

# The Caecidae from French Polynesia with description of eight new species (Caenogastropoda: Rissooidea)

Mauro Pizzini\* (✉) & Bret Raines#

\* Largo della Caffarelletta  
6 - 00179 Roma, Italy;  
pizzini.mauro@gmail.  
com, (✉) Corresponding  
author

# P.O. Box 5124  
Alamogordo, New  
Mexico 88311, U.S.A.;  
rainesbk@yahoo.com

## Abstract

Sixteen species of Caecidae are discussed herein, coming from the South-Pacific Ocean. The specimens were collected from several of the 120 islands of French Polynesia. Eight species are described as new, i.e. *C. tahitianum* n. sp., *C. danieli* n. sp., *C. kontiki* n. sp., *C. cooki* n. sp., *C. bounty* n. sp., *C. australe* n. sp., *C. geigeri* n. sp. and *Meioceras boucheti* n. sp., along with additional data on other species. Furthermore, a morphotype of *Strebloceras subannulatum* Folin, 1879 from Tahiti is also illustrated and discussed.

## Riassunto

Sono trattate in totale sedici specie di Caecidae provenienti dal Sud Pacifico. Il materiale proviene da alcune delle circa 120 isole che fanno parte della Polinesia Francese. Otto di queste specie sono descritte come nuove, *C. tahitianum* n. sp., *C. danieli* n. sp., *C. kontiki* n. sp., *C. cooki* n. sp., *C. bounty* n. sp., *C. australe* n. sp., *C. geigeri* n. sp. e *Meioceras boucheti* n. sp., mentre alle rimanenti dieci, di cui alcune ben note, vengono aggiunti ulteriori dati. *Caecum sepimentum* Folin, 1868, *C. subquadratum* Carpenter, 1858, *C. rostratum* Folin, 1881, *C. amputatum* Hedley, 1894, *C. vertebrale* Hedley, 1899, *C. gulosum* Hedley, 1899, *C. mauritianum* Folin, 1868, *Meioceras legumen* Hedley, 1899, *Meioceras sandwichensis* Folin, 1881 e *Meioceras magatama* (Habe, 1978), quasi tutte specie poco note – i cui tipi originali sono qui illustrati per la prima volta – sono paragonate a quelle nuove. Viene raffigurato inoltre un morfotipo di Tahiti di *Strebloceras subannulatum* Folin, 1879.

## Key words

Caenogastropoda, Caecidae, taxonomy, new species, French Polynesia, South Pacific.

## Introduction

French Polynesia, composed of ca. 120 volcanic islands formed about 20 million years ago, has a land area covering 3,726 km<sup>2</sup>, with another 2,140 km<sup>2</sup> of reefs. From a geopolitical point of view French Polynesia consists of the Austral Islands, Marquesas Islands, Society Islands [Windward Islands (French: *Îles du Vent*) and Leeward Islands (French: *Îles Sous-le-Vent*)], the Tuamotu Archipelago (Tröndlé & Boutet, 2009) and the Gambier Archipelago.

Geomorphologically, there are some differences among the abovementioned archipelagos. The Society Archipelago consists of volcanic islands without reefs (e.g. Mehetia) and islands surrounded by reefs (e.g. Tahiti, Moorea), or with a large lagoon (e.g. Bora-Bora). The Tuamotu Archipelago, consisting of 76 atolls, is one of the richest groups of atolls in the world. The Austral Archipelago consists of either volcanic islands with lagoons (e.g. Raivavae) or islands without lagoons, but with coral reef beds (e.g. Rapa) (Tröndlé & Boutet, 2009). The Marquesas Islands are nearly without coral reef, being directly exposed to the oceanic swell. Notwithstanding, there are also some isolated coral formations, mainly at the end of the bays, which are more calm. Their rocky coasts are made by high cliffs where the sea is nearly always rough. Only the bays have, on their internal sides some short

sandy or gravelly beaches, usually having very little shell-grit (Tröndlé & von Cosel, 2005).

Very few authors have studied the Caecidae of this area; among them, Dautzenberg & Bouge (1933), with their first inventory of marine molluscs of Oceania (including the family Caecidae), and more recently Salvat & Rives (1975, 1984). In 1985, Richard published a list of 1159 species: among the family Caecidae he simply noted *Caecum multiannulatum* Folin in Dautzenberg & Bouge, 1933, *C. sepimentum* Folin, 1868 and four specimens of an undetermined *Caecum* sp. Tröndlé (1986) made a list of Caecidae as well, including *C. arcuatum* Folin, 1867, *C. cf glabella* A. Adams 1868, *C. sepimentum*, Folin 1867, *C. cf vertebrale* Hedley, 1899 and *Caecum* sp. 1, based on Kay's insight (1980). He also pointed out the importance of studying the microfauna, utilized not only as a biodiversity indicator, but also as an important indicator of the environmental conditions and of organism communities.

Recent expeditions to the Marquesas Islands (Museum 9, 1997, 168 stns) and Austral Islands (Benthaus, 2002, 159 stns, depth range of 40-1800 m; Atelier Rapa 2002, 99 stns around Rapa Is., between high tide mark and 52 m depth), organized by the MNHN in collaboration with the Institut de Recherches pour le Développement (IRD), provided numer-



ous marine molluscs, among them those pertaining to the family Caecidae are discussed herein.

Despite the relatively low number of specimens found in this material, sixteen species are addressed, which is a significant increase from the two or three species previously reported from this area. Clearly, our work lays no claim to be all-inclusive of the South-Pacific – another work by Pizzini & Raines on this area is in progress – but only to give a rough picture of the recent species and to provide an update of the species of the family Caecidae found in this very wide area.

## Material and methods

The material studied herein comes from nearly all the archipelagos of the French Polynesian region, excluding the Gambier Archipelago (Fig. 1). It was collected during the Oceanographic Exp. Musorstom 9, 1997 (Marquesas Islands), Benthaut, 2002 and Atelier Rapa 2002 (Austral Islands) and with casual findings by Jean Letourneux (Papeete, Tahiti), covering a part of Tuamotu Archipelago and the Society Islands were sent to us for study. The majority of the islands studied, particularly Tahiti (near Tiarei), shows a unique ecosystem, consisting of lagoons and surrounding reefs from which all the specimens originated. They were found in the shell grit of the intertidal zone at depths varying from 1 to 35 m. (Tröndlé, 1986). In this context few specimens coming from Tahiti, Tatiaroa, Moorea (all Society Islands), Makemo (Tuamotu Archipelago) and Rurutu, Rimatara, Raivavae (all Austral Islands) were examined giving a rough idea of the family Caecidae in this area. All the samples were compared to the type material of *Caecum sepimentum* Folin, 1868, *C. subquadratum* Carpenter, 1858, *M. sandwichensis* Folin, 1881, *C. rostratum* Folin, 1881, *C. amputatum* Hedley, 1894, *C. vertebrale* Hedley, 1899, *C. gulosum* Hedley, 1899, and *Meioceras legumen* Hedley, 1899. In addition, we reported and compared the material to specimens still under study from WAM, AMS and LACM, as well as material from our private collections here indicated as additional material. All type material of the new species is stored in the MNHN.

The following type material was used for comparisons:

*Caecum amydroglyptum* Rehder, 1980, holotype USNM 756977 (Fig. 3A, B); *C. amputatum* Hedley, 1894, holotype AMS C. 68589 (Fig. 3G); *C. berberense* Ladd, 1972, holotype USNM 650429 and paratype USNM 650428 (Fig. 5F, G); *C. bimariginatum* Carpenter, 1858, lectotype NHML n. BMNH 1858.12.9.25 (Fig. 3I); *C. bimariginatum* Carpenter, 1858, 2 syntypes NHML n. BMNH 1903139 from East Indies and NHML n. BMNH 1858.12.9.26 from Australia respectively (Fig. 3J, K); *C. legumen* Hedley, 1899, holotype AMS C5693 (Fig. 6G, H); *C. gulosum* Hedley, 1899, holotype, AMS C5919, (Fig. 3F); *C. hinoidei* Habe, 1978, holotype,

NMNS Mo 55376 (Fig. 5J); *C. maculata* Habe, 1963, orig. type NMNS Mo 39929 (dig. ph.) (Fig. 5E); *C. oahuense* Pilsbry, 1921, lectotype ANSP 127978 (Fig. 2I-J); *C. mauritianum* Folin, 1868, holotype MNHN (Fig. 5L); *C. campanulatum* Raines & Pizzini 2005, holotype LACM 3019 (Fig. 5D); *C. rehderi* Raines & Pizzini 2005, holotype LACM 3019 (Fig. 5K); *C. sepimentum* Folin, 1868, syntype MNHN (Fig. 4G, H); *C. subquadratum* Carpenter, 1858, syntype NHML n. BMNH 1858.12.9.13 (Fig. 3H); *C. ryssotitum* Folin, 1867, lectotype NHML n. BMNH 1868.2.17.7 (dig. ph.) (Fig. 5B); *C. vertebrale* Hedley, 1899, holotype AMS C5917 (dig. ph. Fig. 4J); *C. rostratum* Folin, 1881, holotype MNHN (dig. ph. Fig. 6A); *Meioceras kajiyamai* Habe, 1963, holotype NMNS (dig. ph. Fig. 5I); *Meioceras sandwichensis* Folin, 1881, holotype MNHN (dig. ph. Fig. 6L); *Strebloceras subannulatum* Folin, 1879, 2 syntypes BMNH 1887.2.9.2308-2310 (Fig. 6M-O).

## Abbreviations, acronyms and terminology

AMS = Australian Museum Sydney (Sydney, Australia); ANSP = Academy of Natural Sciences of Philadelphia (USA); LACM = Natural History Museum of Los Angeles County (Los Angeles, USA); MCZ = Museum of Comparative Zoology, Cambridge, Massachusetts (USA); MNHN = Muséum Nationale d'Histoire Naturelle, Paris (France); NHML = Natural History Museum, London (UK), formerly BMNH; NMNS = National Museum of Nature and Science (Tsukuba City, Japan), formerly NSMT; NMNZ = Museum of New Zealand Te Papa Tongarewa, Wellington (New Zealand); USNM = National Museum of Natural History, Washington, D.C. (USA); SBMNH = Santa Barbara Museum of Natural History (USA); WAM = Western Australian Museum, Perth (Australia); BR = Bret Raines colln. (USA); JTC = Jean Tröndlé colln. (France); MP = Mauro Pizzini colln., Rome (Italy); dd = empty shell; lv = live collected specimen; ph = type material examined through photos; dig. ph. = digital photo; fms = fathoms: a unit of length, equivalent to two yards (six feet), used especially for measuring the depth of water in the United States customary system; ft = feet; leg. = collected by; pers. com. = personal communication; dig. ph = seen through digital photos; pres. = prestavit (on loan).

Dorsal: upper or top (convex) side (from Lightfoot, 1992a).

Ventral: under or bottom (concave) side (from Lightfoot, 1992a).

Septum: closure of the shell at the apex or posterior end as it sheds earlier stages (from Lightfoot, 1992a).

Mucro: small to large prong projecting from septum (from Lightfoot, 1992a).

Varix: thickening or swelling of apertural end, often having sculptural details (from Lightfoot, 1992a).

Cutting plane: the plane individuated by the edge of the shell at the apex (excluding septum and mucro).





Fig. 1. Map of the French Polynesia (from Wikimedia Commons [http://commons.wikimedia.org/wiki/File:French\\_Polynesia\\_relief\\_map.svg](http://commons.wikimedia.org/wiki/File:French_Polynesia_relief_map.svg)).

Fig. 1. Carta geografica della Polinesia Francese (da Wikimedia Commons [http://commons.wikimedia.org/wiki/File:French\\_Polynesia\\_relief\\_map.svg](http://commons.wikimedia.org/wiki/File:French_Polynesia_relief_map.svg)).

Class Gastropoda Cuvier, 1797  
Superfamily Rissooidea Gray J.E., 1847  
Family Caecidae Gray J.E., 1850  
Genus *Caecum* Fleming, 1813

*Caecum danielei* n. sp.  
(Fig. 2A-C)

Type material

Holotype MNHN n. 22066 (dd) from type locality; 1 paratype LACM 3129 (dd) Okinawa (Ryukyu Islands, Japan), 1 km W of Onna Village (Horseshoe South), 26°29.7'N, 127°50.6'E, sand and coral rubble, 34 m; 1 paratype MNHN (dd) Saipan (Marshall Islands), Laolao Bay, in surge channel, sand and rubble, 20 m, leg. D. Brennan (BR).

Type locality

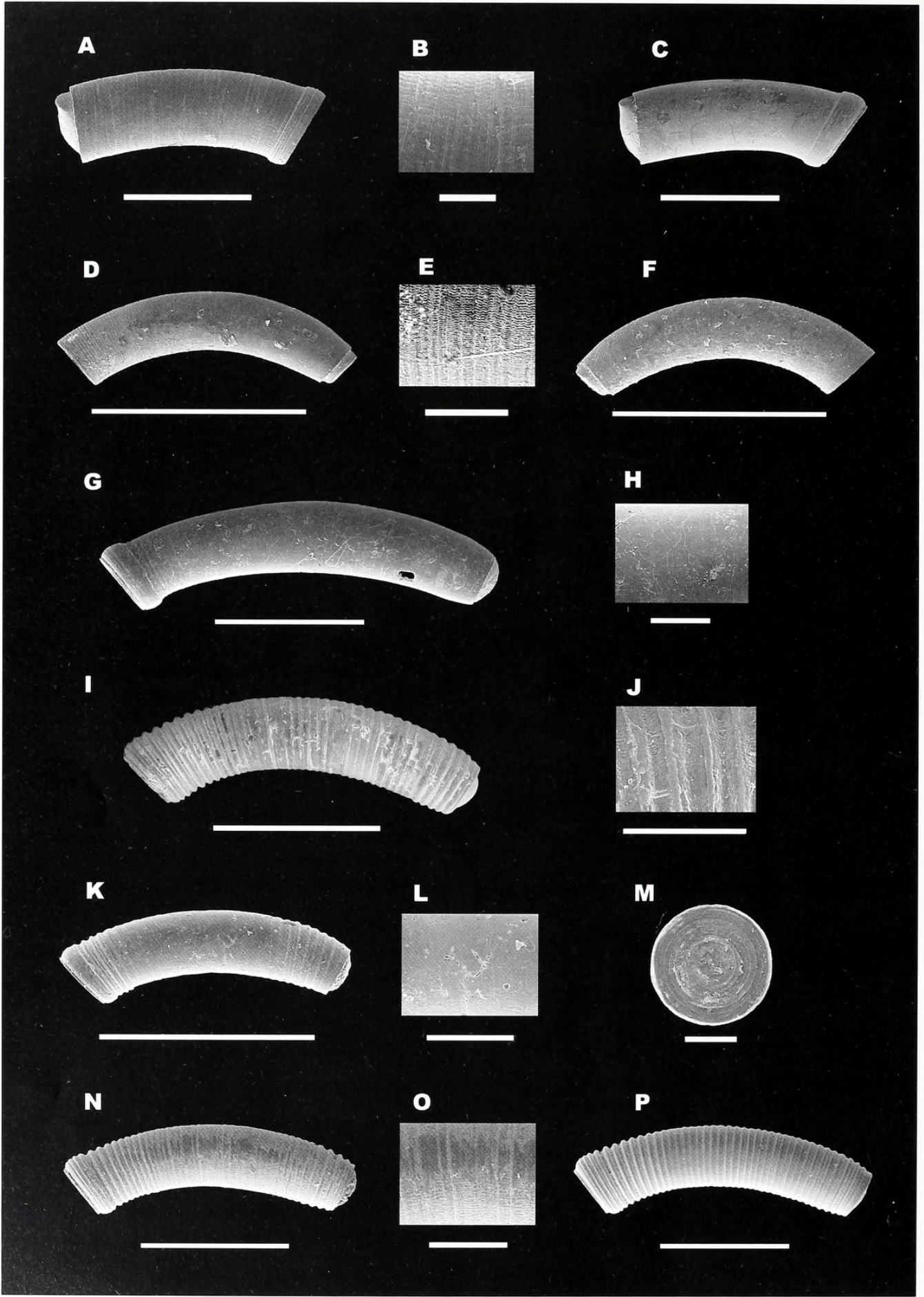
Makemo Is. (Tuamotu Archipelago), Passe Arikitam-

ro, lagoon along side of the airport, shell grit, leg. J. Letourneux.

Description

Tube cylindrical, slightly arched, sculpture comprised of very small rings, irregularly raised covering the shell for nearly its entire length and a worm-like longitudinal microsculpture, usually only slightly visible even at higher magnifications. In some shells, the tube can be completely smooth and crossed only by growth striae. Precocious varices (1-2) may be present on the shell's surface. Septum mucronate, with a somewhat weakly developed mucro tip, inclined nearly 10° from the axis and slightly raised over the cutting plane; posterior margin slightly convex, almost straight, anterior S-shaped. Aperture circular, edged by a varix. Colour white. Operculum and soft parts unknown. Holotype dimensions: length 2.2 mm; diam. in the middle of tube 0.7 mm.







## Distribution

Known from Makemo (Tuamotu Archipelago), Society Islands (Jean Tröndlé, pers. com.), Okinawa (Ryukyu Islands, Japan) and Saipan (Marshall Islands).

## Etymology

This species is named after Daniele Pizzini, the first author's brother.

## Remarks

This species tends to form precocious and multiple varices. This phenomenon is not consistent since, the anomalous varices can develop in any part of the tube. The tendency to form precocious varices before reaching the adult stage is not an isolated phenomenon in the family Caecidae, though there is not yet any explanation for the fact. This phenomenon has previously been noticed for example with the Mediterranean *C. auriculatum* form *decurtata* Monterosato, 1884 (= *C. saavedrae* Beltran, 1965), (Ruggieri, 1994; Pizzini *et al.*, 1995) and the Caraibic *C. breve* Folin, 1876, which may be an abbreviated form of *C. achiro-num* Folin, 1867 (Lightfoot, 1992a). Knowing that the formation of varices indicates the reaching of sexual maturity or the maturity of the gonads (Fretter & Graham, 1962), we presume that some individuals reach this stage prematurely, thus forming varices and still continue their growth (Palazzi, 1979:62; Ruggieri, 1994; Pizzini *et al.*, 1995).

*Caecum danielei* somewhat resembles *C. gulosum* Hedley, 1899 (Fig. 3F) in general shape and the presence of a raised ring rimming the aperture. However, *danielei*'s tube is shorter and differs as well with its worm-like longitudinal microsculpture. Furthermore, the septum of *danielei* is mucronate, with the posterior margin slightly convex to nearly straight, while the anterior is S-shaped. The septum of *gulosum*, however, is dome-shaped with a very small mucro sometimes hidden, barely emerging from the cutting

plane. Another species quite similar to *C. danielei* is *C. amputatum* Hedley, 1894 (Fig. 3G), which shows the same septum features, but having a longer tube and lacking the longitudinal microsculpture as in *danielei*. In addition, the ring surrounding the aperture is simple, without any type of sculpture whereas the new species shows 4-5 small visible rings.

## *Caecum tahitianum* n. sp. (Fig. 2D-F)

## Type material

Holotype MNHN 22067 (dd) and 1 paratype LACM 3134 (lv), 1 paratype NHML (dd), 1 paratype NMNS (dd), 1 paratype NMNZ (dd), 1 paratype MNHN (dd) all from type locality.

## Type locality

Tahiti (Society Islands), Tiarei, fringing reef, shell grit under rocks, leg. J. Letourneux.

## Description

Tube moderately arched, devoid of any type of sculpture, but with microsculpture only visible at very strong magnification, comprising of minute, strong, close-set growth striae, becoming very small rings in the abapical portion of the tube, and cross a very fine longitudinal worm-like striation. Septum somewhat protruded over the cutting plane with the top quite flat, both anterior and posterior margins straight. Aperture non-contracted without any type of varix. Colour brownish in fresh specimens. Operculum light brown. Soft parts unknown. Holotype dimensions: 1.4 mm, diam. max. 0.3 mm.

## Distribution

The species is currently known only from Tahiti, along the northern coast off Tiarei.

**Fig. 2. A.** *Caecum danielei* n. sp., holotype MNHN n. 22066, Makemo (Tuamotu Arch.), Passe Arikitamiro, lateral view (scale bar = 1 mm). **B.** detail of microsculpture (scale bar = 250 µm). **C.** paratype MNHN 23122, Saipan (Marshall Islands), Laolao Bay, lateral view (scale bar = 1 mm). **D.** *Caecum tahitianum* n. sp., holotype MNHN 22067, Tahiti (Society Islands), Tiarei, lateral view (scale bar = 1 mm). **E.** holotype, detail of microsculpture (scale bar = 250 µm). **F.** paratype MNHN 23123, Tahiti (Society Islands), Tiarei, lateral view (scale bar = 1 mm). **G.** *Caecum kontiki* n. sp., holotype MNHN 22068, Tahiti (Society Islands), Tiarei (scale bar = 1 mm). **H.** detail of microsculpture (scale bar = 250 µm). **I.** *Caecum oahuense* Pilsbry, 1921, lectotype, Oahu Is. (Hawaiian Islands) lateral view (scale bar = 1 mm). **J.** lectotype, detail of microsculpture (scale bar = 250 µm). **K.** *Caecum oahuense*, Nuku Hiva Is. (Marquesas Islands) lateral view (scale bar = 1 mm). **L.** detail of microsculpture (scale bar = 250 µm). **M.** detail of operculum (scale bar = 100 µm). **N.** *Caecum oahuense*, Sand Is. (Midway Islands) lateral view (scale bar = 1 mm). **O.** detail of microsculpture (scale bar = 250 µm). **P.** *Caecum oahuense*, Midway Atoll (Midway Islands) lateral view (scale bar = 1 mm).

**Fig. 2. A.** *Caecum danielei* n. sp., olotipo MNHN n. 22066, Makemo (Tuamotu Arch.), Passe Arikitamiro, vista laterale (scala = 1 mm). **B.** dettaglio della microscultura (scala = 250 µm). **C.** paratipo MNHN 23122, Saipan (Marshall Islands), Laolao Bay, vista laterale (scala = 1 mm). **D.** *Caecum tahitianum* n. sp., olotipo MNHN 22067, Tahiti (Society Islands), Tiarei, vista laterale (scala = 1 mm). **E.** olotipo MNHN 22067, dettaglio della microscultura (scala = 250 µm). **F.** paratipo MNHN 23123, Tahiti (Society Islands), Tiarei, vista laterale (scala = 1 mm). **G.** *Caecum kontiki* n. sp., olotipo MNHN 22068, Tahiti (Society Islands), Tiarei (scala = 1 mm). **H.** dettaglio della microscultura (scala = 250 µm). **I.** *Caecum oahuense* Pilsbry, 1921, lectotipo, Oahu Is. (Hawaiian Islands) vista laterale (scala = 1 mm). **J.** lectotipo, dettaglio della microscultura (scala = 250 µm). **K.** *Caecum oahuense*, Nuku Hiva Is. (Marquesas Islands) vista laterale (scala = 1 mm). **L.** dettaglio della microscultura (scala = 250 µm). **M.** dettaglio dell'opercolo (scala = 100 µm). **N.** *Caecum oahuense*, Sand Is. (Midway Islands) vista laterale (scala = 1 mm). **O.** dettaglio della microscultura (scala = 250 µm). **P.** *Caecum oahuense*, Midway Atoll (Midway Islands) vista laterale (scala = 1 mm).



## Etymology

The epithet of the new species refers to the type locality.

## Remarks

Through a transparent area of the tube, at a very close and unusual distance from the cutting plane, the formation of an internal septum can be made out. This morphological characteristic has never been observed before in other species of caecids. The new species resembles *C. subquadratum* Carpenter, 1858 (Fig. 3H), only with regard to the straight parallel margins of the septum "...lateribus rectis, parallelis..." (Carpenter, 1859, p. 433). However, the septa are quite different, *tahitianum* having a very flat top (Fig. 2F), while in *C. subquadratum*, the septum is "...submamillatum...".

### *Caecum kontiki* n. sp. (Fig. 2G, H)

#### Type material

Holotype MNHN 22068 (dd) from type locality.

#### Type locality

Tahiti (Society Islands), Tiarei, fringing reef, shell grit under rocks, leg. J. Letourneux.

#### Description

Tube quite cylindrical, slender, crossed by very fine growth striae becoming small obsolete rings near the aperture and by a vanishing longitudinal striation, only visible at strong magnification. Septum strongly protruding over the cutting plane, dome-shaped with a very small indistinct mucro oriented towards the dorsal side. Aperture rimmed by a varix, crossed by 5-6 minute obsolete rings, though not always detected. Whitish colour. Operculum and soft parts unknown. Holotype dimensions: length: 2.2 mm; min. diam. 0.5, max diam. 0.6.

#### Distribution

Currently known only from Tahiti (Society Islands).

## Etymology

The epithet takes its origin from the name of the pre-Inca sun god Kon-Tiki, which was also the name given to the raft used by Norwegian explorer Thor Heyerdahl in his 1947 expedition from Peru to the Polynesian Islands, to demonstrate that people from South America could have settled Polynesia in pre-Columbian times. The name is here used as noun in apposition.

## Remarks

The new species is quite similar to *C. gulosum* Hedley, 1899 (Fig. 3F) in general shape, but *kontiki* is more slender, has a less exerted dome-shaped septum, and more rounded apertural ring. Furthermore, *gulosum* is "...concentrically sculptured by fine close threads which grow coarser anteriorly", while the sculpture of *kontiki* is formed by very small rings only in the abapical portion of the tube. In addition, the new species shows a worm like longitudinal striation covering the entire tube, unremarkable in *gulosum*. The holotype from Tahiti shows no trace of twisting.

### *Caecum oahuense* Pilsbry, 1921 (Fig. 2I-P)

*Caecum amydroglyptum* Rehder, 1980: p. 32, pl. 5, fig. 12.

#### Type locality

Mokapu Point, Oahu Is., Hawaiian Islands.

#### Material examined

*Caecum oahuense* Pilsbry, 1921, lectotype ANSP 127978 (Fig. 2I, J); MNHN, Marquesas Islands, Stn 02, Nuku Hiva Is., Taiohae Bay, W of Mataupuna, 8°56.22'S, 140°05.68'W, 10-20 m, 2 lv and 2 dd (one of these broken); MNHN, Marquesas Islands, SMCB, Tahuata Is., 09°54'S, 139°07'E, 48 m, leg. J. Poupin, 31/08/1990, 1 dd; Midway Islands, W side of Sand Is., Welles Harbor, 28°12.5'N, 177°24.3'W, 2-8 m, under dead coral, 5 dd, LACM 85-117; Midway Islands, N reef of Midway Atoll, adjacent to The Reef Hotel, (28°16.3'N, 177°21.8'W). 2m, on algae or dead coral, 1 dd, LACM 85-121.

#### Diagnosis

Tube cylindrical, slightly arched, sculptured with rounded raised rings, crossed longitudinally by an indistinct microsculpture visible only with very strong magnification. Septum perfectly dome-shaped, slightly curved and barely emerging from the cutting plane. Aperture circular, surrounded by a ring somewhat larger than the others. Operculum thin, light brown; outer side with 5-6 concentric rings from the border to the center. Soft parts unknown. Lectotype dimensions: length: 2.1 mm; min. diam. 0.43 mm, max. diam. 0.5 mm.

#### Distribution

Described from the Hawaiian Islands, its geographical distribution is here extended to Marquesas Islands and Midway Islands (LACM).



## Remarks

Specimens from the Marquesas Islands consistently show a number of rings near the aperture (5-6), as well as the adapical portion of the tube (8-9), leaving the middle portion completely void of rings (Fig. 2K-L). However in specimens from the Midway Islands, they are nearly obsolete, but still present (Fig. 2N-P). The comparison of Lightfoot (1992b: pp. 1, 4; figs 4, 5) between *oahuense* and *vertebrale*, although correct, nevertheless was focused mainly in terms of number of rings and in the worn area within the central portion of *oahuense*'s tube, not cited in the original description. Annular sculpture in some caecid species is an extremely variable diagnostic character, so its total or partial lack of presence could be misleading – e.g. *C. atlantidis* Watson, 1897 (Nofroni et al.: 26, 88-95). Only after examining a much larger sample of individuals, were we able to recognize its sculpture. For the morphological differences between the respective septa, see the remarks of *vertebrale*.

The confusion surrounding *C. oahuense* is due to the fact Pilsbry never actually selected a holotype. After years of being misplaced, the type lot has finally been located. While the type was awaiting SEM imaging, several inconsistencies were noted. The presumed holotype lot 127978 contains three specimens, which is in agreement with the original label stating "TYPE and 2 others". However, there is a further annotation "Paratype 386397 386400 split from lot by E. Spamer 1992". An examination of lot 386400 also revealed two examples of *oahuense* are contained in that lot bringing the total to five specimens (Daniel Geiger, pers. com.). Pilsbry provided only a brief description and measurements with no illustration. At this time a slightly worn adult specimen from lot ANSP 127978, (Fig. 2I-J) is here designated as the lectotype of *Caecum oahuense* Pilsbry, 1921. The remaining material in this lot consists of one juvenile shell and one other adult shell.

*Caecum amydroglyptum* Rehder, 1980, holotype (USNM 756977) from Easter Is. (Fig. 3A, B) resembles *C. oahuense* very much as well, having the same septum typology, shape of the tube and lacking of rings in the middle portion (Fig. 3A-E). The only notable difference is *amydroglyptum* tends to show a clear longitudinal worm like striation, while that of *oahuense* is weak or almost indistinct, which is well within variation of the species. In conclusion, it is our opinion that only *C. sepimentum*, *C. vertebrale* and *C. oahuense* are valid taxa.

### *Caecum cooki* n. sp. (Fig. 4A, B)

## Type locality

Makemo Is., Passe de Arikitemiro (Tuamotu Archipelago), lagoon along side of the airport, shell grit, leg. J. Letourneux.

## Type material

Holotype MNHN 23124 (dd) and 1 paratype MNHN 23125 (dd juv. 2 stages still attached), from type locality; 1 paratype MNHN 23126 (dd), from Tahiti (Society Islands), Tiarei, fringing reef, shell grit; 1 paratype LACM 3130 (dd), Indonesia, NW side of Lombok, off Ajer & Meno Islets, (8°22'S, 116°04'E) 5-20 m, rubble of steep coral slope; 4 paratypes LACM 3131 (dd), Society Islands, W side of Moorea Island, near Club Mediterranean, (17°30'S, 149°46'W), 2-3 m; 6 paratypes (dd), Saipan, Laolao Bay at 20-30 feet, surge channel, leg. D. Brennan (BR).

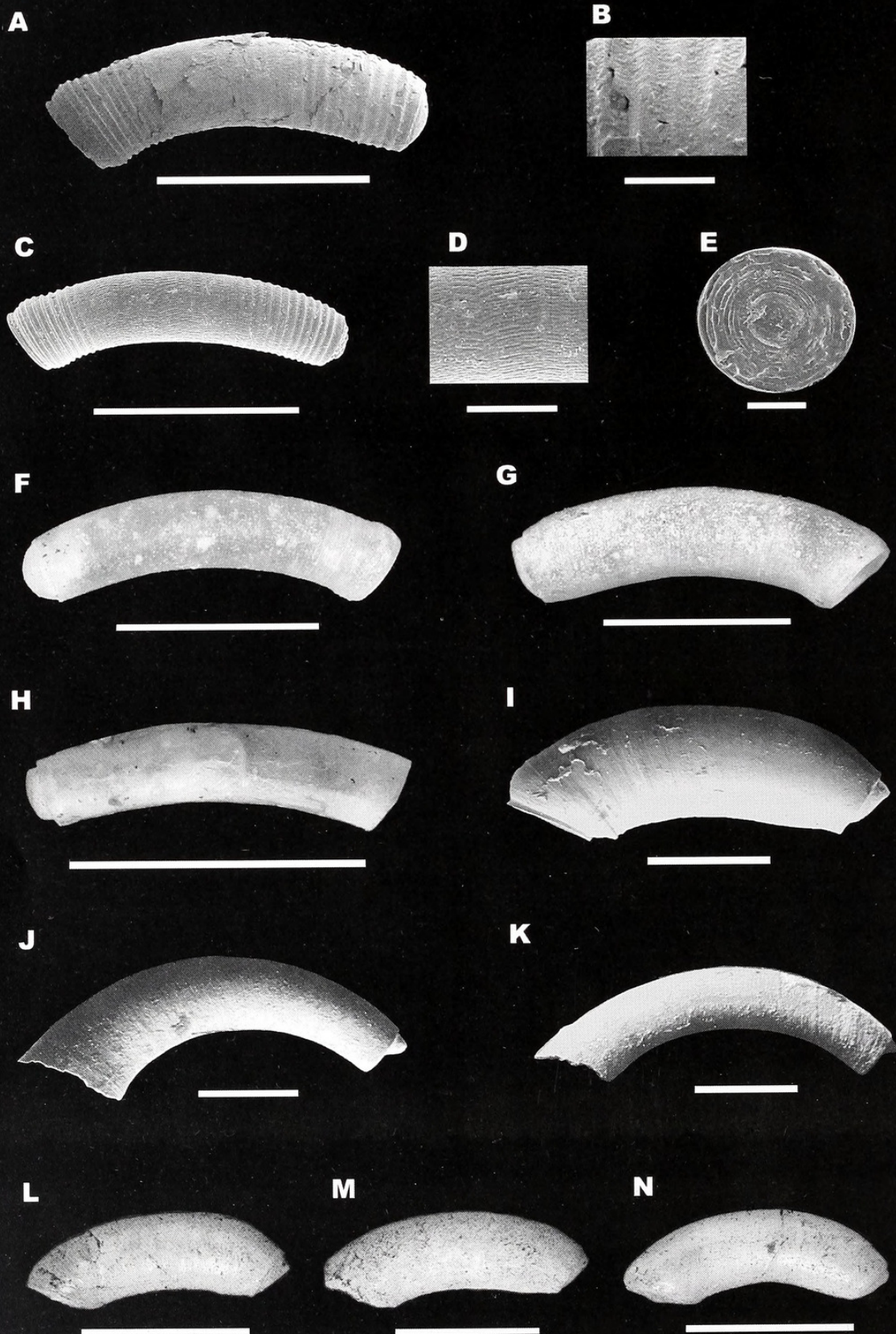
## Material examined

*Caecum bimarginatum* Carpenter, 1858: lectotype (BMNH n. 1858.12.9.25) (from Singapore, in original description), (Fig. 3I) and 2 syntypes BMNH n. 1858.12.9.26 (from Australia) (Fig. 3J-K), and NHML n. 1993139 (from East Indies); *C. ryssotitum* Folin, 1867, 3 syntypes BMNH 1868.2.17.7 (Fig. 3L-N); Tetiaroa (Windward Islands), shell grit, 1 dd juv.; Makemo (Tuamotu Archipelago), Passe Arikitemiro, lagoon along side of the airport, shell grit, 23 dd; Society Islands: C415380 - n. 003252C, Paevaeva, W side Moorea, 17°32.000' S, 149°53.000' W, 4-11 m, on outside of reef, 1 dd (AMS); Watumu, Kenya, 30 m, 2 dd, leg. Contessini (MP); *C. laeve* C. B. Adams, 1852, Kobbe Beach, Canal Zone, Panama, sand under rocks on rocks intertidal, leg. C. Skoglund 15/3/1972 (MP).

## Description

Tube slightly arched. The first quarter of the tube is subcylindrical then becoming cylindrical up to the aperture. For nearly the first one fifth of the total length, the tube bends remarkably toward the ventral side, subsequently it widens forming a swelling, more conspicuous from the ventral side, which abruptly tightens and eventually expands to form a small sharp edge. Surface apparently smooth showing minute faint longitudinal striations visible only at very high magnifications. In addition, numerous rough growth lines are present, more pronounced in the terminal section of the tube. In frontal view, with the posterior edge turned upward, the septum's apex, mucronate, points to the right at almost 30°. Seen in profile its anterior margin is slightly S-shaped; the posterior shows a small concavity after the cutting plane. Operculum, very characteristic, is thick, corneous, light brown; internal surface shows a quite smooth surface with a subcylindrical cusp which is raised at its center; external surface crossed by 6-7 slightly raised concentric rings, with a depressed center. Colour from translucent to chalky white in the beached specimens. Soft parts unknown. Juveniles show a general shape quite similar to the adults, except for the more accentuated concavity of







the septum's dorsal edge and the protruding mucro. Holotype dimensions: length 1.8 mm, diam. in the middle of the tube 0.4 mm.

## Distribution

Society Islands, Tuamotu Archipelago, Indonesia (LACM), Western Samoa (ZSM), and Kenya (MP).

## Etymology

This new species is dedicated to the great British navigator, Captain James Cook, who discovered several islands in Melanesia and Micronesia during his three expeditions.

## Remarks

*Caecum cooki* n. sp. is similar to the Panamic *C. laeve* C.B. Adams, 1852 (Fig. 5A) (holotype figured in Turner, 1956: 127, Pl. 17, fig. 5) in the general shape of the tube, which is however more slender in the former. Furthermore, the new species differs from *C. laeve* by the presence of a longitudinal microsculpture – absent in *C. laeve* – and in the shape of the septum, being more protruded with a pointed mucro and a less angled aperture.

*Caecum laeve*, ranging from Mexico to Panama, is morphologically nearly indistinguishable from *C. ryssotitum* Folin, 1867, a common species from the southern Caribbean (De Jong & Coomans, 1988: p. 39) and the Brazilian coasts (Fig. 5B) (Do Santos Gomes & Absalão, 1996: p. 522) and also to another taxon, *C. bimarginatum* Carpenter, 1858 described based on three syntypes from "Singapore", "Australia" and "East Indies" (Fig. 3I-K), respectively. Among these syntypes, those from Australia (NHML n. BMNH 1858.12.9.26) and East Indies (NHML BMNH n. 1993139) are juveniles of a third stage, not identifiable with certainty. The single adult specimen (NHML n. BMNH 1858.12.9.25), labelled "Singapore", here designated as the lectotype of *C. bimarginatum* Carpenter, 1858, is also quite similar to adults of *C. laeve*.

All three entities are distinguished from the new species (see comparison with *C. laeve*). We maintain *C. laeve* and *C. ryssotitum* as distinct, despite they are morphologically nearly identical with the only unique difference consisting in a more accentuated bending of the dorsal abapical side of the tube of the latter – given their clearly separate ranges in the Panamic coast and Atlantic Oceans, respectively. *Caecum bimarginatum* remains, in our opinion, an entity of doubtful status regarding its geographical range. Other than the lectotype we have found only one specimen and it was from Acapulco (Guerrero, Mexico) (Fig. 5C), far from type locality. Furthermore, we have yet to observed a single specimen of this type amidst the thousands of samples examined from the Indian Ocean (including South East Asia), nor from the Pacific, with the exclusion of the nearly identical *C. laeve* from the Panamic Province, or the similar (yet morphologically quite distinct) *C. cooki*.

## *Caecum bounty* n. sp. (Fig. 4E)

## Type material

Holotype MNHN 23127 (dd) and 5 paratypes MNHN 23128 (dd), from the type locality; 1 paratype LACM 3132 (dd), French Polynesia, Tuamotu Archipelago, Ahe Atoll, 14°28'S, 146°22'W, 1 m.

## Type locality

Musorstom 9 (Marquesas Islands) Stn DW 1288, Ua Huka Is., 8°54'S, 139°38'W, 200-220 m.

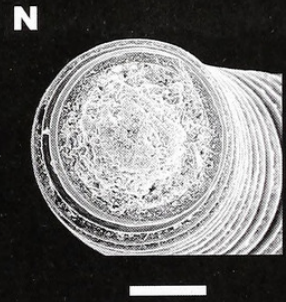
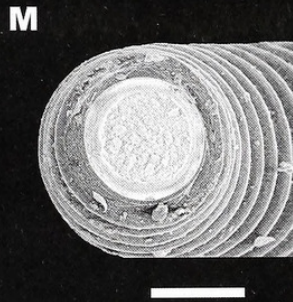
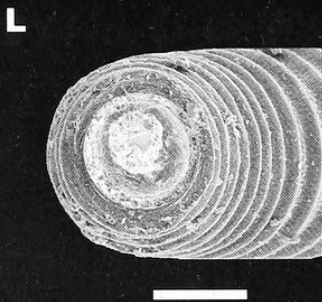
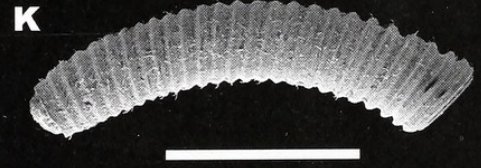
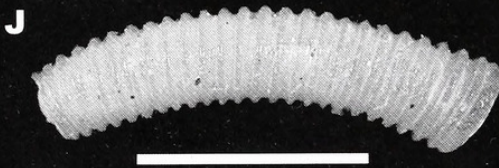
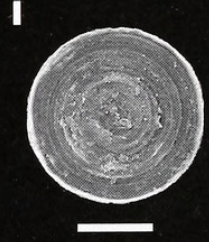
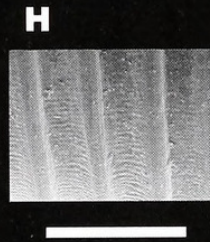
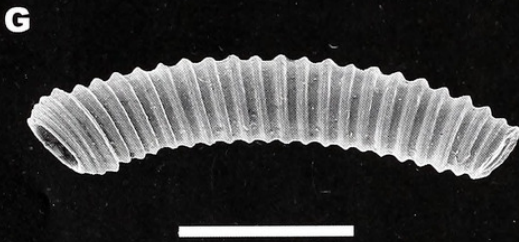
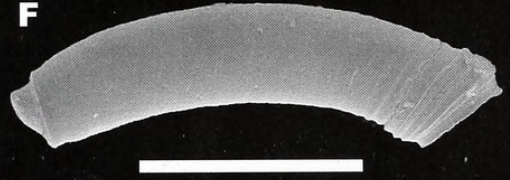
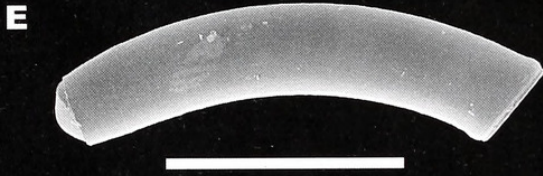
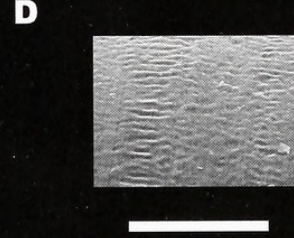
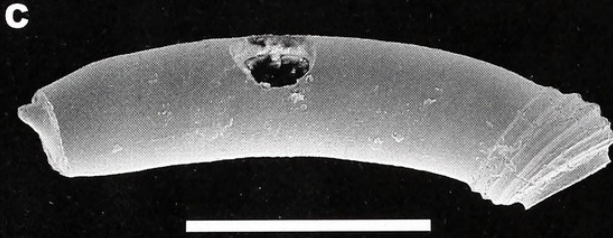
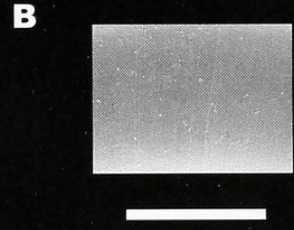
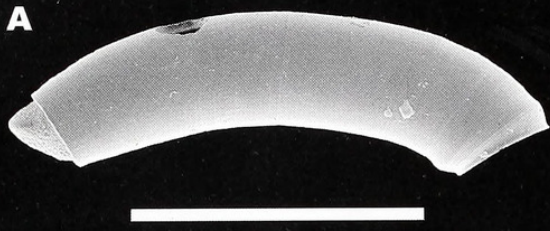
## Description

Tube cylindrical, less arched, smooth, covered only by very fine growth lines, sometimes more pronounced, and by a faint longitudinal striation, sometimes obsolete. Septum dome-shaped less protruded over the cutting plane with a mucro slightly emerging, turned to the right side with an average angle ranging from 35° to 45°. Aperture rimmed by a small

**Fig. 3. A.** *Caecum amydroglyptum* Rehder, 1980, holotype USNM 756977, Onetea, Hotuiti (Easter Island) lateral view (scale bar = 1 mm). **B.** detail of microsculpture (scale bar = 250 µm). **C.** *Caecum amydroglyptum*, Anakena Bay (Easter Island) lateral view (scale bar = 1 mm). **D.** detail of microsculpture (scale bar = 250 µm). **E.** detail of operculum (scale bar = 100 µm). **F.** *Caecum gulosum* Hedley, 1899, holotype AMS C5919, Atoll of Funafuti (Ellice Group) (scale bar = 1 mm). **G.** *Caecum amputatum* Hedley, 1894, holotype AMS C68589, Cabbage Tree Bay, near Manly, New South Wales (Australia) (scale bar = 1 mm). **H.** *Caecum subquadratum* Carpenter, 1859, syntype NHML n. BMNH 1858.12.9.13, Port Elizabeth (Australia) (scale bar = 1 mm). **I.** *Caecum bimarginatum* Carpenter, 1858, lectotype NHML n. BMNH 1858.12.9.25, type locality Singapore, (scale bar = 1 mm). **J.** syntype NHML n. BMNH 1903139, type locality East Indies, (scale bar = 1 mm). **K.** syntype NHML n. BMNH 1858.12.9.26, type locality Australia (scale bar = 1 mm). **L.** *Caecum ryssotitum* Folin, 1867, syntype NHML n. BMNH 1868.2.17.7, type locality "Brasil, Cotes d'America, Golf Mexique etc.". **M.** syntype (scale bar = 1 mm). **N.** syntype (scale bar = 1 mm).

**Fig. 3. A.** *Caecum amydroglyptum* Rehder, 1980, olotipo USNM 756977, Onetea, Hotuiti (Easter Island) vista laterale (scala = 1 mm). **B.** dettaglio della microscultura (scala = 250 µm). **C.** *Caecum amydroglyptum*, Anakena Bay (Easter Island) vista laterale (scala = 1 mm). **D.** dettaglio della microscultura (scala = 250 µm). **E.** dettaglio dell'opercolo (scala = 100 µm). **F.** *Caecum gulosum* Hedley, 1899, olotipo AMS C5919, Atoll di Funafuti (Ellice Group) (scala = 1 mm). **G.** *Caecum amputatum* Hedley, 1894, olotipo AMS C68589, Cabbage Tree Bay, near Manly, New South Wales (Australia) (AMS) (scala = 1 mm). **H.** *Caecum subquadratum* Carpenter, 1859, sintipo NHML n. BMNH 1858.12.9.13, Port Elizabeth (Australia) (scala = 1 mm). **I.** *Caecum bimarginatum* Carpenter, 1858, lectotipo NHML n. BMNH 1858.12.9.25, Singapore, (scala = 1 mm). **J.** sintipo NHML n. BMNH 1903139 type locality East Indies, (scala = 1 mm). **K.** sintipo, NHML n. BMNH 1858.12.9.26, type locality Australia (scala = 1 mm). **L.** *Caecum ryssotitum* Folin, 1867, sintipo NHML n. BMNH 1868.2.17.7, "Brasil, Cotes d'America, Golf Mexique etc.". **M.** sintipo (scala = 1 mm). **N.** sintipo, (scala = 1 mm).







widening of the tube that quickly narrows. Colour transparent. Operculum and soft parts unknown. Holotype's dimensions; length 2.2 mm, diam. in the middle of the tube 0.5 mm.

### Distribution

The new species is at present known only from the Marquesas Islands and Tuamotu Archipelago.

### Etymology

The epithet is derived from British Royal Navy Ship *Bounty*, famous for the mutiny occurred on 28 April 1789 in the Polynesian waters, and it is used herein as noun in apposition.

### Remarks

The new species resembles very much *C. campanulatum* Raines & Pizzini, 2005 from Easter Is. (Chile) (Fig. 5D) in the shape of the tube and typology of microsculpture. They differ mainly in the septum's typology, by *C. bounty* having a dome-shaped septum with a little mucro turned to right side, completely lacking in the former.

*Caecum australe* n. sp.  
(Fig. 4C, D)

### Type material

Holotype MNHN 23148 (dd), from the type locality.

### Type locality

Benthaus 2002 (Austral Islands); Stn DW 1939, N of Raivavae Is., 23°49.7'S, 147°41.6'W, 100 m, IRD-MNHN leg. 15/11/2002.

### Description

Tube slightly arched, subcylindrical only in the adapical portion of the tube, then cylindrical until nearly the aperture. Microsculpture of very fine growth striation crossing a longitudinal worm like

striation especially noticeable in the middle portion of the tube. Aperture surrounded by 4 pronounced rings. Septum a little recessed under the cutting plane, having a finger-like mucro with a rounded top, rising from almost the center. Soft parts unknown. Holotype dimensions: length 2.6 mm, diam. in the middle of the tube 0.5 mm.

### Distribution

Only known from type locality.

### Etymology

The name of the species refers to the area of its type locality.

### Remarks

The shape of the new species is very peculiar among the Caecidae from Southwest Pacific Ocean, so there are no others resembling it. The only one having some limited resemblances with *C. australe* is *C. geigeri* n. sp. only regarding the rings surrounding the aperture (for the differences between *australe* and *geigeri*, see remarks of the latter).

*Caecum geigeri* n. sp.  
(Fig. 4F)

### Type material

Holotype MNHN 23149 (dd), from type locality.

### Type locality

MNHN: Atelier Rapa 2002 (Austral Islands); Stn 38, Rapa Is., N of Anatakuri Bay, 27°37.4S, 144°18.4'W, sediment under large rock, 2 m.

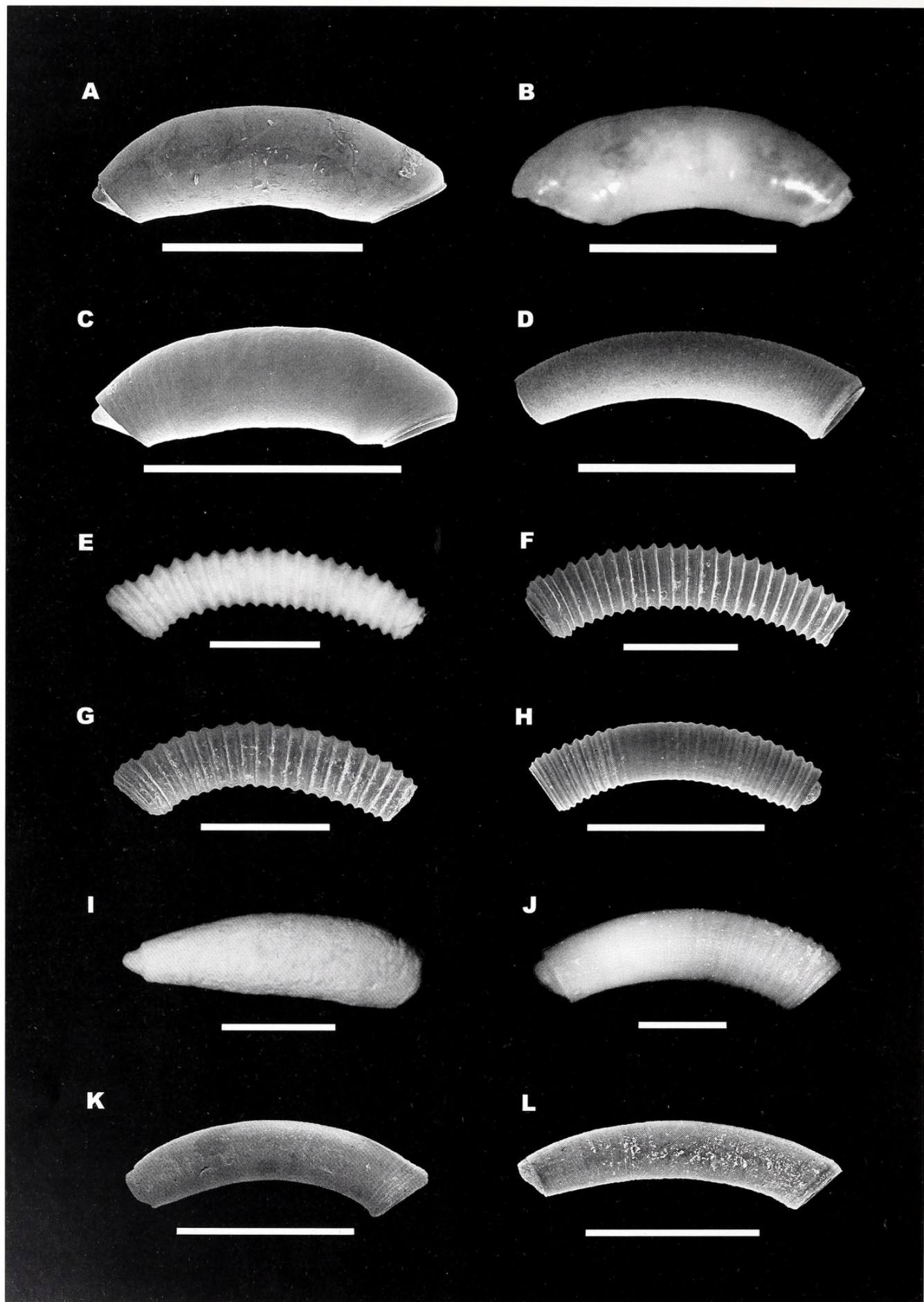
### Description

Tube slightly cylindrical in the adapical part of the tube, then perfectly cylindrical, until the aperture; crossed by rough, indistinct growth lines becoming

**Fig. 4. A.** *Caecum cooki* n. sp., holotype MNHN 23124, Makemo Is. (Tuamotu Archipelago) lateral view (scale bar = 1 mm). **B.** detail of microsculpture (scale bar = 250 µm). **C.** *Caecum australe* n. sp., holotype MNHN 23148, Raivavae Is. (Austral Islands) lateral view (scale bar = 1 mm). **D.** detail of microsculpture (scale bar = 250 µm). **E.** *Caecum bounty* n. sp., holotype MNHN 23127, Ua Huka Is. (Marquesas Islands) lateral view (scale bar = 1 mm). **F.** *Caecum geigeri* n. sp., holotype MNHN 23149, Rapa Is. (Austral Islands) lateral view (scale bar = 1 mm). **G.** *Caecum sepimentum* Folin, 1868, syntipo MNHN, Mauritius Is. **H.** detail of microsculpture (scale bar = 250 µm). **I.** detail of operculum (scale bar = 100 µm). **J.** *Caecum vertebrale* Hedley, 1899, holotype AMS C5917, Atoll of Funafuti (Ellice Group) (scale bar = 1 mm). **K.** *Caecum vertebrale*, Rurutu. (Austral Islands), specimen with a hairy periostracum (scale bar = 1 mm). **L.** details of septum (scale bar = 100 µm). **M.** details of septum (scale bar = 100 µm). **N.** details of septum (scale bar = 100 µm).

**Fig. 4. A.** *Caecum cooki* n. sp., olotipo MNHN 23124, Makemo Is. (Tuamotu Archipelago) vista laterale (scala = 1 mm). **B.** dettaglio della microscultura (scala = 250 µm). **C.** *Caecum australe* n. sp., olotipo MNHN 23148, Raivavae Is. (Austral Islands) vista laterale (scala = 1 mm). **D.** dettaglio della microscultura (scala = 250 µm). **E.** *Caecum bounty* n. sp., olotipo MNHN 23127, Ua Huka Is. (Marquesas Islands) vista laterale (scala = 1 mm). **F.** *Caecum geigeri* n. sp., olotipo MNHN 23149, Rapa Is. (Austral Islands) vista laterale (scala = 1 mm). **G.** *Caecum sepimentum* Folin, 1868, sintipo MNHN, Mauritius Is. **H.** dettaglio della microscultura (scala = 250 µm). **I.** dettaglio dell'opercolo (scala = 100 µm). **J.** *Caecum vertebrale* Hedley, 1899, olotipo AMS C5917, Atoll di Funafuti (Ellice Group) (scala = 1 mm). **K.** *Caecum vertebrale*, Rurutu. (Austral Islands), esemplare con periostraco peloso (scala = 1 mm). **L.** dettaglio del setto (scala = 100 µm). **M.** dettaglio del setto (scala = 100 µm). **N.** dettaglio del setto (scala = 100 µm).







rings near the aperture and by a rough worm-like longitudinal microsculpture. On the first portion of the tube, below the cutting plane, a strong narrowing is noticeable. Septum mucronate, turned to right side at about 15°, with the dorsal margin slightly concave and the ventral one convex (Fig. 4I). Aperture circular, surrounded by three/four major rings; after these rings the aperture narrows. Soft parts unknown Holotype dimensions: length 2.2 mm, diam. in the middle of the tube 0.5 mm.

## Distribution

Only known from type locality.

## Etymology

The new species is dedicated to the well known malacologist Daniel Geiger (SBMNH).

## Remarks

This new species is also unique among the Caecidae from the Pacific Ocean. *C. geigeri* shows some resemblances only with *C. australe* n. sp. having some rings in the abapical part of the tube, but the respective septa are quite different, finger-like in *C. australe*, mucronate in *geigeri*.

### *Caecum sepimentum* Folin, 1868 (Fig. 4G-I)

*Caecum sepimentum* Folin, 1868: p. 84, pl. 6, fig. 7.

*Caecum sepimentum* var. *arcuata* Folin, 1868: p. 84.

*Caecum maculata* Habe, 1963: p. 236, fig. 2.

*Caecum berberense* Ladd, 1972: pp. 22, 23, pl. 5, figs 11-12.

## Type locality

Mauritius Is.

## Material examined

*Caecum sepimentum*: 23 syntypes from Mauritius and Reunion Islands on the same glass slide MNHN

(Kisch, 1959) (Fig. 4G); *C. maculatum* (originally *maculata*, but the word Caecum is neuter): Ankyaba, Kakeroma-jima, near Amami-Oshima Islands (Japan), NMNS Mo 39929 (Fig. 5E); *C. berberense*: drill hole E-1, Eniwetok (Marshall Islands), depth 1.260-1270 ft, Early Miocene (650429/650428 - USNM) (Fig. 5F, G); MNHN: Benthhaus 2002 (Austral Islands); Stn DW 1927, President Thiers Banc, 24°39'S, 146°01.6'W, 95-105 m, 2 lv, IRD-MNHN coll. 13/11/2002; Stn DW 1939, N of Raivavae Is., 23°49.7'S, 147°41.6'W, 100 m, 5 dd and 1 lv, IRD-MNHN coll. 15/11/2002; Stn DW 1968, Arago Bank, 23°22.9'S, 150°43.5'W, 100-120 m, 1 lv, IRD-MNHN coll. 20/11/2002; Stn CP 1918, Neilson Reef, 27°03.4'S, 146°04'W, 130-140 m, 1 dd, IRD-MNHN coll. 11/11/2002; Musorstom 9, 1997 (Marquesas Islands), Stn DW 1206, Hiva Oa Is., 9°51'S, 139°09'W, 352-358 m, 2 dd, Bouchet, Dayrat, Richer leg. 28/08/1997; Stn DW 1222, Hiva Oa Is., 9°44'S, 138°51'W, 340-352 m, 1 dd, Bouchet, Dayrat, Richer leg. 30/08/1997; Atelier Rapa 2002 (Austral Islands); Stn 6, Rapa Is., off Ahurei Bay, live and died coral, 27°36.8'S, 144°16.7'W, 45 m, 1 lv and 2 dd, 05/11/2002; Stn 36, Rapa Is., Kauira Point, coral mainly live, 27°33.5'S, 144°20.8'W, 27 m, 3 lv, 21/11/2002; Stn 48, Rapa Is., off Rukuaga Point, plateau with silty sand, 27°34.1'S, 144°22.1'W, 36 m, 1 dd, 30/11/2002 (MNHN); Austral Islands, Rurutu Is., shell grit from fringing reef, 4 dd juv. + 1 adult, cfr *sepimentum*; Austral Islands, Rurutu Is., shell grit, 2 dd; Austral Islands, Rimatara Is., shell grit, 3 dd; Austral Islands, Raivavae Is., shell grit, 3 dd; Society Islands, Tahiti Is., Tiarei, shell grit, 20 dd; Tahiti Is., Arue, outer slope, shell grit, 35 m, 10 dd; Windward Islands, Tetiaroa Is., shell grit, 1 dd (broken) + 7 dd; Moorea, outer slope, shell grit, 20m, 8 dd; Tuamotu Archipelago, Makemo Is., Arikitamiro Pass, lagoon along side of the airport, shell grit, 20 dd.

## Additional material

117 lots (lv and dd) from Society Islands (AMS); 23 lots (dd) from Papua-New Guinea (AMS); 7 lots (lv and dd) from Solomon Islands (AMS); 1 lot (dd) from Lord Howe Is. (AMS); 2 lots from Tasman Sea (AMS); 1 lot (dd) from Tonga (BR); 62 lots (lv and dd) from

**Fig. 5. A.** *Caecum laeve* C. B. Adams, 1852, Canal Zone, Panama (scale bar = 1 mm). **B.** *Caecum ryssotitum* Folin, 1867, Brazil. (scale bar = 1 mm). **C.** *Caecum bimarginatum* Carpenter, 1858, Acapulco (Guerrero, Mexico), (scale bar = 1 mm). **D.** *Caecum campanulatum* Raines & Pizzini 2005, holotype LACM 3019, Easter Is. (Chile) (scale bar = 1 mm). **E.** *Caecum maculatum* Habe, 1963, type material NMNS, Ankyaba, Kakeroma-jima, near Amami-Oshima Islands (Japan) (scale bar = 1 mm). **F.** *Caecum berberense* Ladd, 1972, holotype USNM-650429, drill hole E-1, Eniwetok (Marshall Islands), Early Miocene, (scale bar = 1 mm). **G.** paratype USNM-650428, (scale bar = 1 mm). **H.** *Caecum vertebrale* Hedley, 1899, Rurutu (Austral Islands), specimen with the central rings obsolete, (scale bar = 1 mm). **I.** *Meioceras kajiyamai* Habe, 1963, holotype NMNS, Ankyaba, Kakeroma-jima, an isle near Amami-Oshima (Japan) (scale bar = 1 mm). **J.** *Meioceras kajiyamai*, holotype NMNS, Ankyaba, Kakeroma-jima, an isle near Amami-Oshima (Japan) (scale bar = 1 mm). **K.** *Caecum rehderi* Raines & Pizzini, 2005, holotype Easter Is. (Chile), lateral view (scale bar = 1 mm). **L.** *Caecum mauritanum* Folin, 1868, holotype MNHN, lateral view (scale bar = 1 mm).

**Fig. 5. A.** *Caecum laeve* C. B. Adams, 1852, Canal Zone, Panama (scala = 1 mm). **B.** *Caecum ryssotitum* Folin, 1867, Brazil, (scala = 1 mm). **C.** *Caecum bimarginatum* Carpenter, 1858, Acapulco (Guerrero, Mexico), (scala = 1 mm). **D.** *Caecum campanulatum* Raines & Pizzini 2005, olotipo LACM 3019, Easter Is. (Chile) (scala = 1 mm). **E.** *Caecum maculatum* Habe, 1963, materiale tipico NMNS, Ankyaba, Kakeroma-jima, presso Amami-Oshima Islands (Japan) (scala = 1 mm). **F.** *Caecum berberense* Ladd, 1972, olotipo USNM-650429, drill hole E-1, Eniwetok (Marshall Islands), Early Miocene, (scala = 1 mm). **G.** paratipo USNM-650428, (scala = 1 mm). **H.** *Caecum vertebrale* Hedley, 1899, Rurutu (Austral Islands), esemplare con anelli centrali obsoleti, (scala = 1 mm). **I.** *Meioceras kajiyamai* Habe, 1963, olotipo NMNS, Ankyaba, Kakeroma-jima, isola presso Amami-Oshima (Japan) (scala = 1 mm). **J.** *Meioceras kajiyamai*, olotipo NMNS, Ankyaba, Kakeroma-jima, isola presso Amami-Oshima (Japan) (scala = 1 mm). **K.** *Caecum rehderi* Raines & Pizzini, 2005, olotipo Easter Is. (Chile), vista laterale (scala = 1 mm). **L.** *Caecum mauritanum* Folin, 1868, olotipo MNHN, vista laterale (scala = 1 mm).



Western Australia (WAM); 1 lot (dd) from Yemen (MP); 127 lots (dd) from Kenya (MP); 1 lot (dd) from Andaman Is. (MP); 3 lots (dd) from Madagascar (MP); 96 lots (dd) from Sudan, Red Sea (MP); 40 lots from Egypt, Red Sea (MP); 1 lot (dd) from Jordan, Red Sea (MP); 5 lots (dd) from Indonesia (MP); 51 lots (dd) from Philippine Islands (MP); 30 lots (dd) from Queensland, Australia (MP); 10 lots (dd) from Hawaiian Islands (MP); 4 lots (dd) from Japan (MP); 35 lots (dd) from Fiji Islands (BR); 31 lots (dd) from Papua - New Guinea (BR); 94 lots (dd) from Japan (BR); 1 lot (100 dd), Midway Islands, W side of Sand Island, Welles Harbor, (28°12.5'N, 177°24.3'W). 2-8 m, under dead coral, LACM 85-117; 1 lot (19 dd), Okinawa, 0.5 km ESE of Zampa-misaki (Bolo Point), (26°26.1'N, 127°42.5'E), 50 m, sand & coral rubble, LACM 78-25; 1 lot (20 dd), Madagascar, Antseranana Prov., S side Nosy Be, out from Hellville, (13°27'S, 48°15'E), 14 m, coral heads & gorgonians, LACM 89-55; 1 lot (10 dd), Kwajalein Atoll, Oceanside of reef at 70 feet, leg. W. Blacketer (BR).

## Diagnosis

Tube subcylindrical, slightly curved, crossed by 20-25 pronounced rings having a sub-rounded surface with interspaces as large as the rings. Near the aperture the tube widens in a swelling crossed by 4-5 rings which squeeze together as the diameter decreases. This swelling, at first tightens, and subsequently enlarges itself in a small, sharp edge that hems the aperture, perfectly circular. A longitudinal microsculpture covering the entire tube can be seen on both the rings and the interspaces. Septum dome-shaped and generally quite flat under the cutting plane with traces of temporary septum often noticeable. The planispiral protoconch is smooth and vitreous, showing a small suture separating it from the teleoconch. Colour dark brown in fresh specimens having periostracum. Operculum corneous, light brown; external surface crossed by 3-4 concentric small rings; internal surface, seen in profile, having a stair-like (3 steps) shape and presenting a sunken nucleus. Soft parts unknown. Mean dimensions: length 2.0 mm, diam. 0.4 mm.

## Distribution

This species is distributed throughout the entire Indo-Pacific area, including Japan (Hasegawa, 2000) and Marquesas Islands (Jean Tröndlé, pers. com.).

## Remarks

With regards to the differences between the juveniles of *sepiumentum* and *vertebrale*, see remarks of the latter species. *Caecum maculatum* Habe, 1963 (Fig. 5E), whose holotype is still dubious (figured in Higo et al., 2001, pl. 33) is clearly a junior synonym of *C. sepi-*

*mentum* Folin, 1868. The examination of the general shape of the tube, sculpture, septum and longitudinal microsculpture of *C. berberense* Ladd, 1972 (Fig. 5F, G), a fossil species (Early Miocene) from Eniwetok (Marshall Islands), allows us to affirm that it should be considered a junior synonym of *C. sepiumentum* as well.

## *Caecum vertebrale* Hedley, 1899 (Figs 4J-N, 5H)

*Caecum vertebrale* Hedley, 1899: p. 425, fig. 15.

*Caecum multiannulatum* Folin in Dautzenberg & Bouge, 1933: p. 354.

## Type locality

Atoll of Funafuti (Ellice Group).

## Material examined

*Caecum vertebrale*: holotype, Atoll of Funafuti (Ellice Group), AMS C5917 (dig. ph. Fig. 4J); *C. oahuense*: lectotype ANSP 127978; Mokapu Point, Oahu Is. (Hawaiian Islands), 21°28'N 157° 44'W, leg. Bryan, W.J.; Musorstom 9, 1997 (Marquesas Islands): Stn DR 1200, Hiva Oa Is., 9°49.9'S, 139°08.9'W, 96-100 m, 1 lv, Bouchet, Dayrat, Richer leg. 28/08/1997; Stn DR 1247, Fatu Hiva Is., 10°34'S, 138°42'W, 1150-1250 m, Bouchet, Dayrat, Richer leg., 01/09/1997, 1 dd (anomalous septum); Marquesas Islands: Stn D 86, Fatu Hiva Is., 10°29'S, 138°40'W, 49 m, 2 dd, J. Poupin-SMCB coll. 29/01/1991 (MNHN); Stn 02, Nuku Hiva Is., Taiohae Bay, W Mataupuna, 8°56.22'S, 140°05.68'W, 10-20 m, 3 dd, Bryce & Kaiser leg. 18/10/1999 (all MNHN); Society Islands: Tahiti, Tiarei, shell grit under rocks, 17 dd; Tetiaroa (Windward Islands), shell grit, 6 dd; Moorea (Windward Islands), shell grit, 20 m, 1 dd; Tuamotu Archipelago: Makemo Is, Arikatiro Pass, lagoon along side of the airport, shell grit, 7 lv + 94 dd; Austral Islands: Rurutu Is., shell grit, 2 dd; Rurutu Is., shell grit from fringing reef, 4 dd juv. cfr *vertebrale* + 5 adult; Raivavae Is., shell grit, 1 dd (worn) cfr *vertebrale*; Raivavae Is., shell grit, 1 dd (3 stages juv. still attached).

## Additional material

**Society Islands:** C415381 - n. 003252C, 2 dd, Paevae-va, W side Moorea, 17°32.000' S, 149°53.000' W, 4-11 m, on outside of reef, 25/10/1986, leg. R. Galtzin; Papua - New Guinea: C415409 - n. 000382C, 8 dd, Port Moresby, Ela Beach, 9°29.000' S, 147°9.000' E, beach, 1956, leg. J. S. Colman, T. Iredale (all AMS); 1 dd, Mahe Is., Seychelles Islands, 1 m, May 1996, leg. I. Nofroni (MP); 42 dd, Abu Rhamada, Egypt, Red Sea, leg. M. Oliverio (MP); 5 dd, Abu Rhamada, Egypt, Red Sea, 15 m, leg. M. Oliverio (MP); 6 dd, Sudan, 25 m, leg. M. Oliverio (MP); 23 dd (2 larval) Sha'ab Rumi, Sudan, Red Sea, 60 m, leg. M. Oliverio (MP); 57



dd, Sanghaneb Reef, Sudan, Red Sea, 95 m, leg. M. Oliverio (MP); 33 dd, Uroa, Zanzibar, Tanzania, 25-30 m, from fishermen (MP); 112 dd, Watami near Malindi, Kenya, 32 m (MPR); 1 dd, Andaman Is., 0-30 m, leg. M. Oliverio (MP); 2 dd, Réunion Is., dredged on sand, leg. M. Oliverio (MP); 2 dd, Cap de la Réunion, 12 m, dredged on sand (MP); 16 dd, Palawan Is., loc. Monoa Bay, Philippine Islands, 11 m, leg. M. Oliverio (MP); 25 dd (1 larval), Meara Is., Palawan Is., Philippine Islands, 15 m, leg. M. Oliverio (MP); 31 dd, N of Green Is. E of Cairns, Queensland, Australia, 8-11 m ex diving, leg. C. Schander (MP); 1 dd, Amami Is., Japan, littoral, leg. Machiko Yamada (MP); 5 dd, Pali coast, Maui Is., Hawaiian Islands, 16 m (MP); 1 lv and 2 dd, Oahu Is, SE Mokapu Point, Hawaiian Islands, beach tide (MP); 2 dd, Lanai Is., Hawaiian Islands, 2-3 m (MP); 2 dd, Maeda Pt., Okinawa (Ryukyu Islands), 8 m, diving, leg. S. Miller (BR); 21 dd (2 juv), Sesoko Jima, Okinawa (Ryukyu Islands, Japan), 6-8 m, diving, leg. S. Miller (BR); 10 dd (2 juv), Horseshoe Reef, Okinawa (Ryukyu Islands, Japan), 38 m, diving, leg. S. Miller (BR); 10 dd, Okinawa, 1 km W of Onna Village (Horseshoe South), (26°29.7'N, 127°50.6'E), 50 m, coral, sand and rubble, LACM 78-99.

## Diagnosis

Tube weakly subcylindrical, crossed by small rings, regularly and slightly raised, which range in number from 25 to 36, with interspaces wider than the rings. Microsculpture comprised of faint longitudinal lines covering the entire length of the tube underscored by the interspaces, but are not visible even at strong optical magnification (180x). Periostracum light brown in colouration; some shells appear to be somewhat stronger in colour and have an obsolete or vague microsculpture. Septum dome-shaped, often with white encrustations, raised over the cutting plane, lacking of any type of mucro. Colour whitish in beached specimens. Aperture somewhat contracted, crossed by a few small rings, forming nearly a continuous outline with the rest of the tube. Operculum light brown: external surface with 9-10 small concentric rings with the central area hollowed, internal surface with some indistinct rings and the central area slightly raised. Soft parts unknown. Dimensions: mean length 2.2 mm, mean diam. 0.6 mm.

## Distribution

The geographical distribution of this species includes southern Japan (Hasegawa, 2000), Zanzibar (Tanzania), Mahé Is. (Seychelles Islands), Mahui Is. and Lanai Is. (both Hawaiian Islands), Society Islands, Papua - New Guinea, Egypt, Red Sea (Sudan), Kenya, Andaman Islands, Réunion Is., Philippine Islands, Australia, Tuamotu Archipelago, Austral Islands and Marquesas Islands (Jean Tröndlé, pers. com.).

## Remarks

Dautzenberg & Bouge (1933) noted and named as *Caecum multiannulatum* new sp. and a *Caecum nov. sp.* (Folin, 1886, p. 684, Pl. II, fig. 12) described by the French author from Honolulu (Hawaiian Islands), which matches perfectly to *C. vertebrale* Hedley, 1899. Richard (1985) also noted *Caecum multiannulatum* Folin in Dautzenberg & Bouge, 1933, while Tröndlé (1986) named the same species as *C. cf. vertebrale* Hedley, 1899 (pers. com.).

The main difference between the juveniles of *vertebrale* and *sepimentum* is that specimens of *vertebrale* show small rings less raised and more closely set than those of *sepimentum*. We agree with Kay's opinion (Kay, 1979) about the diversity between *C. vertebrale* Hedley, 1899 and *C. oahuense* Pilsbry, 1921, but for different reasons. In fact, in our opinion the true morphological difference between *vertebrale* and *oahuense* mainly consist of the septum's shape: gently dome-shaped, less protruded and convex in *oahuense*, while smaller and with stronger convexity, often covered by calcareous incrustations in *vertebrale* (Fig. 4L-N). Furthermore, the borders of *vertebrale*'s septum more central, looking like a round top, and *vertebrale*'s colour is very peculiar, translucent milky white in beached specimens. Originally, Pilsbry (1921: 375) compared *oahuense* to *sepimentum*, mainly focusing on the significant difference in the number of rings between *oahuense* (40) and *sepimentum* (20-25), without taking any account of *vertebrale*, which is actually a much more similar species in general shape of the tube, sculpture and septum. On the basis of the Pilsbry's remarks, we can only surmise Pilsbry may actually have compared it to a young specimen of *vertebrale*, for which young specimens are well-known for frequently being much longer than the adults.

The relative large number of specimens found of *vertebrale*, allowed us to provide new morphological data about the species. Indeed, among these specimens which match perfectly with the original description, we have found a juv. (Fig. 5H), with the rings of the central portion of the tube completely obsolete. The majority of the live collected specimens have a hairy periostracum (Fig. 4K) which has never been seen before within this species.

### *Caecum rostratum* Folin, 1881 (Fig. 6A)

*Caecum rostratum* Folin, 1881: p. 16, pl. 1, figs 7-8.

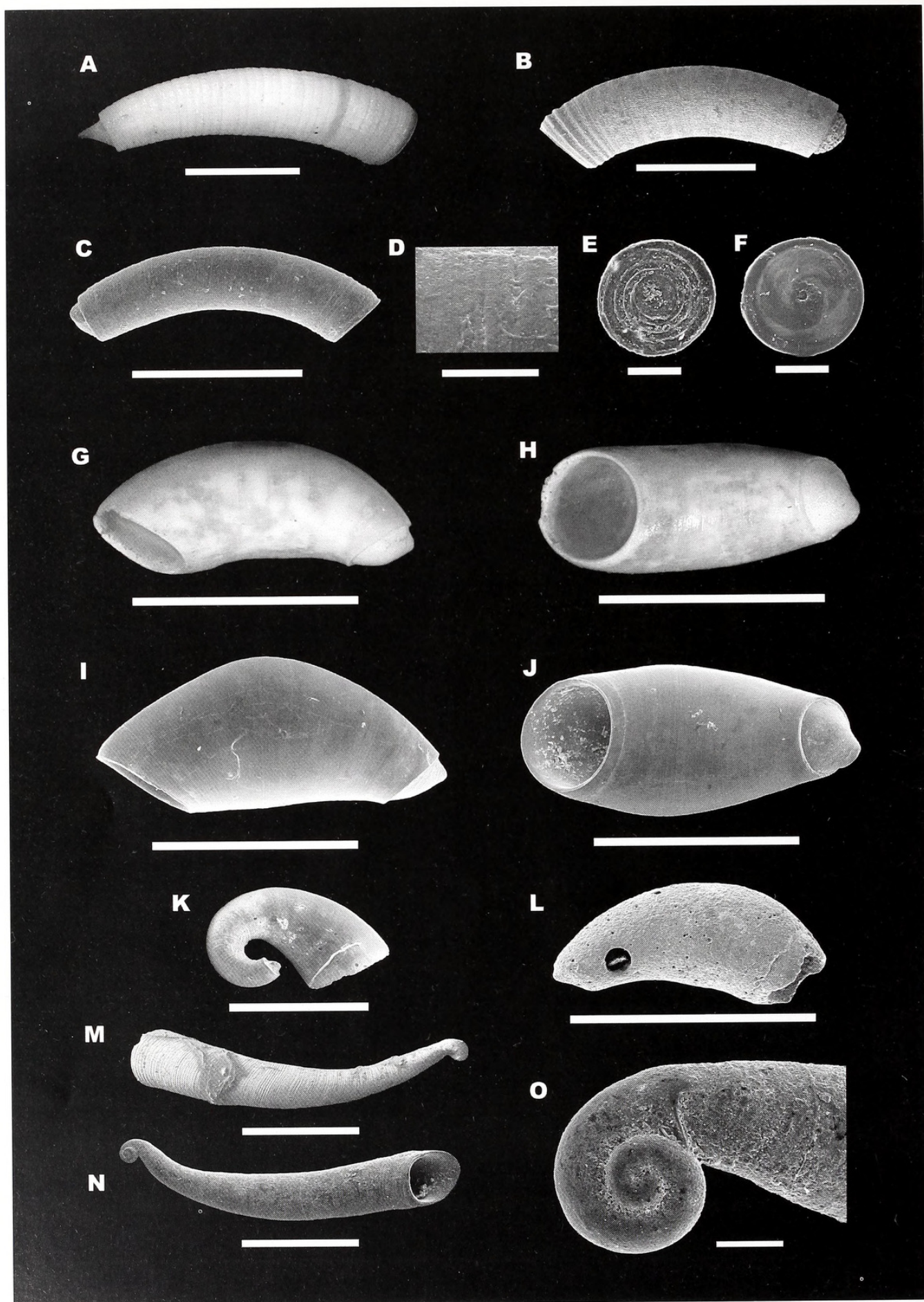
## Type locality

China Seas.

## Material examined

*Caecum rostratum* Folin, 1881, holotype MNHN (dig. ph. Fig. 6A) [According to Kisch, 1959]; *Meioceras ka-*







*jiyamai* Habe, 1963, holotype NMNS (dig. ph. **Fig. 5I**); 2 dd, Tahiti (Society Islands), Arue, outer slope, fine rubble and debris, 20-35 m; 1 dd LACM 82-39, North Celebes (Indonesia), N of Manado, Pisok Pt, 1°34'N, 124°47.5'E, 8-40 m, rocky.

## Diagnosis

Tube subcylindrical, less arched, crossed by 25-35 rings (37-38 in the original type) less raised, having the tops quite flat and the interspaces very narrow. Septum mucronate, hook-shaped, with a dorsal margin concave, then convex, and the dorsal one concave. Aperture smooth, contracted and well defined. Colour white. Operculum and soft parts unknown. Holotype dimensions: length 3.2 mm, diam. 0.7 mm.

## Distribution

China Seas (type locality, Folin, 1881), Philippine Islands, North Celebes, Indonesia (LACM); Tahiti (Society Islands).

## Remarks

The holotype of *C. rostratum* Folin, 1881 (**Fig. 6A**) shows the tube covered by a very weak longitudinal striation, while all the specimens found lack this feature. Despite this appearance, in our opinion these specimens clearly belong to this species due to their general shape, annulated sculpture and the characteristic shape of the hook-shaped septum. Basing ourselves upon the general shape of the specimens, which all maybe young, we believe this species could be placed in the genus *Meioceras*, but for the moment, taking a conservative stance, we will leave it in the genus *Caecum* until additional material can be examined. In comparison with *kajiyamai*, with which *rostratum* is often sympatric, the latter differs in having a much smaller size, pronounced rings and the lack-

ing of the bend on the dorsal side of the tube near the aperture, which is the main morphological characteristic of *M. kajiyamai* (**Fig. 5I**).

## *Caecum neocaledonicum* Folin, 1868 (**Fig. 6B**)

*Caecum fulvum* Kisch, 1959: pp. 17-19, fig. 1.

*Caecum hinoidei* Habe, 1978: p. 4, pl. 1, figs 11-13.

## Type locality

Noumea, New Caledonia.

## Material examined

*Caecum neocaledonicum*: 17 syntypes dd, 1 juv. and 5 fragments, Noumea, New Caledonia, MNHN; lectotype and paralectotype selected by Pizzini, 1998; *C. fulvum*: Mayotte Is. (not seen); *C. hinoidei*: holotype NMNS Mo 55376, Tsuchihama, Tatsugo-cho, Amami-Oshima, south of Kyushu (Japan) (dig. ph. **Fig. 5J**); Musorstom 9, 1997 (Marquesas Islands); Stn DW 1288, Ua Huka Is., 8°54'S, 139°38'W, 200-220 m, 1 dd, Bouchet, Dayrat, Richer leg. 08/09/1997; MNHN, SMCB, Tahuata Is., 09°54'S, 139°07'E, leg. J. Poupin, 1 dd; Tahiti (Society Islands), Tiarei, fringing reef, shell grit under rocks, 8 dd + 4 lv, all juven.; Tahiti (Society Islands), Arue, outer slope, shell grit, 35 m, 2 dd juv.; AMS material - C010964, n. 037382, 2 lv, 21° 0.000' S, 165° 0.000' E, pre 1902, pres. J. Bernier, 1902; C012022, n. 54664, 6 lv, Amedee Is., 22° 29.000' S, 166° 28.000' E, pre 1902, pres. J. Bernier, 1902; C004151, n. 004849B, 6 dd (pars, see *modestum*), cited, Beach at E side of Mt. Panie, 20°36.000' S, 164°50.000' E, 1898. Memoirs of the Australian Museum. 3(7): 426, leg. C. Hedley, pres. C. Hedley; New Caledonia: (Society Islands) C415380 - n. 003252C, 1 dd (broken), Paevaeva, W side Moorea, 17°32.000' S, 149°53.000' W, 4-11 m, on outside of reef, 25/10/1986, leg. R. Galtzin; Fiji Islands: C415366, n. 000430D, 5 dd, Viti Levu, Nadi Bay (Tomba Ko Nandi), 17°44.000'

**Fig. 6. A.** *Caecum rostratum* Folin, 1881, holotype MNHN, near Deux Freres, China Seas (scale bar = 1 mm). **B.** *Caecum neocaledonicum* Folin, 1868, Tahiti (Society Islands) (scale bar = 1 mm). **C.** *Caecum cf rehderi* Raines & Pizzini, 2005, Rapa Is. (Austral Islands), lateral view (scale bar = 1 mm). **D.** detail of microsculpture (scale bar = 250 µm). **E.** detail of operculum exterior (scale bar = 100 µm). **F.** detail of operculum interior (scale bar = 100 µm). **G.** *Caecum legumen* Hedley, 1899, syntype AMS C5693, lateral view, Pava Islet (Atoll of Funafuti) (scale bar = 1 mm). **H.** *Meioceras legumen* (Hedley, 1899), syntype AMS C5693, ventral view, Pava Islet (Atoll of Funafuti) (scale bar = 1 mm). **I.** *Meioceras boucheti* n. sp., holotype MNHN 22069, Tahiti, Arue, lateral view (scale bar = 1 mm). **J.** *Meioceras boucheti* n. sp., holotype MNHN 22069, Tahiti, Arue, ventral view, (scale bar = 1 mm). **K.** *Meioceras boucheti* n. sp., juv. shell, Tahiti, Arue (scale bar = 1 mm). **L.** *Meioceras sandwichensis* Folin, 1881, holotype MNHN, Sandwich Islands (scale bar = 1 mm). **M.** *Strebloceras subannulatum* Folin, 1879, syntype NHML n. BMNH 1887.2.9.2308, reefs of Honolulu, (scale bar = 1 mm). **N.** *Strebloceras subannulatum*, morphotype, Tahiti (Society Islands), Tiarei (scale bar = 1 mm). **O.** *Strebloceras subannulatum*, the same, detail of microsculpture, Tahiti (Society Isl.) (scale bar = 100 µm).

**Fig. 6. A.** *Caecum rostratum* Folin, 1881, olotipo MNHN, nei pressi di Deux Freres, China Seas (scala = 1 mm). **B.** *Caecum neocaledonicum* Folin, 1868, Tahiti (Society Islands) (scala = 1 mm). **C.** *Caecum cf rehderi* Raines & Pizzini, 2005, Rapa Is. (Austral Islands), vista laterale (scala = 1 mm). **D.** dettaglio della microscultura (scala = 250 µm). **E.** dettaglio dell'opercolo, esterno (scala = 100 µm). **F.** dettaglio dell'opercolo, interno (scala = 100 µm). **G.** *Caecum legumen* Hedley, 1899, sintipo AMS C5693, vista laterale, Pava Islet (Atoll of Funafuti) (scala = 1 mm). **H.** *Meioceras legumen* (Hedley, 1899), sintipo AMS C5693, vista ventrale, Pava Islet (Atoll of Funafuti) (scala = 1 mm). **I.** *Meioceras boucheti* n. sp., olotipo MNHN 22069, Tahiti, Arue, vista laterale (scala = 1 mm). **J.** *Meioceras boucheti* n. sp., olotipo MNHN 22069, Tahiti, Arue, vista ventrale, (scala = 1 mm). **K.** *Meioceras boucheti* n. sp., conchiglia larvale, Tahiti, Arue (scala = 1 mm). **L.** *Meioceras sandwichensis* Folin, 1881, olotipo MNHN, Sandwich Islands (scala = 1 mm). **M.** *Strebloceras subannulatum* Folin, 1879, sintipo NHML n. BMNH 1887.2.9.2308, reefs di Honolulu, (scala = 1 mm). **N.** *Strebloceras subannulatum*, morfotipo, Tahiti (Society Islands), Tiarei (scala = 1 mm). **O.** *Strebloceras subannulatum*, lo stesso, dettaglio della microscultura, Tahiti (Society Isl.) (scala = 100 µm).



S, 177°25.000' E, 9-35 m, 1962, leg. J. Laseron, pres. J. Laseron; C415369, n. 000433C, 6 dd, Sovi Bay (Souvi), SW coast Viti Levu 18°11.000' S, 177° 36.000' E, 1962, leg. J. Laseron; C415372, n. 001731C, 8 dd, S coast Viti Levu, Deuba, 18°15.000' S, 178°5.000' E, beach, 01/1979, leg. W. F. and W. F. (Jr) Ponder (all in AMS); Papua - New Guinea: C415398, n. 000381C, 1 dd, Misima Is., Louisiade Archipelago, 10°39.000' S, 152°42.000' E, pre 1941, leg. H. K. Bartlett, T. Iredale; C415399, n. 000381C, 1 dd, Misima Is., Louisiade Archipelago, 10°39.000' S, 152°42.000' E, pre 1941, leg. H. K. Bartlett, T. Iredale; C415400, n. 000344C, 1 dd, Madang, N end Kranket Is., 5°12.000' S, 145°51.000' E, inlet, 26/05/1970, leg. W. F. Ponder & P. H. Colman; C415406, n. 001861C, 1 dd, Louisiade Archipelago, Calvados Chain, Nimoa Is., 11°18.000' S, 153°15.000' E, beach, in front of Mission, 1970, pres. E. Petuch; C415409, n. 000382C, 1 dd, Port Moresby, Ela Beach, 9°29.000' S, 147°9.000' E, beach, 1956, leg. J. S. Colman, T. Iredale; C415410, n. 000382C, 4 dd, Port Moresby, Ela Beach, 9°29.000' S, 147°9.000' E, beach, 1956, leg. J. S. Colman, T. Iredale; C415411, n. 000382C, 8 dd, Port Moresby, Ela Beach, 9°29.000' S, 147°9.000' E, Beach, 1956, leg. J. S. Colman, T. Iredale; C415411, n. 000382C, 4 dd, Port Moresby, Ela Beach, 9°29.000' S, 147°9.000' E, beach, 1956, leg. J. S. Colman, T. Iredale; C415413, n. 003959B, 2 dd, Duke of York Is., off New Britain, 4°10.000' S, 152°29.000' E, circa 1968, leg. P. Savelieff; C415416, n. 000388C, 1 dd, Milne Bay District, Amazon Bay, 10°19.000' S, 149°21.000' E, 13 m, seaweed dredge, 13/09/1948, leg. C.S.I.R.O. pres. G. Whitley; Solomon Islands: C415396, n. 54667, 1 dd, Guadalcanal, Honiara Beach, in front of Hotel Mendana, 9°25.000' S, 159°57.000' E, under debris and coral rubble, HTL, 12/12/1978, leg. W. Richards, pres. W. Richards; Vanuatu Islands: C415364, n. 001301B, 1 dd, Efate Is, SE coast ca. 40 km from Port Vila, White Sands, 17°47.000, 168°33.000, grit, 29/03/1975, leg. P. H. Colman; Tuvalu: C005918, n. 004217B, 13 dd, cited (*C. exile* Folin, 1879); n. 004217B, Funafuti Atoll, 8°31.000' S, 179°13.000' E, 1896. Memoirs of the Australian Museum. 3(7): 426. Royal Society Coral Boring Expedition, leg. C. Hedley; WAM material - Australia: S13586, 1 dd, Transect 1, Kendrew Is., Dampier Archipelago, N.W.A., from shore, 20°28'30" S, 116°32'E, 71-72 m, 13/10/1973; S13606, 5 lv, Pt. Quobba, W.A., beach 07/1974, leg. F. H. Plant; S13607, 1 dd, Pt. Quobba, W.A., tide wash, 07/1974, leg. F. H. Plant; S13615, 1 dd, Browse Is., North-west of Western Australia, 124°E, 14° S, 1970, leg. F. H. Plant; S13624, 3 dd, Kings Beach, North end Bowen, Queensland, 08/1973, leg. F. H. Plant; S13625, 1 dd, Kurrimine beach Q., tide wash, leg. F. H. Plant, 07/1973; S13626, 8 dd, Queensland, Kurrimine (near King Reefs), 17°45'S, 146°09'E, in wash from seaweed and holdfast, tide 0 m, 25/8/1973, leg. F. H. Plant; S13628, 2 dd, Queensland, Alexandra Reef, live on weed Pt Douglas, leg. F. H. Plant, 30/07/1975; S13629, 10 dd, New South Wales, Gunnamatta Bay,

34°03'S, 151°09'E, leg. C.S.I.R.O. Fisheries Staff, 15/09/1950, dredge used; 2 dd (juv), Aqaba, Red Sea, littoral, leg. D. Calandra (MP); 5 dd (juv), Sanghaneb Reef, Sudan, Red Sea, 95 m, dived, 06/12/'92, leg. Oliverio (MP); 1 dd, Soqotra Is., Yemen, leg. M. Oliverio (MP); 31 dd, Ile aux Cerfs, Mauritius, 1.5 m, leg. S. Maggioli (MP); 3 dd, Uroa, Zanzibar, 25-30 m, 11/'92, (MP); 13 dd, Gesira, Somalia, Benadir, beached, leg. S. Palazzi (MP); 17 dd, Abu Dhabi, beached, leg. P. Micali (MP); 1 dd, Hurgada, Egypt, leg. C. Smriglio (MP); 22 dd, Mahe Is., East Coast, Seychelles Islands, 1 m, leg. I. Nofroni (MP); 2 dd, Mahe Is., West Coast, Seychelles Is., 1 m, leg. I. Nofroni (MP); 5 dd, Monoa Bay, Palawan Is., Philippine Islands, 11 m, leg. M. Oliverio (MP); 1 dd (juv), North of Green Is., East of Cairns (Queensland, Australia), Great Barrier Reef, 8-11 m, diving, leg. C. Schander (MP); 1 dd, Beqa Is., Fiji Islands, 20 m, diving, leg.: T. Wiley (BR); 1 dd, Horseshoe Reef, Okinawa (Ryukyu Islands), 38 m, diving, leg.: S. Miller (BR); 16 dd (14 juv), Sha'ab Rumi, Sudan, Red Sea, 60 m, leg. M. Oliverio (MP); 2 dd, Sudan, Red Sea, 25 m, leg. M. Oliverio (MP); 4 dd (2 juv), Abu Rhamada c/o Hurgada, Egypt, Red Sea, 13 m, leg. Liverani (MP); 1 dd, Andaman Is., 10-30 m, leg. M. Oliverio (MP); 1 dd, Tahiti (Society Islands), beached, leg. Drivas (MP); 1 dd, Watumu c/o Malindi, Kenya, 32 m, leg. Contessini (MP); 1 dd, Susans Reef, Kimbe Bay, W. New Britain, Papua - New Guinea, 65 m, ponar grab, leg. D. Geiger (BR); 1 dd, Ike Shima, Okinawa (Ryukyu Islands), 18 m, diving, leg. S. Miller (BR); 1 dd, Australia, Queensland, SE side of Lizard Island, between Lizard Head & Coconut Beach (14°40.9'S, 145°28'E). Intertidal, coral patches & rubble, LACM 79-54; 5 dd, Australia, Queensland, SW side of Lizard Island, (14°40.2'S, 145°26.5'E). Low intertidal, coral rubble and patch reef, LACM 79-53; 1 dd and 1 lv, Indonesia, Irian Jaya, Biak Biak Island, near town landing, (1°09'S, 136°03'E) Intertidal, rocky, LACM 88-43; 31 dd and 15 lv, Guam, Apra Harbor, Western Shoal, (13°27.0' N, 144°40.2'E), 1-2 m, subtidal coral reef, LACM 77-20; 1 dd, Taiwan, Taipei, SE side of Pitou Chiao, E of Chi-lung, (25°08'N, 121°55'E), intertidal, 3m, rocky tidepool, LACM 88-80; 1 dd, Saipan, Laolao Bay at 60-95 feet, under coral overhangs, leg. D. Brennan (BR).

## Diagnosis

Tube subcylindrical, thick, moderately arched, covered by a microsculpture formed by worm-like striae crossed by growth lines, and by a variable number of rings generally very weak in the central portion of the tube, stronger towards the aperture. Septum with an unguiform mucro, positioned from 70° to 90° in relationship to the shell's axis. Whitish in beached shells, with a strong periostracum tawny to light-creamy in colour. Operculum corneous, light brown. Soft parts unknown. Dimensions: length 2.5 mm, diam. 0.6 mm.



## Distribution

Originally described from New Caledonia, this species has a large Indo-Pacific distribution which includes Japan (under the name *C. hinoidei*), Red Sea, Kenya, Yemen, Zanzibar, Somalia, Mauritius Is., Abu Dhabi, Seychelles Islands, Andaman Islands, Papua - New Guinea, Indonesia, Solomon Islands, Okinawa (Ryukyu Islands), Vanuatu, Philippine Islands, Fiji Islands, Tuvalu, Australia, Tahiti (Society Islands), Tuamotu Archipelago and Marquesas Islands (Jean Tröndlé, pers. com.).

## Remarks

All the specimens found show the same morphological characters without any significant variation than those in many other localities of the Indo-Pacific. In our opinion *C. fulvum* Kisch, 1959 (Pizzini, 1998: 38) and *C. hinoidei* Habe, 1978 (Fig. 5J) are junior synonyms of this species.

*Caecum cf rehderi* Raines & Pizzini, 2005  
(Fig. 6C-F)

*Caecum rehderi* Raines & Pizzini, 2005: p. 52, fig. 2.

*Caecum (Brochina) cf glabella* A. Adams, 1868 sensu Lightfoot: p. 4, fig. 6.

## Type locality

In sand collected along the base of cliffs at 10-20 m, off Punta Rosalia, E of Anakena, Easter Is., Chile. 27°04'18"S, 109°19'45"W.

## Material examined

Holotype, LACM 3019 (Fig. 5K); Atelier Rapa 2002 (Austral Islands): Stn 27, Rapa Is, SW of the Gotenaonao Point, 27°38.7'S, 144°19.2'W, 6 m, 2 dd; Stn 38, Rapa Is., N of Anatakuri Bay, 27°37.4'S, 144°18.4'W, sediment under large rock, 2 m, 1 lv and 1 dd; Stn 81, Rapa Is., Akatanui Bay, 27°35.9'S, 144°18.5'W, rocks, 39 dd and 10 lv.

## Additional material

Few lots (lv and dd) from Philippine Islands and Thailand (all MP).

## Diagnosis

Tube slightly subcylindrical, less arched, apparently smooth, but showing a microsculpture comprised of fine growth lines alternating with more conspicuous and gross ones placed at regular but major distances compared with the former. Very light longitudinal microsculpture, visible only at strong magnification. Septum mucronate, usually straight, with ventral margin from slightly to more convex, and the dorsal

with a small appendage bending toward the dorsal side. Aperture hemmed by a slight swelling crossed by 2-3 fine rings. Operculum corneous, light brown, stratified, with external surface crossed by 5-6 concentric rings, growing from the periphery to the center; internal surface smooth showing a raised nucleus with some indistinct helicoidally radiating rays. Soft parts unknown. Colour light brown in fresh specimens, whitish in the beached ones. Dimensions of the photographed specimen: length 1.9 mm; diam. in the middle of the tube 0.4 mm.

## Distribution

Known from the type locality, its geographic distribution is herein extended to Rapa Is. (Austral Islands), Philippine Islands and Thailand.

## Remarks

Lightfoot (1992b) identified this species as *C. (Brochina) glabella* A. Adams, 1868, but in our opinion this is an erroneous identification, due to the strong difference between the mucro's descriptions of *glabella*, "... rounded tongue-like projection" (Lightfoot, 1992b: p. 4, fig. 6) and "...septo parum convexo, subplanato, apice incospicuo..." (A. Adams 1868: p. 3), meaning a septum slightly dome-shaped without any appendage. *Caecum mauritianum* Folin, 1868 (Fig. 5L) strongly resembles *C. rehderi* in the general shape of the tube. However, the latter shows a more rounded and raised aperture's edge and a more pronounced bending of the tube. Furthermore, the dorsal margin of the *rehderi*'s mucro is concave, with its top towards the dorsal side of the tube, while the mucro of *mauritianum* is far right. The ventral margins of the respective mucros are also quite different, with *rehderi*'s being more rounded and pronounced.

Genus *Meioceras* Carpenter, 1858  
Type-species: *Caecum nitidum* Carpenter, 1858 from Caribbean Sea.

*Meioceras legumen* (Hedley, 1899)  
(Fig. 6G, H)

*Caecum legumen* Hedley, 1899: p. 559, fig. 76.

*Fartulum magatama* Habe, 1978: p. 3, pl. 1, figs 7-9.

## Type locality

Pava islet (Atoll of Funafuti).

## Material examined

*Meioceras legumen* Hedley, 1899; Atelier Rapa 2002 (Austral Islands): Stn 43, Rapa Is., Haurei Bay, muddy sand at base of cliff, 27°36.8'S, 144°18.3'W, 45 m, 1 dd, 26/11/2002; Stn 48, Rapa Is., off Rukuaga Point,



plateau with silty sand, 27°34.1'S, 144°22.1'W, 36 m, 8 dd, 30/11/2002; Musorstom 9, 1997 (Marquesas Islands); Stn 1218, 9°44.5'S, 138°50.9'W, 125-135 m, 1 dd, Bouchet, Dayrat, Richer leg., 30/08/1997.

## Diagnosis

Tube pod-shaped, glossy, crossed only by very fine growth striae, gently curved on the dorsal side while the ventral is sometimes nearly straight in its center. Septum very protruded over the cutting plane showing a pointed mucro; in profile, dorsal margin quite straight, ventral one S-shaped. Aperture quite rounded, sometimes oval flattened. Operculum and soft parts unknown. Colour white. Dimensions: length 1.5 mm; diam. 0.4 mm.

## Distribution

Described from Funafuti Atoll and appears to be known from Japan as well as *Fartulum magatama*. Herein its distribution is extended to Fiji Islands and New Caledonia.

## Remarks

*Meioceras legumen* is very similar to the figured holotype of *M. magatama* (Habe, 1978), whose type material has been destroyed by Byones' disease (Hasegawa pers. comm.). The most similar species to *M. legumen* is *M. sandwichensis* Folin, 1881, whose type material (MNHN) is a unique specimen, slightly degraded, but still discernable (Fig. 6L). Excluding *legumen*, neither of the remaining species were found among the studied material. In comparison to *legumen*, *sandwichensis* has the same septum typology, but the general shape is different. With the dorsal profile as the ventral side, *sandwichensis* also has rather constant respective rays, which bend conforming to the tube with a nearly circular silhouette and has a dorsal profile with bending less accented, and its central line nearly straight. *Meioceras legumen* is easily recognizable and separable from all the others, but has never been reported by the few authors that have studied this area.

*Meioceras boucheti* n. sp.  
(Fig. 6I-K)

## Type material

Holotype MNHN 22069 and 1 paratype MNHN 23150 (dd), from type locality; 2 paratypes LACM 3133 (dd), from Aitutaki (Cook Islands), W side off Arutanga, (18°52.3'S, 159°47.5'W), 18-26 m, rubble & Halimeda, outer reef slope.

## Type locality

Tahiti (Society Islands), Arue, 20 m, outer slope, fine rubble and debris.

## Material examined

2 dd, 1 larval stage, 5 juveniles and 2 adult dd (worn) (MP), Tahiti, Arue, 20 m, outer slope, fine rubble and debris (MP).

## Description

Tube pod shaped, completely smooth, with very fine growth striae on the teleoconch. In profile, initially narrow near cutting plane, becoming sharply broader, forming a pronounced gibbosity at about half of the total length, reaching its maximum diameter and then quickly narrowing near the opening. Dorsal side irregularly convex, showing an obtuse angle centrally, while the ventral is sinuous. Seen frontally, teleoconch shows same central gibbosity of its lateral sides. Cutting plane slightly oblique in relation to the axis, roughly 30°. Septum with sharp mucro inclined of ca. 15-20° with the dorsal edge initially concave, then becoming convex up to the edge of the mucro. Anterior ventral margin concave at first, becoming slightly convex in the center, then concave up to the edge. Aperture simple, not rimmed, oblique by roughly 30° in relation to the axis. The third stage of growth shows sculpture formed by scarcely raised rings, that disappear during the shell's growth. Operculum and soft parts unknown. Colour white porcelainous, Holotype dimensions: length 1.7 mm; superior diam. 0.4 mm; diam in the middle of the tube, 0.7 mm; inferior diam. (aperture): 0.6 mm.

## Distribution

This species is known from Tahiti (Society Islands), Tuamotu Archipelago (JTC pers. com.), and Aitutaki (Cook Islands).

## Etymology

This species is named after Philippe Bouchet (MNHN), who gave us the opportunity to study the French Polynesian Caecidae of the MNHN.

## Remarks

The strong and characteristic helicoidal growth of the juvenile stages (Fig. 6K) allows us to place *boucheti* in the genus *Meioceras*, basing ourselves on its typical growth (Carpenter, 1859; Absalão & Pizzini, 2002). The new species resembles *M. sandwichensis* Folin, 1881 (Fig. 6L), although the latter is smaller and lacks the pronounced ventral gibbosity of *M. boucheti*. This morphological feature is a constant, which is present in all the examples found of the new species.

The holotype of *sandwichensis* (MNHN) is a unique specimen, although somewhat worn it is still discernable. In comparison to *sandwichensis*, *boucheti* has



the same typology of septum, but the general shape is quite different. In fact, the dorsal profile of *sandwichensis* shows a bend less accented and a rather constant respective rays, which bend conforming to the tube with an almost circular silhouette, while the ventral one has a central line nearly straight, being sinuous in *boucheti*.

With regards to the date of publication of *Meioceras sandwichensis*, many authors report the year 1886 as the valid date of Vol. 4 of *Les Fonds de la mer* of Folin, where the species was described (Vol. 4: p. 18), instead of 1881, the date printed on the cover of this volume. A few authors have made in depth studies about this problem, involving the dates of many of Folin's species. Among them Iredale (1921: p. 202-203), who discussed only the dates regarding the publication of the volumes 1, 2 and 3; Winckworth (1941: p. 149-151) reports Vol. 4, pages 1-16 refer to the year 1879 and pages 17-48 refer to the year 1880, basing himself upon the issue of deliveries, made of 16 pages each. We believe this evaluation is incorrect, because following this system, e.g. *C. rostratum*, described on pages 16 and 17, should be described in the years 1879 and 1880 at the same time. For this reason we consider Winckworth's statement not reliable. On the other hand, Rehder (1946: p. 74-75) reports Vol. 4 pages 1-32 refer to the year 1881, furthermore his evaluation is also used by the CLEMM database. Following these considerations, we believe it is better to use Rehder's dates of publication, as adopted by the CLEMM database.

*Meioceras legumen* (Hedley, 1899) (Fig. 6G, H) and *Meioceras magatama* (Habe, 1978) (the latter is suspected to be a junior synonym of the former), have the same septum feature of *sandwichensis*. Among the species of the genus *Meioceras*, there are no significant differences about the septum's shape. In fact, some of the other *Meioceras* from the Atlantic (Brazil and Caribbean) as *M. tumidissimum*, *M. bitumidum*, *M. deshayesi*, *M. crossei* (all Folin, 1869) etc. are quite similar in general shape.

Subfamily Streblocerinae Bandel, 1996

Genus *Strebloceras* Carpenter, 1858

***Strebloceras subannulatum* Folin, 1879  
(Fig. 6M-O)**

*Strebloceras subannulatum* Folin, 1879: p. 807.

**Type locality**

Reefs of Honolulu, 40 fms.

**Material examined**

Syntypes: 2 dd, BMNH n. 1887.2.9.2308-2310; Musorstom 9, 1997 (Marquesas Islands); Stn DW 1288, 8°54'S, 139°38'W, 200-220m, 2 dd; Tahiti (Society Islands), Tiarei, fringing reef, shell grit, 4 dd; Makemo

(Tuamotu Archipelago), Passe Arikitamiro, lagoon along side of the airport, shell grit, 3 dd; Aitutaki (Cook Islands), W side off Arutanga, 18°52.3'S, 159°47.5'W, rubble & Halimeda, outer reef slope, 18-26m, 1 dd (LACM 74-36); Moorea (Society Islands), 17°30'S, 149°46'W, 2-3m, W side of island near Club Mediterranean, 4 dd and 3 juv., LACM 87-79.

**Diagnosis**

"Larval shell - diam. of the last whorl about 0.23 mm - slightly trochospiral, consisting of roughly 2 and a half whorls. The tube is separated from the protoconch by an incision which, when seen in side-view, is horseshoe shaped (fig. 14B); the tube has a double curve that forms itself on two different levels and is crossed by a microsculpture whose abapical portion consists of fine, sinuous growth striations that gradually transform themselves, as they grow, into fairly clear-cut, visible rings on the abapical portion of the tube. The aperture is perfectly circular, with an almost sharp, oblique edge. The operculum and the soft parts are unknown. Colour whitish. Dimensions: average length: 3.5 mm; min. diam. 0.18 mm, max. diam. 0.7 mm." (from Raines & Pizzini, 2005: p. 64).

**Distribution**

The distribution of this species limited to the Hawaiian Islands, Easter Is. (Raines & Pizzini, 2005) and the Society Islands (Shasky, 1989 and present authors), is herein extended to the Tuamotu Archipelago and to Aitutaki Is. (Cook Islands).

**Remarks**

The specimens from Tahiti - having a more pronounced bending just after the spiral nucleus and a somewhat reddish colour - expand their teleoconch's width more rapidly, but showing the same morphological characteristics as the typical series, i.e. the growth striation, number of whorls of the trochospiral protoconch and the growth pattern on two different axial levels. The point where the tube shows an abrupt sharp bend is visible in all the specimens to some degree. As for the reddish colour and the rapid growth of the tube, we believe it is only a local morphological variation within the variability range of this species. A much similar specimen from Hawaii was figured by Shasky (1989). The specimens from Makemo have a less marked bend and the growth of the tube is slightly smaller, notwithstanding they belong to the same species.

**Conclusions**

With this work, despite the relative limited number of specimens found, we have increased the number



of valid species to sixteen, of which eight are new. Among the remaining eight well known species, we can surmise that *C. sepimentum* Folin, 1868, *C. vertebrale* Hedley, 1899, *C. neocaledonicum* Folin, 1868 and *Strebloceras subannulatum* Folin, 1879 are widely distributed throughout the entire Indo-Pacific. Despite the clear abovementioned increasing of Caecidae, (possibly due to the poorness of attention to this family in the examined area) the rarefaction of molluscs, especially in relation to the well known and very rich biodiversity triangle – New Caledonia, Philippine Islands, Papua-New Guinea – (Bouchet et al., 2002) is evident. The different factors which determined, during the geological ages, the gradual molluscs species rarefaction in this wide area were very well pointed out by Salvat (1971). We agree with Salvat's explanation of this problem, that is the theory of the expansion of oceanic bottoms on one hand and glacial and interglacial ages during the Quaternary on the other. Notwithstanding, we really believe that a wider sampling area including a greater number of islands and with a consequently larger number of specimens found, would give us a much higher number of species living in French Polynesia.

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## Appendix

### Station list

\* = live collected

### Expédition Musorstom 9, 1997, N/O "Alis", Marquesas Islands

Stn 02, Nuku Hiva Is., Taiohae Bay, W of Mataupuna, 8°56.22'S, 140°05.68'W, 10-20 m; *C. geigeri* n. sp. \*, *C. vertebrale*.

Stn 1218, 9°44.5'S, 138°50.9'W, 125-135 m, Bouchet, Dayrat, Richer leg., 30/08/1997; *M. legumen*.

Stn DR 1200, Hiva Oa Is., 9°49.9'S, 139°08.9'W, 96-100 m, Bouchet, Dayrat, Richer leg. 28/08/1997; *C. vertebrale*\*.



Stn DR 1247, Fatu Hiva Is., 10°34'S, 138°42'W, 1150-1250 m, Bouchet, Dayrat, Richer leg., 01/09/1997; *C. vertebrale*.  
 Stn DW 1206, Hiva Oa Is., 9°51'S, 139°09'W, 352-358 m, Bouchet, Dayrat, Richer leg. 28/08/1997; *C. sepimentum*.  
 Stn DW 1222, Hiva Oa Is., 9°44'S, 138°51'W, 340-352 m, Bouchet, Dayrat, Richer leg. 30/08/1997; *C. sepimentum*.  
 Stn DW 1288, Ile Ua Huka, 8°54'S, 139°38'W, 200-220 m, Bouchet, Dayrat, Richer coll., 8/9/1997; *C. bounty* n. sp., *C. neocaledonicum*, *Strebloceras subannulatum*.

## Expédition Benthaus 2002, Austral Islands

Stn DW 1927, President Thiers Banc, 24°39'S, 146°01.6'W, 95-105 m, 2 lv, IRD-MNHN coll. 13/11/2002.  
 Stn DW 1939, N of Raivavae Is., 23°49.7'S, 147°41.6'W, 100 m, IRD-MNHN leg. 15/11/2002; *C. sepimentum*\*; *C. australe* n. sp.  
 Stn DW 1968, Arago Bank, 23°22.9'S, 150°43.5'W, 100-120 m, IRD-MNHN coll. 20/11/2002; *C. sepimentum*\*.  
 Stn CP 1918, Neilson Reef, 27°03.4'S, 146°04'W, 130-140 m, 1 dd, IRD-MNHN coll. 11/11/2002; *C. sepimentum*.

## Expédition Atelier Rapa 2002, Austral Islands

Stn 6, Rapa Is., off Ahurei Bay, live and died coral, 27°36.8'S, 144°16.7'W, 45 m, 05/11/2002; *C. sepimentum*\*.  
 Stn 27, Rapa Is, SW of the Gotenaonao Point, 27°38.7'S, 144°19.2'W, 6 m; *C. cf rehderi*\*.  
 Stn 36, Rapa Is., Kauira Point, coral mainly live, 27°33.5'S, 144°20.8'W, 27 m, 21/11/2002; *C. sepimentum*\*.  
 Stn 38, Rapa Is., N of Anatakuri Bay, 27°37.4S, 144°18.4'W, sediment under large rock, 2 m; *C. geigeri* n. sp., *C. cf rehderi*\*.  
 Stn 43, Rapa Is., Haurei Bay, muddy sand at base of cliff, 27°36.8'S, 144°18.3'W, 45 m, 26/11/2002; *M. legumen*.  
 Stn 48, Rapa Is., off Rukuaga Point, plateau with silty sand, 27°34.1'S, 144°22.1W, 36 m, 30/11/2002; *C. sepimentum*, *M. legumen*.  
 Stn 81, Rapa Is., Akatanui Bay, 27°35.9'S, 144°18.5'W, rocks; *C. cf rehderi*\*.

## Other material

MNHN, from Marquesas Islands, SMCB, Tahuata Is., 09°54'S, 139°07'E, 48 m, leg. J. Poupin, 31/08/1990.  
 Stn D 86, Fatu Hiva Is., 10°29'S, 138°40'W, 49 m, J. Poupin-SMCB coll. 29/01/1991 (MNHN); *C. vertebrale*.  
 MNHN, from Marquesas Islands, SMCB, Tahuata Is., 09°54'S, 139°07'E, leg. J. Poupin, *C. neocaledonicum*.





Pizzini, Mauro and Raines, Bret. 2011. "The Caecidae from French Polynesia with description of eight new species (Caenogastropoda: Rissooidea)." *Bollettino malacologico* 47, 23–46.

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