

Anomalodesmata (Bivalvia) from the Surinam shelf, the Caribbean region

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The present paper records 11 taxa of Anomalodesmata (Poromyidae, Cuspidariidae, Verticordiidae) from Surinam and adjacent waters. One taxon (*Cardiomya surinamensis*) was previously known from the area, and two (*Cuspidaria luymesii* and *C. altenai*) are new species. The total distribution of the taxa is outlined. Comparison with the Anomalodesmata of Saba Bank is made. *Verticordia acuticostata* is ampho-Atlantic, *V. ornata* is ampho-American. The material comprises 269 samples from 95 stations, and consists of 27 live-collected specimens and some 2000 detached valves. The scarcity of live specimens may be due to the turbid water and the movement of bottom sediment.

Key words: Bivalvia, Anomalodesmata, Poromyidae, Cuspidariidae, Verticordiidae, taxonomy, biogeography, shelf fauna, Caribbean, Surinam.

INTRODUCTION

The present paper deals with the bivalves of the subclass Anomalodesmata Dall, 1889, obtained by three surveys of the shelf of Surinam and the adjacent areas of French Guyana (to 52°50' W). The stations investigated were taken on lines roughly at right angles to the

Vessel	Year/Month	Area	No. of stations	Depth range in metres
H.NL.M.S.'Snellius'	iii-v.1966	Western shelf of Surinam, legs A-H	66	10-100
H.NL.M.S.'Luymes'	iii-iv.1969	Eastern shelf of Surinam, legs A, I-N	66	5-940
H.NL.M.S.'Luymes'	viii-ix.1970	French Guyana	23	6-617
		Surinam	20	
		British Guyana	72	
		Totals	247	5-940

Table 1. Samples studied.

Family	No. of samples	No. of species	No. of specimens	No. of single valves
Poromyidae	57	1	8	627
Cuspidariidae	151	7	16	514
Verticordiidae	58	3	2	865
Totals	266	11	26	2006

Table 2. Summary of the material of Anomalodesmata.

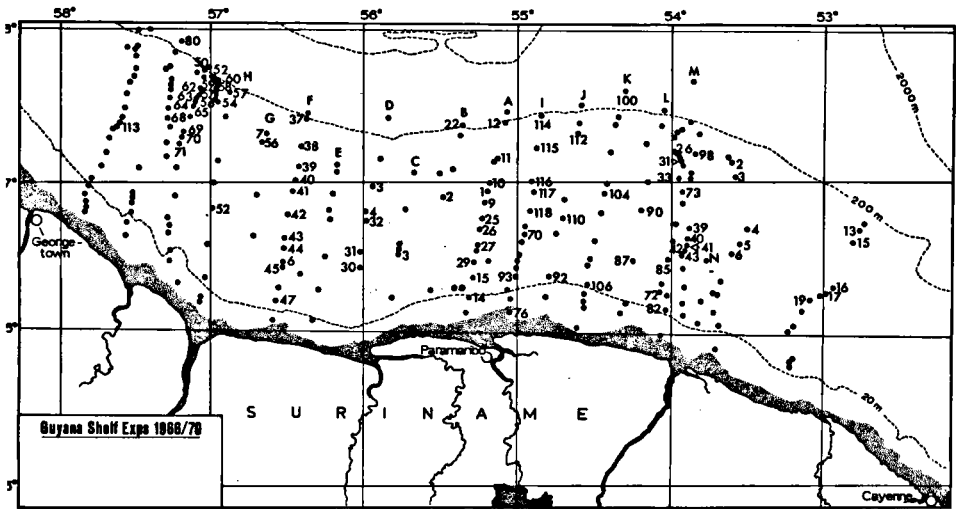


Fig. 1. Stations operated during the Surinam expeditions 1966/70. Anomalodesmata were obtained at the numbered stations.

general coastline and parallel to each other; some stations were worked more than once. Besides biological sampling, the programme included geomorphology, sedimentology and hydrography. The stations are shown in fig. 1; the 95 stations yielding *Anomalodesmata* are numbered. Most of the material was collected by the 0.1 m² van Veen grab.

Additional samples from the U.S. National Museum, Smithsonian Institution, Washington, D.C. (NMNH), the Allan Hancock Foundation, Los Angeles, and the Zoological Museum of Copenhagen (ZMUC) have also been examined. The various expeditions are indicated by the following acronyms: OCPS (Onderzoek van het Continentale Plat van Suriname = Investigation of the Continental Shelf of Surinam) and CICAR (an international venture: Cooperative Investigation of the Caribbean and adjacent regions).

Altena (1965, 1968, 1969, 1971a, b, 1975a, b) dealt with the bivalves of the shelf of Surinam. The summarizing paper (1971b) enumerates 128 species of which 5 are *Anomalodesmata*: *Lyonsia hyalina* Conrad, 1831, *Anticorbula sinuosa* (Morrison, 1943), *Periploma coquettae* Altena, 1968, *Cardiomya surinamensis* Altena, 1971, *Verticordia ornata* (d'Orbigny, 1842). The species listed were found as a few single valves each.

The present survey describes an extensive material, adding several species to the fauna:

Poromyidae.- *Poromya rostrata* Rehder, 1943

Cuspidariidae.- *Cuspidaria luymesii* spec. nov. (valves only); *C. altenai* spec. nov.; *Cardiomya ornatissima* (Orbigny, 1842); *C. surinamensis* Altena, 1971; *Myonera lamellifera* (Dall, 1881); *M. paucistriata* (Dall, 1881); *Plectodora granulatus* (Dall, 1881).

Verticordiidae.- *Verticordia acuticostata* (Philippi, 1844) (valves only); *V. fischeriana* (Dall, 1881) (valves only); *V. ornata* (Orbigny, 1842).

As can be seen from the list, the first three species recorded by Altena (1971b) were not found in the present material. Of these, *Anticorbula sinuosa* is an oligohaline species, byssally attached in the boreholes of teredinids. The remaining two species were found in small numbers only (1-5 valves).

The *Anomalodesmata* of the Caribbean region are poorly known both as regards taxonomy and distribution, and most species have been recorded a few times only. In the present contribution I have attempted to summarize all available records of the species dealt with. I have adhered to the classification proposed by Bernard (1979). The material, including the types, is kept in the National Museum of Natural History, Leiden, the Netherlands. All shell measurements are in mm. Abbreviations used: v = detached valves, p = paired valves (usually live collected specimens).

THE ENVIRONMENT

The physiography and hydrography of the Surinam waters have been treated by numerous authors. The present review is based on Altena (1969), Cadée (1975), and Vervoort (1967, 1971).

The shelf is gently sloping down to a depth of about 100 m. The shelf edge is located about 80 nautical miles off the coast. Over large areas the shelf is completely flat. A number of slopes, former terraces, occur. A calcareous shoulder is present at the continental slope. The shelf reaches its greatest depth (95-100 m), some distance before the calcareous shoulder. There is a very distinct submarine trough running the full length of the continental slope. The calcareous shoulder rises from this trough, reaching its greatest height at about 93 m, falling off steeply into the deep sea.

Near the coast, the bottom sediment is predominantly mud. With increasing depth more or less coarse sand dominates, often mixed with large amounts of calcareous skeletal remains. The trough along the calcareous shoulder is filled with mud. The sediment of the slope is dominated by soft mud.

The hydrography is dominated by the westward directed current carrying very turbid water originating from the Amazon River. This causes a heavy deposition of mud in the near shore waters to a depth of 20-25 m. Because of the interaction of the tidal movement and the western current, the mud shoals are always on the move. Upwelling occurs commonly and is the main cause of the relatively high nutrient content of the water. Outside of the turbid coastal water, a zone of relatively high primary production occurs, located at depths of between 20 and 60 m. The temperature of the bottom water varies between 23°C and 28°C at 100 m depth at the shelf edge. The upwelling is now accompanied by a pronounced lowering of the water temperature. The salinity at the bottom varies between 34 and 36.5 ‰.

SYSTEMATICS

Poromyidae

Poromya rostrata Rehder, 1943 (figs 2, 11-13)

Poromya granulata (pars); Dall, 1881: 108; 1886: 281.

Poromya rostrata Rehder, 1943: 189, pl. 19 figs 11, 12; Parker, 1960: 323, pl. 5 fig. 20 a, b; Rice & Kornicker, 1965: 137, pl. 16 figs 9, 10.

Material. – ‘Snellius’ Surinam Shelf Expedition, March-May 1966, OCPs I, stations: A1/19v, B2/12v, C3/3v, D4/9v, F6/11v, A9/53v, A10/31v, A11/3v, A12/1v, A15/15v, A25/20v, A26/34v, A27/33v, A29/9v, D33/4v, F6/1p, F38/5v, F39/2v, F40/25v, F41/29v, F42/5v, F44/13v + 1p, F45/1v, F47/1v, G56/3v, G57/11v, H57/2p;

‘Luymes’ Surinam Shelf Expedition, March-April 1969, OCPs II, stations: L90/1v, I93/1v, K104/4v, J110/1v, J112/14v +2p, I114/6v, I116/45v +2p, I117/28v, I118/29v +1p;

‘Luymes’ Guyana Shelf Expedition, August-September 1970, CICAR cruise 15, stations: 2/2v, 4/2v, 5/19v, 6/18v, 15/1v, 16/2v, 17/9v, 26/4v, 31/8v, 39/9v, 40/7v, 43/1v, 50/9v, 52/9v, 56/1v, 57/6v, 59/4v, 62/5v, 63/1v, 64/3v, 65/3v, 68/2v, 70/8v.

Additional material. – U.S. Coast Survey Steamer ‘Blake’: Barbados, 183 m, NMNH/1 valve; Sta. 262, 1.iii.1879, 12°01'45"N 61°47'25"W, 172 m, fine sand, NMNH/1 specimen (dry), 1 valve.

U.S. Commission of Fish & Fisheries, ‘Albatross’: Sta. 2404, 15.iii.1885, 28°44'N 85°16'W (Gulf of Mexico), 110 m, grey sand, NMNH/9 valves; Sta. 2602, 18.x.1885, 34°38'30"N 75°33'30"W (Cape Hatteras to Charleston S.C.), 227 m, rock, sand, NMNH/11 valves; Sta. 2646, 9.iv.1886, 25°47'N 80°05'W (off Florida), 155 m, grey sand, foraminifera, NMNH/7 valves.

‘Eolis’ cruises 1910-15 (Dr J. B. Henderson): Sand Keys, Florida, 115 m, NMNH/1 specimen (dry).

State University of Iowa Expedition to Barbados, 1918 (Dr J. B. Henderson): 19 stations off Barbados at depths of 46-186 m, altogether NMNH/3 specimens (dry) and 64 valves; Sta. 115, off Antigua, 220 m, NMNH/25 valves.

Off Delray Beach, Palm Beach County, Florida, 128 m, NMNH/1 specimen (dry), holotype USNM No. 536152. (6)

R.H. Parker leg. 1960: Mississippi Delta region, 82-88 m, ZMUC/3 valves.

Shell. – The valve is solid, inequilateral, the postumbonal part forming 53-57% of the total length. It is inequivalve, the right valve being the larger. In lateral view the umbo is prominent and pointed, and the postero-dorsal edge is only slightly curved. The posterior part of the valve is rostrate, this character being more prominent in the left valve. Smaller valves are less rostrate, some being regularly oval in outline. The whole external surface is densely covered with regular, radiating rows of fine granules. The right valve has a strong cardinal tooth, the left valve has a distinct posterior lateral tooth. The right valve has a distinct regular crenulation along the ventral edge; the left valve is devoid of crenulation. The whole interior surface has a fine radiating striation. The posterior part of the pallial impression is straight or slightly concave.

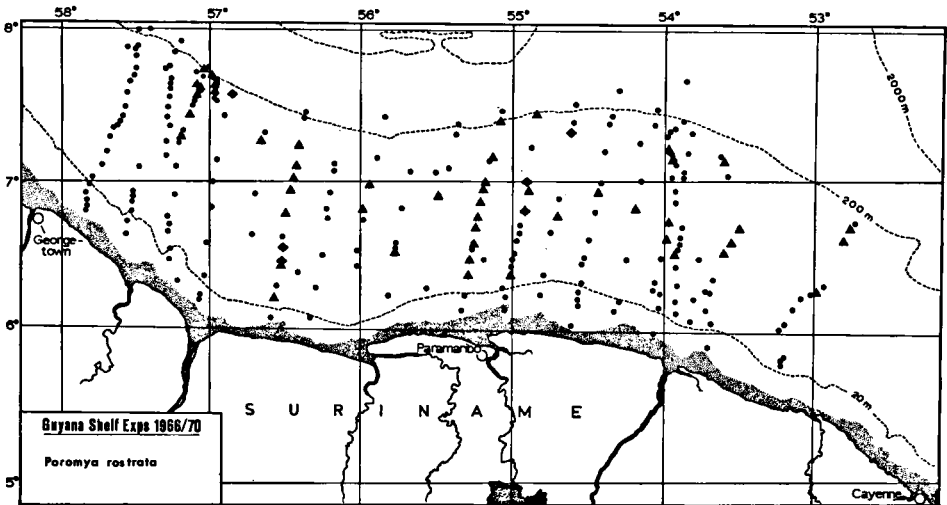


Fig. 2. Records of *Poromya rostrata* Rehder, 1943. ◆ indicates "live" specimens; ▲ indicates empty shells.

Soft parts. – The gross anatomy is similar to that of *P. granulata* Nyst & Westendorp, 1839, studied by Yonge (1928) and Morton (1981). The siphonal tentacles (seven pairs and one unpaired dorsally) are slender and pointed, but stout and blunt in *P. granulata*. The inhalant siphon has a large interior valve, having a pointed ventral edge. The mantle is very delicate, thickened along the ventral edge. The conchiolin at the mantle edge has minute spines with flat bases and tops and straight or slightly concave sides. The septum is delicate with small septal muscles and two pairs of branchial sieves. The foot is elongate, and the anterior labial palps are very large.

Measurements. – The holotype is 7.3 mm long, the largest valve of the present collection measures 10.5 mm.

Remarks. – The species was identified by comparison with the holotype. The material of *Poromya* from the Caribbean region kept in the NMNH was examined. The collection consists of some 50 samples, nearly one half of which was assigned to *P. granulata* while the remaining ones were not assigned to species. A number of samples proved to be *P. rostrata*; they are listed under 'Additional material'; among these were four samples assigned to *P. granulata* and recorded by Dall (1881, 1886).

Poromya granulata is the type of the genus. It was described from the Pliocene (?) of Belgium. Its recent horizontal distribution extends from West Greenland to Morocco and Madeira and includes the Mediterranean; the reported vertical range is from 30 to 2650 m. The records of the species from the Caribbean region by Dall (1881, 1886) have been quoted by subsequent authors, e.g. Johnson (1934) and Abbott (1974). The samples from NMNH seen by me appear to belong to several species and do not include any material of *P. granulata*, indicating that this species does not occur in the Caribbean region.

In *Poromya granulata* the shape of the valve is oval, with a straight posterior end, whereas in *P. rostrata* the postero-dorsal edge is straight and the posterior end is rostrate.

In *P. granulata* versus *P. rostrata* the umbo is rounded instead of pointed, the ventral edge of the right valve is smooth, not crenulated, and the pallial sinus is shallow, not (nearly) absent.

Distribution. – Previous records of *P. rostrata* appear in the list of additional material. The horizontal distribution extends from about 34°38'N to off French Guyana to 52°50'W. There is a single record from the Gulf of Mexico. The vertical distribution is from 33 to 227 m (live specimens 33-172 m).

Cuspidariidae

Cuspidaria luymesii spec. nov. (figs 3, 4)

Material. – Holotype RMNH 101065 (indicated by asterisk in following enumeration of material), all other specimens are paratypes: RMNH 101066-101077

'Snellius' Surinam Shelf Expedition, March-May 1966, OCPS I, stations: B2/1v, A9/1v*, A10/1v, A11/1v, F41/1v, H57/1v;

'Luymes' Surinam Expedition, March-April 1969, OCPS II, stations: M73/1v, J112/1v;

'Luymes' Guyana Shelf Expedition, August-September 1970, CICAR cruise 15, stations: 5/2v, 39/1v, 56/2v, 57/2v, 63/1v, 64/1v.

Diagnosis. – Commarginal sculpture becoming more distinct towards the edge and the posterior projection; left valve with a distinct sulcus along the postero-dorsal edge; right valve with a long posterior lateral tooth; interior of shell glossy with a radiating sculpture.

Shell. – The shell is delicate, semi-transparent, slightly inequivalve and inequilateral, the postumbonal part forming 61-63% of the total length. The umbo is rounded and slightly prosogyrate. The posterior projection is moderately long and only indistinctly marked; its posterior edge is truncate. The umbonal part of the antero-dorsal edge may be slightly thickened or reflected, particularly in the larger left valves. The posterior dorsal edge is slightly concave. The left valve has a distinct sulcus along and parallel to the postero-dorsal edge; the sulcus gradually becomes less distinct towards the posterior end. The postero-ventral edge is only slightly concave. The umbonal part of the external surface is smooth, but gradually an irregular, close-set commarginal sculpture develops which gradually becomes coarser towards the edge. At the posterior projection this sculpture turns upwards along a line running from near the umbo to the postero-ventral angle; the line sometimes forms a slight sulcus. Dorsal of the line of curvature the direction of the sculpture reflects the shape of the posterior edge. It becomes coarser, more close-set and wrinkled being formed by the periostracum. The two specimens with soft parts have part of the shell covered with a coating consisting of mud with embedded sand grains, foraminifera and bryozoa. The coating may attain a thickness of 0.7 mm; in the holotype it is present on the ventral part of the posterior projection and in the paratype on the anterior part of the shell. The coating is absent in the single ('dead') valves. The hinge is delicate;

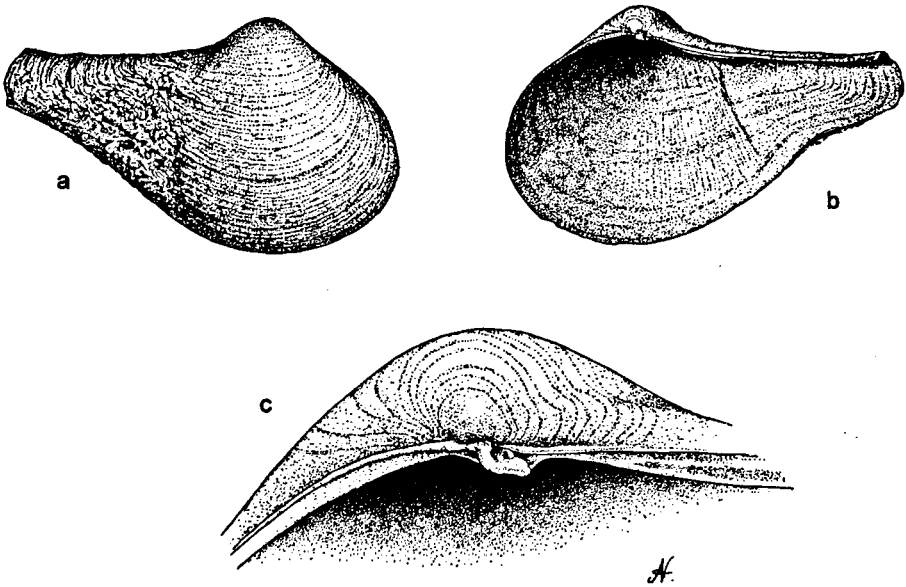


Fig. 3. *Cuspidaria luymsi*, holotype. a, exterior of right valve; b, interior of right valve; c, hinge and umbo of right valve (RMNH 101066).

the resilifer is triangular, projecting postero-ventrally. The right valve has a distinct, elongate posterior lateral tooth, extending from a little behind the resilifer, fading off posteriorly to some distance anterior of the adductor scar. This sculpture appears as rows of opaque spots on the umbonal part of the shell exterior.

Soft parts. – The mantle is delicate with an extremely thickened edge, the pedal opening extends nearly half the distance to the base of the siphon. The siphonal sheath is thin with a thickened papillose edge. The inhalant siphon is stout with a reddish brown distal half, the exhalant siphon is small. The siphonal tentacles are stout with extended, more or less disc-shaped distal ends. The septum is very muscular with four pairs of septal pores. About 20 evenly distributed and delicate lateral septal muscles are present. The anterior septal retractors are tripartite; the median section is free a short distance behind the insertion. The foot is rather large, pointed.

Measurements and proportions. –

	holotype	paratype
length	12.9 mm	15.9 mm
height	7.3 mm	9.7 mm
breadth	2.6 mm	4.1 mm
postumbonal length height/length	0.57	0.61
postumbonal length breadth/length	0.20	0.25

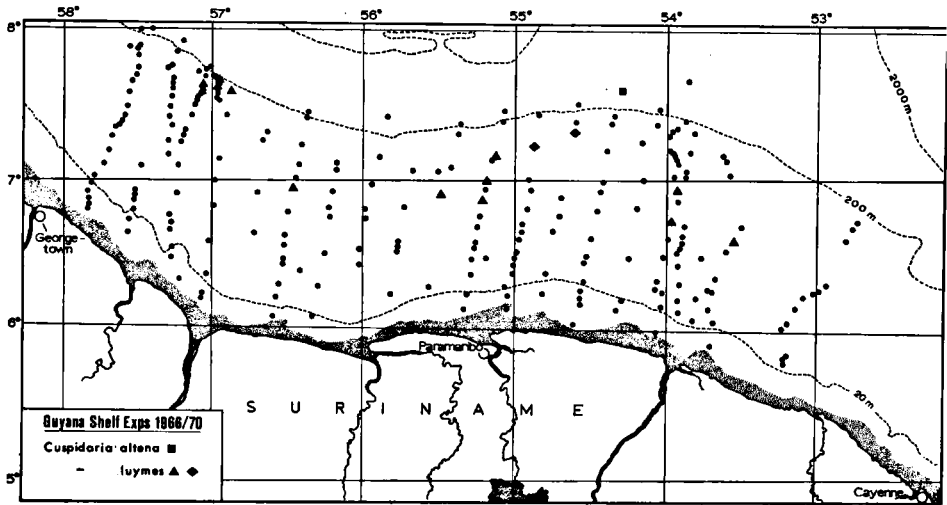


Fig. 4. Records of *Cuspidaria luymesii* spec. nov. and *C. altenai* spec. nov.

Remarks. – The present species is established with some hesitation. It seems to be close to the North Atlantic *Cuspidaria obesa* (Lovén, 1846). I have compared the new species with specimens of *C. obesa*. The latter has a shorter posterior projection, a less distinct comarginal sculpture, a short, but more projecting lateral tooth and a straight postero-dorsal edge. It also lacks the radiating sculpture of the interior. *Cuspidaria luymesii* would also seem to be close to *C. pellucida* (Stimpson, 1853), a species known from the northwest Atlantic, from the Gulf of St. Lawrence to Maine, and depths of between 75 and 175 m. Verrill & Bush (1898: 805, pl. 75 fig. 8, pl. 76 fig. 8) described and figured the species. It differs from *C. luymesii* by having a slightly different outline of the shell, which is nearly smooth; the right valve has a short, very prominent and strongly curved lateral tooth located immediately posterior of the resilium; it also lacks the radiating striation of the internal surface. *Cuspidaria luymesii* is also similar in general shape to *C. parapodema* Bernard (1969: 2232, fig. 2); the species was also described and figured by Bernard (1974: 41, fig. 2, pl. 12 figs 1,2). It occurs in the Californian region at depths from 53 to 320 m. It has a similar shape as *C. luymesii*, but the posterior ventral edge is slightly more concave. It has a smooth external surface, which like that of *C. luymesii*, is partly coated; it has a shorter lateral hinge tooth and lacks the radiating sculpture of the internal surface.

Etymology. – This new species is named after the Dutch hydrographic vessel H.NL.M.S. 'Luymes'; J.L.H. Luymes was Chief of the Hydrographic Department of the navy in the years 1914-1934.

Cuspidaria altenai spec. nov. (figs 4, 14, 15)

Material. – 'Luymes' Surinam Shelf Expedition, March-April 1969, OCPS II, Sta. K100, 5 valves (holo-

type RMNH 101078 and 4 paratypes RMNH 101079).

Diagnosis. – Shell thick, inflated. Antero-dorsal edge of right valve thickened, erect. Right valve with a large, curved, postero-lateral tooth. Posterior adductor scar triangular, deeply impressed.

Shell. – The valve is solid, inflated, with a short, compressed and dorsally directed posterior projection. It is strongly inequilateral, the posterior projection forming 66-70% of the total length. The umbo is low and the ventral edge is strongly curved. The sculpture consists of an irregular, commarginal striation. The antero-dorsal edge of the right valve is thickened and erect, that of the left valve is simple. The postero-dorsal edge is straight on the proximal part, distally it is dorsally curved. A fine distinct ridge runs from the umbo to the postero-ventral angle of the posterior projection; dorsal of this the periostracum forms irregular folds reflecting the shape of the posterior edge. One or two much finer ridges run from the umbo onto the posterior projection, close to the postero-dorsal edge. The resilium is triangular, deeply impressed. The right valve has a very large and curved posterior lateral tooth, reaching from just posterior of the resilium to the central part of the posterior adductor scar; the latter is triangular and deeply impressed, particularly at the anterior edge.

Measurements and proportions:

	1 (holotype)	2	3	4
length	10.6 mm	12.4 mm	10.6 mm	10.6 mm
height	7.7 mm	9.4 mm	7.6 mm	7.6 mm
breadth	2.6 mm	3.5 mm	2.9 mm	2.9 mm
postumbonal length	6.6 mm	7.6 mm	6.7 mm	6.8 mm
postumbonal %	62	61	63	64
height/length	0.73	0.76	0.72	0.72
breadth/length	0.25	0.28	0.27	0.27

Remarks. – The present species seems to be closely related to the species (erroneously) assigned to *Cuspidaria subtorta* (G.O. Sars, 1878) by Verrill & Bush (1898: 806, pl. 73 fig. 1, pl. 74 figs 4, 5). The species figured by Verrill & Bush differs from *C. altenai* by having a long posterior lateral tooth in the right valve and a small prominent tooth in the left valve, posterior of the resilifer. The present species is also similar to *C. pellucida* Verrill & Bush (1898: 805, pl. 75 fig. 8, pl. 76 fig. 8). The latter has a more prominent umbo and a differently shaped ventral edge. The hinge teeth of the two species are similar both having a prominent tooth in the posterior right valve. The largest valves studied by Verrill & Bush measured less than 5 mm length, and may be juveniles. The present valves may represent the adults of *C. pellucida*.

Etymology. – The new species is named in honour of Dr C.O. van Regteren Altena,

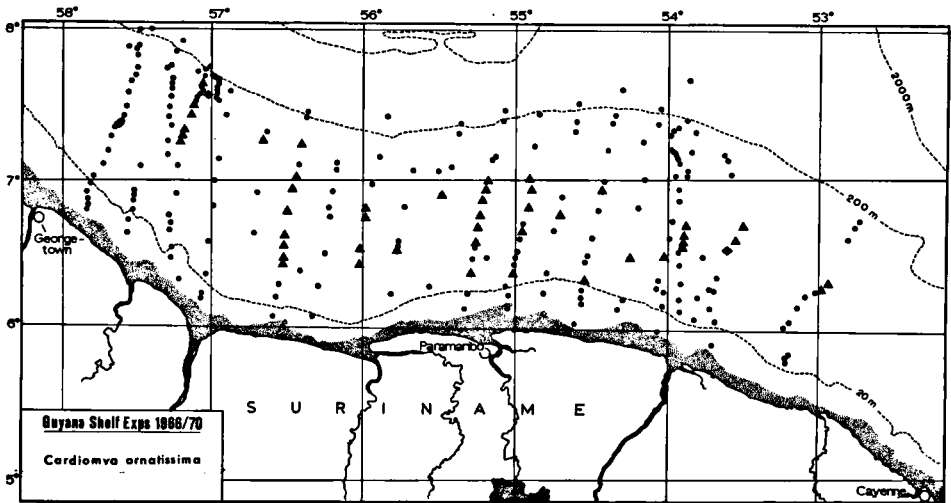


Fig. 5. Records of *Cardiomya ornatissima* (Orbigny, 1842).

curator of molluscs in the Rijksmuseum van Natuurlijke Historie, Leiden, 1952-1968.

Cardiomya ornatissima (Orbigny, 1842) (fig. 5)

Cardiomya ornatissima; Knudsen, 1982: 133.

Material. – ‘Snellius’ Surinam Shelf Expedition, March-May 1966, OCPS I, stations: A1/5v, B2/10v, C3/5v, D4/5v, F6/10v, A9/17v, A10/9v, A15/2v, A25/5v, A26/18v, A27/13v, D30/1v, D31/1v, D32/1v, F38/2v, F40/27v, F41/15v, F42/5v, F43/1v, F44/7v, F45/3v, G56/2v;

‘Luymes’ Surinam Expedition, March-April 1969, OCPS II, stations: I70/1v, M85/2v, L87/1v, I93/1v, K104/1v, K106/2v, J110/1v, I116/12v, I117/12v, I118/8v;

‘Luymes’ Guyana Shelf Expedition, August-September 1970, CICAR cruise 15, stations: 4/1v, 5/6v, 6/11v + 1p, 16/2v, 17/6v, 39/6v, 40/2v, 41/1v, 42/1v, 63/3v + 1p, 64/14v, 65/2v, 68/1v, 69/1v, 70/2v, 71/11v, 113/5v + 1p.

Remarks. – Knudsen (1982) identified his material by comparison with the syntypes. The sculpture of the valves is very characteristic, consisting of very prominent radiating ribs. The left valve has 13-14 ribs while the right valve has only 7-8. In the left valve the posteriormost rib is bipartite, while the corresponding one in the right valve is undivided.

Distribution. – Knudsen (1982) summarized the known distribution: from the Cape Hatteras region (about 35°N) to the northeastern coast of Brazil at depths from 4 (?), 24 (?), 34 to 620 m.

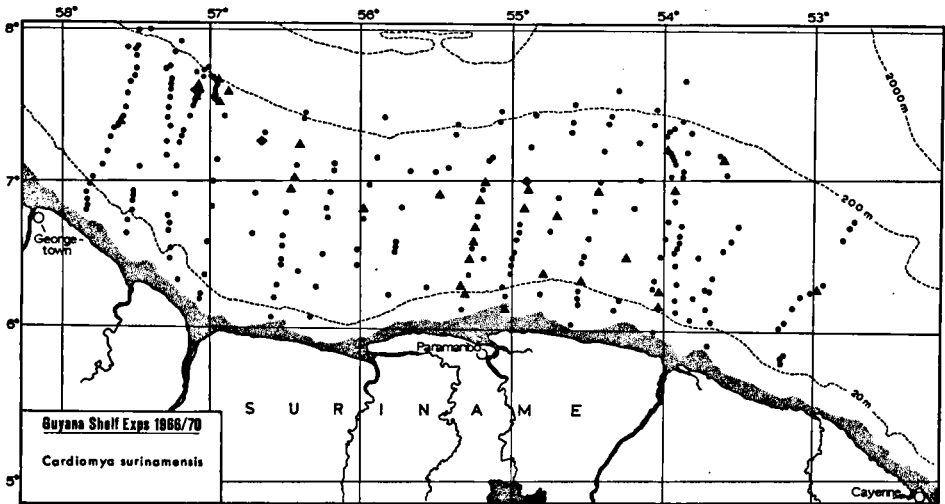


Fig. 6. Records of *Cardiomya surinamensis* Altena, 1971.

Cardiomya surinamensis Altena, 1971 (figs 6, 16)

Cuspidaria (*Cardiomya*) *spec.*, Altena, 1968: 160.

Cardiomya surinamensis Altena, 1971a: 78, textfig. 3a, b; 1971b: 83, textfig. 25a, b.

Material. — 'Snellius' Surinam Shelf Expedition, March-May 1966, OCPS I, stations: exp/3v, B2/1v, D4/1v, A9/2v, A10/2v, A14/1v, A26/2v, A27/5v, A29/1v, F38/4v, F40/1v, F41/1v, G56/1p, H57/3v;

'Luymes' Surinam Expedition, March-April 1969, OCPS II, stations: M72/1v, M73/1v, I76/1v, M82/1v, L87/1v, J92/2v, K104/1v, K106/8v, J110/2v, I116/2v + 1p, I117/1v, I118/3v;

'Luymes' Guyana Shelf Expedition, August-September 1970, CICAR cruise 15, stations: 2/2v, 17/1v, 26/3v, 52/1v, 54/7v, 56/7v, 57/11v, 58/1v, 59/1v, 60/2v, 62/1v, 63/2v + 2p, 64/1v, 65/2v, 113/2v.

The description of the species was based on 5 valves (2 right and 3 left ones) obtained off Surinam (6°22.5'N 55°10'W, depth 20 m, "Coquette" Sta. 197, 10.vi.1957). The somewhat worn valves adhered to tubes of *Diopatra cuprea* (Bosc) (Polychaeta) and were from 4.5 to 6.3 mm long. Altena (1971a) gave a good description and good figures of the species. The present samples were identified by comparison with the holotype.

The present material enables me to extend the original description. The shell is thin, with a low rounded umbo, an inflated disc and a compressed posterior projection. The postumbonal part forms 58-60% of the total length. The dorsal margin is erect and straight at the posterior projection. The disc has a marked radiating sculpture. This is much less developed on the anterior half of the disc and the low rounded and irregular ribs do not extend onto the umbonal part of the shell. The posterior half of the disc has 4-6 distinct ribs reaching from the umbo and extending beyond the ventral edge of the shell. These ribs gradually become more distinct and sharper towards the posterior projection. The

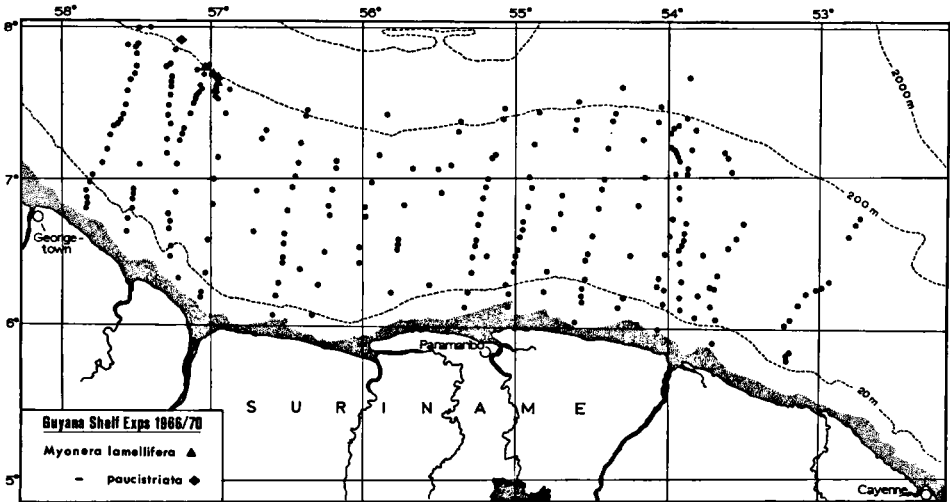


Fig. 7. Records of *Myonera lamellifera* (Dall, 1881) and *M. paucistriata* (Dall, 1881).

interstices between these ribs have 1-3 faint secondary ribs. The posterior projection has 4-5 faint radiating ribs. The shell has a fine commarginal striation which becomes somewhat coarser on the posterior projection. The resilifer is small, triangular and deeply impressed. The external sculpture appears as sulci on the inner face of the shell disc. The posterior adductor scar is large with a deeply impressed anterior part. The largest valve of the present material has a shell length of 10.2 mm.

Myonera lamellifera (Dall, 1881) (figs 7, 17)

Neaera lamellifera Dall, 1881: 113.

Myonera lamellifera; Dall, 1886: 304, pl. 3 fig. 7; 1889: 68, pl. 3 fig. 7.

Material. – ‘Luymes’ Guyana Shelf Expedition, August-September 1970, CICAR cruise 15, stations: 50/1v, 52/1v, 57/2v, 59/1v, 60/1v.

Distribution. – Dall (1881, 1886) recorded the species (“living”) from ‘Blake’ Sta. 36, northern part of Yucatan Bank (23°13' N 89°16' W), depth 154 m. He repeats the record in 1890 and also recorded the species from off Cedar Keys, west coast of Florida at 457 m depth. There seems to be no other published record of this species.

Myonera paucistriata (Dall, 1882) (figs 7, 18, 19)

Neaera paucistriata; Dall, in Bush, 1885: 473.

Myonera paucistriata; Dall, 1886: 302; 1889: 68; 1890: 283, pl. 13 fig. 12; Bernard, 1974: 69; Abbott, 1974: 568, fig. 6227.

Material. – ‘Luymes’ Guyana Shelf Expedition, August-September 1970, CICAR 15: sta.: 80/1p.

Remarks. – The shell is very thin, transparent and inequilateral, the postumbonal part forming 57% of the total length. The umbo is small and the posterior projection is not well defined. The concentric sculpture consists of regular, widely spaced and sharp ribs on the anterior part of the valve, extending backwards to the anteriormost of the two umbonal-ventral ribs. The posterior part of the valve has a faint irregular concentric striation. The umbonal part has a fine radiating striation. The two umbonal-ventral ribs are prominent and sharp, ventrally extending beyond the edge of the shell. The resilium is long and narrow, no hinge teeth are present. The umbonal-ventral ribs appear as deep sulci on the interior and the concentric sculpture is distinctly seen.

Myonera paucistriata is the type species of the genus *Myonera* Dall & Smith, 1886 (see Bernard, 1979: 69).

Distribution. – The known distribution of *M. paucistriata* can be summarized as follows:

reference	locality	depth in m
Dall, 1881: 105; -86: 288; -89: 277	see list of ‘Material’	183-922
Marini, 1974: 242	31°08’ S 49°31’ W 22°34’ S 40°29’ W	183-253 213
Rice & Kornicker, 1965: 137	Campeche Bank, Gulf of Mexico	68-220

The horizontal distribution extends from 32° 40’ N (off South Carolina) to off British Guyana (present record). The vertical distribution extends from 353 to 1609 m, both records are without indication of the presence of live specimens; the latter are recorded from 618 m (present material) to 849 m.

Plectodon granulatus (Dall, 1881) (figs 8, 20, 21)

Plectodon granulatus; Knudsen, 1982: 136.

Material. – ‘Snellius’ Surinam Shelf Expedition, March-May 1966, OCPS I, stations: B2/1v, D4/1v, F6/1v, G7/1v, A9/3v, A10/3v, A25/1v, A26/2v, A27/1v, A29/1v, D32/1v +1p, D33/5v, F38/1v, F40/2v, F42/3v, F44/1v, H52/v1 +1p, G56/3v, H57/16v + 1p;

‘Luymes’ Surinam Expedition, March-April 1969, OCPS II, stations: I70/1v, M73/1v, M98/1v, K104/2v, J110/1v, J112/7v + 2p, I116/2v, I117/1v, I118/5v;

‘Luymes’ Guyana Shelf Expedition, August-September 1970, CICAR cruise 15, stations: 5/2v, 15/1v, 50/1v +1p, 56/4v, 57/11v, 59/2v, 62/3v, 63/2v, 64/2v, 65/2v, 68/1v.

Distribution. – Knudsen (1982) summarized the known distribution of *P. granulatus*:

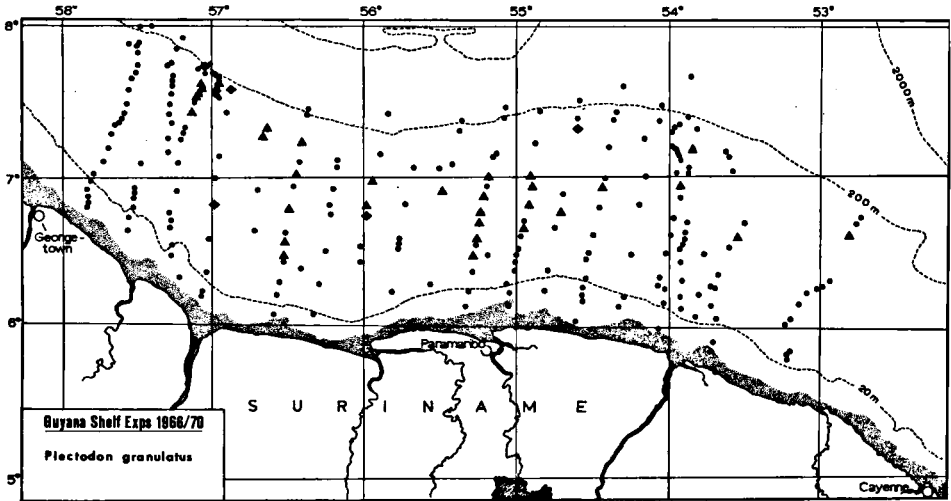


Fig. 8. Records of *Plectodon granulatus* (Dall, 1881).

from southern Florida throughout the Caribbean region to Iles Testigos, at about 63°W. The present material extends the distribution further eastward along the South American continent to about 52°50' W.

Verticordiidae

Verticordia acuticostata (Philippi, 1844) (fig. 9)

Hippagus acuticostatus Philippi, 1844: 42, pl. 14 fig. 19 a-c.

Pecchiolia acuticostata; Jeffreys, 1881: 933.

Verticordia acuticostata; Dall, 1881: 105; Locard, 1898: 204; Marini, 1974: 242, figs 5, 6; Abbott, 1974: 563, fig. 6160.

Verticordia fischeriana; Rice & Kornicker, 1965: 137, pl. 16 figs 5, 6.

Verticordia japonica; Allen & Turner, 1974: 529.

Material. – ‘Snellius’ Surinam Shelf Expedition, March-May 1966, O. C. P. S. I: Sta. A12, 2 valves.

Additional material (all samples from NMNH). – U. S. Coast Survey Steamer ‘Blake’: Sta. 5, 24°15' N 82°13' W, 419 m, 2 valves, 3 fragments; Barbados, 183 m, 3 valves. U. S. Commission of Fish & Fisheries, ‘Albatross’: Sta. 2400, 28°41' N 86°06' W (Gulf of Mexico), 309 m, grey mud, 2 valves; Sta. 2402, 28°36' N 85°33' 30" W (Gulf of Mexico), 203 m, grey mud, 1 valve; Sta. 2660, 28°40' N 78°46' W (off Cape Canaveral, Florida), 922 m, yellow foraminifera, 1 valve; Sta. 2750, 18°30' N 63°31' W (Lesser Antilles), 907 m, fine, grey sand, 3 valves. State University of Iowa Expedition to Barbados, 1918 (Dr J. B. Henderson): Sta. 317, off Western Dry Rocks, Florida, 201 m, 1 valve. Johnson-Smithsonian Deep-Sea Expedition, 1933: Sta. 94, 18°37' 45" N 65°05' W, 732 m, 1 valve. Samples from the Jeffreys collection: ‘Josephine’ Expedition 1869, Azores, 585-1097 m, 1 valve; ‘Porcupine’ Expedition 1870, off Portugal, depth unknown, 2 valves;

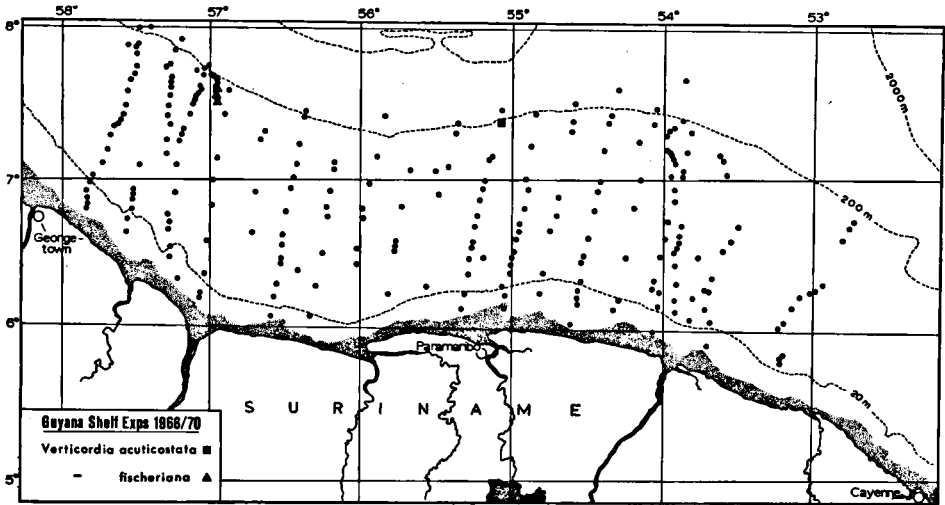


Fig. 9. Records of *Verticordia acuticostata* (Philippi, 1844) and *V. fischeriana* (Dall, 1881).

Mediterranean, Messina, Seguenza leg., 4 valves.

Remarks. – The two ‘Snellius’ valves agree completely with the NMNH material, including those from the Azores and the Lusitanian region.

The umbo is strongly involuted. The valve has 14-20 very narrow and prominent radiating ribs, extending beyond the edge of the valve. The interstices between the ribs are 3-4 times the breadth of a rib. The ribs have a dense cover of pointed spines round the edge. The basal part of the ribs and the interstices are irregularly and densely nodulose. In smaller valves the ribs appear as sulci on the shell interior. In larger valves the sulci are present only near the edge of the valve.

The species was described from fossil (Tertiary) deposits and it may still be doubted, whether the recent *V. acuticostata* is conspecific with the fossil one. Some authors, among which Allen & Turner (1974), have synonymised *V. acuticostata* with *V. japonica* Adams, 1862, an Indo-Pacific species. A closer study of large samples of the two taxa including an anatomical investigation has never been done. Under these circumstances I prefer to retain the specific name *V. acuticostata* for the taxon occurring in the Atlantic. The shells may attain a length of about 10 mm. The shell figured by Rice & Kornicker (1965) as *V. fischeriana* Dall is *V. acuticostata* Philippi.

Distribution. – The known distribution of *V. acuticostata* in the Caribbean region may be summarized as follows:

reference	locality	depth in m
Dall, 1881: 105; -86: 288; -89: 277	see list of ‘Material’	183-922
Marini, 1974: 242	31°08’S 49°31’W	183-253
	22°34’S 40°29’W	213
Rice & Kornicker, 1965: 137	Campeche Bank, Gulf of Mexico	68-220

The species is widely distributed in the Caribbean region from about 28°40'N (off Cape Canaveral, Florida) to South Brazil at 31°S; the distribution also includes the Mexican Gulf. The vertical range is from 68 to 922 m. None of the references mentioned indicate the presence of live specimens. It also occurs in the central Atlantic (Azores) and the Lusitanian region. Locard's record from a depth of 4255 m off the Azores needs confirmation; the species is probably not abyssal.

Verticordia fischeriana Dall, 1881 (fig. 19)

Verticordia fischeriana; Allen & Turner, 1974: 528; Knudsen, 1982: 124.

Material. – 'Luymes' Guyana Shelf Expedition, August-September 1970, CICAR cruise 15, stations: 56/4v, 57/5v, 62/1v.

Remarks. – The valves agree well with the available figures of the species, and also with the valves found off the Saba Bank.

Distribution. – The known distribution of *Verticordia fischeriana* was summarized by Knudsen (1982). The species is widely distributed in the Caribbean region from about 35°N to about 31°S. The vertical distribution is from 76 m (present material) to about 500 m.

Verticordia ornata Orbigny, 1842 (fig. 19)

Verticordia ornata; Abbott, 1974: 563, fig. 6158; Allen & Turner, 1974: 530; Knudsen, 1982: 128.

Verticordia (Trigonulina) ornata; Bernard, 1974: 117, text fig. 12, pl. 31 figs 1-2.

Material. – 'Snellius' Surinam Shelf Expedition, March-May 1966, OCPS I, stations: A1/26v, C3/3v, F6/4v, A9/42v + 2p, A10/25v, A11/22v, A12/1v, A15/8v, B22/6v, A25/19v, A26/62v, A27/46v, A29/7v, F37/3v, F38/25v, F39/12v, F40/17v, F41/27v + 1p, F42/24v, F43/12v, F44/19v, F45/2v, F47/2v, H57/2v;

'Luymes' Surinam Expedition, March-April 1969, OCPS II, stations: L87/1v, J110/2v, I115/1v, I116/20v, I117/17v, I118/8v,

'Luymes' Guyana Shelf Expedition/v, August-September 1970, CICAR cruise 15, stations: 2/24v, 3/20v, 4/1v, 5/19v, 6/23v, 13/1v, 17/16v, 19/8v, 26/10v, 31/2v, 33/2v, 39/25v, 40/9v, 50/5v, 52/1v, 54/20v, 56/29v, 57/36v, 60/50v, 63/6v, 64/7v, 69/1v, 70/29v, 71/44v.

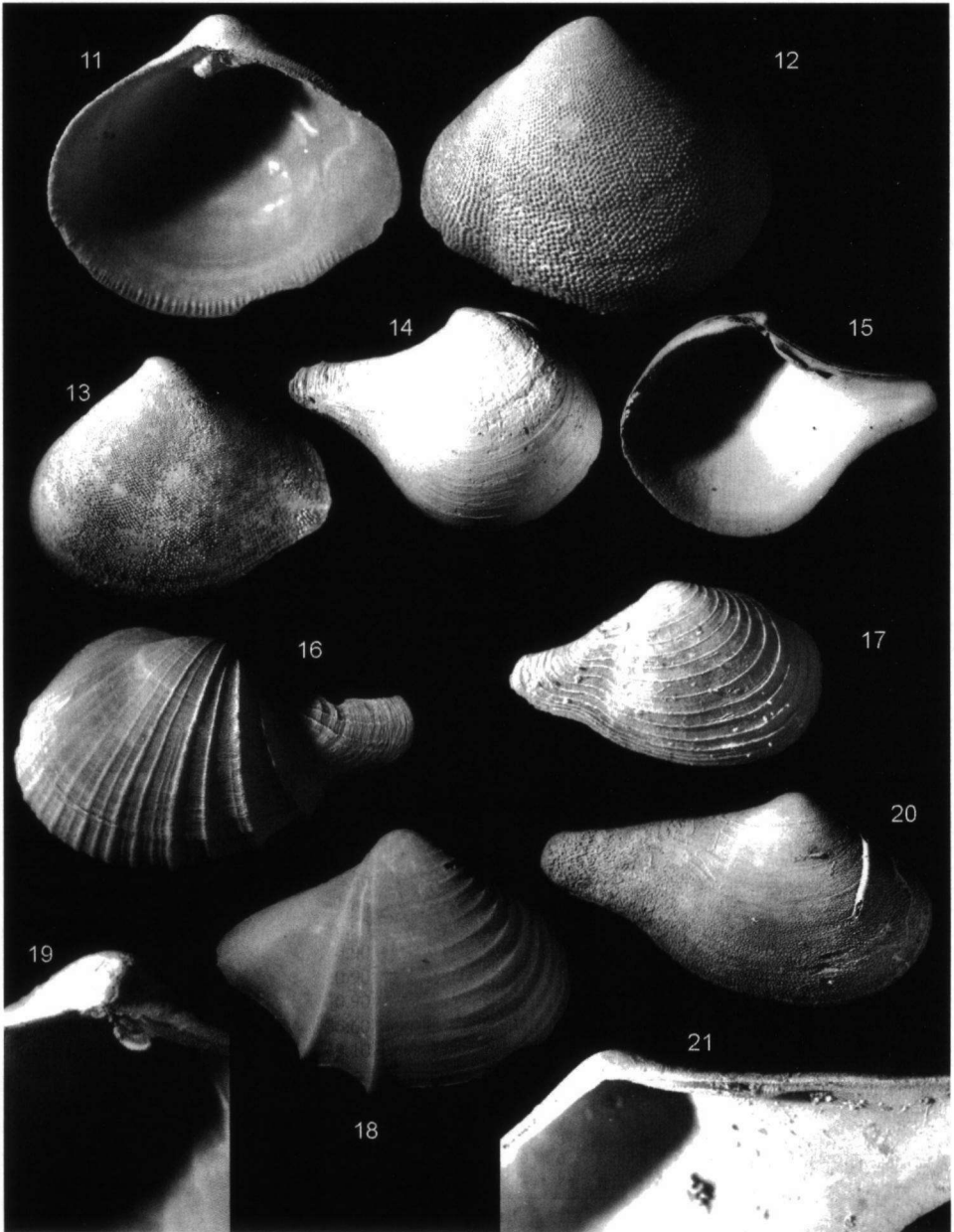
Remarks. – The present valves agree very well with the available figures and with the valves from the Saba Bank (Knudsen, 1982)

Distribution. – The known distribution of *Verticordia ornata* was summarized by Knudsen (1982). The species is ampho-American. In the West Atlantic it is found from about 42°N to about 32°42'S, with numerous records in the Caribbean and the Gulf of Mexico. Bernard (1974) summarized the East Pacific records: from about 34°N to 12°S. The known vertical distribution is from 24 to 850 m in the West Atlantic and from 18 to 168 m in the East Pacific.

GENERAL REMARKS

The list below gives the taxa of *Anomalodesmata* known from the Saba Bank (Knudsen, 1982) and Surinam.

	Saba Bank	Surinam
PERIPLOMATIDAE		
<i>Periploma coquettae</i> Altena		x
LYONSIIDAE		
<i>Anticorbula sinuosa</i> (Morrison)		x
<i>Lyonsia hyalina</i> (Conrad)		x
POROMYIDAE		
<i>Poromya rostrata</i> Rehder		x
<i>Poromya umbonata</i> Knudsen	x	
CUSPIDARIIDAE		
<i>Cuspidaria consociata</i> (Smith)	x	
<i>Cuspidaria luymesii</i> spec. nov.		x
<i>Cuspidaria alienai</i> spec. nov.		x
<i>Cardiomya alternata</i> (Orbigny)	x	
<i>Cardiomya ornatissima</i> (Orbigny)	x	
<i>Cardiomya saba</i> Knudsen	x	
<i>Cardiomya surinamensis</i> Altena		x
<i>Leiomya claviculata</i> (Dall)	x	
<i>Myonera lamellifera</i> (Dall)		x
<i>Myonera limatula</i> (Dall)	x	
<i>Myonera paucistriata</i> (Dall)		x
<i>Myonera</i> spec.	x	
<i>Plectodon granulatus</i> (Dall)	x	
<i>Plectodon</i> spec.	x	
Cuspidariid spec. A	x	
Cuspidariid spec. B	x	
VERTICORDIIDAE		
<i>Verticordia acuticostata</i> (Philippi)		x
<i>Verticordia fisheriana</i> Dall	x	x
<i>Verticordia granulifera</i> (Verrill)	x	
<i>Verticordia monosteira</i> (Dall)	x	
<i>Verticordia ornata</i> (Orbigny)	x	x
<i>Verticordia quadrata</i> Smith	x	



Figs 11-21. Anomalodesmata, types and samples. 11-12, *Poromya rostrata* Rehder, 1943, holotype (NMNH 536152); 13, *Poromya rostrata* Rehder, 1943, Sta. J112 (OCPS II); 14-15, *Cuspidaria altenai* spec. nov., holotype, right valve, exterior and interior (RMNH 101078); 16, *Cardiomya surinamensis* Altena, 1971, left valve, Sta. I117 (OCPS II); 17, *Myonera lamellifera* (Dall, 1881), exterior of right valve, Sta. 59 (CICAR 15); 18-19, *Myonera paucistriata* (Dall, 1881), exterior of right valve, hinge, Sta. 80 (CICAR 15); 20-21, *Plectodon granulatus* (Dall, 1881), exterior and interior of right valve, Sta. 68 (CICAR 15).

A total of 17 taxa is known from the Saba Bank, while 14 taxa are known from Surinam, 11 of which are found in the present material.

The following three taxa from Surinam reported by Altena (1971b, 1975a) were not found in the present material: *Periploma coquettae*, *Anticorbula sinuosa*, and *Lyonsia hyalina*. None of these have been found at the Saba Bank.

The following four taxa are recorded from both Saba Bank and Surinam: *Cardiomya ornatissima*, *Plectodon granulatus*, *Verticordia fisheriana*, and *V. ornata*.

The following four taxa are known from shells only: *Cuspidaria altenai*, *Myonera lamellifera*, *Verticordia acuticostata*, and *V. fisheriana*.

A total of 269 samples was obtained during the survey. *Anomalodesmata* were obtained at 95 stations, but only 17 stations yielded live specimens (see Appendix).

It appears that most stations had only one taxon of live *Anomalodesmata*, three had two taxa, and three taxa were found at one station only. One or two specimens were found at each station. The scarcity of *Anomalodesmata* may be due to the turbidity of the current and the movement of sediment.

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APPENDIX

List of stations where Anomalodesmata were collected

The following abbreviations have been used: agtr for Agassiz trawl, bx for box sampler, pg for Petersen grab, vV for van Veen grab. A + stands for a specimen (or specimens) rather than valves.

1. 'Snellius' Surinam Shelf Expedition, March-May, 1966, OCPS I:
- Sta.Exp, Experimental station, 25.03.1966, 06°13'N 55°17'W, vV, 25 m, sandy mud.
- Sta A1, 01.04.1966, 06°55.7'N 55°12.4'W, bx, 56 m, hard sand with shells and Bryozoa, some mud.
- Sta B2, 02 & 03.04.1966, 06°54.1'N 55°29.0'W, vV & agtr, 51 m, hard sand with some mud.
- Sta C3, 04.04.1966, 06°31.5'N 55°47.3'W, bx, 36 m, sandy clay with many Bryozoa.
- Sta D4, 05.04.1966, 06°48.5'N 55°58.9'W, vV, 48 m, sandy clay with Bryozoa and dead Mollusca.
- Sta F6, 12.04.1966, 06°26.6'N 56°33.0'W, bx, 33 m, mud and fine sand, some clay fragments.
- Sta F6*, 12.04.1966, 06°29.2'N 56°32.3'W, vV, 33 m.
- Sta G7, 13.04.1966, 07°16.8'N 56°47.6'W, agtr, 64 m.
- Sta A9, 21.04.1966, 06°52.2'N 55°12.4'W, vV, 51 m, coarse sand with mud and many dead Mollusca.
- Sta A10, 21.04.1996, 06°59.5'N 55°11.2'W, vV, 56 m, coarse sand with mud and many dead Mollusca.
- Sta A11, 22.04.1966, 07°08.2'N 55°08.8'W, vV, 75 m, hard sand with some mud and many shell fragments.
- Sta A12, 22.04.1966, 07°22.7'N 55°05.5'W, vV, 120 m, calcareous rock fragments.
- Sta A14, 23.04.1966, 06°14.2'N 55°19.2'W, vV, 18 m, heavy clay.
- Sta A15, 23.04.1966, 06°21.2'N 55°17.7'W, vV, 33 m, sandy clay with shell fragments.
- Sta B22, 27.04.1966, 07°21.6'N 55°22.2'W, vV, 240 m, heavy clay.
- Sta A25, 28.04.1966, 06°44.3'N 55°13.5'W, vV & agtr, 44 m, sandy mud with clay and many shell fragments.
- Sta A26, 28.04.1966, 06°40.5'N 55°14.4'W, vV, 45 m, sand with some mud and many shell fragments.
- Sta A27, 28.04.1966, 06°35.1'N 55°15.4'W, vV, 41 m, sandy mud with clay and shell fragments.
- Sta A29, 28.04.1966, 06°28.0'N 55°16.7'W, vV, 37 m, sandy mud with numerous shells of lamellibranchs.
- Sta D30, 03.05.1966, 06°26.2'N 56°02.5'W, agtr, 40-34 m, heavy clay with some mud and fine sand.
- Sta D31, 03.05.1966, 06°32.2'N 56°02.1'W, agtr, 39 m, sandy clay with superficial worm tubes and shell fragments.
- Sta D32, 03.05.1966, 06°44.5'N 55°59.6'W, vV, 48.5 m, sandy mud with many shell fragments.
- Sta D33, 04.05.1966, 06°56.6'N 55°56.9'W, agtr, 62-60 m; muddy sand with shells of lamellibranchs and fragments of Gastropoda.
- Sta F37, 05.05.1966, 07°24.6'N 56°22.4'W, vV, 121 m, mud with shell fragments and some coral remains.
- Sta F38, 05.05.1966, 07°13.8'N 56°24.4'W, vV & agtr, 81 m, sand with shell fragments.
- Sta F39, 05.05.1966, 07°05.4'N 56°25.8'W, vV, 65 m, sand with some mud and coarse shell fragments.
- Sta F40, 06.05.1966, 07°00.2'N 56°26.5'W, vV & Agtr, 59 m, sand with some fine mud and

fine shell fragments.

Sta F41, 06.05.1966, 06°54.8'N 56°28.6'W, vV, 60 m, coarse sand with some mud and many shell fragments.

Sta F42, 06.05.1966, 06°46.5'N 56°30.6'W, vV, 40 m, sandy mud with shell fragments.

Sta F43, 06.05.1966, 06°37.2'N 56°31.3'W, vV, 37 m, sand with mud at surface, covering blue-black clay.

Sta F44, 06.05.1966, 06°33.6'N 56°31.6'W, vV, 38 m, sandy mud with shell fragments.

Sta F45, 07.05.1966, 06°26.5'N 56°32.8'W, vV, 34 m, sandy mud with shell fragments.

Sta F47, 07.05.1966, 06°13.2'N 56°35.2'W, vV, 27 m, sandy mud with shell fragments.

Sta H52, 09.05.1966, 06°50.3'N 56°59.2'W, vV, 39 m, coarse sand with mud and shell fragments.

Sta G56, 10.05.1966, 07°15.6'N 56°40.0'W, agtr, 68 m, coarse sand with some mud, shell fragments.

Sta H57, 11.05.1966, 07°35.7'N 56°52.6'W, vV & rd, 94 m, coarse sand with some mud and coarse shell fragments.

2. 'Luymes' Surinam Shelf Expedition, March-April, 1969, OCPS II:

Sta I70, 26.03.1969, 06°39 'N 54° 57'W, pg & agtr, 40 m, fine sand with some mud and many shell fragments.

Sta M72, 29.03.1969, 06°15'N 54°02'W, vV, 25 m, sandy mud with many shell fragments, soft blue clay in deeper strata.

Sta M73, 31.03.1969, 06°55'N 53°54.5 'W, agtr, 55 m, fine blackish sand with some mud, many shell fragments and Bryozoa.

Sta I76, 08.04.1969, 06°08.8'N 55°03.5'W, agtr, 6 m, soft blue mud with brown surface, some fragments of hard clay in lower strata.

Sta M82, 10.04.1969, 06°09.4'N 54°02.8'W, agtr, 22 m, globular reef fragments, mixed with some coarse sand and mud.

Sta M85, 11.04.1969, 06°28.7'N 54°02.2'W, vV, 36 m, sandy mud with many shell fragments and Bryozoa.

Sta L87, 11.04.1969, 06°28.1'N 54°15.3'W, vV, 33.5 m, greenish, fine sand with some mud, worm tubes, Mollusca and Bryozoa.

Sta L90, 12.04.1969, 06°48.0'N 54°11.4'W, agtr, 45 m, sandy mud with inclusions of heavy clay, many shell fragments and Bryozoa.

Sta J92, 14.04.1969, 06°22.0'N 54°47.7' W, vV, 27 m, blue clay with shell fragments, surface soft, grayish-brown.

Sta I93, 14.04.1969, 06°22.0'N 55°01'W, vV, 30.7 m, soft, sandy mud with very soft, grayish-brown surface.

Sta M98, 16.04.1969, 07°10.6'N 53°50.7'W, rd, c. 85 m, coarse sand with reef fragments and many shell fragments.

Sta K100, 17.04.1969, 07°36'N 54°18'W, agtr, c. 300 m, soft grey mud.

Sta K104, 21.04.1969, 06°54.8'N 54°26'W, agtr, 55 m, soft, greenish mud with much fine, greenish sand. Inclusions of hard clay fragments and shells.

Sta K106, 21.04.1969, 06°19'N 54°33.0'W, vV & agtr, 22 m, fairly firm, greyish-blue clay with brownish, soft surface, some shell fragments.

Sta J110, 22.04.1969, 06°45.2'N 54°42.7'W, agtr, 46.5 m, grey, soft muddy sand with shell fragments and Bryozoa.

Sta J112, 22.04.1969, 07°18.3'N 54°36.3'W, vV & agtr, 88.5 m, sandy, greyish-green mud with shell fragments.

Sta I114, 23.04.1969, 07°26'N 54°49'W, vV, 132 m, greenish-grey, muddy sand with many shell fragments.

Sta I115, 24.04.1969, 07°13'N 54°32'W, agtr, c. 83 m, coarse sand with some mud and shell and reef fragments.

Sta I116, 24.04.1969, 06°59.8'N 54°54'W, agtr, c. 60 m, grayish-green, sandy mud with yellowish-brown surface layer. Many shell frag-

ments.

Sta I117, 24.04.1969, 06°55'N 54°54'W, agtr, c. 54 m, greyish-green, sandy mud with yellowish-brown surface layer, many shell fragments.

Sta I118, 25.04.1969, 06°48'N 54°55'W, agtr, c. 49 m, sandy, greenish-grey mud with yellowish-green surface layer, many shells and Bryozoa.

3. 'Luymes' Guyana Shelf Expedition, August-September 1970, CICAR Cruise 15:

Sta 2, 24.08.1970, 07°07'N 53°36'W, vV, 93 m, sandy calcarenite.

Sta 3, 24.08.1970, 07°02'N 53°35'W, vV, 80 m, calcareous sand.

Sta 4, 24.08.1970, 06°41'N 53°30'W, vV, 54 m, sandy calcarenitic pelite.

Sta 5, 24.08.1970, 06°36'N 53°33'W, vV, 44 m, calcareous sand.

Sta 6, 24.08.1970, 06°32'N 53°35'W, vV, 44 m, muddy calcareous sand.

Sta 13, 25.08.1970, 06°43'N 52°46'W, vV, 132 m, fine sand & mud.

Sta 15, 26.08.1970, 06°36'N 52°50'W, vV, 72 m, calcareous sand.

Sta 16, 26.08.1970, 06°18'N 52°57'W, vV, 56 m, muddy calcareous sand.

Sta 17, 26.08.1970, 06°16'N 53° W, vV, 52 m, muddy calcareous sand.

Sta 19, 26.08.1970, 06°15'N 53°06'W, vV, 42 m, muddy calcareous sand.

Sta 26, 27.08.1970, 07°12'N 53°56'W, vV, 86 m, coarse sand.

Sta 31, 27.08.1970, 07°06'N 53°54'W, vV, 84 m, sandy mud.

Sta 33, 27.08.1970, 07°01'N 53°56'W, vV, 74 m, sandy mud.

Sta 39, 28.08.1970, 06°41'N 53°52'W, vV, 45 m, muddy sand.

Sta 40, 28.08.1970, 06°37'N 53°53'W, vV, 43 m, muddy sand, shells.

Sta 41, 28.08.1970, 06°34'N 53°53'W, vV,

about 40 m, sand, shells.

Sta 42, 28.08.1970, 06°34'N 53°55'W, vV, 39 m.

Sta 43, 28.08.1970, 06°31'N 53°56'W, vV, 35 m, shell gravel.

Sta 50, 30.08.1970, 07°43'N 57°05'W, vV, 96 m, sandy mud.

Sta 51, 30.08.1970, 07°41'N 57°01'W, vV, 98 m, muddy sand.

Sta 52, 30.08.1970, 07°41'N 56°59'W, vV, 96 m, muddy sand.

Sta 54, 30.08.1970, 07°32'N 56°58'W, vV, 78 m, muddy sand.

Sta 56, 30.08.1970, 07°34'N 56°58'W, vV, 86 m, muddy sand, shells.

Sta 57, 30.08.1970, 07°36'N 56°57'W, vV, 90 m, sandy mud, shells.

Sta 58, 30.08.1970, 07°37'N 56°57'W, vV, 94 m, muddy sand.

Sta 59, 30.08.1970, 07°38'N 56°57'W, vV, 96 m, sandy mud, shells.

Sta 60, 30.08.1970, 07°39'N 56°57'W, vV, 95 m, sandy mud, shells.

Sta 62, 31.08.1970, 07°37'N 57°04'W, vV, 76 m, shells, dead corals.

Sta 63, 31.08.1970, 07°35'N 57°04'W, vV, 71 m, sand.

Sta 64, 31.08.1970, 07°35'N 57°05'W, vV, 68 m, muddy sand.

Sta 65, 31.08.1970, 07°33'N 57°05'W, vV, 63 m, sandy bottom.

Sta 68, 31.08.1970, 07°25'N 57°08'W, vV, 51 m, muddy sand.

Sta 69, 31.08.1970, 07°20'N 57°10'W, vV, 46 m, muddy sand.

Sta 70, 31.08.1970, 07°18'N 57°12'W, vV, 41 m, muddy sand, shells.

Sta 71, 31.08.1970, 07°15'N 57°12'W, vV, 35 m, muddy sand, shells.

Sta 80, 01.09.1970, 07°56'N, 57°12'W, agtr, 618 m, muddy bottom.

Sta 113, 05.09.1970, 07°22'N 57°37'W, vV, 32 m, muddy bottom.