear why hardly any dredging data are available from this zone: there is only one record of *Crassostrea rhizophorae* from three fathoms. In the material washed ashore the sometimes very fresh shells of several species lacking in the dredged samples are common. It seems, therefore, likely that these species live in the inshore zone; they are: *Lunarca ovalis, Cyrtopleura costata, Pholas campechiensis, Polymesoda aequilatera, Tivela mactroides, Protothaca pectorina, Do-*

*nax denticulatus, Donax striatus, Iphigenia brasiliensis, Tagelus plebeius,* and *Macoma constricta.* Two of the most common species seem at least to find their optimum in this zone, as they are hardly represented in the dredged samples, viz., *Chione subcancellata* and *Mulinia cleryana.* The common occurrence on the beach of worn upper (left) valves of *Anomia simplex* is puzzling, as this is a species which needs a solid substratum for fixing its byssus.

On the whole this zone appears to be poorer in species than the deeper zones are. This is probably due to the adverse ecological conditions, like the absence of hard rock, the often shifting mud banks, the silted water and the variable salinity caused by the great quantity of fresh water entering this zone from several large rivers, especially in the rainy seasons.

The species marked with a d in the fourth column opposite their name come from samples dredged at depths between 3 and 30 fathoms. HIGMAN (1959) distinguishes four zones off the Surinam coast inside the 40 fathom line. The first of these has just been dealt with under No. (3). The others are:

(4) The intermediate zone. "Beyond five fathoms, trawlable bottom, largely consisting of soft, sticky, gray mud, extends out to approximately 18 or 19 fathoms where it gives way to rougher dead shell bottom ... The water color in the intermediate zone changes from brown on the inshore side to milky green offshore."

(5) The shell ridge zone. "Within the general depth interval, 19 to 23 fathoms, a zone of rough bottom apparently parallels most of the Surinam Coast. Although the ridge is narrow along the eastern and central Surinam coast, exploratory operations indicate a widening in the vicinity of the Coppename River and disruption of the ridge in the vicinity of the Maroni River. Try-net catches included dead encrusted shells, dead coral, gorgonids, and sponge."

(6) The offshore zone. "In water deeper than 23 fathoms hard trawlable bottom, consisting predominantly of gray mud and fine shell, extends to at least the 40-fathom depth curve -- the limit of the trawling gear. Scattered through this zone are extensive patches of soft blue and black mud. Large expanses of the gray mud bottom are covered with a fine moss-like gorgonids-growth

which clogged the trawl meshes. ... The water color in this zone is the deep blue that is characteristic of the open ocean."

A larger material with more exact bathymetrical data would be necessary for a detailed correlation of the distribution of bivalves with this zonation. There are, however, indications that some species are characteristic for, in some cases perhaps even restricted to, one or two of these zones, viz.,

for the inshore and intermediate zones: *Nucula venezuelana* and *Mactra iheringi*;

for the intermediate zone: *Yoldia crosbyana* and *Yoldia egregia*;

for the shell and offshore zones: *Amusium papyraceum*;

for the offshore zone: *Aequipecten lineolaris*.

The bivalve fauna from deeper water (between 5 and 30 fathoms) is certainly richer in species than that of the intertidal and inshore zones. Of the 87 species dredged between 5 and 30 fathoms 57 have not yet been found on the coast. Although three of these occur in the ridges, which makes it probable that they are living in the inshore zone too, it seems likely that most of the deeper water species do not enter this zone. As the census of the deeper zones is less complete than that of the inshore fauna, this difference will probably appear to be greater when more material can be examined.

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