

Sampling the depth:
New data on the Caecidae (Mollusca, Gastropoda)
from northeastern Papua New Guinea

Angelo VANNOZZI & Walter RENDA



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Sampling the depth: New data on the Caecidae (Mollusca, Gastropoda) from northeastern Papua New Guinea

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ABSTRACT

The Caecidae J. E. Gray, 1850 collected from several deep-water stations of the BIOPAPUA, PAPUA NIUGINI and KAVIENG expeditions carried out by the Muséum national d'Histoire naturelle, Paris, are revised. About 200 specimens of this family were collected, belonging to three genera and 20 species, i.e., *Caecum* Fleming, 1813 (15 species), *Mauroceras* Vannozi, 2019 (three species) and *Parastrophia* de Folin, 1869 (two species). Five species are described as new: *Caecum restrictum* n. sp., *C. miliarium* n. sp., *C. microannulatum* n. sp., *C. lozoueti* n. sp. and *C. temporale* n. sp. All recorded species are illustrated. Except for *C. miliarium* n. sp., occurring in large number in the type locality and showing the complete growth sequence, all species are represented by few specimens, often in poor condition. With the addition of the five new species and the new record of *Caecum dakuwaga* Pizzini, Raines & Vannozi, 2013, the inventory of the Caecidae known from northeastern Papua New Guinea reached 43 species. Furthermore, an indeterminate specimen, possibly belonging to an undescribed species, is illustrated.

KEY WORDS

Caenogastropoda,
Caecidae,
Oceania,
new record,
new species.

RÉSUMÉ

Échantillonner les profondeurs : nouvelles données sur les Caecidae (Mollusca, Gastropoda) du nord-est de la Papouasie-Nouvelle-Guinée.

Les Caecidae J. E. Gray, 1850 collectés dans plusieurs stations en eau profonde des expéditions BIOPAPUA, PAPUA NIUGINI et KAVIENG menées par le Muséum national d'Histoire naturelle, Paris, sont révisés. Environ 200 spécimens de cette famille ont été collectés, appartenant à trois genres et 20 espèces, i.e., *Caecum* Fleming, 1813 (15 espèces), *Mauroceras* Vannozi, 2019 (trois espèces) et *Parastrophia* de Folin, 1869 (deux espèces). Cinq espèces sont décrites comme nouvelles : *Caecum restrictum* n. sp., *C. miliarium* n. sp., *C. microannulatum* n. sp., *C. lozoueti* n. sp. et *C. temporale* n. sp. Toutes les espèces recensées sont illustrées. À l'exception de *C. miliarium* n. sp. qui est présent en grand nombre à tous les stades de croissance dans la localité type, toutes les espèces sont représentées par quelques spécimens, souvent en mauvais état. Avec l'ajout de la nouvelle signalisation de *Caecum dakuwaga* Pizzini, Raines & Vannozi, 2013, l'inventaire des Caecidae connus du nord-est de la Papouasie-Nouvelle-Guinée atteint 43 espèces. En outre, un spécimen indéterminé, appartenant peut-être à une espèce non décrite, est illustré.

MOTS CLÉS

Caenogastropoda,
Caecidae,
Océanie,
signalisation nouvelle,
espèces nouvelles.

INTRODUCTION

The Caecidae J. E. Gray, 1850 is a speciose family of tiny benthic gastropods distributed worldwide in cold-temperate to tropical seas, including around 250 Recent species (WoRMS 2023). Their peculiar shape, generally characterized by a loosely-coiled and mostly truncated teleoconch, makes them easily distinguished among other gastropods. This family is currently divided into three subfamilies: Strebloceratinae Bandel, 1996, including three Recent species (1%), showing a persistent trochospiral protoconch; Ctiloceratinae Iredale & Laseron, 1957, including 29 Recent species (12%), characterized by a persistent and mostly uncoiled protoconch and a tubular or secondarily recoiled teleoconch; and Caecinae J. E. Gray, 1850, including 215 Recent species (87%) (WoRMS 2023), characterized by a truncated tubular adult shell, with protoconch and early teleoconch portions discarded during the growth and the posterior end sealed by a calcareous septum (de Folin, 1875; Bandel 1996; Lima *et al.* 2013; Raines 2020).

Generic arrangement within this family is still insufficient due to the high level of homoplasy of shell characters (Absalão & Pizzini 2002; Egger *et al.* 2020). Although a few studies including anatomy and genetics were published (Di Staso 1905; Götze 1938; Zaslavskaya & Kolbin 2009; Egger *et al.* 2020; Neusser *et al.* 2021), taxonomy within the Caecidae is mostly based on shell morphology (Pizzini *et al.* 2013; Raines 2020), which is considered as a good proxy for species identification (Egger *et al.* 2020).

However, the alpha taxonomy of caecids is complicated due to the highly conservative shell morphology, which remained substantially unchanged since the early Eocene (Gougerot 1975; Maxwell & Beu 1990; Goedert & Raines 2016). Furthermore, the lack of both protoconch and early teleoconch in the adult stage further complicates taxonomic work within the subfamily Caecinae.

As a result of the extensive oceanographic campaigns carried out by the Muséum national d'Histoire naturelle, Paris, during the last 30 years, knowledge of caecid diversity has substantially increased, leading to the discovery of several new species from the Indo-West Pacific. Northeastern Papua New Guinea and surrounding archipelagoes were the focus of three expeditions, i.e., BIOPAPUA (2010; <https://doi.org/10.17600/10100040>), PAPUA NIUGINI (2012; <https://doi.org/10.17600/18000841>) and KAVIENG (2014; <https://doi.org/10.17600/14004400>). The Caecidae from northeastern Papua New Guinea were recently studied based on shallow-water samplings (0-60 m depth) from the PAPUA NIUGINI and KAVIENG expeditions (Vannozi 2019b), with 37 recorded species. Examination of several deep-water samples from both BIOPAPUA and KAVIENG expeditions led to the discovery of further species, one new for the region and five new to science, which are formally described herein. As a result, the number of the Caecidae known from northeastern Papua New Guinea increased to 43 species. All recorded species are illustrated. A single indeterminate specimen, possibly belonging to a further undescribed species, is also illustrated.

MATERIAL AND METHODS

The examined material consisted of about 200 shells sorted from 11 sediment samples originating from two oceanographic expeditions carried out by the Muséum national d'Histoire naturelle, Paris: BIOPAPUA (two stations) and KAVIENG (nine stations). Two specimens from two deep-water stations of PAPUA NIUGINI Expedition were also included. Details on the expeditions can be found at: <https://expeditions.mnhn.fr/>. Details of the stations containing the examined material are reported in Table 1. The sampled localities are shown in Figure 1.

All specimens are empty shells without operculum and are housed in the MNHN. A few other samples in the private collection of the second author were also examined.

Specimens were manually sorted out of dry deep-water sediment samples loaned by the MNHN under a stereomicroscope. Digital photographs were taken using a Bresser MikroCam II 20 MP 1 camera and images processed with Bresser MikroLab II software. Shells were measured using ImageJ 1.52a software (Rasband 2018). Shell length is the maximum measurable size. Maximum and minimum diameters refer to the widest and narrowest tube sections, corresponding to the apertural swelling or varix (when present) and the apical end, respectively. Protoconch size was determined as the diameter of the circle circumscribing the protoconch viewed from top. The number of protoconch whorls were counted following Spada *et al.* (2023).

Relevant shell characters for species identification within the family Caecidae include: overall shell profile; tube twisting; protoconch and early teleoconch (when available); presence and shape of protoconch varix; presence of sculpture and/or microsculpture; aperture inclination; shape of the aperture and presence of apertural swelling or varix; shape of the septum and presence and shape of the appendix (micro); presence and shape of a temporary septum; presence, shape and appearance of the macula (Lightfoot 1992; Nofroni *et al.* 1997; Pizzini *et al.* 1998; Vannozi *et al.* 2015; Vannozi 2022b). Dorsal and ventral sides refer to the convex and concave sides of the tube, respectively. Right and left sides are referred to with the apex of the shell pointing upwards and in ventral view. Truncation of earlier shell portions in the subfamily Caecinae defines the cutting plane (Vannozi 2022b).

All illustrated specimens are adult unless otherwise specified. Diagnoses and descriptions provide information on adult shell and, if available, on juvenile and larval stages.

We have used a standardised format for the citation of specimen data in “Type material” and “Material examined” sections, as described by Chester *et al.* (2019), with the following data fields:

Country (or major geographic area) • number of specimens (lv and/or sh); locality data (from largest to smallest); geographic coordinates (in decimal degrees); depth; date (format “16.I.1998”); other collecting data (e.g.: habitat); collection and catalogue code.

TABLE 1. — List of stations from MNHN expeditions containing the examined material.

Expedition	Station	Locality	Coordinates	Depth (m)	Date
BIOPAPUA	DW3680	Vitu Islands	04°37'S, 149°27'E	615-647	27.IX.2010
BIOPAPUA	DW3754	Off Bougainville	05°02'S, 154°29'E	615-632	13.X.2010
KAVIENG 2014	CP4418	New Ireland	02°27'S, 150°40'E	335-340	28.VIII.2014
KAVIENG 2014	DW4412	New Ireland	02°33'S, 150°40'E	500-600	27.VIII.2014
KAVIENG 2014	DW4463	New Ireland	02°44'S, 150°35'E	240-305	3.IX.2014
KAVIENG 2014	DW4464	New Ireland	02°43'S, 150°36'E	140-214	3.IX.2014
KAVIENG 2014	DW4465	New Ireland	02°43'S, 150°36'E	90-228	3.IX.2014
KAVIENG 2014	DW4470	New Ireland	02°45'S, 150°37'E	163-358	3.IX.2014
KAVIENG 2014	DW4486	New Ireland	02°28'S, 149°54'E	272-276	5.IX. 2014
KAVIENG 2014	DW4487	New Ireland	02°25'S, 149°59'E	130-153	6.IX.2014
KAVIENG 2014	DW4495	New Ireland	02°24'S, 149°55'E	272-274	6.IX.2014
PAPUA NIUGINI	CP3957	W Sek Island	05°05'S, 145°51'E	452-504	28.XI.2012
PAPUA NIUGINI	DW3977	N Bagabag Is.	04°44'S, 146°12'E	480-490	5.XII.2012

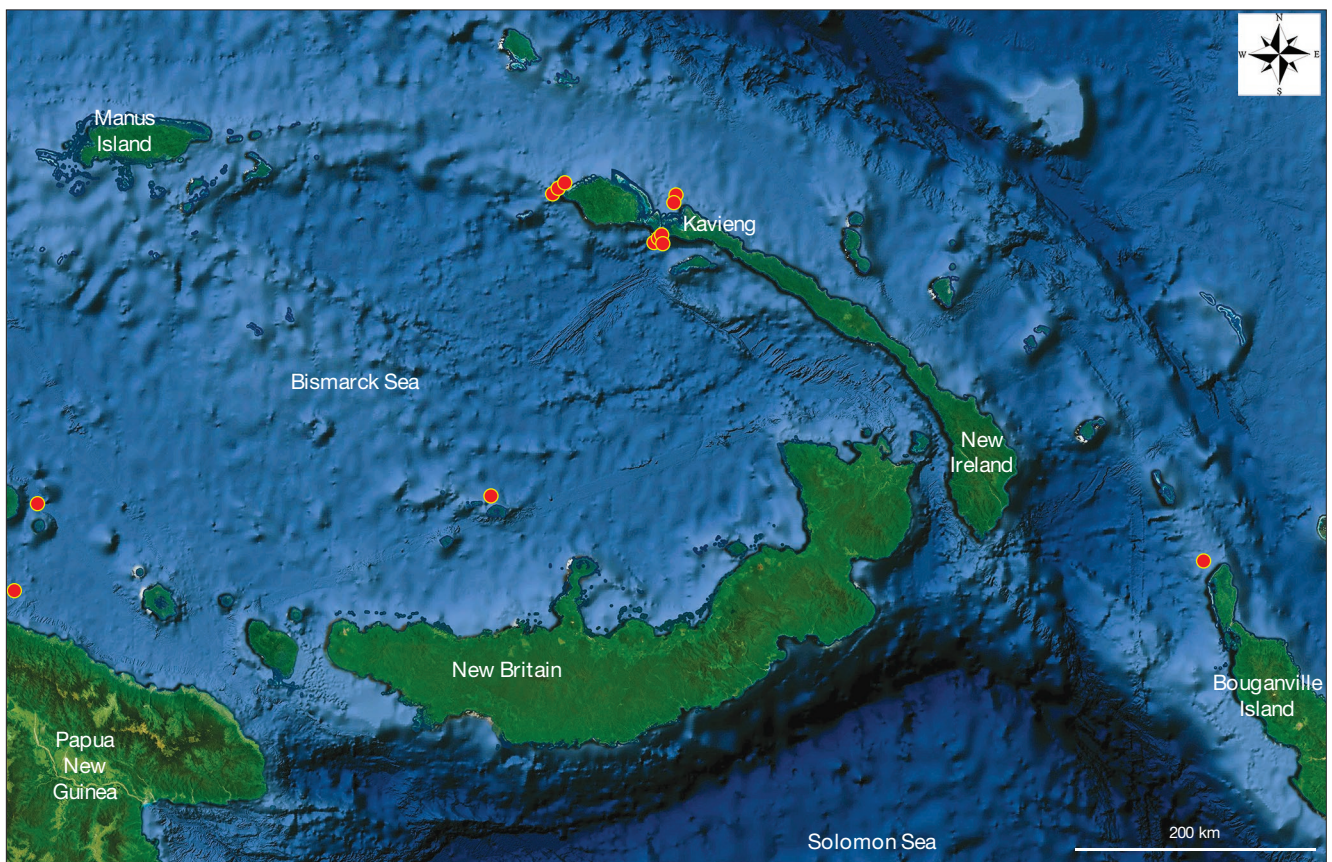


FIG. 1. — Map of northeastern Papua New Guinea showing the sampled stations listed in Table 1.

ABBREVIATIONS

Institutions

AMS	Australian Museum, Sydney;
LACM	Natural History Museum of Los Angeles County, Los Angeles;
MNHN	Muséum national d'Histoire naturelle, Paris;
NMNS	National Museum of Nature and Science (formerly NSMT), Tokyo.

Private collections

coll. IK	Ingo Kurtz collection, Zornheim;
coll. WR	Walter Renda collection, Amantea.

Other abbreviations

c.	circa;
diam	diameter;
fragm	fragmentary specimen;
gs	growth stage;
IWP	Indo-West Pacific;
juv	juvenile specimen;
lv	live-collected specimen;
max	maximum;
min	minimum;
ph	material examined through photograph;
PNG	Papua New Guinea;
sh	empty shell without soft parts and operculum;
stn	station.

SYSTEMATICS

Class GASTROPODA Cuvier, 1797
 Superfamily TRUNCATELLOIDEA J. E. Gray, 1840
 Family CAECIDAE J. E. Gray, 1850
 Subfamily CAECINAE J. E. Gray, 1850

Genus *Caecum* Fleming, 1813

Caecum Fleming, 1813: 63.

TYPE SPECIES. — *Dentalium trachea* Montagu, 1803 by subsequent designation by J. E. Gray (1847: 203).

Caecum sepimentum de Folin, 1868
 (Fig. 2A-D)

Caecum sepimentum de Folin, 1868b: 84, pl. 6, fig. 7. — Vannozi 2023: 424, fig. 2A-C and synonymy therein.

TYPE MATERIAL. — **Lectotype.** Mauritius • sh; Mauritius; MNHN-IM-2000-24907.

Paralectotypes. Mauritius • 20 sh; same data as for lectotype; MNHN-IM-2000-24908.

TYPE LOCALITY. — Indian Ocean, Mauritius.

MATERIAL EXAMINED. — **Papua New Guinea** • 1 sh; Vitu Islands; 4°37'S, 149°27'E; 615-647 m depth; 27.IX.2010; BIOPAPUA Stn DW3680; MNHN • 4 sh; Off Bougainville; 5°02'S, 154°29'E; 615-632 m depth; 13.X.2010; BIOPAPUA Stn DW3754; MNHN • 8 sh (3 juv); New Ireland; 2°44'S, 150°35'E; 240-305 m depth; 3.IX.2014; KAVIENG 2014 Stn DW4463; MNHN • 3 sh; New Ireland; 2°43'S, 150°36'E; 140-214 m depth; 3.IX.2014; KAVIENG 2014 Stn DW4464; MNHN • 2 sh; New Ireland; 2°43'S, 150°36'E; 90-228 m depth; 3.IX.2014; KAVIENG 2014 Stn DW4465; MNHN • 7 sh (3 juv); New Ireland; 2°45'S, 150°37'E; 163-358 m depth; 3.IX.2014; KAVIENG 2014 Stn DW4470; MNHN • 7 sh (4 juv); New Ireland; 2°28'S, 149°54'E; 272-276 m depth; 5.IX.2014; KAVIENG 2014 Stn DW4486; MNHN. **Philippines** • 5 sh; Mactan, Punta Engano; beached; coll. WR.

DISTRIBUTION. — The whole IWP. From the east coast of Africa (Red Sea to eastern South Africa) to Maldives, Papua New Guinea, Philippines, Japan, Australia, New Caledonia, French Polynesia, Hawaii (Kay 1979; Lightfoot 1992a; Hasegawa 2000; Albano & Pizzini 2011; Pizzini & Raines 2011; Pizzini *et al.* 2013; Vannozi *et al.* 2015; Vannozi 2017, 2019b, 2023; Blatterer 2019; unpublished data). Allochthonous to the Mediterranean Sea (Pagli 2009; Ovalis & Mifsud 2014).

DIAGNOSIS. — Shell of average size for the genus, colourless or creamy, often with darker blotches. Protoconch planorbid, multispiral of *c.* 2 whorls. Teleoconch tubular, arched, with strong collabral rings. Early teleoconch conical, rings increasing in strength during the growth. Adult shell subcylindrical, evenly arched. Sculpture of *c.* 20 strong rings with a somewhat subtriangular outline. Aperture preceded by a swelling, ending with several concentric small rings. Microsculpture of fine longitudinal threads. Septum almost flat without mucro, lying below the cutting plane. Periostracum brownish. Operculum thick, terraced. Animal described by Vannozi (2019b). Adult shell length *c.* 2.5 mm, protoconch size 375 µm.

REMARKS

All deep-water (90-647 m depth) examined specimens are worn, confirming that this species is exclusive to shallow-water habitats. Freshly-collected specimens, known only from shallow water, often show a colour pattern of brown blotches (Fig. 2C, D).

Caecum vertebrale Hedley, 1899
 (Fig. 2E-H)

Caecum vertebrale Hedley, 1899: 425, fig. 15. — Vannozi 2019b: 74 and synonymy therein.

TYPE MATERIAL. — **Holotype.** Tuvalu • sh; Funafuti Atoll; AMS n. C5917.

TYPE LOCALITY. — Pacific Ocean, Tuvalu, Funafuti Atoll.

MATERIAL EXAMINED. — **Papua New Guinea** • 1 sh; Off Bougainville; 5°02'S, 154°29'E; 615-632 m depth; 13.X.2010; BIOPAPUA Stn DW3754; MNHN • 1 sh; New Ireland; 2°24'S, 149°55'E; 272-274 m depth; 6.IX.2014; KAVIENG 2014 Stn DW4495; MNHN • 1 sh; Bagabag Island; 4°44'S, 146°12'E; 480-490 m depth; 5.XII.2012; PAPUA NIUGINI Stn DW3977; MNHN.

DISTRIBUTION. — Philippines, northeastern PNG, Japan, New Caledonia, Loyalty, Vanuatu, Society, Tuvalu (Hedley 1899; Pizzini *et al.* 2013; Hasegawa 2000; Vannozi 2017, 2019b).

DIAGNOSIS. — Shell of average size for the genus, colourless, semi-transparent. Protoconch unknown. Teleoconch tubular, arched, with strong collabral rings. Early teleoconch conical, smooth with rings gradually appearing and increasing in strength during the growth. Adult shell cylindrical, evenly arched. Sculpture of *c.* 25 strong, rounded rings. Aperture simple, edged by two paired rings. Septum dome-shaped without mucro, sometimes encrusted. Animal described by Vannozi (2019b). Adult shell length *c.* 2.5 mm.

REMARKS

A few rather worn specimens were examined, all of them showing unusual septa. One of them shows a unique hemispherical mucro positioned in the middle of the septum. However, the other examined specimens show irregular shapes. Occasionally, the septum in *C. vertebrale* shows irregular shapes (Pizzini *et al.* 2013: fig. 8K, M), therefore we attribute no specific value to the peculiar shape shown in Figure 2E-H.

Caecum japonicum (Habe, 1978)
 (Fig. 2I-L)

Pictocaecum japonicum Habe, 1978: 3, pl. 1, figs 14-17.

Caecum japonicum – Vannozi 2019b: 87 and synonymy therein.

TYPE MATERIAL. — **Holotype.** Japan • sh; Kyushu, Matsugaura, Chirancho on the coast of Kagoshima Bay; NSMT Mo 55371 (NMNS). **Paratype.** Japan • 1 sh; same data as for holotype; NSMT Mo 55372 (NMNS).

TYPE LOCALITY. — Pacific Ocean, Japan, Kyushu, Matsugaura, Chirancho on the coast of Kagoshima Bay.

MATERIAL EXAMINED. — **Papua New Guinea** • 2 sh (1 juv); New Ireland; 2°44'S, 150°35'E; 240-305 m depth; 3.IX.2014; KAVIENG 2014 Stn DW4463; MNHN • 2 sh; New Ireland; 2°43'S, 150°36'E; 140-214 m depth; 3.IX.2014; KAVIENG 2014 Stn DW4464; MNHN • 2 sh; New Ireland; 2°43'S, 150°36'E; 90-228 m depth; 3.IX.2014; KAVIENG 2014 Stn DW4465; MNHN.

DISTRIBUTION. — Maldives, Andaman, Thailand, Philippines, Japan, northern Australia, northeastern PNG, New Caledonia, Vanuatu, Fiji, Tonga (Habe 1963; Hasegawa 2000; Pizzini *et al.* 2013; Vannozi 2017, 2019b, unpublished data).



FIG. 2. — *Caecum* Fleming, 1813 species from deep-water stations from northeastern PNG: **A, B**, *C. sepimentum* de Folin, 1868 from Stn DW4463 (**B**: juvenile); **C, D**, *C. sepimentum* from Mactan, Philippines, beached (coll. WR); **E-H**, *C. vertebrale* Hedley, 1899 from Stn DW3754; **I, J**, *C. japonicum* (Habe, 1978) from Stn DW4464; **K, L**, *C. japonicum* from Stn DW4463 (**L**, juvenile); **M**, *C. inflatum* Vannozi, 2017 from Stn DW4463; **N**, *C. inflatum* from Kotok, Indonesia, beached (coll. WR). Scale bar: 1 mm, details not to scale.

DIAGNOSIS. — Shell of average size for the genus, whitish or colourless, usually showing brown and/or white bands arranged in collabral or zigzag pattern. Protoconch planorbid, multispiral of *c.* 2 whorls. Teleoconch tubular, arched, almost smooth. Early teleoconch conical, slightly twisted with very fine rings disappearing during the growth. Adult shell subcylindrical, smooth, tapering toward the apex, bent toward the aperture. Aperture simple, contracted, inclined. Septum low dome-shaped, slightly protruding without mucro, recessed below the cutting plane. Periostracum light brown, sometimes hairy. Operculum thin and flat. Animal described by Vannozi (2019b). Adult shell length *c.* 2.5 mm, protoconch size *c.* 360 µm.

REMARKS

Caecum japonicum is a widespread and common species, showing a variety of colour patterns that allow easy identification, although colourless specimens occur. Worn specimens appear white.

Caecum inflatulum Vannozi, 2017
(Fig. 2M, N)

Caecum inflatulum Vannozi, 2017: 124, fig. 1E-L.

TYPE MATERIAL. — **Holotype.** Philippines • lv; Bohol Is., Ubajan, 16 m depth; MNHN-IM-2000-33074.

Paratypes. Philippines • 1 lv juv; Panglao Is., Biking; 4 m depth; reef; MNHN-IM-2000-33075 • 4 lv, 2 sh; Balicasag Is.; 21 m depth; floor of cave with sponges; MNHN-IM-2000-33076 • 1 lv, 1 sh; Panglao Is., Pontod Islet; 3 m depth; sand bottom with dead coral; MNHN-IM-2000-33077.

TYPE LOCALITY. — Pacific Ocean, Philippines, Bohol Is., Ubajan, 16 m depth.

MATERIAL EXAMINED. — **Papua New Guinea** • 1 sh (fragm); New Ireland; KAVIENG 2014 Stn DW4463; 2°44'S, 150°35'E; 240-305 m depth; 3.IX.2014; MNHN.
Indonesia • 1 sh; Kotok Island; beached; 1985; coll. WR.

DISTRIBUTION. — Indonesia (new record), Philippines, northeastern PNG (Vannozi 2017, 2019b).

DIAGNOSIS. — Shell of average size for the genus, colourless, semitransparent and glossy. Protoconch unknown. Teleoconch tubular, slightly arched, with strong collabral rings. Early teleoconch subcylindrical. Adult shell subcylindrical, slightly arched, tapering toward the apex. Sculpture of rather well-developed rings of uneven width, vanishing in the late teleoconch. Completely smooth specimens occur. Aperture simple, slightly contracted, preceded by a slight swelling. Shallow longitudinal grooves sometimes occur. Septum protruding, convex, with a high dorsal nail-like mucro. The mucro shows a slight hump at half of its height. Animal described by Vannozi (2019b). Length 2 mm.

REMARKS

Caecum inflatulum is a rather variable species, although the shape of the septum allows easy identification. This species can only be compared with *C. attenuatum* de Folin, 1880 and *C. chinense* de Folin, 1868, both of them showing a similar septum. However, the former shows a sculpture of very fine rings and a differently-shaped aperture, while the latter shows a more conical and smooth shell with annular microsculpture (Albano & Pizzini 2011; Vannozi 2017).

Caecum microannulatum n. sp.
(Fig. 3A-E)

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TYPE MATERIAL. — **Holotype.** Papua New Guinea • sh (length 1.27 mm, Fig. 3A-D); New Ireland, KAVIENG 2014 Stn DW4464; 2°43'S, 150°36'E; 140-214 m depth; 3.IX.2014; MNHN-IM-2000-38948.

TYPE LOCALITY. — Pacific Ocean, Papua New Guinea, New Ireland; 2°43'S, 150°36'E; 140-214 m depth.

OTHER MATERIAL EXAMINED. — **Papua New Guinea** • 1 sh (juv); same data as for holotype; MNHN.

Japan • 1 sh (ph); Okinawa, 1 km E of Onna Village (Horseshoe South); 26°29.7'N, 127°50.6'E; 43 m depth; B. Raines leg.; sand and coral rubble; LACM 1978-16.1.

DISTRIBUTION. — Known from northeastern PNG and southern Japan.

ETYMOLOGY. — The adjective *microannulatum* is composed of the Greek *μικρό* (small) and Latin *annulatus* (ringed), due to the sculpture of the shell consisting of very small rings. The term *μικρό* also alludes to the small size of this species.

DESCRIPTION

Shell small for the genus, whitish, semitransparent. Protoconch unknown. Teleoconch tubular, slightly arched, with fine collabral rings. Early teleoconch conical. Adult shell cylindrical, tapering toward the apex, slightly dextrally twisted in ventral view. Surface covered by more than 60 collabral rings, separated by as-wide interspaces. Macula none detected. Aperture somewhat ventrally inclined, preceded by a strong varix-like swelling, crossed by faint annulations, then contracting and ending with a fine reflected lip. Septum low dome-shaped, bimamillated due to the presence of a strong, almost dorsal nail-like mucro, slightly lower than the septum. Periostracum none detected. Operculum and soft parts unknown. Holotype: length 1.27 mm, max diam 0.29 mm, min diam 0.22 mm.

REMARKS

A juvenile specimen (Fig. 3E), likely belonging to *Caecum microannulatum* n. sp., was found in the same station as the holotype and shows a clearly conical and twisted tube and an almost flat septum with pointed mucro, as usually shown by juveniles.

The new species can be compared with *Caecum directum* Vannozi, 2019, *C. virginiae* Pizzini, Raines & Vannozi, 2013 and *C. musorstomi* Pizzini, Raines & Vannozi, 2013. *C. directum*, described from Kranket Island (Madang, PNG) shows a similar septum with strong almost dorsal nail-like mucro and a fine annulated sculpture. However, it differs by the larger size and more solid shell, the less prominent sculpture, the less curved tube and the very strong apertural varix which is oriented to the left side of the tube. *C. virginiae*, described from Fiji and reported from Kranket Is. (PNG), shows a similar size as the new species. However, it differs by the subcylindrical tube, the finer annular sculpture consisting of more than twice the number of rings and a different shape of the septum. *C. musorstomi*, described from New Caledonia and reported from several localities in the SW Pacific, is slenderer, larger and shows a weaker and irregular annular sculpture, a narrower apertural varix and a lower septum with sharper mucro.

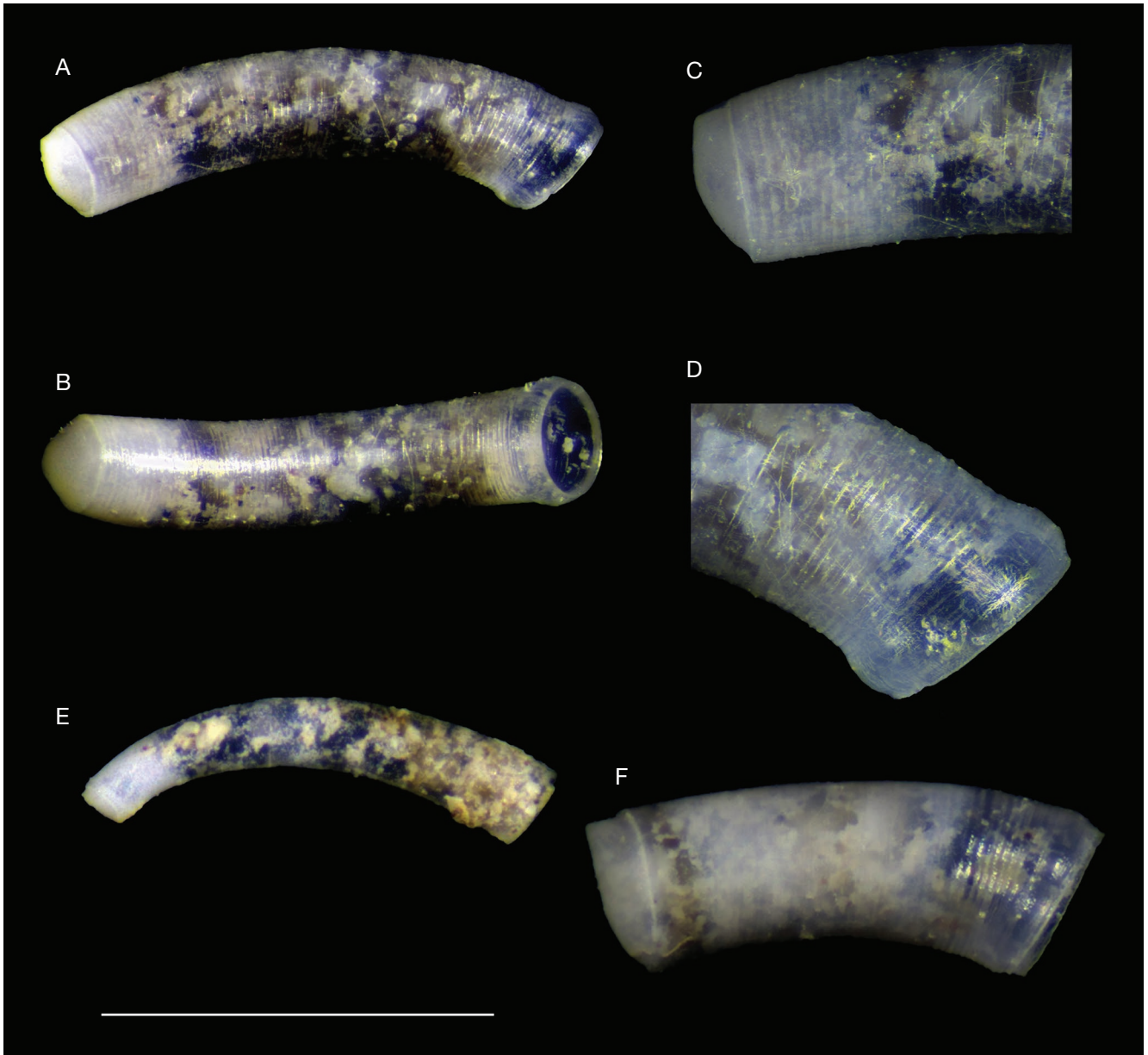


FIG. 3. — *Caecum* Fleming, 1813 species from deep-water stations from northeastern PNG: **A-D**, *Caecum microannulatum* n. sp., holotype MNHN-IM-2000-38948; **E**, *C. microannulatum* n. sp., juvenile from type locality; **F**, *C. musorstomi* Pizzini, Raines & Vannozzi, 2013 from Stn DW4412, transitional growth stage. Scale bar: 1 mm, details not to scale.

Caecum musorstomi
Pizzini, Raines & Vannozzi, 2013
(Fig. 3F)

Caecum musorstomi Pizzini, Raines & Vannozzi, 2013: 27, figs 12G-I, 19F. — Vannozzi 2019b: 86, fig. 4J-N and synonymy therein.

TYPE MATERIAL. — **Holotype.** New Caledonia • 1 lv; Nouméa Sector SW, Larégnère reef, inner slope; 22°19.9'S, 166°17.6'/166°16.1'E; 12-16 m depth; 3.V.1993; MNHN-IM-2000-24921.

Paratypes. New Caledonia • 1 lv, 5 sh, 1 juv., 1 sh broken; same data as for holotype; MNHN-IM-2000-24922 • 1 lv; Nouméa Sector SW, Platier îlot Maître, MONTRouZIER Stn 1351; 22°20'23"N, 166°25'41"E; 0-1 m depth; 25.XI.1992; MNHN-

IM-2000-24923 • 1 lv; Nouméa Sector, Pointe Magnin, MONTRouZIER Stn 1355; 22°18'54"N, 166°26'35"E; 7-10 m depth; 3.XII.1992; MNHN-IM-2000-24924 • 1 lv, 17 sh; Cap Woodin, LAGON Stn DW1233; 22°23'34"N, 166°47'39"E; 45-50 m depth; 9.III.1993; MNHN-IM-2000-24925 • 9 sh; Touho sector, Channel NE of Banc de Touho, MONTRouZIER Stn 1260; 20°43'59"N, 165°13'59"E; 49-50 m depth; 1-30.IX.1993; MNHN-IM-2000-24926 • 2 sh; Touho sector, Touho Channel, MONTRouZIER Stn 1261; 20°46'59"N, 165°16'30"E; 45-56 m depth; 1-30.IX.1993; MNHN-IM-2000-24927 • 2 sh; Touho sector, Grand Reef Mangalia Lagoon, MONTRouZIER Stn 1264; 20°44'30"N, 165°15'53"E; 8 m depth; 1-30.IX.1993; MNHN-IM-2000-24928 • 1 sh; Touho sector, Grand Reef Mangalia Lagoon, MONTRouZIER Stn 1266; 20°39'36"N, 165°14'42"E; 10-15 m depth; 1-30.IX.1993; MNHN-IM-2000-24929 • Koumac

sector, Koumac bay, MONTRouZIER Stn 1277; 20°34'0"N, 164°16'0"E; 0-2 m depth; 1-31.X.1993; MNHN-IM-2000-24520 • 1 sh; Koumac sector, Rat Island, MONTRouZIER Stn 1284; 20°33'42"N, 164°10'59"E; 0-1 m depth; 1-31.X.1993; MNHN-IM-2000-24521 • 1 sh; Koumac sector, Paagoumène, MONTRouZIER Stn 1289; 20°29'12"N, 164°10'11"E; 0-1 m depth; 1-31.X.1993; MNHN-IM-2000-25159 • 1 lv; Koumac sector, Paagoumène, MONTRouZIER Stn 1289; 20°29'12"N, 164°10'11"E; 0-1 m depth; 1-31.X.1993; M. Pizzini collection • 1 lv, 1 sh; Koumac sector, Babouillat Point, MONTRouZIER Stn 1292; 20°22'23"N, 164°6'47"E; 0-1 m depth; 1-31.X.1993; MNHN-IM-2000-24522 • 2 lv, 2 sh; Koumac sector, Lagoon between earth and the Infernet, MONTRouZIER Stn 1299; 20°34'23"N, 164°13'0"E; 12-14 m depth; 1.X.1993/31.X.1993; MNHN-IM-2000-24523 • 2 lv; Koumac sector, areas of the Karembé Plateau, MONTRouZIER Stn 1303; 20°38'48"N, 164°17'5"E; 0-8 m depth; 1-31.X.1993; MNHN-IM-2000-24524 • 1 sh; Koumac sector, Great Koumac Reef, KOUMAC Stn 1331; 20°40'36"N, 164°12'6"E; 55-57 m depth; 31.X.1993; MNHN-IM-2000-24525.

Vanuatu • 1 sh; E Aoré Island, Mambeto Point, SANTO 2006 Stn DB08; 15°34'37"N, 167°13'46"E; 12 m depth; 12.IX.2006; MNHN-IM-2000-24526 • 8 lv, 13 sh; S Aoré Island, SW Port Lautour, SANTO 2006 Stn DB12; 15°36'38"N, 167°10'3"E; 10-18 m depth; 13.IX.2006; MNHN-IM-2000-24527 • 1 lv, 2 sh; E Louganville, Between Wharf E Unity Park & Customs, SANTO 2006 Stn DB14; 15°30'53"N, 167°11'0"E; 10-14 m depth; 13.IX.2006; MNHN-IM-2000-24528 • 1 sh; NW Urélapa Island, SANTO 2006 Stn DB20; 15°36'30"N, 167°1'21"E; 22-25 m depth; 15.IX.2006; MNHN-IM-2000-24529 • 2 sh; Palikulo Bay, Old Japanese Fisheries, SANTO 2006 Stn DB40; 15°28'48"N, 167°15'9"E; 5 m depth; 19.IX.2006; MNHN-IM-2000-24530 • 3 sh; NW Aésé Island, Palikulo Bay, SANTO 2006 Stn DB69; 15°24'23"N, 167°13'2"E; 38 m depth; 27.IX.2006; MNHN-IM-2000-24532 • 3 sh; Palikulo Bay, E Cape Undine, SANTO 2006 Stn DS43; 15°27'54"N, 167°14'16"E; 22 m depth; 20.IX.2006; MNHN-IM-2000-24533 • 2 sh; E Palikulo Bay, W Old Japanese Fisheries-Wharf, SANTO 2006 Stn DS54; 15°28'48"N, 167°15'9"E; 5 m depth; 22.IX.2006; MNHN-IM-2000-24534 • 1 sh; S Oyster Island, Outer reef, SANTO 2006 Stn FB40; 15°22'55"N, 167°11'42"E; 9 m depth; 29.IX.2006; MNHN-IM-2000-24535 • 5 lv, 2 sh; SE Malo Island, W Malokilikili Island, SANTO 2006 Stn FB52; 15°42'42"N, 167°15'15"E; 7 m depth; 5.X.2006; MNHN-IM-2000-24536 • 1 lv; E Aoré Island, S Port Benier Bay, SANTO 2006 Stn FB61; 15°34'23"N, 167°12'36"E; 2-3 m depth; 9.X.2006; MNHN-IM-2000-24537 • 1 sh; Tutuba Island, Vanatova Bay, SANTO 2006 Stn FB92; 15°33'35"N, 167°16'33"E; 2-4 m depth; 14.X.2006; MNHN-IM-2000-24538 • 1 sh; Matewulu Beach, N Matafou River Mouth, SANTO 2006 Stn LD09; 15°22'10"N, 167°11'17"E; 2-3 m depth; 14.X.2006; MNHN-IM-2000-24539 • 2 sh; Strait N Tāngoa Island, SANTO 2006 Stn LD29; 15°35'17"N, 167°59'24"E; 10-12 m depth; 13.X.2006; MNHN-IM-2000-24540 • 2 sh; Segond Channel, Sakara River Mouth, SANTO 2006 Stn LS17; 15°31'4"N, 167°10'30"E; 7 m depth; 14.X.2006; MNHN-IM-2000-24541 • 1 sh; Segond Channel, Off Maritime College, SANTO 2006 Stn NS36; 15°31'39"N, 167°9'31"E; 2-3; 02.X.2006; MNHN-IM-2000-24542 • 1 sh; Segond Channel, Beach Front Maritime College, SANTO 2006 Stn NS37; 15°31'21"N, 167°9'46"E; 2-3 m depth; 02.X.2006; MNHN-IM-2000-24543 • 1 lv; Segond Channel, NW Aoré Island, SANTO 2006 Stn NB12; 15°33'31"N, 167°9'37"E; 20 m depth; 19.IX.2006; MNHN-IM-2000-24544 • 2 sh; E Aoré Island, Ambuei Bay, SANTO 2006 Stn ZB16; 15°32'23"N, 167°12'8"E; 5 m depth; 17.X.2006; MNHN-IM-2000-24545.

TYPE LOCALITY. — Pacific Ocean, New Caledonia, Nouméa Sector SW, Larégnère reef, 22°19.9'S, 166°17.6'E/166°16.1'E, inner slope, 12-16 m depth.

MATERIAL EXAMINED. — Papua New Guinea • 1 sh (gs); New Ireland; 2°33'S, 150°40'E; 500-600 m depth; 27.VIII.2014; KAVIENG 2014 Stn DW4412; MNHN.

DISTRIBUTION. — Thailand, Philippines, northeastern PNG, New Caledonia, Vanuatu (Pizzini *et al.* 2013; Vannozi 2017, 2019b, unpublished data).

DIAGNOSIS. — Shell of average size for the genus, colourless, semi-transparent. Protoconch unknown. Teleoconch tubular, slightly arched, with fine collabral rings. Early teleoconch slender, subcylindrical. Adult shell slender, cylindrical, evenly arched. Sculpture of fine rings, best visible toward the aperture. Aperture preceded by a well-developed swelling crossed by small rings. Longitudinal microsculpture present. Septum slightly protruding with a rounded mucro rotated toward the right side. Periostracum light brownish. Operculum thin, flat. Soft parts unknown. Adult shell length *c.* 2 mm.

REMARKS

Caecum musorstomi is a widespread species and occurs frequently. It shows rather constant characters and is usually easily identified. Only a single specimen was found in the examined material. This specimen is a short form, showing a length which is half the usual adult shell length. Short specimens are known from several species and are regarded as transitional growth stages (Pizzini *et al.* 1995; Lee unpublished).

Caecum restrictum n. sp.
(Fig. 4)

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TYPE MATERIAL. — Holotype. Papua New Guinea • sh (length 1.9 mm, Fig. 4A-D); New Ireland, KAVIENG 2014 Stn DW4486; 2°28'S, 149°54'E; 272-276 m depth; 5.IX.2014; MNHN-IM-2000-38944. Paratypes. Papua New Guinea • 2 sh worn; same data as for holotype; MNHN-IM-2000-38945.

TYPE LOCALITY. — Pacific Ocean, Papua New Guinea, New Ireland, 2°28'S, 149°54'E; 272-276 m depth.

OTHER MATERIAL EXAMINED. — Papua New Guinea • 1 sh; Off Bougainville; 5°02'S, 154°29'E; 615-632 m depth; 13.X.2010; BIOPAPUA Stn DW3754; MNHN.

DISTRIBUTION. — Known from northeastern PNG (western New Ireland and eastern Bougainville Island).

ETYMOLOGY. — The specific epithet is derived from the Latin adjective *restrictus* (restricted) to indicate the adapically constricted tube. The epithet alludes also to the restricted distribution of the species.

DESCRIPTION

Shell small for the genus, tubular, smooth, colourless, semi-transparent. Protoconch unknown. Teleoconch tubular, arched, almost smooth. Early teleoconch unknown. Adult shell tubular, cylindrical, clearly tapering close to the apex, straight in ventral view. Surface smooth. Microsculpture of evenly-spaced growth lines defining fine flat rings visible in the abapical half. Macula none detected. Aperture preceded by a strong varix-like swelling crossed by coarse growth lines,

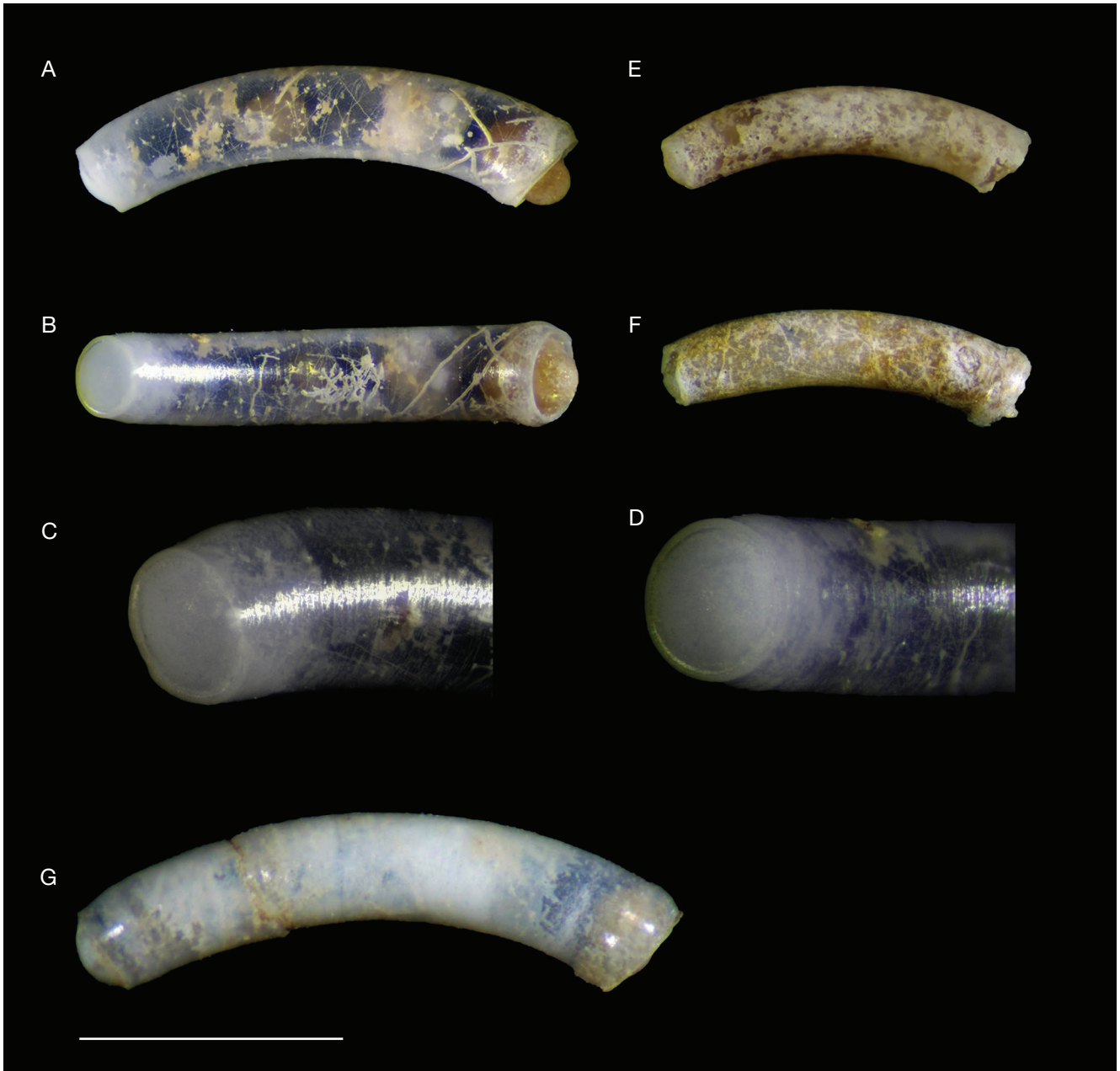


FIG. 4. — *Caecum restrictum* n. sp.: **A-D**, holotype MNHN-IM-2000-38944; **E, F**, paratypes MNHN-IM-2000-38945 from type locality; **G**, specimen from Stn DW3754 (MNHN). Scale bar: 1 mm, details not to scale.

then contracting and ending with a fine reflected lip. Septum low dome shaped without mucro, slightly recessed below the cutting plane. Traces of temporary septum visible at the boundary of the septum with the tube. Periostracum none detected. Operculum and soft parts unknown. Holotype: length 1.9 mm, max diam 0.4 mm, min diam 0.3 mm.

REMARKS

This species is known from a few specimens. The two paratypes, originating from the type locality, although smaller and worn, display the characters shown by the holotype and have been designated accordingly.

Caecum restrictum n. sp. can be compared with *C. succineum* de Folin, 1880, *C. biomaglo* Vannozzi, 2023 and *C. iricolor* Vannozzi, 2023, all of them showing smooth shells with dome-shaped septum without mucro. *Caecum succineum*, described from Cape York, NE Australia, but recorded throughout the IWP, is smaller and slenderer, is not clearly constricted close to the apex and shows several rings close to the aperture. *Caecum biomaglo*, described from Mayotte, is larger and stouter and shows a longitudinal microsculpture. *Caecum iricolor*, also described from Mayotte, is larger and shows a slightly twisted iridescent tube, sometimes with longitudinal grooves.

Caecum miliarium n. sp.
(Fig. 5)

[urn:lsid:zoobank.org:act:8FFDAF1B-E8DE-435D-B8AF-4953A5C66CBC](https://doi.org/10.21203/rs.3.rs-38946)

TYPE MATERIAL. — **Holotype.** Papua New Guinea • sh (length 1.3 mm, Fig. 5A-D); New Ireland, KAVIENG 2014 Stn CP4418; 2°27'S, 150°40'E; 335-340 m depth; 28.VIII.2014; MNHN-IM-2000-38946.

Paratypes. Papua New Guinea • 106 sh (10 larval); same data as for holotype; MNHN-IM-2000-38947.

TYPE LOCALITY. — Pacific Ocean, Papua New Guinea, New Ireland; 2°27'S, 150°40'E; 335-340 m depth.

DISTRIBUTION. — Known only from the type locality.

ETYMOLOGY. — From the Latin adjective *miliaris* (meaning: of a thousand, containing a thousand) because the sample collected in the type locality contained a great number of specimens of the new species.

DESCRIPTION

Shell small for the genus, smooth, colourless, semitransparent, somewhat iridescent. Protoconch planorbid, multispiral of *c.* 2 whorls, smooth and shiny, the last portion detached and straight, ending with a simple aperture with slightly reflected lip. Teleoconch tubular, arched, smooth. Early teleoconch subcylindrical, slightly twisted. Adult shell subcylindrical, slightly dextrally twisted in ventral view. Surface covered by very fine wavy longitudinal and discontinuous threads, evenly spaced but becoming more and more numerous and crowded going from the apex to the aperture. Macula none detected. Aperture somewhat inclined, without a clear swelling and ending with a fine reflected lip. Septum low dome shaped without mucro, slightly recessed below the cutting plane. Temporary septum thick, opaque, hemispherical, persistent, lying on the permanent one. Young stage with flatter and more recessed septum. Periostracum none detected. Operculum and soft parts unknown. Holotype: length 1.3 mm, max diam 0.25 mm, min diam 0.20 mm. Protoconch size 395 µm.

REMARKS

Among the characteristics of this species, a rather persistent temporary septum can be highlighted. It is entirely preserved in the holotype and partially preserved in the paratype shown in Figure 5F. The presence of numerous specimens in the type locality, including the complete growth series, allowed a clear and exhaustive knowledge of shell ontogeny of the new species. In fact, except for three juveniles, likely belonging to *C. frugi* Vannozi, 2019, the lot originating from Stn CP4418 contained only specimens *C. miliarium* n. sp. Furthermore, the presence of all growth stages, all well preserved, suggests that the actual habitat was sampled during the expedition and that this species lives in the aphotic zone, unlike the majority of other members of the family.

The new species can be compared with *Caecum frugi*, which shows a similar size and septum. However, *C. miliarium* n. sp. is readily distinguished by the wider tube and the longitudinal

microsculpture visible also at low magnification, whereas in *C. frugi* the microsculpture is denser and visible only at very high magnification. Furthermore, *C. frugi* shows a different shape of the tube, more cylindrical and with inflated abapical portion. A similar microsculpture is shown also by *C. neo-caledonicum* de Folin, 1868, described from New Caledonia and occurring in the whole IWP, but this species is larger and otherwise different in several aspects as shown below.

A further comparison can be made with *C. suteri* Odhner, 1925, a small species described from New Zealand, currently in the synonymy of *Caecum digitulum* Hedley, 1904. In fact, although this species differs by the small finger-like mucro, absent in the new species, it shares a quite similar protoconch showing about the same number of whorls and a prolonged straight portion before the transition with the teleoconch (Odhner 1924: 29; pl. 1; fig. 19).

Caecum dakuwaqa

Pizzini, Raines & Vannozi, 2013
(Fig. 6A-E)

Caecum dakuwaqa Pizzini *et al.* 2013: 19, fig. 10K-O.

TYPE MATERIAL. — **Holotype.** Fiji • sh; SE of Viti Levu; 18°18.5'S, 178°05.8'E; MNHN-IM-2000-24843.

Paratypes. Fiji • 8 sh; same data for holotype; MNHN-IM-2000-24844 • 2 sh; Bligh Water, MUSORSTOM 10 Stn DW1314; 17°16'9"N, 178°14'51"E; 656-670 m depth; 5.VIII.1988; MNHN-IM-2000-24847 • 8 sh; Bligh Water, MUSORSTOM 10 Stn DW1333; 16°50'21"N, 178°12'33"E; 200-215 m depth; 8.VIII.1988; MNHN-IM-2000-24848 • 2 sh; Bligh Water, MUSORSTOM 10 Stn DW1334; 16°51'22"N, 178°13'56"E; 251-257 m depth; 9.VIII.1988; MNHN-IM-2000-24849 • 3 sh; S Viti Levu, MUSORSTOM 10 Stn DW1365; 18°12'43"N, 178°32'22"E; 295-302 m depth; 15.VIII.1988; MNHN-IM-2000-24850 • 1 sh; S Viti Levu, MUSORSTOM 10 Stn DW1376; 18°18'40"N, 178°9'4"E; 497-504 m depth; 17.VIII.1988; MNHN-IM-2000-24851 • 2 sh; S Viti Levu, MUSORSTOM 10 Stn DW1381; 18°17'46"N, 177°54'25"E; 275-430 m depth; 18.VIII.1988; MNHN-IM-2000-24852 • 2 sh; SE Viti Levu, MUSORSTOM 10 Stn CP1354; 17°42'36"N, 178°54'58"E; 959-963 m depth; 12.VIII.1988; MNHN-IM-2000-24853 • 4 sh; S Viti Levu, MUSORSTOM 10 Stn CP1363; 18°12'23"N, 178°33'0"E; 144-150 m depth; 15.VIII.1988; MNHN-IM-2000-24854 • 9 sh; S Viti Levu, MUSORSTOM 10 Stn CP1366; 18°12'21"N, 178°33'3"E; 149-168 m depth; 15.VIII.1988; MNHN-IM-2000-24855 • 14 sh; S Viti Levu, MUSORSTOM 10 Stn CP1369; 18°11'7"N, 178°23'26"E; 392-433 m depth; 16.VIII.1988; MNHN-IM-2000-24856. Vanuatu • 1 sh; S-SE Santo, MUSORSTOM 8 Stn DW1072; 15°39'53"N, 167°19'36"E; 622-625 m depth; 4.X.1994; MNHN-IM-2000-24845 • 15 sh; E Santo, MUSORSTOM 8 Stn DW1105; 15°2'35"N, 167°7'29"E; 154-179 m depth; 7.X.1994; MNHN-IM-2000-24846.

TYPE LOCALITY. — Pacific Ocean, Fiji, southeast of Viti Levu, 18°18.5'S, 178°05.8'E, 260-305 m depth.

MATERIAL EXAMINED. — Papua New Guinea • 1 sh; New Ireland; 2°44'S, 150°35'E; 240-305 m depth; 3.IX.2014; KAVIENG 2014 Stn DW4463; MNHN • 2 sh (1 juv); New Ireland; 2°45'S, 150°37'E; 163-358 m depth; 3.IX.2014; KAVIENG 2014 Stn DW4470; MNHN.

DISTRIBUTION. — Northeastern PNG (new record), Vanuatu, Fiji (Pizzini *et al.* 2013; Vannozi 2019b).

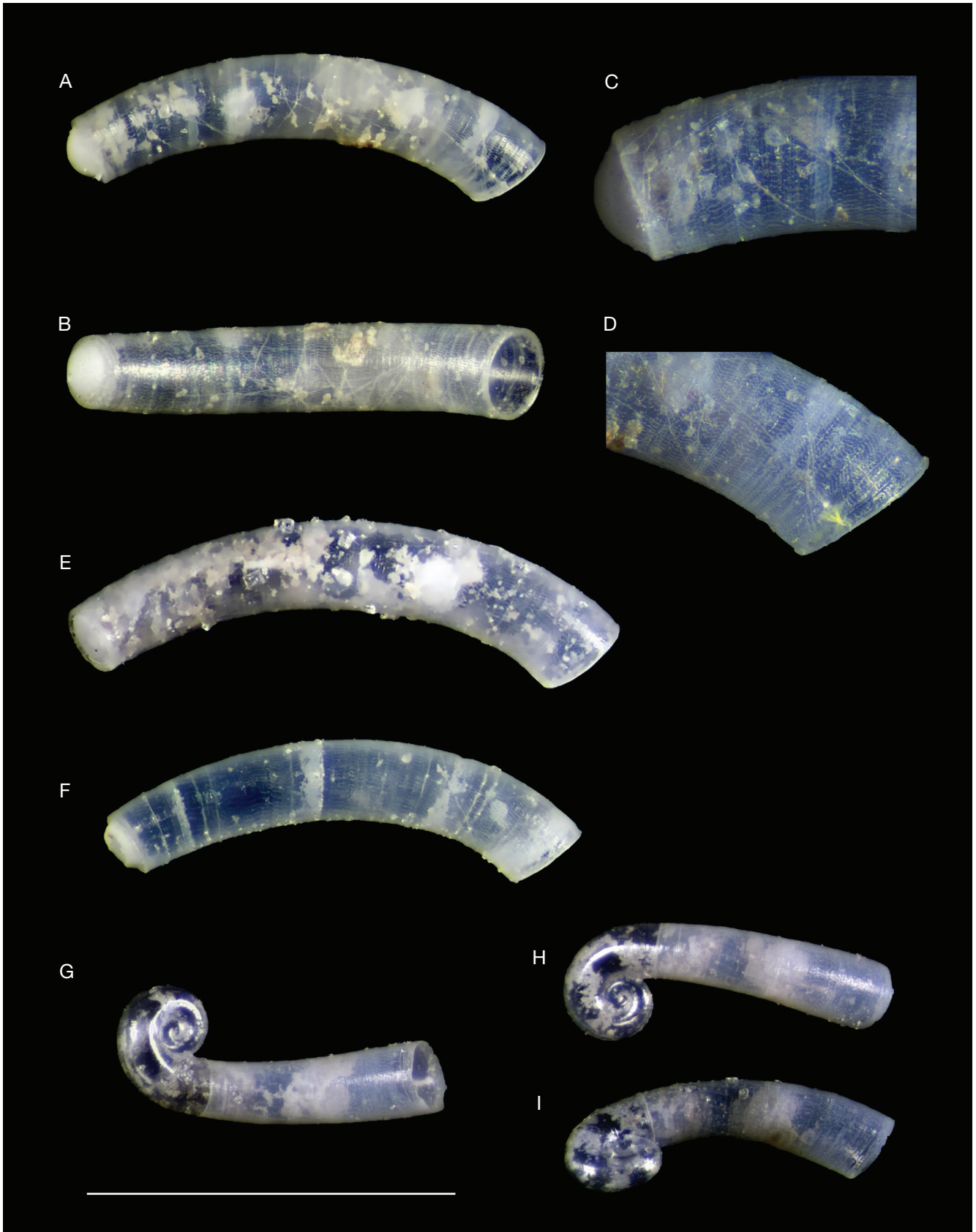


FIG. 5. — *Caecum miliarium* n. sp.: **A-D**, holotype MNHN-IM-2000-38946; **E-I**, paratypes MNHN-IM-2000-38947; **E**, growth stage; **F**, specimen with partially worn temporary septum; **H-I**, postlarval specimen, different views. Scale bar: 1 mm, details not to scale.

DIAGNOSIS. — Shell small for the genus, colourless, transparent, with several brownish annular bands separated by three-four times as-wide interspaces. Protoconch unknown. Teleoconch tubular, slightly arched, dextrally twisted, with very fine rings. Early teleoconch conical. Adult shell slender, subcylindrical, flaring toward the aperture, then contracting and ending with a reflected lip. Septum almost flat without mucro, recessed below the cutting plane. Operculum and soft parts unknown. Adult shell length 1.8 mm.

REMARKS

This species is distinctive due to the subcylindrical twisted tube with bell-shaped aperture. The specimens recorded from PNG are very fresh and allowed to recognise the presence of a colour pattern in this species, never reported so far. In fact, this species is characterised by a colourless transparent shell with narrow brown annular bands separated by three or four times as-wide interspaces. Further knowledge on this species came from a juvenile specimen (Fig. 6C, D), showing a more twisted and more tapering tube. This species occurs in several IWP localities but was recorded always below 100 m depth, suggesting that its habitat occurs in the mesophotic-aphotic zone.

Caecum cf. *succineum* de Folin, 1880
(Fig. 6F)

MATERIAL EXAMINED. — Papua New Guinea • 1 sh; New Ireland; KAVIENG 2014 Stn DW4495; 2°24'S, 149°55'E; 272-274 m depth; 6.IX.2014; MNHN.

DESCRIPTION

Shell small for the genus, smooth. Protoconch unknown. Teleoconch tubular, arched, almost smooth. Early teleoconch unknown. Adult shell tubular, slender, subcylindrical, slightly dextrally twisted, smooth. No sculpture except for very fine rings in the abapical part. Aperture preceded by a rounded, varix-like swelling crossed by growth lines. Septum low dome shaped without mucro lying slightly below the cutting plane. Length 1.5 mm.

REMARKS

A single, worn specimen comparable to *C. succineum* was found. Attribution to de Folin's species is tentative due to the slenderer tube and the varix-like swelling before the aperture shown by this specimen. *Caecum succineum* is a widespread species occurring in the whole IWP (Vannozi 2023), but this species needs a revision in order to determine its range of variability.

Caecum neocaledonicum de Folin, 1868
(Fig. 6G, H)

Caecum neo-caledonicum de Folin, 1868a: 57, pl. 6, figs 1, 2.

Caecum neocaledonicum – Vannozi 2019b: 76, fig 7B and synonymy therein.

TYPE MATERIAL. — Lectotype. New Caledonia • sh; Nouméa; MNHN-IM-2000-24909.

Paralectotypes. New Caledonia • 22 sh; same data as for lectotype; MNHN-IM-2000-24910.

TYPE LOCALITY. — Pacific Ocean, New Caledonia, Nouméa.

MATERIAL EXAMINED. — Papua New Guinea • 1 sh (juv); New Ireland; 2°44'S, 150°35'E; 240-305 m depth; 3.IX.2014; KAVIENG 2014 Stn DW4463; MNHN • 2 sh (juv); New Ireland; 2°43'S, 150°36'E; 140-214 m depth; 3.IX.2014; KAVIENG 2014 Stn DW4464; MNHN • 1 sh; New Ireland; 2°45'S, 150°37'E; 163-358 m depth; 3.IX.2014; KAVIENG 2014 Stn DW4470; MNHN.

DISTRIBUTION. — The whole IWP, from the Red Sea and east coast of Africa to Japan and French Polynesia (Hasegawa 2000; Pizzini & Raines 2011; Pizzini *et al.* 2013; Vannozi 2017, 2019b, 2022b; Blatterer 2019).

DIAGNOSIS. — Shell small to large for the genus, white, solid but not very thick, wide. Protoconch planorbic, multispiral of 1.75 whorls. Teleoconch tubular, arched. Early teleoconch conical, then subcylindrical, smooth. Adult shell subcylindrical, with few strong rings close to the aperture. Septum protruding, dome-shaped with a clear marginal mucro rotated toward the right side. Microsculpture of conspicuous wavy longitudinal furrows. Periostracum light brownish. Operculum thick, flat. Animal described by Vannozi (2019b). Adult shell length in the range 1.5-4 mm, protoconch diameter 310 µm.

REMARKS

Caecum neocaledonicum is easily distinguished notwithstanding the variability shown during shell ontogeny by the relatively wide tube and the presence of the longitudinal microsculpture (Pizzini 1998). The few specimens examined from northeastern PNG are remarkable due to their small size. However, no other differences with respect to specimens from other IWP localities could be observed.

Caecum frugi Vannozi, 2019
(Fig. 6I, J)

Caecum frugi Vannozi, 2019b: 80, fig. 2V-Y.

TYPE MATERIAL. — Holotype. Papua New Guinea • sh; Kavieng Lagoon, W entrance to Nissel Passage; KAVIENG 2014 Stn KB02; 2°35.2'S, 150°46.2'E, 6 m depth; MNHN-IM-2000-34763.

TYPE LOCALITY. — Pacific Ocean, Papua New Guinea, Kavieng Lagoon, 2°35.2'S, 150°46.2'E, 6 m depth.

MATERIAL EXAMINED. — Papua New Guinea • 1 sh; New Ireland; KAVIENG 2014 Stn DW4412; 2°33'S, 150°40'E; 500-600 m depth; 27.VIII.2014; MNHN • 3 sh (juv); New Ireland; KAVIENG 2014 Stn CP4418; 2°27'S, 150°40'E; 335-340 m depth; 28.VIII.2014; MNHN.

DISTRIBUTION. — Known from northeastern PNG (Vannozi 2019b).

DIAGNOSIS. — Shell small for the genus, whitish, semitransparent. Protoconch unknown. Teleoconch tubular, arched, almost smooth. Early teleoconch cylindrical, arched, flaring toward the aperture. Adult shell cylindrical, smooth except for several hardly-visible rings in the abapical part. Abapical part slightly swollen, then contracted before the aperture, ending with a fine reflected lip. Septum dome-shaped, on the cutting plane, with a hardly visible mucro just above the cutting plane. Periostracum light brown, dull. Operculum and soft parts unknown. Adult shell length 1.4 mm.

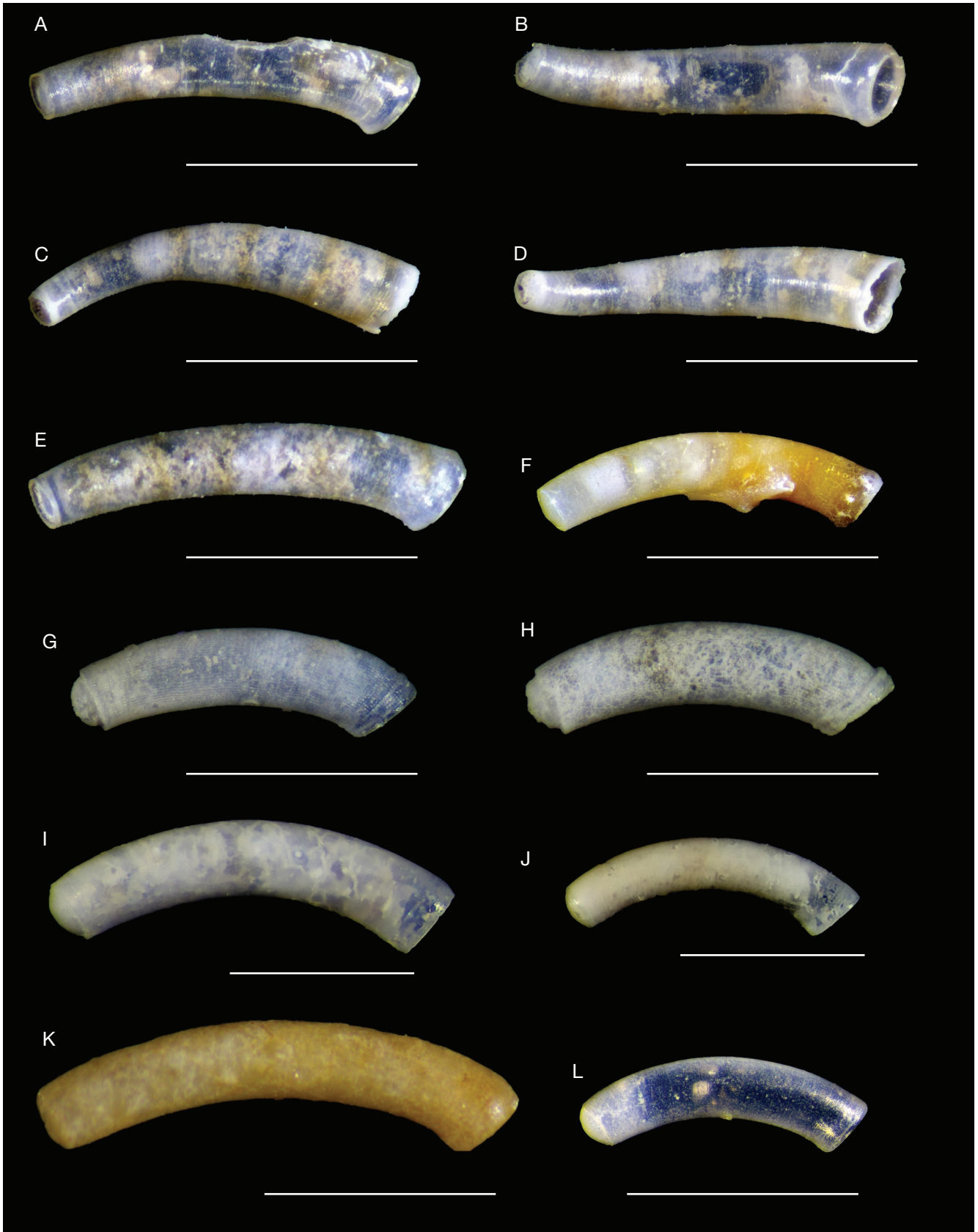


FIG. 6. — *Caecum* Fleming, 1813 species from deep-water stations from northeastern PNG: **A-D**, *C. dakuwaqa* Pizzini, Raines & Vannozi, 2013 from Stn DW4470 (**C**, **D**: juvenile); **E**, *C. dakuwaqa* from Stn DW4463; **F**, *C. cf. succineum* from Stn DW4495; **G**, *C. neocaledonicum* de Folin, 1868 from Stn DW4470; **H**, *C. neocaledonicum* from Stn DW4464; **I**, *C. frugi* Vannozi, 2019 from Stn DW4412; **J**, *C. frugi* juv. from Stn CP4418; **K**, *C. neoguineanum* Vannozi, 2019 from Stn DW4495; **L**, *C. sp.* from Stn DW4465 [MNHN-IM-2022-2399](#). Scale bars: A-H, K, L, 1 mm; I, J, 0.5 mm.

REMARKS

Caecum frugi was described on a single specimen, hence its variability is unknown. Among the examined material, we found a specimen well fitting the holotype, although the annulation in the abapical part is hardly visible (Fig. 6I). Three juveniles were found together with *C. miliarium* n. sp. and, due to the very small tube diameter and the compatible septum shape, likely belong to *C. frugi* (Fig. 6J).

Caecum neoguineanum Vannozi, 2019
(Fig. 6K)

Caecum neoguineanum Vannozi, 2019b: 87, fig. 5A-J.

TYPE MATERIAL. — **Holotype.** Papua New Guinea • sh; S Sek Island; 5°07.0'S, 145°49.4'E, 17 m depth; MNHN-IM-2000-34766. **Paratypes.** Papua New Guinea • 1 sh; same data as for holotype; MNHN-IM-2000-34767 • 1 sh; W Kranket Island, dredged; 5°11.7'S, 145°48.8'E; 16-28 m depth; MNHN-IM-2000-34768.

TYPE LOCALITY. — Pacific Ocean, Papua New Guinea, South of Sek Island, 5°07.0'S, 145°49.4'E, 17 m depth.

MATERIAL EXAMINED. — Papua New Guinea • 1 sh; New Ireland; 2°24'S, 49°55'E; 272-274 m depth; 6.IX.2014; KAVIENG 2014 Stn DW4495; MNHN.

DISTRIBUTION. — Known from northeastern PNG (Vannozi 2019b).

DIAGNOSIS. — Shell of average size for the genus, whitish, slightly glossy. Protoconch unknown. Teleoconch tubular, slightly arched, smooth. Early teleoconch subcylindrical, slightly arched, tapering toward the apex. Adult shell cylindrical, slender, slightly arched. Tube slightly inflated before the aperture, which is simple, slightly contracted and inclined, lip not reflected, sharp. No microsculpture. Septum low dome shaped without mucro, recessed below the cutting plane. Operculum and soft parts unknown. Adult shell length c. 2 mm.

REMARKS

A single worn specimen was found in the examined material, well fitting the holotype. The most similar species is *C. japonicum* due to the low dome-shaped septum without mucro and contracted aperture. However, *C. neoguineanum* is slenderer and more cylindrical and shows a characteristic inflated aperture.

Caecum sp.
(Fig. 6L)

MATERIAL EXAMINED. — Papua New Guinea • 1 sh; New Ireland; KAVIENG 2014 Stn DW4465; 2°43'S, 150°36'E; 90-228 m depth; 3.IX.2014; MNHN-IM-2022-2399.

DESCRIPTION

Shell small for the genus, colourless, semitransparent. Tube subcylindrical, smooth, tapering toward the apex, slightly flaring toward the aperture. Sculpture none detected. Microsculpture of only fine growth lines. Aperture simple, contracted after a slight swelling. Septum on the cutting

plane, dome shaped, asymmetric, without visible mucro. Protoconch, early stages, operculum and soft parts unknown. Length 1.25 mm.

REMARKS

This single specimen could not be classified according to any known species. Although it is rather fresh and likely adult, the lack of striking characters suggests us to wait for additional material in order to clarify its identity.

Caecum lozoueti n. sp.
(Fig. 7D-I)

[urn:lsid:zoobank.org:act:E0AE9D31-298F-4E9F-9C16-F66A66E51CBE](https://zoobank.org/urn:lsid:zoobank.org:act:E0AE9D31-298F-4E9F-9C16-F66A66E51CBE)

Caecum cf. *glabellum* Carpenter in Adams, 1868: 365. — Pizzini *et al.* 2013: 24-25, fig. 11N-P.

TYPE MATERIAL. — **Holotype.** Loyalty • lv (length 1.77 mm, Fig. 7F-I); Baie du Santal, récif Shelter, LIFOU 2000 Stn 1432; 20°53.5'S, 167°02.7'E; 12-32 m depth; 21.IX.2000; MNHN-IM-2012-37972. **Paratype.** Loyalty • 1 sh; Lifou, Santal Bay, in front of Peng, LIFOU 2000 Stn 1412; 20°54.2'S, 167°07.4'E; 2-5 m depth; 14.XI.2000; MNHN-IM-2012-37974.

TYPE LOCALITY. — Pacific Ocean, Loyalty, Baie du Santal, Récif Shelter; 20°53.5'S, 167°02.7'E; 12-32 m depth.

OTHER MATERIAL EXAMINED. — Papua New Guinea • 1 sh; Sek Island; PAPUA NIUGINI Stn CP3957; 5°05'S, 145°51'E; 452-504 m depth; 28.XI.2012; MNHN-IM-2022-2398.

DISTRIBUTION. — Known from northeastern PNG and Loyalty (Pizzini *et al.* 2013).

ETYMOLOGY. — The species is dedicated to Pierre Lozouet (MNHN) for his prompt help provided with the samples of this species preserved in the MNHN.

DESCRIPTION

Shell small for the genus, colourless, semitransparent. Protoconch unknown. Teleoconch tubular, arched, almost smooth. Early teleoconch unknown. Adult shell subcylindrical, with coarse longitudinal striation. Microsculpture of fine, worm-like grooves, visible close to the aperture. Aperture without a clear swelling, ending in a fine reflected lip. Septum low dome-shaped without mucro, smooth, slightly recessed below the cutting plane. Periostracum thick, opaque, showing a longitudinal striation. Operculum circular, thin, flat. Soft parts unknown. Holotype: length 1.77 mm, max diam 0.36 mm, min diam 0.29 mm.

REMARKS

This small species was tentatively classified as *Caecum glabellum* by Pizzini *et al.* (2013) due to the small size and the simple, dome-shaped septum. However, the presence of a coarse longitudinal striation and of a worm-like microsculpture as well, excludes the possibility that it might represent *Caecum glabellum*, which is today considered as a *nomen dubium* due to the lack of type material and of Japanese specimens fitting Carpenter's description (Vannozi 2022a).

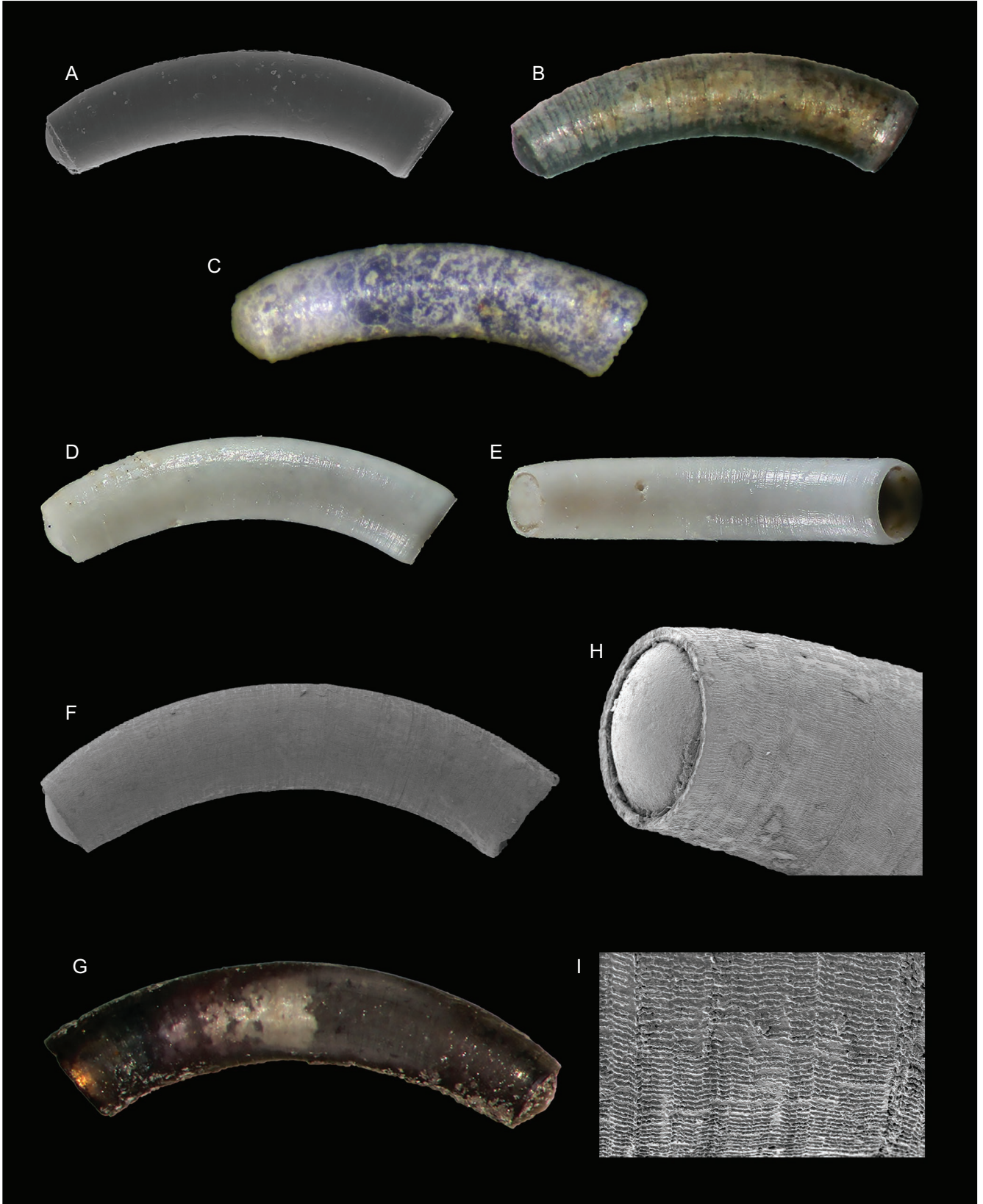


FIG. 7. — *Caecum* Fleming, 1813 new species: **A-C**, *Caecum temporale* n. sp.: **A, B**, holotype MNHN-IM-2012-37957; **C**, specimen from Stn DW4464 MNHN-IM-2000-38950; **D-I**, *Caecum lozoueti* n. sp.: **D, E**, specimen from Stn CP3957 MNHN-IM-2022-2398; **F-I**, holotype MNHN-IM-2012-37972. Scale bars: A, B, D-G, 1 mm; C, 0.5 mm, details not to scale. Image courtesy of D. Geiger (A), M. Hennion (B, G) and A. Le Goff (F, H, I).

The finding of a further specimen from PNG let us recognise the characters of this species. However, the specimens from Loyalty, already in the MNHN collection, were preferred as type specimens due to the better condition.

Caecum crystallinum de Folin, 1880, described from Hawaii from a single fragmentary specimen without apex, shows a similar microsculpture. However, in this species the tube is slenderer and expands before the aperture. Study of Hawaiian topotypical specimens is necessary in order to determine the actual shape of the septum in de Folin's species.

The new species superficially resembles *Caecum succineum* due to the small size and the low dome-shaped septum without mucro. However, *C. succineum* shows a few rings and a small but clear swelling before the aperture. Furthermore, it shows a completely different microsculpture, i.e., collabral rather than longitudinal.

Caecum temporale n. sp.
(Fig. 7A-C)

[urn:lsid:zoobank.org:act:AE3D8F94-B452-4EFC-8CE7-6F3D1FEA47D3](https://doi.org/10.21203/rs.3.rs-3111111/v1)

Caecum cf. *campanulatum* Raines & Pizzini, 2005. — Pizzini *et al.* 2013: 21, fig. 11B.

TYPE MATERIAL. — **Holotype.** Fiji • lv (length 1.26 mm, Fig. 7A, B); S Viti Levu, MUSORSTOM 10 Stn DW1381; 18°18'S, 177°54'E; 275-430 m depth; 18.VIII.1998; MNHN-IM-2012-37957.

TYPE LOCALITY. — Pacific Ocean, Fiji, S Viti Levu, 18°18'S, 177°54'E, 275-430 m depth.

OTHER MATERIAL EXAMINED. — **Papua New Guinea** • 1 sh; New Ireland; KAVIENG 2014 Stn DW4464; 2°43'S, 150°36'E; 140-214 m depth; 3.IX.2014; MNHN-IM-2000-38950.

DISTRIBUTION. — Known from northeastern PNG and Fiji (Pizzini *et al.* 2013).

ETYMOLOGY. — From Latin *temporalis* (temporary) due to the presence of obvious remains of the temporary septum in all examined specimens.

DESCRIPTION

Shell small for the genus, colourless, semitransparent. Protoconch unknown. Teleoconch tubular, arched, almost smooth. Early teleoconch unknown. Adult shell subcylindrical, smooth, tapering toward the apex. Sculpture of distinct but not prominent irregular rings throughout the tube. Microsculpture of only irregular growth lines. Aperture preceded by a minute but clear swelling, ending with a reflected lip. Septum dome-shaped without mucro, on the cutting plane. Remains of the temporary septum visible. Operculum circular, thin, flat. Soft parts unknown. Holotype: length 1.27 mm, max diam 0.27 mm, min diam 0.20 mm.

REMARKS

This very small elusive species is known from a couple of specimens only but could not be classified according to any known species. It was known from a single specimen, tenta-

tively classified as *C. campanulatum* Raines & Pizzini, 2005, endemic to Easter Island (Pizzini *et al.* 2013). The finding of a further specimen from PNG convinced us about the identity of this species. However, the specimen from Fiji, already in the MNHN collection, was preferred as holotype due to the better condition.

Caecum temporale n. sp. is distinctive due to the persistence of the temporary septum, which disguises its actual shape and makes the septum show an irregular appearance.

The new species can be compared with *Caecum succineum* and *C. bathus* Pizzini, Raines & Vannozi, 2013, both of them showing a substantially smooth tube and a simple, low dome-shaped septum. The former differs due to the presence of few coarse rings preceding the aperture and the regular annular microsculpture (Pizzini *et al.* 2013: fig. 12C). The latter has a similar general aspect but shows a longitudinal worm-like microsculpture.

Caecum temporale n. sp. can also be compared with *C. lozoueti* n. sp. due to the general aspect and the simple dome-shaped septum without mucro. However, *C. temporale* n. sp. shows a slight but well-defined swelling before the aperture and lacks both the longitudinal striation and the worm-like microsculpture observed in *C. lozoueti* n. sp.

Genus *Mauroceras* Vannozi, 2019

TYPE SPECIES. — *Meioceras kajiyamai* Habe, 1963 by original designation (Vannozi 2019a).

Mauroceras kajiyamai (Habe, 1963)
(Fig. 8A-C)

Meioceras kajiyamai Habe, 1963: 235, fig. 5.

Mauroceras kajiyamai – Vannozi 2023: 431, and synonymy therein.

TYPE MATERIAL. — **Holotype.** Japan • sh; Ankyaba, Kakeroma Jima, near Amami-Oshima; NMST.

TYPE LOCALITY. — Pacific Ocean, Japan, Ankyaba, Kakeroma Jima, an isle near Amami-Oshima.

MATERIAL EXAMINED. — **Papua New Guinea** • 2 sh (1 juv); Vitu Islands; 4°37'S, 149°27'E; 615-647 m depth; 27.IX.2010; BIOPAPUA Stn DW3680; MNHN • 1 sh; New Ireland; 2°43'S, 150°36'E; 90-228 m depth; 3.IX.2014; KAVIENG 2014 Stn DW4465; MNHN.

DISTRIBUTION. — The whole IWP, from the eastern coast of Africa to Maldives, Philippines, PNG, Japan, New Caledonia (Habe 1963; Hasegawa 2000; Pizzini *et al.* 2013; Vannozi 2017, 2019a, b, 2023, unpublished data).

DIAGNOSIS. — Shell of average size for the genus, colourless, semi-transparent, glossy. Protoconch planorbic, smooth, of 1.75 whorls, ending with thickened sinusigera lip. Teleoconch openly coiled, tubular. Early teleoconch rapidly growing forming an open spiral like a cow's horn, with sharp uniform rings becoming flat and hardly visible apically. Adult shell subcylindrical, tapering toward both the apex and the aperture. Maximum width located apically at about ¼ of the length. Septum recessed below the cutting plane,

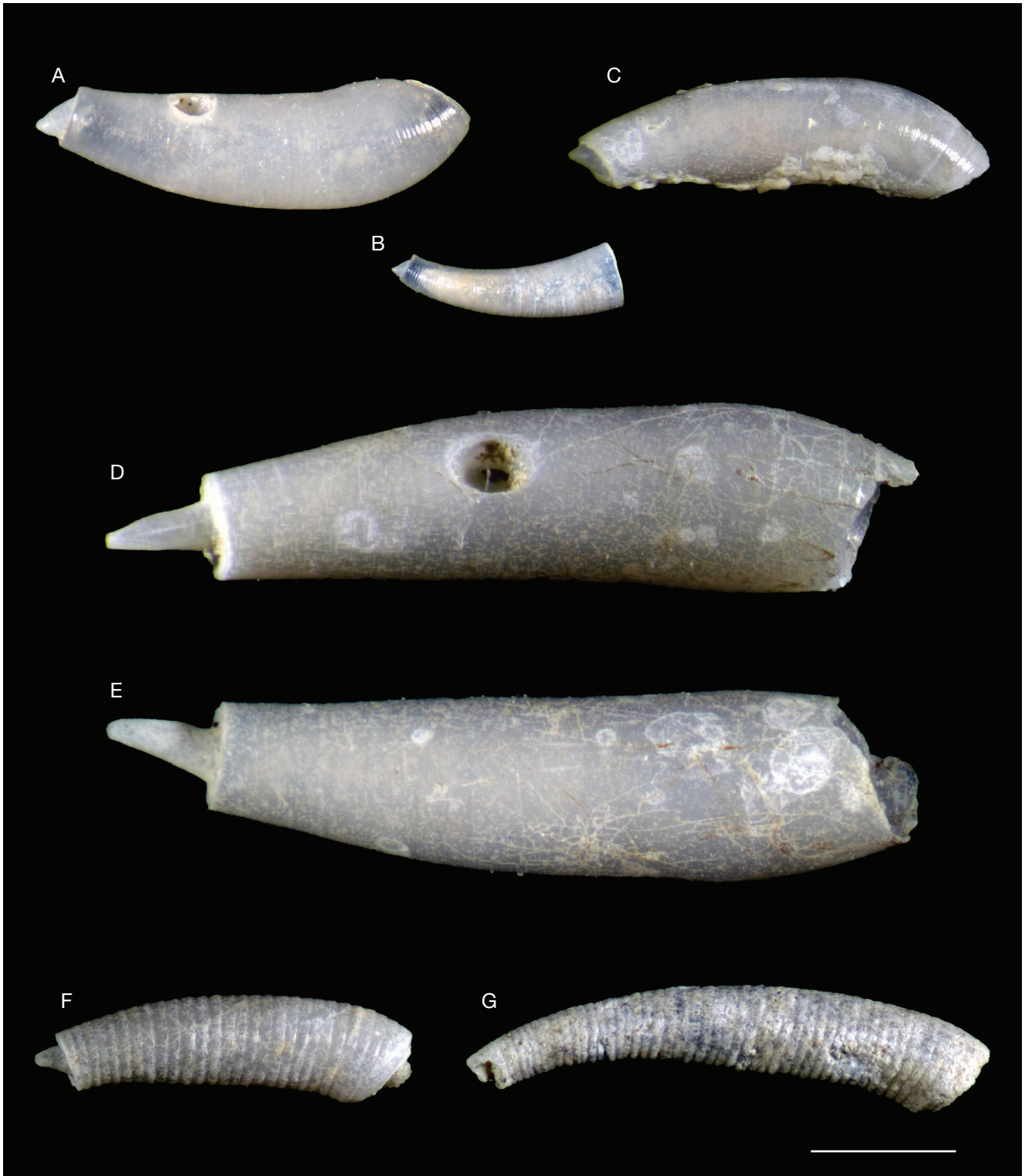


FIG. 8. — *Mauroceras* Vannozzi, 2019 species from deep-water stations from northeastern PNG: **A, B**, *M. kajiyamai* (Habe, 1963) from Stn CP3680 (**B**, juvenile); **C**, *M. kajiyamai* from Stn DW4465; **D, E**, *M. rhinoceros* (Pizzini, Raines & Vannozzi, 2013) from Stn DW4470; **F, G**, *M. serratum* (Vannozzi, 2017) from Stn DW4465 (**G**, growth stage). Scale bar: 1 mm.

with a strong mucro, showing a straight dorsal side and a sloping, slightly convex ventral side. Aperture simple with reflected lip. Operculum and soft parts unknown. Adult shell length *c.* 3 mm, protoconch size 300 μ m.

REMARKS

This species is widespread and shows little variability. The specimens from PNG show no differences with respect to specimens from other IWP localities.

Mauroceras rhinoceros
(Pizzini, Raines & Vannozi, 2013)
(Fig. 8D, E)

Meioceras rhinoceros Pizzini *et al.* 2013: 42, fig. 16A-C.

Mauroceras rhinoceros – Vannozi 2019b: 91, and synonymy therein.

TYPE MATERIAL. — **Holotype.** Loyalty • sh; Lifou, Baie de Santal, NE of the Bay, level of Cila, 25-30 m depth; MNHN-IM-2000-24880. **Paratypes.** Loyalty • 1 sh; same data as for holotype; MNHN-IM-2000-24881.

Papua New Guinea • 2 sh; New Britain, Rabaul, 4°12'S, 152°11'E; AMS C044117-n. 003958B.

Indonesia • 1 sh; N Sulawesi, off Menado, S side of Bunaken and Siladen; 1°36.2'N, 124°46'E; 5-20 m depth; LACM 88-55 • 1 sh; Gulf of Tomini, Kep. Togian, Batudaka Is., 12-17 m depth; coll. IK.

TYPE LOCALITY. — Pacific Ocean, Loyalty, Lifou, Baie de Santal, NE of the Bay, level of Cila, 25-30 m depth.

MATERIAL EXAMINED. — **Papua New Guinea** • 1 sh; New Ireland; 2°45'S, 150°37'E; 163-358 m depth; 3.IX.2014; KAVIENG 2014 Stn DW4470; MNHN.

DISTRIBUTION. — Indonesia, North Sulawesi, Philippines, north-eastern PNG (Pizzini *et al.* 2013; Vannozi 2017, 2019a, b, unpublished data).

DIAGNOSIS. — Shell very large for the genus, whitish, glossy. Protoconch planorbid, smooth, of 1.75 whorls, ending with thickened sinusigera lip. Teleoconch almost straight, tubular. Early teleoconch conical, rapidly growing, with hardly visible annular sculpture. Adult shell subcylindrical, tapering toward both the apex and the aperture. Maximum width located adapically at about ¼ of the length. Septum recessed below the cutting plane, with a strong hook-like mucro projecting well beyond the cutting plane. Aperture oblique, simple with reflected lip. Operculum and soft parts unknown. Adult shell length *c.* 6 mm, protoconch size 280 µm.

REMARKS

This huge species can be considered as the giant of the family. Due to its peculiar characters and the large size, it is easily identified.

Mauroceras serratum (Vannozi, 2017)
(Fig. 8F, G)

Meioceras serratum Vannozi, 2017: 136, fig. 3F-N.

Mauroceras serratum – Vannozi 2019b: 90.

TYPE MATERIAL. — **Holotype.** Philippines • sh; Bohol, Maribohoc Bay, depth 85-110 m; MNHN-IM-2000-33080.

Paratypes. Philippines • 1 sh juv; same data as for holotype; MNHN-IM-2000-33081 • 1sh; Panglao, off Momo Beach, 85 m depth; MNHN-IM-2000-33082.

TYPE LOCALITY. — Philippines, Bohol Island, Maribohoc Bay, depth 85-110 m.

MATERIAL EXAMINED. — **Papua New Guinea** • 2 sh (1 gs); New Ireland; KAVIENG 2014 Stn DW4465; 2°43'S, 150°36'E; 90-228 m depth; 3.IX.2014; MNHN • 1 sh; New Ireland; KAVIENG 2014 Stn DW4487; 2°25'S, 149°59'E; 130-153 m depth; 6.IX.2014; MNHN.

DISTRIBUTION. — Sulawesi, Philippines, PNG, Society, Marshall (Vannozi 2017, 2019a, b, unpublished data).

DIAGNOSIS. — Shell of average size for the genus, colourless, transparent, glossy. Protoconch unknown. Teleoconch tubular, with strong, flat and wide rings. Early teleoconch conical, slightly twisted. Adult shell subcylindrical, tapering toward both the apex. Aperture simple, inclined, slantwise cutting the last two rings and ending with a reflected lip. Surface smooth with growth lines only. Septum on the cutting plane with a strong pointed mucro, rounded in ventral view. Operculum and soft parts unknown. Adult shell length *c.* 2.5 mm.

REMARKS

A few, very worn shells were found. Among them, a growth stage with juvenile part still attached was recovered (Fig. 8G).

Subfamily CTILO CERATINAE Iredale & Laseron, 1957

Genus *Parastrophia* de Folin, 1869

TYPE SPECIES. — *Moreletia cornucopiae* de Folin, 1869 by original designation (de Folin 1869: 174).

Parastrophia megadattilida
Pizzini, Raines & Vannozi, 2013
(Fig. 9A-C)

Parastrophia megadattilida Pizzini, Raines & Vannozi, 2013: 47, figs 17F-I. — Vannozi 2019b: 96 and synonymy therein.

TYPE MATERIAL. — **Holotype.** Vanuatu • lv; W Tutuba, SANTO 2006 Stn DS103; 15°34.1'S, 167°16.0'E; 10-80 m depth; 14.X.2006; MNHN-IM-2000-24894.

Paratypes. Vanuatu • 1sh; same data as for holotype; MNHN-IM-2000-24895 • 3 sh; same data as for holotype; Stn DS 99; 100-105 m depth; MNHN-IM-2000-24896 • 1 sh; same data; DS 104; 80 m depth; MNHN-IM-2000-24897.

Fiji • 1 sh; Fiji Islands; MUSORSTOM 10; Std DS 1333; 200-215 m depth; 1998; MNHN-IM-2000-24898 • 2 sh; same data; Stn DS 1334; 251-257 m depth; MNHN-IM-2000-24899 • 1 sh; same data; Stn DS 1381; 275-430 m depth; MNHN-IM-2000-24548.

TYPE LOCALITY. — Pacific Ocean, Vanuatu, W Tutuba, 15°34.1'S, 167°16.0'E, 70-80 m depth.

MATERIAL EXAMINED. — **Papua New Guinea** • 4 sh; New Ireland; KAVIENG 2014 Stn DW4463; 2°44'S, 150°35'E; 240-305 m depth; 3.IX.2014; MNHN • 1 sh; New Ireland; KAVIENG 2014 Stn DW4464; 2°43'S, 150°36'E; 140-214 m depth; 3.IX.2014; MNHN • 1 sh; New Ireland; KAVIENG 2014 Stn DW4470; 2°45'S, 150°37'E; 163-358 m depth; 3.IX.2014; MNHN.

DISTRIBUTION. — Philippines, north-eastern PNG, Vanuatu, Fiji (Bandel 1996, Pizzini *et al.* 2013, Vannozi 2017, 2019b).

DIAGNOSIS. — Shell of average size for the genus, slender, whitish. Coiled protoconch of 0.75 whorls, uncoiled protoconch slender, straight, ending with a strong varix. Varix with a squarish profile crossed by longitudinal cordlets. Teleoconch slowly growing, with a sculpture of regular strong rings. Aperture surrounded by a strong varix. Multiple varices occur. Microsculpture of fine longitudinal cordlets surmounting the rings. Animal described by Vannozi (2019b). Adult shell length *c.* 3.5 mm.

REMARKS

A few worn specimens occurred in the studied material, one of them with preserved coiled protoconch. No differences were observed with respect to specimens from other IWP localities.



FIG. 9. — *Parastrophia* de Folin, 1869 species from deep-water stations from northeastern PNG: **A-C**, *P. megadattilida* Pizzini, Raines & Vannozzi, 2013 from Stn DW4463; **D, E**, *P. cf. ivani* Vannozzi, 2017 from Stn DW4470 (**D**) and Stn DW4487 (**E**). Scale bar: 1 mm.

Parastrophia cf. *ivani*

Vannozi, 2017

(Fig. 9D, E)

MATERIAL EXAMINED. — Papua New Guinea • 1 sh; New Ireland; KAVIENG 2014 Stn DW4470; 2°45'S, 150°37'E; 163-358 m depth; 3.IX.2014; MNHN • 1 sh; New Ireland; KAVIENG 2014 Stn DW4487; 2°25'S, 149°59'E; 130-153 m depth; 6.IX.2014; MNHN.

DESCRIPTION

Shell small for the genus, colourless, semitransparent. Coiled protoconch small of 0.75 whorls. Uncoiled protoconch conical, slightly curved, ending with a clear varix showing a crenulated edge. Teleoconch conical, virtually smooth, gradually growing, showing a few hardly-visible rings both apically and abapically. Microsculpture of fine growth lines. Hardly visible longitudinal cordlets occur in the early teleoconch. Aperture simple, slightly dilated and then contracted. Length *c.* 2.8 mm.

REMARKS

Two specimens, none of them in good condition, were examined. Attribution is tentative due to slight differences with respect to specimens of *Parastrophia ivani* examined from other localities.

DISCUSSION

Examination of deep-water samples from northeastern Papua New Guinea provided a good number of caecid species (20), belonging to the genera *Caecum* (15), *Mauroceras* (three) and *Parastrophia* (two). Five of them, all belonging to the genus *Caecum*, were recognized as new to science. Another species, *C. dakuwaga*, not recorded in shallow-water stations previously studied (Vannozi 2019b) led to an increase of the number of Caecidae known from this region to 43 species. A further single specimen remained unidentified, and may likely belong to an undescribed species.

The occurrence of a low number of specimens from deep-water stations was not unexpected because the Caecidae are commonly described as shallow-water dwellers, feeding on diatoms among sand grains (Moore 1961; Morton 1975; Bandel 1996). However, this picture needs to be partly re-evaluated. In fact, while the occurrence of several specimens in poor condition belonging to, e.g., *Caecum sepimentum* or *Mauroceras serratum*, suggests their downslope drift from shallow-water biotopes after death, the abundance of fresh shells of *C. miliarium* n. sp., as well as the finding of *C. dakuwaga*, a species always recorded in deep-water stations, with preserved colour pattern, indicate that other habitat preferences within this family might occur. It may be hypothesised that some caecids adapted to the mesophotic and aphotic zones as detritivores.

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