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Reflexion sur la recherche :

"Voudriez-vous me dire, s'il vous plaît, par où je dois m'en aller d'ici ?"
"Cela dépend beaucoup de l'endroit où tu veux aller," dit le chat
"Peu importe l'endroit"...dit Alice
"En ce cas, peu importe la route que tu prendras."
"...pourvu que j'arrive quelque part", ajouta Alice en guise d'explication.
"Oh, tu n'en manquera pas d'arriver quelque part," dit le chat, si tu marches assez longtemps"

'Would you tell me, please, which way I ought to go from here?'
'That depends a good deal on where you want to get to,' said the Cat.
'I don't much care where -' said Alice.
'Then it doesn't matter which way you go,' said the Cat.
'- so long as I get somewhere,' Alice added as an explanation.
'Oh, you're sure to do that,' said the Cat, 'if you only walk long enough.'

Lewis Carroll, Alice in Wonderland

Guidelines

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These descriptions will be sent to the Editor of *Xenophora* (redaction@xenophora.org) in English (with an abstract or introduction in French). The illustrations must be provided in high definition, on CD or other digital media. Colour pictures are preferred. Captions of the figures and plates must be provided with the references to the pictures. Texts shall be provided in *.doc, *.txt or *.rtf format, while the photos must be in jpg format with 300 dpi resolution. The pictures submitted can be used by *AFC-Xenophora* for any of its publication, magazine or its web-site.

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**Revision of the *Pionoconus magus* species complex (Gastropoda: Conidae).
Description of six new species from the *Pionoconus magus* complex:
P. hervillardi from Vanuatu,
P. samaraiensis and *P. manusensis* from P.N.G.,
P. vitilevuensis from Fiji Isl.,
P. kwajaleinensis from Marshall Isl.
and *P. niasensis* from West Sumatra and Nicobar Islands.**

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ABSTRACT

All synonyms of *Pionoconus magus* are revised to assess today's situation of the various species described over time, including a point on *P. magus* conotoxins and a brief review of the phylogenetic tree.

Six new species of *Pionoconus* of this species complex from the Tropical Western Pacific and Eastern Indian Oceans are described. *Pionoconus hervillardi* sp. nov. from Vanuatu is compared with *P. robini* Limpalaër & Monnier, 2012, *P. fischoederi* (Röckel & da Motta, 1983) and *P. morrisoni* (G. Raybaudi Massilia, 1991). *Pionoconus samaraiensis* sp. nov. from the Solomon Sea, Southeast of Papua New Guinea is compared with *P. epistomium* (Reeve, 1844), *P. carinatus* (Swainson, 1822) and *P. aff. carinatus*. *Pionoconus manusensis* sp. nov. from the Bismarck Sea, East of Papua New Guinea is compared with *P. raphanus* (Hwass in Bruguière, 1792), *P. carinatus* (Swainson, 1822) and *P. aff. carinatus*. *Pionoconus vitilevuensis* sp. nov. primarily from Fiji Archipelago and *Pionoconus kwajaleinensis* sp. nov. from Marshall Islands are both compared with *P. magus* (Linnaeus, 1758) and *P. alexisallaryi* Cossignani, 2018. Finally, *Pionoconus niasensis* sp. nov. from West Sumatra and Nicobar Islands is compared with *Pionoconus vitilevuensis* sp. nov. and *Calibanus furvus* f. *frauenfeldi* (Crosse, 1865) with which it is confused in the literature.

To ensure better reading, the morphometrics graphs have been replicated in annex 2.

RÉSUMÉ

Les synonymes de *Pionoconus magus* sont révisés en détail pour comprendre leur situation actuelle. Un point est fait sur les conotoxines du complexe d'espèces *Pionoconus magus* ainsi que sur la situation de l'arbre phylogénétique. Six nouvelles espèces de *Pionoconus* de l'Ouest de l'Océan Pacifique et de l'Est de l'Océan Indien tropicaux sont décrites.

Pionoconus hervillardi sp. nov. du Vanuatu est comparé à *P. robini* Limpalaër & Monnier, 2012, *P. fischoederi* (Röckel & da Motta, 1983) et avec *P. morrisoni* (G. Raybaudi Massilia, 1991). *Pionoconus samaraiensis* sp. nov. de la Mer des Salomon, Sud-Est de la Papouasie Nouvelle-Guinée est comparé à *P. epistomium* (Reeve, 1844), *P. carinatus* (Swainson, 1822) et *P. aff. carinatus*. *Pionoconus manusensis* sp. nov. de la Mer de Bismarck, Est de la Papouasie Nouvelle Guinée, est comparé à *P. raphanus* (Hwass in Bruguière, 1792), *P. carinatus* (Swainson, 1822) et à *P. aff. carinatus*. *Pionoconus vitilevuensis* sp. nov. provenant principalement de l'Archipel des Fidji et *Pionoconus kwajaleinensis* sp. nov. des îles Marshall sont comparés à *P. magus* (Linnaeus, 1758) et à *P. alexisallaryi* Cossignani, 2018. Enfin, *Pionoconus niasensis* sp. nov. de l'Ouest de Sumatra et des Iles Nicobar est comparé à *Calibanus furvus* f. *frauenfeldi* (Crosse, 1865) avec lequel il est confondu dans la littérature et à *Pionoconus vitilevuensis* sp. nov.

Pour assurer une meilleure lecture de ceux-ci les graphes morphométriques ont été répliqués en annexe 2.

Part 1: Introduction and Revision of the complex *Pionoconus magus* (Linnaeus, 1758).

Attempting to do any research around *Pionoconus magus* and naming it a “complex” is a euphemism for most seashell collectors or museum curators. The shell bears its true name: “The magician cone”. The infinite variations of colours and shapes combined with the many names made available over the years pose a challenge that, we believe, needed to be taken.

The complex of species that is often lumped with *Pionoconus magus* (e.g., Röckel, Korn & Kohn, 1995 and Walls, 1979) is still only partly understood. As presented by those authors *Pionoconus magus* has a wide geographical range from Sumatra to Fiji and from Southern Japan to New Caledonia. It also has a wide array of shapes from conical to conoid, cylindrical, etc. and a considerable range of patterns and colours. On the other hand, the species is known to have some of the biggest eggs among Indo-Pacific Conidae species (Kohn & Perron, 1994) and it is deduced from this that the species has a direct development. Another conclusion of Kohn and Perron was that species with direct development tended to have smaller geographic ranges. There appears to be a possible contradiction between the taxonomic conclusion of a unique species with a wide geographical range in the “*Pionoconus magus*” complex and the observations from eggs, shell shapes and patterns that point to several more or less cryptic species. Many authors have considered the existence of several species. Da Motta wrote a detailed review in “World Shells” in which various species are validated. In “Philippines Marine Mollusks” volume II (2008) Gabriella Raybaudi Massilia considers that “*C. magus* is suspected to include a complex of species” and recognizes 4 species from the Philippines:

- *C. magus* Linnaeus, 1758,
- *C. assimilis* A. Adams, 1854,
- *C. carinatus* Swainson, 1822,
- *C. metcalfei* Reeve, 1843.

The first and third authors of this work together with Robin and Roux (2018) presented a first and accordingly preliminary attempt to sort the species that compose it. The book contained several unnamed species related to the complex. One of these was named by Cossignani (2018) as *Pionoconus alexisallaryi*. Here, we deal with the other and add more that appeared to need names while the authors were conducting their research with more material at hand.

A first step before the description of new species is to assess the identity and the status of the taxa that have been referred to *Pionoconus magus*.

A. Identity and Status of *Pionoconus magus* (Linnaeus, 1758)

1. Original Description

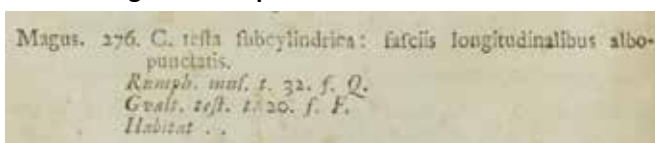


Figure 1. original description of *P. magus*, (Linnaeus, 1758) *Systema Naturae per regna tria naturae*, Ed. 10 Vol.1 P. 824.

In the brief original description, “*C. subcylindrical shell: longitudinal bands dotted with white*” Linnaeus refers to 2 figures, the first one from Rumphius (1705) and the second one from Gualtieri (1742). The text is as short as it is inadequate: it may apply to several species of cones.

However, in many cases, the identity of the species meant by Linnaeus is clarified through the figures cited with the diagnose. Unfortunately it is not the case here.

The specimen of Rumphius is most likely to be *C. augur* “Solander” Humphrey, 1786 as Hanley (1855) stated. Hence the African locality used by many authors over the years. Rumphius names his shell as “*Voluta Maculosa*”. We can note that this figure has no longitudinal bands and that *Rolaniconus augur* is not known to be dotted with white.

The figure disagrees with the text of the diagnose. It therefore cannot be used to establish the identity of *Pionoconus magus*.

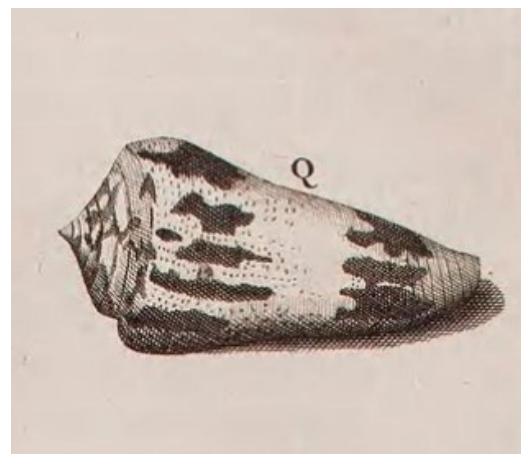


Figure 2. Rumphius' figure, 1st edition, pl. 32. Fig. Q.

The engraving from Gualtieri shows a shell that was considered by Dodge, (1953) to most likely represent *Conus aurantius* Hwass in Bruguiere, 1792. The examination of the figure does not show any tubercles at shoulder and this dismisses Dodge's opinion. Gualtieri's figure could indeed belong to some members of the “*Pionoconus magus* complex” but it is too poor to be attributed firmly to a precise taxon.

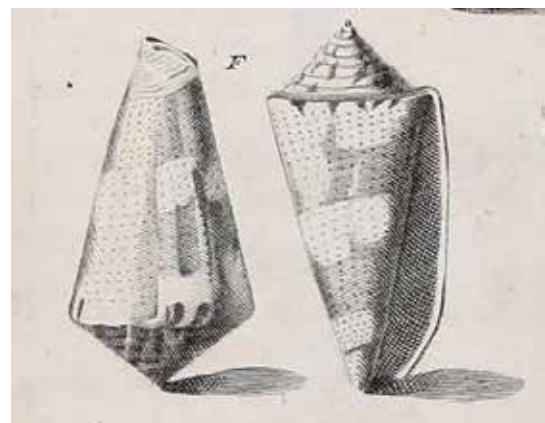


Figure 3. Gualtieri's figure, pl. 20. Fig F.

The identity of *Pionoconus magus* cannot therefore be ascertained with the indications of the 10th edition of *Systema Naturae*. More conclusive informations are needed.

In the 12th edition (1767) a supplementary figure from Seba's plate 44 is inserted by Linnaeus.

Obviously, this figure is not representative of *Pionoconus magus*. Dodge hypothesizes that there may have been a confusion with figure 30 (that looks like *Pionoconus achatinus*). In fact, other figures from the same plate (such as 12 and 29) could also match with *P. magus*.

In any case, it does not help to understand which concept of species Linnaeus had in mind.

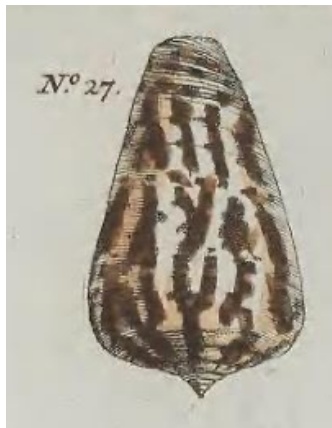


Figure 4. Seba's figure pl. XLIV Fig. 27.

2. Linnaeus complementary description

In "Museum Ulricae" Linnaeus gives a more detailed description: "shell less ovate, oblong, less tightly coiled, the base especially internally striated-scaly" "Colour whitish with longitudinal bands of brown scales; the shell is sometimes surrounded by a single obsolete band in the middle; in addition, sprinkled with very small white or gray dots". He also invites the reader to avoid confusion with his *Conus striatus*. This complementary description is much more informative but not yet enough. Linnaeus also gives new references to figures of previous authors. He refers to Rumphius again but alters the original representation from plate 32. Fig. Q to plate 34 Fig. A representing *C. aurisiacus*, Linnaeus, 1758. Linnaeus also added Argenville plate 15 figure H., this shell being *C. ammiralis* « Le vice-amiral ».

As stated by other authors (Hanley, 1855; Dodge, 1953) these figures are of unrelated species. It seems that Linnaeus tried to find the best possible illustrations for his concept. But his efforts were fruitless.



Figure 5. Rumphius' figure, 1st edition pl. 34. Fig. A.



Figure 6. D'Argenville pl.15 Fig. H.

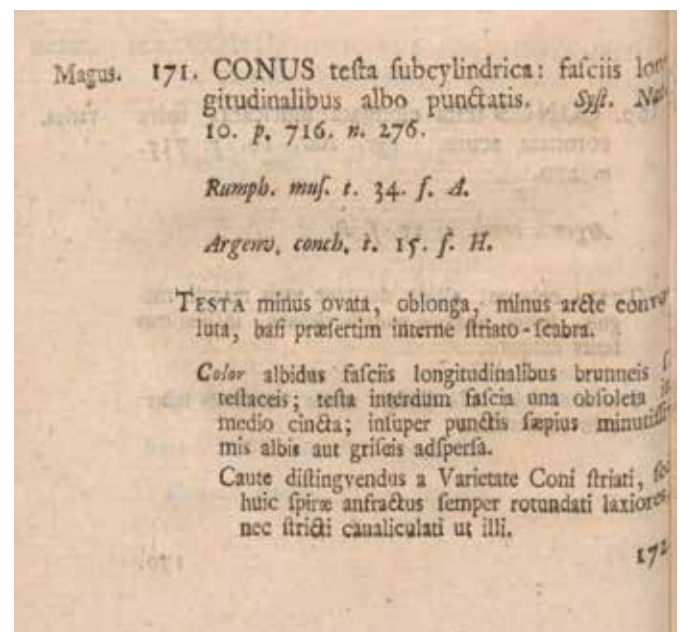


Figure 7. "Linnaeus" Museum Ulricae p. 560, n° 171 description of *C. magus*.

3. Establishing the identity of *Pionoconus magus*

Subsequent authors, however, would help to establish the modern concept of *Pionoconus magus*

Dodge (1953) stated that Chemnitz (1795) discussed the identity of *Conus magus* and declared that his figure 1295 on plate 140 represented Linnaeus' concept. Dodge also refers to Lamarck (1822) who cites a figure by Martini (1769-1777) in plate LII, figures 579 and 580 that is "a very fair picture of the *magus* of authors". In "Animaux Sans Vertèbres" Lamarck gives several references to figures in various previous works among which those from "La Conchyliologie" D'Argenville et de Favanne (fig. 8 and 9 below).



Figure 8. « Les Châteaux en Espagne » La Conchyliologie, Vol. 2.



Figure 9. *Conus magus* La Conchyliologie, Appendice D'Argenville.

Later, Reeve (Conchologia Iconica, 1849) illustrated *Conus magus* on pl. 35 fig. 190a to 190e and described five forms



Figure 10. Reeve's figures of *Conus magus* pl. 35 Figs. 190a to e.

These figures show the variability of the species as understood by Reeve

Kiener also illustrates in the Species plate LXVII figs 1 to 1c and under the number 250 (p. 283). He gives a precise description and good figures of shells present in Lamarck's collection.

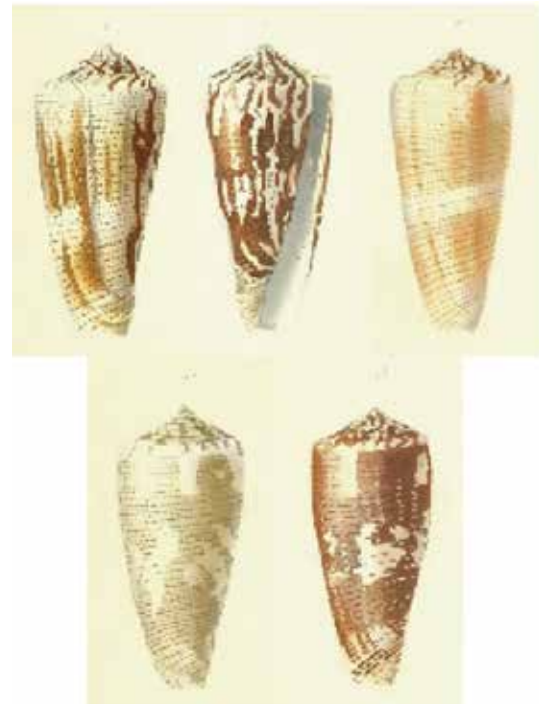


Figure 11. Kiener's figures of *Conus magus* pl. LXVII fig 1.

Kiener's concept is compatible with Reeve. The concept of the variable *Conus magus* Linnaeus, 1758 is now established for the future.

However, it remains to ensure that Linnaeus' concept was also the same.

In 1963, Alan Kohn published a revision of Linnaeus' cones. After establishing that Linnaeus knew the shells from the royal collection of Sweden (that he studied for the preparation of "Museum Ulrica") he assigned a neotype from the M.L.U. collection (fig 12). We reproduce here Kohn's statement on the identity of *P. magus*: "In my opinion the identity of the nominal species depends on the description added by Linnaeus in the Museum Ulrica (p. 560, N° 171). This specimen agrees with the description in the Museum Ulrica, as well as with *C. magus* of authors and it is here selected as neotype of *C. magus*. Statement of the characteristic features of *C. magus* are given by Reeve (1843: p 35, sp. 190) and Kiener (1849-50: p. 283). The apparently extreme range of morphological variations in *C. magus* and the large number of subsequently closely similar nominal species present a complex zoological problem the elucidation of which awaits intensive study."

Now the identity of *Pionoconus magus* is settled. It becomes possible to deal with the knots of related species hiding beneath the variability of the complex.



Figure 12. *Pionoconus magus* neotype UUZM (A.J. Kohn).

4. Remarks and anecdotes

- a. **Strange French vernacular names.** In Encyclopédie Méthodique, Histoire Naturelle des Vers, 1792, Bruguière makes an inventory of the various descriptions or references given to *conus magus* since 1705. He identifies 4 varieties of *C. magus* (by opposition to Favanne who has listed 15 in La conchyliologie ou Histoire naturelle des coquilles) and he identifies the first one as the true *magus* from Linnaeus and places its habitat in the Indian Ocean (La mer des grandes Indes) p. 725. The confusion is such that the list of original names given is varied and demonstrates the complexity and perplexity that ancient authors had in defining what *P. magus* really looks like. Among them, « La nébuleuse », « La nuée d'or », or « Les Châteaux en Espagne ». Favanne reproduces a letter from a conchyliologist based in La Rochelle, France, to an anonymous distinguished amateur in Paris reviewing in the following terms La Conchyliologie from D'Argenville : “ The author (D'Argenville) will allow me, not to take his word for granted as I am certain that I have seen these cones more than once in some Paris collections, it is therefore very well known. (D'Argenville claimed that this shell was unique and only in his cabinet. See Fig. 8) We are told that it has 4 white columns and that 4 other white marks are directly on top of those columns. But all this “colonnade” is just a Castle in Spain, a romanesque description.” (La Conchyliologie, p.522). The Germans on their side call the cone “the nebula”, marking a bit more the confusion. The Dutch called it “Gestreept achaa” when the representation used by D' Argenville (Fig. 9) looks very much like *conus achatinus* with a high apex.
- b. **Type locality and geographical range.** No type locality is designated for *Conus magus*, (Linnaeus, 1758). From specimens in the authors' collections and study of the literature, the geographical range can be restricted to the Western Tropical Pacific Ocean from the Philippines to north Malaysia, northwest Indonesia, south Japan, and maybe the extreme north of Australia.

- c. **Other remarks.** Many articles were published over time. we retain here the most important and interesting.

The study using the largest quantity of specimens of *Pionoconus magus* ever conducted is most certainly the one from the Norton expedition to the Philippines from 1966 to 1968 undertaken by R.F. Cichocki and A.K. Branford and was published in Carfel Philippines Shells News in December 1984. The study itself is limited to an inventory of the colours and patterns of 577 specimens and concludes that 21 colours variations can be identified! The study has the merit of highlighting the complexity of this species and the need for a deeper examination at the shell morphology. As no pictures were published with the paper, we cannot assess how many Philippino species belonging to the complex were indeed included.

B. Taxa belonging to *Pionoconus magus* complex or ascribed to it

There is little doubt that the lack of a clear concept of *Pionoconus magus* during the 18th and 19th centuries triggered the introduction of a rather important number of taxa that have been synonymized or placed in the complex. This trend continued in the 20th century. In 1993-1994 A.J. da Motta published the first revision of the taxonomy of the complex aiming for a better understanding of what *P. magus* is and what it is not.

1. *Conus adansoni* Lamarck, 1810, *sensu* Reeve, 1843 and G. B. Sowerby II, 1858



Figure 13. *C. adansoni* original figure.

Description: (from Reeve's English text) “Shell shortly turbinated, stout round the upper part, bluish white, marbled with olive-green, encircled with snowy white flakes and numerous dot-interrupted lines; spire convex, apex pointed, rose-tinted”.

Types: one Reeve's syntype was in Cuming's Collection. Its present whereabouts are unknown. Sowerby's syntypes are also lost. Type locality: Red Sea (both Reeve and Sowerby).

Nomenclatural status: according to Filmer (2001) an invalid name, a homonym of *C. adansonii* Lamarck, 1810.

Taxonomic status: doubtful (*nomen dubium*), Lamarck's name was applied to a different species. From the type locality in the “Red Sea” it may have been confused by Reeve and Sowerby with the species from the Red Sea later named *C.*

nigropunctatus Sowerby II, 1858 or it is possibly an error for *C. adansonii* Lamarck, 1810, with an erroneous type locality (Filmer, 2001). Sowerby's shells also look somehow like *C. striolatus*. Reeve himself (plate 36, species 193) states: "possibly an extreme variety of the *Conus magus*..."

2. *Conus albus* G.B. Sowerby III, 1887

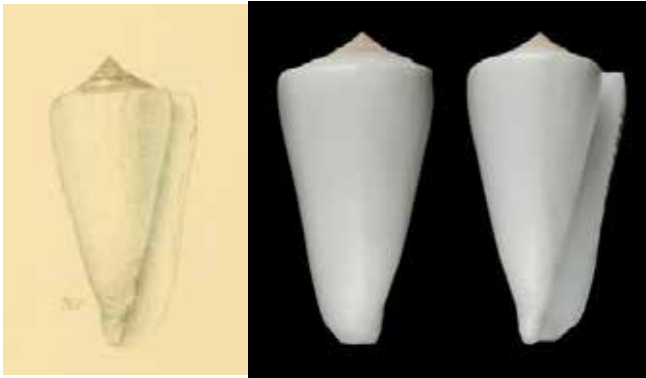


Figure 14a. *C. albus* original figure
Figure 14b. *C. albus* holotype NHMUK.

Description : (translated from the Latin in the original publication) "shell elongate, white, smooth, transversely finely striated, minutely striated anteriorly; spiral shortly conical, slightly raised at the apex; grooved suture; 10 whorls, spirally very finely striated, the first 5 slowly sloping, the following 6-8 very lightly crowned, then concave depressed; the last whorl sub-acutely angled below the shoulder, somewhat convex below, narrower or very slightly constricted in the middle, a little wider towards the base, the columella folded at the base, obliquely twisted, turgid, the lip acute, deeply sinuous above, internally arched.»

Type: holotype 49 x 25 mm NHMUK. Type Locality: Unknown.

Nomenclatural status: an available name (Filmer, 2001).

Taxonomic status: synonym of *Calibanus furvus* Reeve, 1843 (Filmer, 2001), *nomen dubium* (da Motta, 1993). Coomans, Moolenbeek & Wils, 1980 (Plate 6, fig. 1) place this species as a synonym of *P. magus*. For us, it is clearly a synonym of *Calibanus furvus* (Reeve, 1843).

3. *Pionoconus alexisallaryi* T. Cossignani, 2018



Figure 15. *P. alexisallaryi* holotype MNHN-IM-2000-34606.

Description: (from the original publication) Shell of medium size for the genus, of sub-triangular shape, with an average raised spire and slightly concave profile; the sutures are just recessed; the colour of the spire, seen from above, is a very pronounced brown-white alternation, slightly zigzagging.

The last whorl has linear sides, the aperture is moderately wide with a shoulder that starts just under the previous whorl; the external colouration can also be seen in the bordure of the inner lip. The colour of the interior is marble white. The siphon canal is linear and the columellar aperture, in proximity of the canal, deviates slightly towards the outside.

More than 30 spiral lines, raised, and with a more intense, almost brown colouration, run along the surface of the last whorl; axial spots of a more intense almost brown colouration are found on the last whorl and sometimes constitute real intense colouration. A paler spiral band runs through the last whorl, and two more paler bands are present, one immediately under the suture and one almost close to the end of the siphon canal. Soft parts unknown.

Type: holotype 49.5 mm. MNHN-IM-2000-34606. Type Locality: Solomon Islands.

Nomenclatural status: an available name.

Taxonomic status: a valid species (Robin, 2021). Represented in "A Taxonomic Iconography of Living Conidae" (Monnier, Limpalaër, Robin & Roux – 2018), as *Pionoconus aff. circae*. P. 651. Some collectors think that this description was a replacement for *P. magus* var. *circae*. This is a misinterpretation as the two taxa are different, and we consider both valid. *P. circae* range being restricted to the south Philippines.

Remarks: 1) The geographical range of *P. alexisallaryi* runs from Solomon Islands to New Caledonia, Vanuatu and extends to the Queensland coasts).

2) In the original publication the comparison pictures include a *Pionoconus magus*, 40 mm, Madagascar. *P. magus* is not present anywhere in the Indian Ocean. The pictures and mostly the apex view confirm that this shell is indeed a specimen of *Strategoconus (Vituliconus) striatellus* (Link, 1807).

4. *Conus ambaroides* Shikama, 1977



Figure 16. *C. ambaroides* holotype KPMY-5691.

Description: (from Shikama's original description) "Shell small sized, conical and with slightly curved sides, Spire not high with 6 volutions. Suture not deep and spiral striations distinct. Surface of last whorl smooth, lustrous, white and with beautiful blotches of orange colour. There are running about 20 spiral colour striations of brown and white dotting. Anterior tip of last whorl carries about 20 spiral grooves. Aperture narrow and inner surface white with light violetish tint. Spire also carries brown regular blotches."

Type: holotype: 33.2 mm x 15.8 mm in KPMY. Type Locality: Philippines.

Nomenclatural status: an available name (Filmer, 2001).

Taxonomic status: synonym of *P. magus* (Coomans, Moolenbeek & Wils, 1980; da Motta, 1993; Filmer, 2001). We consider it to be a synonym of *Pionoconus metcalfii* (Reeve, 1843). The holotype is a juvenile shell.

5. *Conus anceps* A. Adams, 1854



Figure 17. *C. anceps* lectotype NHMUK.

Description: (from the original Latin description) "shell of pyramidal-conical shape, transversely striated, anteriorly

strongly grooved, solid, white, red-variegated, decorated with two transverse orange bands, spire conical, sharp, excavated whorls, sub-crenulated at the sutures, with the last whorl posteriorly subtruncate; the lip is bent towards the interior in the middle."

Type: lectotype designated by Coomans, Moolenbeek & Wils, 78 x 36 mm in NHMUK (not represented in original publication). Type Locality: Moluccas, Indonesia.

Nomenclatural Status: an available name (Filmer, 2001).

Taxonomic status: Synonym of *P. magus* (Van Nostrand, 1967). Synonym of *P. consors* (Coomans, Moolenbeek & Wils, 1980; da Motta, 1993; Röckel, Korn & Kohn, 1995; Filmer, 2001; Walls, 1979; Tucker & Tenorio, 2013). No elements in the description or in our comparisons with many specimens showed any difference from *P. consors*. It is a species living from Southern Japan to Thailand in the west and New Caledonia in the South.

6. *Conus assimilis* A. Adams, 1854

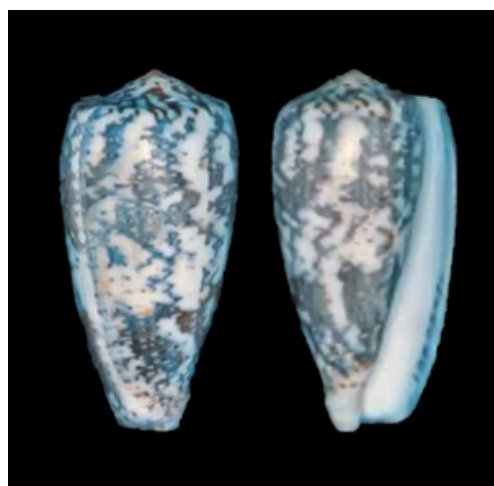


Figure 18. *C. assimilis* lectotype NHMUK.

Description: (extracts from the original Latin description) "last whorl ventricosely conical." ... "Greyish blue and white clouds with spiral lines of alternating brown-white dashes." ... "Conical pointed spire" ... "pink tip." ... "Margin of internal lip articulated with black and white".

Type: lectotype designated by Coomans, Moolenbeek & Wils: 53 x 27.1 mm NHMUK. Type locality Australia (dubious fide Filmer, 2001).

Nomenclatural Status: an available name (Filmer, 2001).

Taxonomic status: da Motta, 1993 considers it as a valid species that "can readily be recognized from its peculiar colouration...". This opinion is shared by G. Raybaudi Massilia (2008). Other authors consider it as a synonym of *P. magus* (Coomans, Moolenbeek & Wils, 1981; da Motta, 1993; Röckel, Korn & Kohn, 1995; Filmer, 2001; Tucker & Tenorio, 2013). It is also our opinion. In the Philippines, the variability in colours forms a continuum even if some micro-populations are rather constant in this respect.

7. *Conus borneensis* G.B. Sowerby II, 1866



Figure 19a. *C. borneensis*, original figure.

Figure 19b. *C. borneensis* holotype NHMUK.

Description: (translated from Latin in Sowerby, 1866) “subcylindrical shell, oblong, narrowed below, furrowed, subinflated above, smooth, dark yellow, darkly flamed with red, aperture purple inside, margin spotted.”

Type: holotype: 32 x 15 mm. in NHMUK. Type Locality Borneo, Indonesia.

Nomenclatural status: an available name*, an invalid name: homonym of *C. borneensis* Adams & Reeve, 1848 (Filmer, 2001). (* status should be unavailable as it is a homonym).

Taxonomic status: a juvenile shell synonym of *P. magus*.

8. *Cucullus caesius* Röding, 1798

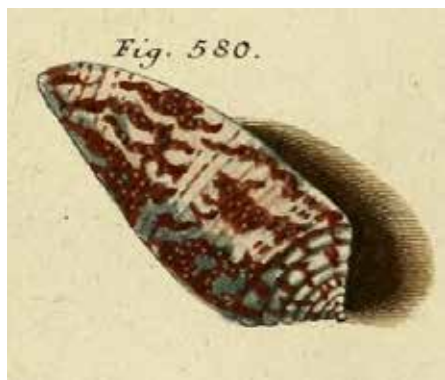


Figure 20. *C. caesius* lectotype representation.

Description: “narrow elongate, spire with dark brown bloches, brown last whorl with white patches and spiral rows of dark brown elongate dots separated by white dots.” Introduced by Röding in “Museum Boltenianum” under the name “Die weiszblaue Tüte”.

Type: Kohn, 1975 designates as lectotype the figure in Martini (1773) pl.52 fig. 580. Type locality: none.

Nomenclatural status: an available name (Filmer, 2001).

Taxonomic status: Röding refers to Gmelin’s “*C. achatinus*” and then to the Martini’s figure 580. Kohn (1975) states that

this representation is most likely of *Pionoconus magus*. We agree with Kohn’s conclusion which is shared by other authors (Walls, 1979; Coomans, Moolenbeek & Wils, 1981; Röckel, Korn & Kohn, 1995; Filmer, 2001; Tucker & Tenorio, 2013). For da Motta (1993) the figure is unrecognizable and the taxon “should therefore be regarded as *nomen dubium*”.

9. *Conus carinatus* Swainson, 1822



Figure 21. *C. carinatus* representation of holotype.

Description: from Swainson’s text: “Shell nearly cylindrical, carinated, fulvous; spire depressed, concave, spotted, tip acute, the whorls very concave, with numerous subgranulated striae; base obtuse, striated, with a gibbous belt.”

Type: representation of holotype in Swainson, (1822) designated by Kohn (1988). Type locality: Philippines (Coomans, Moolenbeek & Wils, 1983).

Nomenclatural status: an available name (Filmer, 2001).

Taxonomic status: classified as synonym of *P. magus* (Walls, 1979; Coomans, Moolenbeek & Wils, 1983; Kohn, 1988; Röckel, Korn & Kohn, 1995; Filmer, 2001). For da Motta (1993-94) the figure and description cannot be associated with any existing population and the taxon should therefore be regarded as *nomen dubium*. G. Raybaudi Massilia (2008) considers that *C. carinatus* is a valid species. We agree with this opinion. The species has no morphological resemblance with *P. magus*. It looks like *P. quasimagus* (Bozzetti, 2016) that has a more conical shape and a darker colour as stated in Monnier *et al.*, 2018.

10. *Conus cernohorskyi* da Motta, 1983



Figure 22. *C. cernohorskyi* holotype MHNG.

Description: (from the original description) “Shell stoutly turbinated, solid, with a conic spire consisting often flat whorls and a pink obtuse apex, the whorls engraved with strongly prominent spiral threads, the penultimate whorl having a concave slope on subangular shoulders; sides are moderately convex below the shoulder but continuing flat towards the base. The surface of the body whorl is rough to the touch and consists of shallow spiral grooves and ridges crossed with axial striae; some specimens having closely aligned granulations on the spiral ridges. Ground colour of the shell is white, with irregular speckles of brown marking the spire in a radial pattern; body whorl is decorated with longitudinal streaks, some of chocolate-brown, others, reddish-brown, and separated into two sections by a median white belt, some specimens having the perpendicular streaks coalescing into merging patches of brown to form partially circular bands. Thickness of the shell is noticeably revealed within the aperture, which is porcelainous-white and widens somewhat towards the anterior end. Base of the columella has a pronounced twist.”

Type: holotype 46.4 x 26.8 mm MHNG MNH-983.110. Type locality: Borongan, East Samar, Philippines.

Nomenclatural status: an available name (Filmer, 2001).

Taxonomic status: we consider that *C. cernohorskyi* is a stout form, synonym of *Pionoconus metcalfei* (Reeve, 1843) as did G. Raybaudi Massilia; 2008. It is considered as a synonym of *P. magus* by various authors (Coomans, Moolenbeek & Wils, 1983; Röckel, Korn & Kohn, 1995; Filmer, 2001).

11. *Conus circae* G.B. Sowerby II, 1858

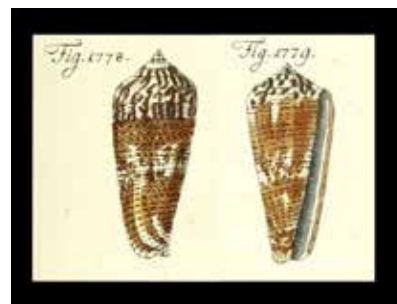


Figure 23a. *C. circae* in Chemnitz.



Figure 23b. *C. circae* original representation of syntypes (left) and var. (right).

Description: (from the Latin diagnose in the original description) “similar to *monachus*, but solid, swelled near the shoulder, and contracted at the centre.”

Types: representations of two syntypes in Sowerby II, 1858, figs 513 and 514. The shells were in Cuming’s Collection and their whereabouts are unknown. Type locality Philippines (Filmer, 2001).

Nomenclatural status: this name has a rather complex nomenclatural history. It was first proposed by Chemnitz but his work is not consistently binominal, therefore the names he used have no status. Dillwyn (1817) and Reeve (1849) used the specific name “*circae*” as a synonym of their *Conus magus* rendering it unavailable. Finally, it is Sowerby (1858) that uses Chemnitz’s name for the same species he considers valid and he makes “*circae*” available under his authorship.

Taxonomic status: we consider that the shells as described by Sowerby represent a valid species from the Southern Philippines (Robin, 2021; Monnier, Limpalaër, Roux & Robin, 2018).

Da Motta, in World Shells (1993-94) highlighted the obvious contradiction between the original shell represented by Chemnitz (fig.23a) which is consistent with *P. magus* and those illustrated by Sowerby II (fig.23b).

There are 2 syntypes used as figs 513 and 514. A third shell identified as “var.” and illustrated in fig. 525 will be later used to described *Conus frauenfeldi*. We demonstrate further in the present article that this is in fact *Calibanus furvus* (Reeve,1843) (NHMUK 1984065/2).

12. *Conus clandestinus* Dillwyn, 1817



Figure 24. *C. clandestinus* in Chemnitz Pl. 140 Fig. 1296.

Description: “a conical-oblong shell, red, red-brown fire crossed red threads with the finest pure white, white band redeemed, convex spiral, concentrically striated, of white and red spots.”

Type: whereabouts unknown.

Nomenclatural status: *nomen nudum*: introduced by Dillwyn as a synonym of *Conus magus*. Reeve (1849) used the same name as a synonym of *C. magus* using the same illustration as reference.

13. *Conus consors* G.B. Sowerby I, 1833



Figure 25. *C. consors* lectotype representation.

Description: translated from the original description in Latin: “oblong-turbinite, yellow, banded with orange, inflated above, shallowly contracted in the middle, slightly attenuated below; spire raised; channeled and furrowed whorls.”

Type: Kohn designated as representation of lectotype the picture in “The conchological illustrations” pt. 36, fig. 42.

Nomenclatural status: an available name (Filmer, 2001).

Taxonomic Status: a valid species. (See pl. 18) related to *P. magus*.

14. *Conus consul* Boivin, 1864



Figure 26. *C. consul* original representation of holotype.

Description: (first lines of the original description, translated from the French): “...Elongated, white background with large spots of a dark yellow, wide, transversely and regularly covered with oblong square dots, close to each other, some white, others very dark brown, which represent tight lines; these spots almost completely cover the last whorl; an almost white area is reserved below the upper two-thirds the shell, and on every white part of the last whorl smaller brown spots can be seen. The spire is convex and concentrically striate; there are eight to nine whorls clearly separated by a groove...”. The shell “... does not seem to have reached its complete development.”

Type: representation of the holotype 43 x 19 mm, in Journal de Conchyliologie Vol.12: 33-35 pl 1 fig. 5-6 (original destroyed during WWII). Type locality unknown.

Nomenclatural status: an available name (Filmer, 2001).

Taxonomic status: a synonym of *P. magus* for a young shell (Walls, 1979, Coomans, Moolenbeek & Wils, 1985; da Motta, 1993-94; Röckel, Korn & Kohn, 1995; Filmer, 2001).

15. *Conus dauliei* Crosse, 1858



Figure 27a. *C. dauliei* original figure.

Figure 27b. *C. dauliei* holotype IRSNB.

Description: (translated from the Latin original description) “Shell elongate-turbinite, subcylindrical, pale yellow, decorated with two darker zones and brown lines, interrupted and as if articulated; spire subtended, pointed, slightly striate, with pale-yellow flames, oblique, variegated; apex pink, pointed; aperture and base milky; in the lower part of the last whorl subflexuous grooves are impressed.”

Type: holotype: 70 x 33 mm in IRSNB. Type locality: Mayotte.

Nomenclatural status: an available name (Filmer, 2001).

Taxonomic status: a valid species (Robin, 2021; Monnier, Limpalaër, Roux, Robin, 2018) it replaces *P. consors* in the Western Indian Ocean. The pattern is pale orange with fine spiral reddish lines covering the last whorl. The shape is more narrowly conical with a higher spire. Other authors (Walls, 1979; Coomans, Moolenbeek & Wils, 1985; Röckel, Korn & Kohn, 1995; Filmer, 2001) place the taxon in the synonymy of *P. consors*.

16. *Conus epistomioides* Weinkauff, 1875



Figure 28. *C. epistomioides* lectotype LMD.

Description: (translated from the original description) "Shell elongate-turbinate, straight, thin, smooth, grooved towards the base, whitish, interrupted by bands and coloured with longitudinal flames of orange; spire short, broad-conical, spotted, with 8 flat whorls, spirally narrowly grooved (8 grooves on penultimate whorl), suture impressed, canaliculate; apex smooth and corneous (two whorls), wide aperture, milky inside, sharp lip strongly sinuous above."

Type: lectotype: 32 x 15.5 mm in LMD. Type locality "probably east Africa" (Dubious). Type designation: Coomans, Moolenbeek and Wils (1986)

Nomenclatural status: an available name (Filmer, 2001).

Taxonomic status: We agree with many previous authors that this is a synonym *P. magus* (subadult) (Walls, 1979, Coomans, Moolenbeek & Wils, 1986; Röckel, Korn & Kohn, 1995; Filmer, 2001). Da Motta (1993-1994) considers it to be a "sibling species" with *P. magus*.

Remarks: in the original description the designated figures are erroneous (pl. 57, Figs 5-6 instead of 6-7).

17. *Conus epistomium* Reeve, 1844



Figure 29a. *C. epistomium* original figure.
Figure 29b. *C. epistomium* lectotype 48 x 21 mm NHMUK N° 1982229.

Description: (from Reeve's original description): "shell elongately turbinated, straight, rather thin, white encircled with two bands of peculiarly flowing orange-brown spots, spots crossed with faint white dotted lines; spire rather depressed spotted with light brown."

Type: from the type lot of two shells in NHMUK, Coomans, Moolenbeek & Wils designated a lectotype. Type locality: "Mauritius". It is certainly erroneous.

Nomenclatural status: an available name (Filmer, 2001).

Taxonomic status: a valid species (Robin, 2021; Monnier, *et al.*, 2018). The lectotype is found dead, presenting typical orange colours of long beach exposition. This is a typical *P. epistomium* from Indonesia to south Philippines. A large population has been discovered recently in Eastern Indonesia, this has allowed better study and comparison. (see pl.5 & Morphological analysis Appendix.). Da Motta also considers the species as valid but "within a range of species associated to *gubernator*". Other authors place the taxon in synonymy with *P. magus* (Filmer, 2001; Walls, 1979; Coomans, Moolenbeek & Wils, 1986; Röckel, Korn & Kohn, 1995).

18. *Conus fenellus* E.A Smith, 1876



Figure 30. *C. tenellus* representation in Chemnitz, 1795.

Description: none. Cited by the author in the synonymy of "*Conus magus* Linn."

Type: none, figure in Chemnitz 1795, plate 183, figs 1782 and 1783.

Nomenclatural status: an unavailable name: introduced as a synonym of *C. magus*. E.A. Smith does not explain the name change and therefore is not proceeding to an emendation of the original name.

Taxonomic status: the figures are hardly identifiable and may represent *Phasmoconus* (*Nimboconus*) *nimbosus* (Hwass in Bruguière, 1792). It is likely that there is a “*lapsus calami*” in the spelling of the species name. Chemnitz had “*tenellus*”. Chemnitz’s name was validated in taxonomy by Holten (1802) with reference to the same figures and is considered as a synonym of *P. (N.) nimbosus*.

Remarks: If the name is allocated to E.A. Smith, 1876, Tyon places it as a synonym of *P. magus* in “Manual of conchology, structural and systematic”, P. 53, 1862, using references of Chemnitz, 1795 and misspelling the name. Da Motta (1993-1994) places it as a synonym of *P. magus* based on E.A. Smith, 1876. In da Motta’s paper the name is misspelled as “*fenullus*”. E.A. Smith only uses the name in a list of *P. magus* synonyms and not as a new or valid species.

like fulgurations and standing out against a beautiful white background: in some of these flames one can distinguish small, inconspicuous white dots. The suture is well marked and inserted between two bulges. The spire is quite prominent and streaked, white with a very small number of brown spots: it ends in a fairly pointed and pinkish top. There are 11 whorls; the embryonic whorls (2) are smooth and pinkish white; the next five, more or less rosy, present this particularity that they are crowned by a circle of slightly marked granulations; the last, five times larger than the spire bears a not very sharp carina, and is grooved on the basal part: the latter is white as well as the aperture. The outer edge is strongly indented near the suture”.

Type: lectotype: 43.2 x 23.6 mm NHMUK 1984065/1; paralectotype 1984065/2. Type locality: Madagascar (erroneus) corrected by G. Raybaudi Massilia to Padang, South-West Sumatra, East Indian Ocean.

Nomenclatural Status: an available name (Filmer, 2001).

Taxonomic status: a synonym of *Calibanus furvus* (Reeve, 1843).

Remarks: after reviewing a shell in the collection of the first author that matched the description and the morphological characters of *P. frauenfeldi* we asked Andreia Salvador, Senior Curator, at the NHMUK to provide pictures of the 2 types. After comparison it makes no doubt that these are *C. furvus* (Reeve, 1843). The taxonomic history of *Conus frauenfeldi* is reviewed in detail further in this publication.

The type locality designated by G. Raybaudi Massilia must therefore be corrected again to Philippines (a country visited by Cuming).

19. *Conus frauenfeldi* Crosse, 1865



Figure 31a. *C. frauenfeldi* original figure.



Figure 31b. *C. frauenfeldi* lectotype 1. NHMUK 1984065/1 & paralectotype 1984065/2 MHMUK (Photographic Unit @ Kevin Webb).

Description: (translated from the French original description): “shell turbate, a little squat, fairly solid, shiny and appearing smooth although, seen up close, it presents a kind of very faintly marked network, formed by the interlacing, at a right angle, of the growth lines with a certain number of obsolete transverse lines: in the fresh state, it is covered with a rather thick epidermis of an olive yellow colour: its colouring system consists of large brown flames, with angular flexions, forming

20. *P. fucatus* Reeve, 1849



Figure 32a. *P. fucatus* original figure.



Figure 32b. *P. fucatus* syntype 1 NHMUK 1984063/1.

Figure 32c. *P. fucatus* syntype 2 NHMUK 1984063/2.

Description: (from the original description) “Shell conically turbinated, smooth or obsoletely peculiarly indented, ridged at the base, spire conspicuously striately grooved, intermediate ridges granulated, apex raised, sharp; ash-olive, spire marbled with white.”

Types: syntypes: 19 x 9.5 mm & 17 x 8.5 mm in NHMUK. Type locality: Philippines.

Nomenclatural status: an available name (Filmer, 2001).

Taxonomic status: the two syntypes from NHMUK present different characteristics. They are too different to assess that they belong to the same species. The first syntype matches a juvenile *P. magus* and is therefore a synonym. The spire of the second syntype is tuberculate and the last whorl shape is wider and probably belongs to another unrecognizable species. (see pl. 12, 14a & 14b for comparison). Walls (1979) considers it is a synonym of *Conus boeticus* (which may agree with the second syntype). Other authors place it in synonymy with *P. magus* (da Motta, 1993-94; Röckel, Korn & Kohn, 1995, Filmer, 2001).

21. *Conus fulvobullatus* da Motta, 1982



Figure 33. *C. fulvobullatus* Holotype MHNG 982.114.

Description: from the original description: “Shell cylindrically ovate and smooth, having eight imperceptibly convex spiral whorls, with a rose-tinted apex; sutures channeled, with five deep spiral threads; shoulder weakly carinated; body whorl narrower at the shoulder with sides which are inflated. Ground colour is white with large golden-yellow maculations, occasionally daubed with dark brown smudges, arranged in a circular pattern to produce two broad, and vague bands, encircled with continuous rows of brown dot-interrupted spiral lines. The aperture is arched over its length and dilated towards the base; columella slightly twisted and appears to have folds; interior is porcelaneous-white.”

Type: holotype: 52.5 x 25 mm. MHNG 982.114. Type locality: East Coast of Malaysia.

Nomenclatural status: an available name (Filmer, 2001).

Taxonomic status: synonym of *P. magus* (Röckel, Korn & Kohn, 1995, Filmer, 2001.) G. Raybaudi Massilia (2008) lists it as a form of *Conus assimilis* that she considers to be a valid species. da Motta compares the shell with *Textilia bullata*. It is very clear that the shape, body whorl structure and spire have nothing

in common with this species. His comparison to *P. magus* is very short and based on the numerous variations of *P. magus* not presenting anything close to this shell. We now know that this is a very common form of *P. magus* found throughout the Philippines down to Malaysia and up to Taiwan.

22. *Conus innexus* A. Adams, 1854



Figure 34a. *C. innexus* original figure.



Figure 34b. *C. innexus* NHMUK 1977159/1 & 2.

Description: (translated from the Latin original description). “shell elongate-turbinate, smooth, solid, yellow, hazy orange, with two broad bands, ornamented with orange-brown and articulated transverse lines loosely packed; pointed conical spire, slightly stepped whorls, strongly grooved concentrically, dotted with reddish at margin; straight lip, arched posteriorly; the inside of the aperture is white.”

Types: 3 syntypes. NHMUK 1977159/1 58.6 x 26.5 mm; 1977159/2 50.6 x 23.8 mm; 1977159/3 48.1 x 21.4 mm. Type locality: Natal, South Africa (dubious).

Nomenclatural status: an available name (Filmer, 2001).

Taxonomic status: synonym of *P. consors* (Walls, 1979; Röckel, Korn & Kohn, 1995; Filmer, 2001). We share this opinion from the observation of the pictures of two syntypes that are similar to *Conus anceps*. Da Motta (1993-94) shares this opinion too. The shells most probably originate from the Tropical Western Pacific Ocean.

Filmer (<http://www.theconecollector.com/lib/docs/filmer/HI.pdf>) presents 3 syntypes. The digital representation of syntype 1 and 3 are identical.

23. *Conus lictor* Boivin, 1864

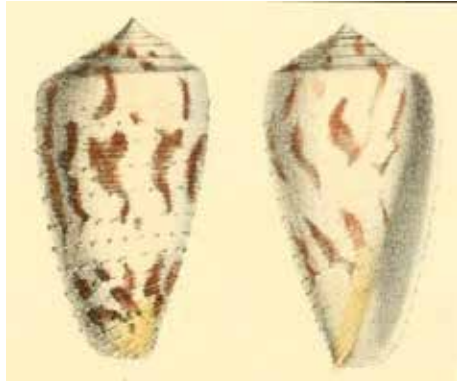


Figure 35. *C. lictor* original illustration.

Description: translated from Boivin's Latin text "Shell elongate-truncate, white, granulated, with red flames axially separated in two bands; convex spire, striated, spotted, pointed; white apex; almost straight aperture."

Type: holotype: 40 x 20 mm. Location unknown, Lost, Type locality unknown.

Nomenclatural status: an available name (Filmer, 2001)

Taxonomic status: synonym of *Strategoconus striatellus* (Link, 1807) (Filmer, 2001; Röckel, Korn & Kohn, 1995). Placed as synonym of *P. magus* by Walls, 1979 and *Conus chenui* Crosse, 1857 (syn. of *Conus ferrugineus* Hwass in Bruguière, 1792 for us) by da Motta, 1993-94. G. Raybaudi Massilia (2008) considers that it is a valid species. For the present authors this is without doubt a synonym of *S. striatellus*.

24. *Conus macei*, Crosse, 1865



Figure 36a. *C. macei* original.

Figure 36b. *C. macei* NHMUK holotype.

Description: translated from Crosse's Latin text "oblong-turbinate, not thick, smooth, under a thin olive-shiny epidermis, white, with irregular, numerous, chestnut-brown longitudinal stripes; suture a little unevenly impressed; spire slightly elevated, apex obtuse; 8 convex whorls, 2 smooth embryonic, polished, whitish-pink ones, followed by whitish and brown variegated striated ones; body whorl five times the length of the spire, striated in the vicinity of the suture, then smooth, grooved towards the base; aperture whitish-violet; lip slightly emarginate at the suture."

Type: holotype: 38 x 17.5 mm. NHMUK. Type Locality: Vizagapatam, (Madras, India), (erroneous)

Nomenclatural status: an available name (Filmer, 2001).

Taxonomic status: for da Motta (1993-94) it is a synonym of *Floraconus mozambicus* (Hwass in Bruguière, 1792) of which it is a juvenile shell. We share this opinion. Placed as synonym of *P. magus* by Walls, 1979.

25. *Conus melancholicus* Lamarck, 1810



Figure 37. *C. melancholicus* figure in Martini, pl. 52, fig. 572.

Description: translated from Latin: "subcylindrical, elongate, orange-red, very shallowly cancellated; irregularly maculated band of yellow; striated spire, flat-pointed, variegated".

Type: 52 mm. Lost, was cited to be in MNHN (Lamarck, 1810). Type locality unknown.

Nomenclatural status: an available name (Filmer, 2001).

Taxonomic status: *nomen dubium* (Walls, 1979; Kohn, 1981; Röckel, Korn & Kohn, 1995; Filmer, 2001). Several authors consider it to be a valid species: Kiener (1845-49), Kaicher (1977), Marsh & Rippingale (1964) all for an unnamed species. This will be discussed in further detailed later in the present paper

We recommend placing this taxon as *nomen dubium* as the actual type was lost and the figure in Martini represents a specimen of *Pionoconus circumcissus* (Born, 1778) that is also the type for *Cucullus terebellum* Röding, 1798 (Kohn, 1992). There is no type Locality, the cited figure is not representing the intended species.

26. *Conus metcalfii* Reeve, 1843



Figure 38a. *C. metcalfii* original figure.

Figure 38b. *C. metcalfii* syntype NHMUK probably the represented specimen.

Description: (from Reeve's original description) "Shell elongately oval, granulated over its entire surface, granules very fine, ranged with great regularity; whitish background, irregularly bedaubed with pale orange-brown, encircled with a narrow white belt round the middle; spire somewhat exserted, spotted with orange-brown, apex acuminate".

Type: syntype: 27.7 x 13.4 mm. NHMUK. Type Locality: unknown.

Nomenclatural status: an available name (Filmer, 2001).

Taxonomic status: a valid species (G. Raybaudi Massilia, 2008; Robin, 2021; Monnier, *et al.*, 2018). Other authors have it as a synonym of *P. magus* (Röckel, Korn & Kohn, 1995, Filmer, 2001). Walls (1979) place it in the synonymy of *P. nigropunctatus*.

Remarks: the represented specimen is a juvenile shell (see pl. 17). Adults are generally smooth.

27. *Conus poehlianus* (Sowerby III, 1887)



Figure 39a. *C. poehlianus* original figure.

Figure 39b. *C. poehlianus* holotype NHMUK.

Description: from the English original description: "An elongated nearly cylindrical shell, white, with the faintest possible tinge of yellow in a central zone and on the apex; compared with an albino variety of *C. ochroleucus*, it is of more cylindrical form, and has not the columellar twist characteristic of that species."

Type: holotype: 48 x 22 mm NHMUK Type Locality: New Ireland (Papua New Guinea).

Nomenclatural status: an available name (Filmer, 2001).

Taxonomic status: we provisionally considered this taxon as a synonym of *P. consors* as do other authors (Röckel, Korn & Kohn, 1995; Filmer, 2001; G. Raybaudi Massilia, 2008). Walls (1979) considers it as a valid species. (See pl.18).

28. *Pionoconus quasimagus* Bozzetti, 2016



Figure 40. *P. quasimagus* holotype MNHN.

Description: extracts from the original description translated from the Italian: "Shell of medium-great dimensions for the genus"... "solid, conical to ventricosely conical shape, spire of moderate height and of a slightly concave profile, shoulder angulate, last whorl with straight flanks"... "Protoconch of two whorls"... "Teleoconch of six concave whorls, deep suture, strongly marginated, a strong groove positioned between the sutural margin and the shoulder spirally runs through the teleoconch"... "Straight aperture, wider at base; surface of the last whorl covered with dense minute cords, wider and higher towards base;"... "Orange-brown colour, on the flanks of the last whorl are present 2 wide darker bands that are separated in the holotype by a couple of straight yellowish bands; scarcely visible, a pattern of spiral lines articulated of yellowish dots is present in a discontinuous manner on the flanks of the last whorl. White spire, sutural ramp with radial flamules of an orange-brown colour more visible on the shoulder where they form an almost continuous line, yellowish line below the shoulder. Inside of aperture white."

Type: holotype in MNHN-IM-2000-28443. Type locality: Pilas Island, Mindanao, Philippines.

Nomenclatural status: an available name.

Taxonomic status: a valid species (Robin, 2021; Monnier, Limpalaër, Robin, Roux, 2018). Its solid pattern, even on the spire, and limited geographical range in Southern Philippines allow to separate it from *P. raphanus* (*vide infra*).

29. *Conus raphanus* Hwass in Bruguière, 1792.

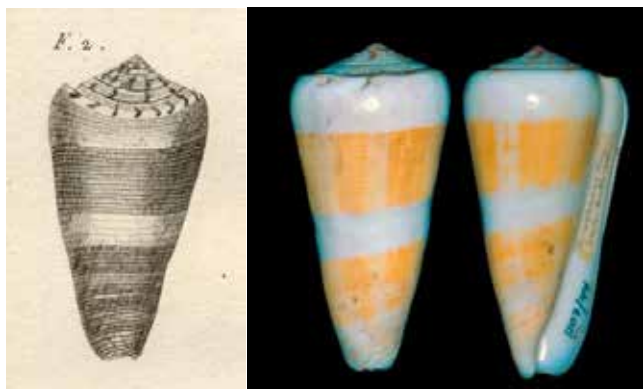


Figure 41a. *C. raphanus* original figure.

Figure 41b. *C. raphanus* lectotype MHNG 1107/44.

Description: translated from the original Latin diagnosis: “shell subcylindrical (transversely striated) white, with two bands of yellow linearly dotted, obtuse striated spire spotted with brown, tip pink.”

Type: lectotype: 61 x 31 mm. MHNG 1107/44. Type Locality: Asiatic Ocean.

Nomenclatural status: an available name (Filmer, 2001).

Taxonomic status: we consider it a valid species (Robin, 2021; Monnier, Limpalaër, Robin, Roux, 2018) (See pl. 11). Kohn (1992) provisionally considers it a synonym of *P. magus*. Other are more affirmative for a synonymy with *P. magus*: Walls, 1979; Röckel, Korn & Kohn, 1995. Filmer, 2001; G. Raybaudi Massilia, 2008.

30. *Conus rollandi* Bernardi, 1860



Figure 42a. *C. rollandi* original figure.

Figure 42b. *C. rollandi* holotype MNHN-IM-2000-2516.

Description: translated from the original Latin diagnose: “Shell turbate, pale, concentrically and regularly lined, base slightly cordate; moderately high spire, concentrically striated; wavy suture; the last whorl is ornamented with longitudinal reddish-yellow spots, angular in the middle.”

Type: holotype: 34 x 18 mm. MNHN-IM-2000-2516. Type Locality: unknown.

Nomenclatural status: an available name (Filmer, 2001).

Taxonomic status: the shell was found dead. The orange colour is typical of beach exposed shell and does not indicate a true colour. It does look like a juvenile beached *P. magus*. Walls (1979) places it as a synonym of *Pionoconus nigropunctatus*. For da Motta (1993-94) it is a *nomen dubium*. Other authors (Röckel, Korn & Kohn, 1995; Filmer, 2001) consider it is a synonym of *P. magus* as the present authors do.

31. *Conus signifer* Crosse, 1865



Figure 43a. *C. signifer* original figure.

Figure 43b. *C. signifer* holotype NHMUK.

Description: (translated from the French original description) “turbinate-elongated shape, quite solid, smooth and polished, of a slightly purplish brown: on this background stand out, in the vicinity of the suture, towards the middle part and near the base, irregularly shaped stains, most often white, but sometimes purplish, the whole of which forms like three transversal zones: moreover, with a little attention, one perceives, on the shell, numerous transverse narrow lines, interrupted in places, jointed in brown and white and weakly marked. The suture is irregularly marked, the spire moderately high, strongly striated, spotted with white and brown and with a slightly obtuse apex. Whorls are 9 in number and weakly convex, the embryonic whorls are smooth and pinkish white; the last, barely keeled, is six times higher than the spire, attenuated and grooved at the basal part, where the columella, apparent and slightly twisted, forms a kind of longitudinal fold. The aperture is white inside, the external edge is rather strongly enhanced in the vicinity of the suture.”

Type: holotype: 40 x 19 mm. NHMUK. Type Locality: unknown.

Nomenclatural status: an available name (Filmer, 2001).

Taxonomic status: a synonym of *P. magus* for many authors (Walls, 1979, Röckel, Korn & Kohn, 1995, Filmer, 2001). Da Motta associates the taxon with *Rhizoconus pertusus* Hwass in Bruguière, 1792. In our opinion, it represents an extreme pattern form of *P. raphanus*.

32. *Conus tasmaniae* Sowerby II, 1866



Figure 44a. *C. tasmaniae* original figure.

Figure 44b. *C. tasmaniae* holotype NHMUK.

Description: translated from the original Latin description: “elongate-cylindrical yellowish, painted with irregular longitudinal stripes, slightly spirally lirate, acute above, apex depressed, aperture angle sub inflated, tapering towards the base.” (“Differing from *C. magus* chiefly in the narrow, attenuated form.”).

Type: holotype: 40.5 x 20 mm. NHMUK. Type Locality: Tasmania (erroneus).

Nomenclatural status: an available name (Filmer, 2001).

Taxonomic status: a synonym of *P. magus* (Walls, 1979, Röckel, Korn & Kohn, 1995, Filmer, 2001). For da Motta (1993-94), it is a distinct species based on its shape. The holotype appears to be a worn young specimen of *P. magus* in our opinion.

33. *Conus tenellus* Holten, 1802

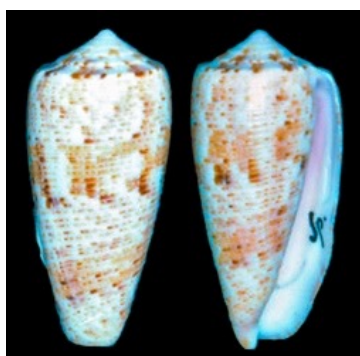


Figure 45. *P. tenellus* Dillwyn, 1817.

See supra species 18 *Conus fenellus*: it is based on the same figure and *tenellus* is the correct spelling.

Nomenclatural status: an available name (Filmer, 2001). The name “tenellus” was also published by Dillwyn, 1817 and Reeve, 1849, based on the same reference than Holten, Reeve and E.A. Smith (for *fenellus*). They are invalid being in the same time homonyms and objective synonyms.

Taxonomic status: a synonym of *Phasmoconus* (*Nimboconus*) *nimbosus* (Hwass in Bruguière, 1792).

34. *Conus turschi* da Motta, 1985



Figure 46. *C. turschi* holotype MHNG.

Description: from the original description “Shell smooth and subcylindrical, with a conic spire and acute apex, consisting of 11 whorls, the first 4 post-embryonic, being beaded. The surface of its declivous whorls are imperceptibly convex and narrowly folded towards appressed sutures, causing the spiral profile to appear slightly stepped. Striation of spiral whorls are strongly incised with the first two adapical volutions more deeply grooved, creating twin ridges of greater prominence to give an appearance as if each whorl is girdled with a distinct ring. Shoulder is angulate but lightly carinate without a pronounced keel. The elongate body whorl has sides which are very slightly convex down the whole of its attenuated length. The anterior end is sculptured with about 8 raised sulci and the columella is strongly plicated; its outer lip, sharply trenchant. The ground colour is fulvous and the pattern is quite variable, but always within a theme of vermicular chocolate brown streaks, to specimens which are completely without these maculations. Some specimens have these ornamentations only at the upper portion; still others, only very sparsely streaked or none at all. The holotype was selected for its more profuse markings. The spire is decorated with dark brown speckles in a radial pattern; the body whorl, encircled with dark brown streaks in perpendicular rows. A median spotless belt separates two broader transverse bands of a darker tawny shade, with another clear zone at the lower section. Aperture has a nacreous-white interior. The periostracum is light brown and translucent, becoming opaque with maturity.”

Type: holotype: 82 x 28.5 mm. MHNG. Type Locality: Andaman Sea, off Kantang, S.W. Thailand.

Nomenclatural status: an available name (Filmer, 2001).

Taxonomic status: a synonym of *P. consors* (Filmer, 2001, Röckel, Korn & Kohn, 1995). We share this opinion. As stated by da Motta himself there is a continuum between strongly streaked shells and the unpatterned ones. The geographical distribution given by the author encompasses most of the known range for *Pionoconus consors*. (See pl. 18).

35. *Conus ustulatus* Reeve, 1844



Figure 47a. *C. ustulatus* original representation.

Figure 47b. *C. ustulatus* holotype NHMUK.

Description: from the original English text: «Shell rather elongated turbinated, a little swollen round the upper part, edge rounded, transversely very finely ridged; pale burnt red, encircled round the middle with a narrow white belt; spire convex, spirally striated, ornamented with a few scattered purple-red spots upon the upper edge of each whorl; apex pointed.»

Type: holotype: 42 x 21 mm. NHMUK. Type locality: “New Holland” (probably erroneous).

Nomenclatural status: an available name (Filmer, 2001).

Taxonomic status: this taxon has been historically placed in synonymy of either *P. consors* (Walls, 1979) or *P. magus* (Röckel, Korn & Kohn, 1995; Filmer, 2001). G. Raybaudi Massilia (2008) places it as a form of *Conus carinatus*. Our opinion is that *Pionoconus ustulatus* represents a valid species from the Philippines (see Monnier *et al.* (2018) and Robin (2021) (See pl. 19).

Remarks: the first whorls are most often marked with black. Juveniles are often granulose and more brightly coloured. Shells matching the holotype are only known from the Philippines (Monnier & al, 2018 p. 655). Shells from a population originating from Manus Island are strikingly similar and are described below in this study.

36. *Pionoconus vezzaroi* T. Cossignani, 2016



Figure 48. *P. vezzaroi* holotype MMM.

Description: (translated from the original Italian description) “... Shell of moderate-great size for the genus”... “maximum height of 54 mm., solid, conical shape, spire of moderate height with an almost rectilinear profile, angulate shoulder, last whorl with straight flanks. Protoconch dome shaped, squashed with two whorls, teleoconch constituted of 6 whorls almost straight with 5 inconspicuous spiral sulci. Suture well visible, margin barely inflated, one groove positioned between the sutural margin and the shoulder runs spirally around the teleoconch. Straight aperture. Colour brown-orange, the flanks of the last whorl present 1 paler band of creamy yellow colour. Spire pale with inconspicuous brown flaming close to the suture. White inside the parture.”

Type: 53.75 X 27.90 mm. MMM. Type locality: Aliguay Island.

Nomenclatural status: an available name.

Taxonomic status: it is a synonym of *Pionoconus quasimagus* (Monnier *et al.*, 2018; Tucker & Tenorio, online 2017).

37. *Conus worcesteri* Brazier, 1891



Figure 49a. *C. worcesteri* original representation.

Figure 49b. *C. worcesteri* holotype SAMA D6178.

Description: from the original description “Shell turbinated, thick, ventricose round the upper part, smooth; spire acuminate, apex sharp, with minute spiral striae below the suture; ivory white beneath a dirty yellowish epidermis, variegated with four purple or pinkish-brown bands flowing down here and there in flexuous streaks or blotches, columella slightly twisted ; aperture white, lip thin.”

Holotype: 48 x 25 mm. SAMA D6178. Type Locality: Mauritius island (dubious).

Nomenclatural status: an available name (Filmer, 2001).

Taxonomic status: a synonym of *P. magus* for Walls (1979), Röckel, Korn & Kohn (1995), Filmer (2001). A *nomen dubium* for da Motta (1994).

After close examination of the thin periostracum, the general morphology of the shell, the lack of dotted lines on the last whorl and the apex of the holotype we conclude that this is not a *P. magus*, it does not belong to the genus *Pionoconus* in which the periostracum is generally thicker. After reviewing the second and first authors’ collections we conclude that *C. worcesteri* is *Floraconus novaehollandiae* (A. Adams, 1855). Therefore, we place it in the genus *Floraconus*. Below is a representation of one the shells present in the 2nd author’s collection. Type locality Western Australia. Size 30 to 60 mm.



Figure 50. *Floraconus anemone novaehollandiae*
Coll. FP.# 3-5-1442 31.64 x 16.64 mm
Port Hedland, Australia.

Bibliographie

- D'ARGENVILLE, A.J.D., DE FAVANE, J. DE M. & DE FAVANE, J.G. DE M. (1780). La conchyliologie ou Histoire naturelle des coquilles de mer, d'eau douce, terrestres et fossiles ; avec un traité de la zoomorphose ou représentation des animaux qui les habitent : Ouvrage dans lequel on trouve une nouvelle méthode de les diviser. Famille Huitième Cornets ou volutes. 3rd edition. Vol. 2 & 3. 848 p. & 80 pls. G. de Bure, Paris.
- BERNARDI, A. C., (1860.b). Descriptions d'espèces nouvelles. *Journal de Conchyliologie*, Paris Vol. 8: pp.331-332; pl 12.
- BOIVIN, A., (1864). Description de cinq espèces nouvelles du genre *Conus*. *Journal de Conchyliologie* Vol. 12(1):33-40, pl.1
- BOZZETTI, L., *Pionoconus quasimagus* (Gastropoda: Prosobranchia: Conidae) nuove specie dalle Filippine meridionali. *Malacologia Mostra Mondiale*. 92: 13-14. [Erratum: *Malacologia Mostra Mondiale* 109: 9].
- BRAZIER, J., (1891) Description of a new cone from Mauritius. *Proceedings of the Linnean Society of New South Wales*, series 2, Vol.16:276, pl. 19. Sydney.
- BRUGUIERE, J.G., (1792). Cône. Histoire Naturelle des Vers. Encyclopédie Méthodique, ou par ordre des matières, par une société de gens de lettres de savants et d'artistes. pp. 586-757. Panckouke, Paris.
- CHEMNITZ, J.H., (1788). Neues Systematisches Conchylien-Cabinet. Band 10. 376 p., 36 p 36 pls. G.N. Raspe; Nürnberg.
- COOMANS, H.E., MOOLENBEEK, R.G. & WILS, E. (1980). Alphabetical revision of the (sub) species in recent Conidae. 3. *albus* to *antillarum* with the description of *Conus algoensis agulhasi*, nov. subspecies. *Basteria* 44 (1-4): 17-49, 6 maps, 5 pls.
- COSSIGNANI, T., (2016). *Pionoconus vezzaroi* (Gastropoda: Prosobranchia: Conidae) nuova specie dalle Filippine. *Malacologia Mostra Mondiale*. 93, p.28. Cupra Marittima.
- COSIGNANI, T., (2018). *Pionoconus alexisallaryi*, nuovo cono. *Malacologia Mostra Mondiale*, 101, pp 24-26. Cupra Marittima.
- CROSSE, J.C.H., (1858). Diagnose de coquilles nouvelles. *Revue et Magasin de Zoologie*. série 2, Vol. 10: p.81. Guérin-Méneville, Paris.
- CROSSE, J.C.H., (1865). Description de cônes nouveaux provenant de la collection Cuming. *Journal de Conchyliologie*, Paris Série 3, 13 (5): pp. 299-315 + 3 pls.
- DA MOTTA, A. J., (1983). Two new species for the genus *Conus* (Gastropoda: Conidae). *Publicações Ocasionalis da Sociedade Portuguesa de Malacologia*, 2. p. 1-8; 1 pl. Lisboa.
- DA MOTTA, A. J., (1985). A discussion of a confusing group of species in the genus *Conus* (Gastropoda-Conidae), with the description of a new species. *Publicações Ocasionalis da Sociedade Portuguesa de Malacologia*. 5: 1-7, 2 pls. Lisboa.
- DA MOTTA, A. J., (1993-1994). *Hermes (Pionoconus) magus* (Linnaeus, 1758) Which is a *magus*: which are not and why. *World Shells*, 4, pp 3-9; 5, pp. 18-21; 6, pp. 18-21; 7, pp 28-31. Roma.
- DODGE, H., (1953). A historical review of the mollusks of Linnaeus. Part 2. The class Cephalopoda and the genera *Conus* and *Cypraea* of the class Gastropoda. *Bulletin of the American Museum of Natural History*, vol. 103, art. 1, p. 1-134. New York.
- FILMER, R.M., (2001). A Catalogue of nomenclature and taxonomy in the living Conidae 1758-1998. 388 p. Backhuys Publishers; Leiden.
- GUALTIERI, N., (1742). *Index Testarum Conchyliorum quae adservantur in museo Nicolai Gautieri philosophi et medico collegiati florentini et methodice distributae exhibentur*. 102 pls. Albizzini; Florence.
- HANLEY, S., (1855). *Ipsa Linnæi Conchyliæ*. The shells of Linnæus determined from his manuscripts and collections. ... Also, an exact reprint of the *Vermes Testacea* of the "Systema naturæ" and "Mantissa. 586 p. 5 pls. Williams & Norgate, London.
- KAICHER, S.D., (1977). Card catalogue of world-wide shells. Packs 14 - Conidae IV, pls. 1329-1434; 106 figs. Arcade Lithographing Co., Bradenton.
- KIENER, L.C., (1845-1850). Species général et iconographie des coquilles vivantes, comprenant la collection du Muséum d'Histoire naturelle de Paris, la collection Lamarck, celle du Prince Masséna (appartenant maintenant à M. le baron Benjamin Delessert), et les découvertes récentes des voyageurs. Vol. 2, Famille des Enroulées. Genre Cône : 379 p. 111 pls. J. B. Baillière; Paris.

- KOHN, A.J., (1963). Type specimens and identity of the described species of *Conus*. I. The species described by Linnaeus, 1757–1767. — *Journal of the Linnean Society of London*, Zoology, Vol. 44 (302); 740-768; 4 pls. London.
- LAMARCK, J.B.P., (1810). Sur la détermination des espèces parmi les animaux sans vertèbres, et particulièrement parmi les mollusques testacés. *Annales du Muséum National d'Histoire Naturelle*, Vol. 15: pp. 20-40, 263-286, 422-442; Paris.
- LAMARCK, J.B.P., (1822). Histoire naturelle des animaux sans vertèbres présentant les caractères généraux et particuliers de ces animaux, leur distribution, leurs classes, leurs familles, leurs genres, et la citation des principales espèces qui s'y rapportent précédée d'une introduction offrant la détermination des caractères essentiels de l'animal, sa distinction du végétal et des autres corps naturels ; enfin, l'exposition des principes fondamentaux de la Zoologie. Vol. 7. 711 p. Guiraudet; Paris.
- LINNAEUS, C., (1758). *Systema Naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis. Editio decima, reformata* [10th revised edition], vol. 1: 824 pp. Laurentius Salvius: Stockholm.
- LINNAEUS, C., (1764). *Museum s:æ r:æ m:tis Ludovicæ Ulricæ reginæ svecorum, gothorum, vandalorumque &c. &c. &c. In quo animalia rariora, exotica, imprimis insecta & conchilia describuntur & determinantur prodromi instar editum*, 110 pp. Laurentius Salvius: Stockholm.
- LINNAEUS, C., (1767). *Systema Naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis. Editio duodecima, reformata* [12th revised edition], vol. 1: 1171 pp. Laurentius Salvius: Stockholm.
- MARSH, J.A. & RIPPINGALE, O.H., (1964). *Cone shells of the world*. (First edition). 185 p., 24 col. pl. The Jaracanda Press, Brisbane.
- MARTINI, F.H.W. & CHEMNITZ, J.H., (1769-1777). Neues systematisches conchylien-Cabinet. Vols 1-3, Nürnberg.
- MONNIER, E., LIMPALAËR, L., ROBIN, A., ROUX, C., (2018) A Taxonomic Iconography of Living Conidae. Vol. 2. Pp. 606-1207. ConchBooks, Hackenheim & AFC, Paris.
- RAYBAUDI MASSILIA, G., (2008) In Poppe, G. T. Conidae In Philippine Marine Mollusks. Vol. II., 848 p. Conchbooks, Hackenheim.
- REEVE, L.A., (1843). *Conchologia Iconica* or, Illustrations of the shells of molluscous animals. Vol. 1: pls 1-41. Reeve & Brothers; London.
- ROBIN, A., (2018). *Compendium of Marine Gastropods*. 676 p. AFC, Paris & ConchBooks, Hackenheim.
- RÖCKEL, D., KORN, W. & KOHN, A.J., (1995). *Manual of the living Conidae*. Vol. 1: Indo-Pacific Region. Verlag Christa Hemmen, Wiesbaden. 517 p.
- RÖDING, P.F., (1798). *Museum Boltenianum sive catalogus cimeliorum e tribus regnis naturae quae olim collegerat Joa. Fried Bolten, M.D.p. d., per XL. annus Proto Physicus hamburgensis. Pars secunda continens conchylia sive testacea univalvia, bivalvia & multivalvia*. VIII + 199 p., Trapi; Hamburg.
- RUMPHIUS, G.E., (1705). *D'Amboinsche Rariteitskamer*, 1st edition, 567 pp. + 112 pls., Fr. Halma; Amsterdam.
- SEBA, A., (1758). *Locupletissimi rerum naturalium thesauri accurate descriptio*. Vol. 3: 212 p. 116 pls.
- SHIKAMA, T., (1977), Description of new and noteworthy Gastropoda from Western Pacific and Indian Oceans. *Science Reports of the Yokohama National University*, section 2, 24: 18-23; 5 pls.
- SMITH, E.A., (1876). A list of marine shells, chiefly from the Solomon Islands, with descriptions of several new species. *Journal of the Linnean Society of London* Vol.12: 64; pp. 535-562; 1 pl. London.
- SOWERBY, G.B. I., (1833-34). *The Conchological Illustrations, or coloured figures of all the hitherto unfigured recent shells* Parts 24-25-28-29-32-33-36-37-54-55-56-57. G.B. II Sowerby, London.
- SOWERBY, G.B. II., (1857-58). *Monographs of the genus Conus in Thesaurus conchyliorum, or Monographs of genera of shells*. Vol. 3: 56 p.; 24pls. Van Voorst, London.
- SOWERBY, G.B. II., (1866). Appendix to Monograph of the Genus *Conus*. in *Thesaurus conchyliorum, or Monographs of genera of shells*. Vol. 3: pp. 24-25; 4 pls. London.
- SOWERBY, G.B. III, (1887). Supplement to monograph of the genus *Conus*. In G. B. Sowerby II (ed.), *Thesaurus conchyliorum, or monographs of genera of shells*. Vol. 5 (44): pp. 249-279; pls 507-512. London.
- SWAINSON, W., (1822). *Zoological Illustrations or original figures and descriptions of new, rare, or interesting animals*. Selected chiefly from the classes of ornithology, entomology, and conchology, and arranged on the principles of Cuvier and other modern zoologists. Vol. II. Unpaged; 119 pls. Balldin & al., London.
- TYRON, G.W., (1862) *Manual of conchology, structural and systematic with illustrations of the species*.
- WALLS, J.G., (1979). *Cone Shells: A synopsis of the living Conidae*. 1011 p., 113 figs, 1 150 col. figs. TFH Publications Inc., Neptune City, New Jersey.
- WEINKAUFF, H.C., (1873-1875). *Die Familie der Coneae oder Conidae*. I. *Conus* Linné, angefangen von Dr. Küster (1837-1838) durchgesehen ergänzt und vollendet von

H.C. Weinkauff (1873-1875). Systematisches Conchylien-cabinet von Martini und Chemnitz. Band IV (2): 1-413, 71 pls. Verlag Von Bauer & Raspe, Nürnberg.

Abbreviations:

IRSNB: Institut Royal des Sciences Naturelles, Brussels
 KPMY: Kanagawa Prefectural Museum, Yokohama
 LMD: Löbbecke Museum, Düsseldorf
 MHNG: Muséum d'Histoire Naturelle de Genève
 MMM: Mostra Mondiale Malacologia, Cupra Marittima
 MNHN: Muséum National d'Histoire Naturelle, Paris
 NHMUK: Natural History Museum of United Kingdom, London
 SAMA: South Australian Museum, Adelaide
 UUZM: Uppsala University, Museum of Evolution, Zoology Section

Part 2: From *Pionoconus magus* venom to conotoxin MVIIA and Prialt

par Sébastien Dutertre.

Cone snails are venomous marine predators that use potent neurotoxic molecules, called conotoxins, to subdue their prey and deter predators. These venoms represent an important source of novel pharmacological compounds with therapeutic potential. Yet, the investigation of the composition of these venoms was initially motivated by the need to understand the molecular basis for the reported human injuries and deaths, with the hope of finding a cure. Indeed, whereas local traditional knowledge likely identified cone shells as potentially deadly much earlier, the first report of a fatal case of envenomation dated back to 1705 (Rumphius). Since then, about 3 dozen fatalities have been reported, almost all due to the largest fish hunting species, *Gastrodium geographus* (AJ Kohn, Int J Clin Pharm Therap, 2016).

The seminal pharmacological studies from the Australian Bob Endean in the early 1960s confirmed the potent paralyzing activity of venom extracts from piscivorous cone snail species, including *Gastrodium geographus*, *Gastrodium tulipa*, *Pionoconus catus*, *Pionoconus striatus* and *Pionoconus magus* (R. Endean, Toxicon, 1963 and 1965). Venom extracts from the latter were found to be even more toxic than those from the infamous *G. geographus* (minimum lethal dose 0.2 - 0.7 µg vs 1.6 - 24.1 µg per mouse). It was also found that *P. magus* venom has direct action on vertebrate skeletal and cardiac musculature (R. Endean, Toxicon, 1965 and 1974). Later, several paralytic toxins were isolated and pharmacologically investigated from *P. magus* venom, including the 25 amino acid long ω-conotoxin MVIIA (Fig. 1). This conotoxin was biochemically characterized to get it with the closely related MVIIIB as selective calcium channel blockers (Olivera BM, Biochemistry, 1987). The NMR structure of MVIIA shows a lack of secondary structure, except for a short triple-stranded antiparallel beta-sheet. Yet, the 3 disulfide bridges allow for a well-ordered peptide backbone (Fig. 2).



Figure 1. The ω-conotoxin MVIIA sequence. It displays 25 amino acids and 3 disulfide bonds, whose connectivity is depicted as grey lines.

Initially used as a pharmacological tool to study the Cav2.2 channels, omega conotoxin MVIIA went on to become the first, and still only, analgesic drug from cone snail venom. George Miljanich was responsible for the development of this basic tool to a therapeutic drug within the US-based Neurex company. Interestingly, despite the synthesis of hundreds of derivatives, the natural sequence, as produced by the cone, was selected for the clinical trials. Approved in 2004 for the treatment of chronic pain, this novel and non-addictive analgesic sold under the commercial name Prialt (generic name Ziconotide) was a relief for many patients who became tolerant to common opioid based drugs (Miljanich GP. Curr Med Chem. 2004). Jazz Pharmaceuticals, which later acquired Prialt, recorded \$27 million in net product sales in 2017 and recently sold its right related to Prialt to TerSera Therapeutics LLC for \$80 million in cash at closing.

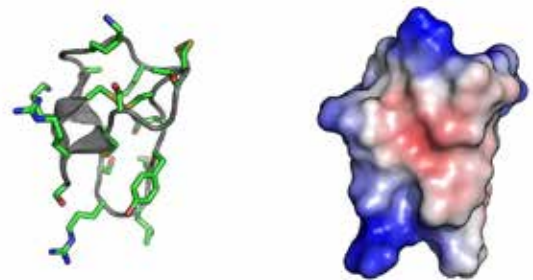


Figure 2. Three-dimensional (NMR) structure of ω-conotoxin MVIIA. On the left is shown the stick representation, where the peptide backbone is shown in grey and side chain amino acid in green. On the right is shown the molecular surface with electrostatics (red is negative and blue positive).

More recently, with the advances in structural determination of membrane proteins, a three-dimensional view of the interaction between conotoxin MVIIA and its target, the Cav2.2 channel, was revealed in detail (Fig. 3). The cryo-EM complex shows the pore blocking effect of this conotoxin, where the ECL of Cav2.2 has to accommodate for the peptide through an upward tilt (Gao S, Yao X, Yan N. Nature, 2021). Given the narrow therapeutic window of Prialt (the dose where side effects become apparent is close to the therapeutic dose), this insight into the molecular interactions has the potential to lead to the design of more selective derivatives of omega conotoxin MVIIA, and ultimately better drugs.

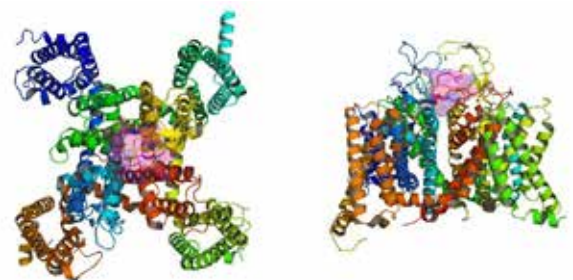


Figure 3. CryoEM structure of the complex between ω-conotoxin MVIIA and its human target Cav2.2 calcium channel. On the left is the complex viewed from the extracellular space (top view) and on the right is the same complex viewed from the side (within the cell membrane). The channel is shown as cartoon representation, whereas MVIIA is shown as pink transparent molecular surface representation. It can clearly be seen that

the antagonist action of MVIIA is due to its pore blocking effect, effectively stopping the ion flow through the channel.

As a side note, it can be seen through this short summary of the history of Prialt that the true origin of MVIIA remains uncertain in light of the current description of new species in the complex « *magus* ». Indeed, some of the early work was carried out using specimens from Australia, then the biochemical characterization was done using specimens from the Philippines, where at the time, many species were grouped together under the name « *Pionoconus magus* ». Yet, interestingly, specimens of *Pionoconus alexisallaryi* collected from Night Is., Far North Queensland in Australia were shown to inject MVIIA as one of the major components of their venom (CA Kapono, Toxicon, 2013). This result tends to suggest that MVIIA may be produced by different species within the *Pionoconus magus* complex. However, further comparative studies are needed to investigate the venom composition of these newly described species

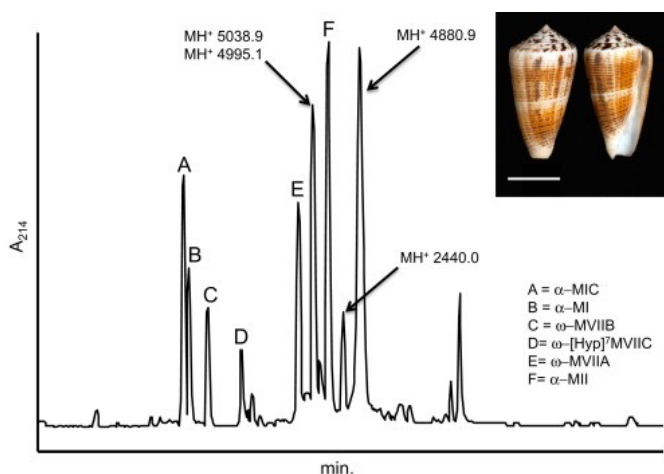


Figure 4. RP-HPLC trace (UV at A₂₁₄ nm) of the TCEP reduced milked venom of *Pionoconus alexisallaryi*. Capital letters identified peaks containing previously characterized conotoxins, including MVIIA.

BIBLIOGRAPHY

- ENDEAN, R. & RUDKIN C., (1963) Studies of the venons of some Conidae. *Toxicon*. 1: 49-64 pp.
- ENDEAN, R. & RUDKIN, C., (1965) Further studies of the venons of Conidae. *Toxicon*. 2: 225-249 pp.
- ENDEAN, R. & IZATT J., (1965) Pharmacological study of the venom of the gastropod *Conus magus*. *Toxicon* 3(2): 81-93 pp.
- ENDEAN, R. & GYR P. PARISH G., (1974) Pharmacology of the venom of the gastropod *Conus magus*. *Toxicon*. 12(2): 117-129 pp.
- GAO, S. YAO, X. & YAN, N., (2021) Structure of human Cav2.2 channel blocked by the painkiller ziconotide. *Nature*, 596(7870): 143-147 pp.
- KAPONO, C.A., THAPA, P., CABALTEJA, C.C., ET AL., (2013) Conotoxin truncation as a post-translational modification to increase the pharmacological diversity within the milked

venom of *Conus magus*. *Toxicon* 70: 170-178 pp.

- KOHN, A.J., (2016) Human injuries and fatalities due to venomous marine snails of the family Conidae. *International Journal of Clinical Pharmacology and Therapeutics*. 54(7): 524:538 pp.
- MILJANICH, GP., (2004) Ziconotide neuronal calcium channel blocker for treating severe chronic pain. *Current Medicinal Chemistry* 11(23): 3029-3040
- OLIVERA, B.M., CRUZ L.J., DE SANTOS V., ET AL., (1987) Neuronal calcium channel antagonists. Discrimination between calcium channel subtypes using omega-conotoxin from *Conus magus* venom. *Biochemistry* 21;26(8): 2086-2090
- RUMPHIUS, G.E., (1705). D'AMBOINSCHÉ RARITEITKAMER, 1ST EDITION 567 PP. + 112 PLS., FR. HALMA; AMSTERDAM.

Part 3: The species complex *Pionoconus magus* and the phylogenetic tree.

Using DNA to improve the identification of Conidae (and other Gastropoda) has been a long time request from many conchylilogs and malacologists.

If DNA tools have made huge progress over the past years, it does not mean that sequencing all species is an easy task. First, the cost associated to DNA sequencing and the analysis of the data remains non negligible. Second, since several years, there is a global trend to systematically control the access to biodiversity and, in particular to genetic resources. In this context, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity was originally created to protect countries and people from the wrong use of discoveries by corporations or individual to profit from the common biodiversity and thereby to contribute to the conservation and sustainable use of biodiversity. Consequently, in countries that have ratified the Nagoya protocol, but also in other countries that have set up similar rules, the procedure to obtain permits to collect, export and produce genetic resources from the collected samples is becoming more and more difficult, to the point that it is now simply impossible to collect organisms for scientific purpose in some countries. Permits can take months or years to obtain and that may create a system where a competitive approach is taken between countries, scientists or corporations and where the understanding of biodiversity may become a second thought. In other words, if the Nagoya Protocol was originally thought as a system to protect biodiversity and ensure a good share of the benefits, it ended up as a bureaucratic system that is slowing down the scientific research, even if, at best, only 0.01% of the studies will eventually lead to economic benefits (i.e. a patent that could have a financial value).

As we see, the linkage between biodiversity studies ("you cannot protect what you don't know"), and the economic potential of such biodiversity is slowing down the pure research as we, conchologists, see it. As we see, the linkage between biodiversity studies ("you cannot protect what you don't know"), and the economic potential of such biodiversity is slowing down the pure research as we, conchologists, see it.

Consequently, if scientifically it is of course justified to argue that any taxonomic article (species description, classification, etc.) should be accompanied by molecular analyses with DNA sequences, the cost of the sequencing and, more importantly, the difficulty to (legally) access samples from the field makes it a utopic statement.

The complex *magus* is not different in that aspect. If the South Pacific is one of the most prolific zone for Gastropods in general and Conidae in particular the level of available data is still very low and it will take a long time before it is completed to a malacologist's satisfaction. So, there is unfortunately not much to see at this date on the morphogenetic tree of the complex. The few analysis done in the early days were often conducted without proper malacology involvement to assess the veracity of a given species and the shells, of no interest for the researchers, were often dismissed. The genus *Pionoconus* is still barely untouched and the volume of available materials extremely low to understand the potential species or subspecies present in each geographical region.

In modern days we see a far better methodology where shells are identified, preserved with all its data and the shell itself is attached to its DNA record. We still have not seen many conotoxins articles, despite a large volume of publication, containing a complete DNA sequencing and a proper morphological review of the shell to confirm its species. We are facing different specialties that are unfortunately not linked into common research programs.

The tree below represents all available DNA analyses to this day around *P. magus*. If the conotoxins are studied by many laboratories around the globe the research is based on potential molecules to be potentially used by pharmaceutical laboratories not to help identify or confirm species and the DNA analysis is often not done.

The current Nagoya discussions to reinforce proactive permits on publicly available sequences seems to go in the direction of a purely economic view of the world. We hope that the conservation and sustainable use of biodiversity is not forgotten and will become the main focus of the organisation.

BIBLIOGRAPHY

- PUILLANDRE. N, BOUCHET P., DUDA T.F. F., *ET AL.*, (2014) Molecular phylogeny and evolution of the cone snails (Gastropoda, Conoidea). *Molecular Phylogenetics and Evolution*, Elsevier 78:290-303. hal-02002437
- URIBE J., ZARDOYAR R., PUILLANDRE N., (2018) Phylogenetic relationships of the conoidean snails (Gastropoda: Caenogastropoda) based on mitochondrial genomes. *Molecular Phylogenetics and Evolution*, Elsevier, 127:898-906. hal-02002442

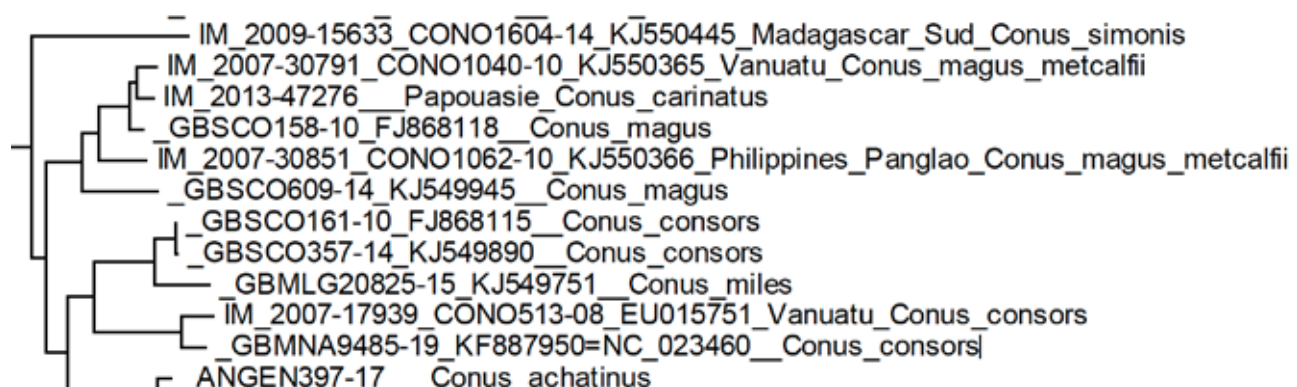


Figure 1. Extract of the phylogenetic tree *Pionoconus*
MNHN catalog number (e.g. IM-2009-15633), BOLD (Barcode of Life Database)
accession number (e.g. CONO1604-14), GenBank accession number (e.g. KJ550445).

Part 4: Description of six new species from the *Pionoconus magus* complex

Summary table of species described and compared.

<i>P. hervillardi</i> sp. nov. <i>Efaté Isl., Vanuatu</i>	↗	<i>P. robini</i>
	↗	<i>P. fiscoederi</i>
	→	<i>P. morrisoni</i>
	↘	<i>P. aff. hervillardi</i>
	↘	<i>P. striatus striatus</i> (juveniles from Vanuatu)
<i>P. samaraiensis</i> sp. nov. <i>Samarai Isl., PNG</i>	↗	<i>P. epistomium</i>
	→	<i>P. carinatus</i>
	↘	<i>P. aff. carinatus</i>
<i>P. manusensis</i> sp. nov. <i>Manus Isl., PNG</i>	↗	<i>P. carinatus</i>
	→	<i>P. aff. carinatus</i>
	↘	<i>P. raphanus</i>
<i>P. vitilevuensis</i> sp. nov. <i>Viti Levu Isl., Fiji</i>	↗	<i>P. raphanus</i>
	→	<i>P. alexisallaryi</i>
	↘	<i>P. magus</i>
<i>P. kwajaleinensis</i> sp. nov. <i>Kwajalein Isl., Marshall</i>	↗	<i>P. raphanus</i>
	→	<i>P. alexisallaryi</i>
	↘	<i>P. magus</i>
<i>P. niasensis</i> sp. nov. <i>Nias Isl., N.W. Sumatra / Nicobar</i>	→	<i>Calibanus furvus f. frauenfeldi</i>
	↘	<i>P. vitilevuensis</i> sp. nov.

MATERIAL AND METHODS

Taxonomy follows Monnier, Limpalaër, Robin & Roux (2018). We describe shell morphology using the terminology established in Röckel *et al.* (1995) and modified in Monnier, Limpalaër, Robin & Roux (2018). Adult shells were measured with digital calipers, most of the time the measurements were rounded to 0.01 millimeter.

Manuel J. Tenorio performed a comparative morphometric statistical study on several *Pionoconus* species. We used analysis of the covariance (ANCOVA) using the corresponding morphometric trait (MD, HMD or SH) as variable, taxon as factor, and SL as co-variate. Statistically significant differences at 95% probability level ($p < 0.05$) appear highlighted in yellow in the tables below.

Distribution maps were made with Tableau Software using the latitudes and longitudes from the studied specimen data.

REPOSITORIES

MNHN: Muséum National d’Histoire Naturelle, Paris, France
MHNG: Muséum d’Histoire Naturelle, Geneva, Switzerland
NHMUK: Natural History Museum, United Kingdom
NMSF: Natural History Museum Senckenberg, Frankfurt, Germany
SMNS: Staatliches Museum für Naturkunde, Stuttgart, Germany, Bob da Motta reference collection.
ZIUU: Uppsala Universitet, Zoologiska Museum, Sweden
UCA: Universidad de Cádiz, Cádiz, Spain
EM: Eric Monnier reference collection, Paris, France
FP: Fabrice Prugnaud reference collection, Suresnes, France
LL: Loïc Limpalaër reference collection, Haudivillers, France
FL: Felix Lorenz reference collection, Buseck-Beuern, Germany
GH: Gérard Hervillard reference collection, Maisons-Alfort, France
SJ: Scott Johnson reference collection, Santa Barbara, California, USA
CR: Christophe Roux reference collection, Vitry-sur-Seine, France
PK: Paul Kersten reference collection, Hoornaar, Netherlands

ABBREVIATIONS

C.M. & W: Coomans, Moolenbeek & Wils
R.K.K.: Röckel, Korn & Kohn.

RESULTS

SYSTEMATICS

Family CONIDAE Fleming, 1822
Genus *Pionoconus* Mörch, 1852

Shell morphometry
SL: maximum shell length
MD: maximum diameter
H: height
SH: spire height = SL-AH
HMD: height of maximum diameter
W: shell weight
AH: aperture height
RD: relative diameter (= MD/AH)
V: estimated "model" volume (= SL x MD x H)
RSH: relative spire height (= SH/SL = (SL-AH) / SL)
PMD: relative position of the maximum diameter (= HMD/AH)
RW: relative shell weight 'length' (= W/SL)
RW': relative shell weight 'volume' (= W/V)

A. *Pionoconus hervillardi* sp. nov. (Plate 1, Figs. 1–4)



Figure 1. holotype of *Pionoconus hervillardi* sp. nov. MNHN-IM-2000-37097

Material examined: Holotype and 3 paratypes of *Pionoconus hervillardi* sp. nov. have been studied. The holotype is deposited in the Muséum National d’Histoire Naturelle, Paris, France, under the number MNHN-IM-2000-37097 (ex-Eric Monnier’s collection). The paratypes are stored in private collections. (See Table 1 for details).

Type	Institution	Dimensions – Weight SL x MD x W (mm x mm x g)	Locality
Holotype	MNHN-IM-2000-37097	30.63 x 13.97 x 2.1	Tukutuk Beach, Efate Isl., Vanuatu, 1-10 m
Paratype 1	Coll. EM	24.35 x 11.38 x 1.1	Tukutuk Beach, Efate Isl., Vanuatu, 1-10 m
Paratype 2	Coll. EM	27.53 x 13.40 x 2.1	Tukutuk Beach, Efate Isl., Vanuatu, 1-10 m
Paratype 3	Coll. LL	26.74 x 13.78 x 2.3	Vanuatu, 10 m

Table 1. Types of *Pionoconus hervillardi* sp. nov.

Synonymy:
2018. *Pionoconus* sp. Monnier, Limpalaër, Roux, Robin.
Taxonomic Iconography of Living Conidae: 657, figs. 1, 2, 3, 5 (Vanuatu). [fig. 4 is a juvenile *Pionoconus striatus striatus*].

Type locality: Tukutuk Beach, Efate Island, Vanuatu

Distribution and habitat: Almost all the few studied shells of *P. hervillardi* sp. nov. have been collected mixed together with *P. floccatus* by G. Hervillard on the beach after a strong hurricane in August 1989 at 1-10 m deep. It is therefore currently only known from its type locality. Further research in Vanuatu should contribute to a better knowledge of the species range.



Figure 2. Distribution map of *Pionoconus hervillardi* sp. nov.

Etymology: The new species is dedicated to our longtime friend Gérard Hervillard member (together with the authors) of the board of directors of AFC (Association Française de Conchyliologie). Gérard collected some specimens of this rare new species during the many stays he made in Vanuatu.

Description of the shell of *Pionoconus hervillardi* sp. nov.

Morphometric parameters:

SL = 24 - 31 mm (mean SL = 27.3 mm); RD = 0.54 - 0.60 (mean RD = 0.57); PMD = 0.71 - 0.86 (mean PMD = 0.83); RSH = 0.14 - 0.17 (mean RSH = 0.16); RW = 0.45 - 0.86 g/cm (mean RW = 0.69 g/cm); RW' = 0.37 - 0.49 g/cm³ (mean RW' = 0.42 g/cm³).

Description: Shell moderately small sized, ventricosely conical in profile. The shell is moderately light in weight. The protoconch is not observed intact in the examined specimens) The shell has about 10 whorls. Spire is moderate (mean RSH = 0.16) with a straight outline. Teleoconch sutural ramps are flat in profile and juxtaposed with about 4 deep spiral grooves and intervening ribs and fine radial growth lines and threads (Fig. 3). The suture is narrow and shallow with a weakly undulate sutural line. The shoulder is subcarinate. The last whorl is smooth with less than ten broad flat spiral ribs on the abapical part. The profile of the last whorl is convex.

The columellar fold is medium and white. Columellar lip is rather straight in the abapical part and convex in the adapical one. Aperture lip profile is convex, and the aperture is wider at base than near shoulder. The lip is white coloured inside. The outer lip is convex and the profile of the origin of the lip is receding with a comma shaped anal notch. The ground colour of the last whorl is white overlaid with intricate brown irregular blotches set that leave a mostly white zone in the middle of the last whorl. Under magnification, narrow darker spiral lines can be observed. The colour and pattern of the spire are consistent with those of the last whorl.



Figure 3. spire of *Pionoconus hervillardi* sp. nov.

Living animal and radula:

The soft parts, radula and DNA of the new species are not known.

COMPARISONS

Pionoconus hervillardi sp. nov. from Vanuatu is compared with *P. robini* Limpalaër & Monnier, 2012 from Philippines, *P. fiscoederi* (Röckel & da Motta, 1983) from Philippines and *P. morrisoni* (G. Raybaudi Massilia, 1991) from Ashmore Reef, Timor Sea. The new species is also compared with 2 similar shells from the same locality that we call here *P. aff. hervillardi*. Considering the small sample available for the measurements of the new species, the shell morphometric differences cannot be considered statistically strong.



Figure 4. Distribution map of *Pionoconus hervillardi* sp. nov. and 4 compared species.

Figure 4 shows the geographical repartition of *Pionoconus hervillardi* sp. nov., *P. aff. hervillardi*, *P. robini*, *P. fiscoederi* and *P. morrisoni* in the tropical western Pacific Ocean.

I. Differentiating features

1 *P. robini* Limpalaër & Monnier, 2012



Figure 5. *Pionoconus robini* Limpalaër & Monnier, 2012. Holotype 26.15 x 13.50 mm in MNHN-IM-2000-24816. Type locality: Balabac Isl., Palawan, Philippines.

Pionoconus hervillardi, sp. nov. has a similar size range (average size: 27.3 mm with a maximum size SL= 30.6 mm for the new species instead of an average size of 24.4 mm and a maximum size of 31.9 mm for *P. robini*). The new species appears to be narrower (average value of the relative diameter RD = 0.57 versus 0.62 for *P. robini* and less conoid with an average PMD = 0.83 versus 0.85 for *P. robini*. The spire has similar height (average RSH: 0.16). The new species is lighter than *P. robini* (RW'= 0.42 g/cm³ versus 0.56 g/cm³).

The pattern and colour range give some distinctive characters. The first whorls of *P. robini* are pink while they are white in the new species. The colour of most *P. robini* is reddish brown with exceptional specimens being dark brown. The new species is only known by brown shells. In the pale zones of the last whorl the new species only shows faint widely separated spiral lines while they are more crowded and conspicuous in *P. robini*. The geographical range of the new species is, so far, restricted to the Island of Vaté in Vanuatu and is widely separated from Palawan in the Philippines where *P. robini* is known to live.

2. *P. fischoederi* (Röckel & da Motta, 1983)

Pionoconus hervillardi, sp. nov. is significantly smaller, reaching a maximum recorded size of 30.6 mm versus 50 mm (39.4 mm in our sample) for *P. fischoederi*. The new species is slenderer (average RD = 0.57 versus 0.59), the shell shape (PMD = 0.83 versus 0.82) and height of spire (RSH = 0.16 versus 0.15) are almost the same. *P. fischoederi* is heavier (RW'= 0.50 g/cm³) than the new species (RW'= 0.42 g/cm³).

In contrast with the new species, the pattern of *P. fischoederi* looks more intricate: it shows numerous broken spiral hairlines; the darker zones are sided and connected by chevrons like streaks. These features are not seen in the new species.

Moreover, the first whorls of *P. fischoederi* are pink and not white and the colour of its pattern varies widely from orange to black. Moreover, the geographical range of *P. fischoederi* is restricted to Palawan, Philippines and is thus totally disjunct from that of the new species.



Figure 6. *Pionoconus fischoederi* (Röckel & da Motta, 1983). Holotype 33.7 x 16.4 mm in NMSF. Type locality: Coron, Palawan, Philippines in sand & coral rubble, at about 30 m deep.

3. *P. morrisoni* (G. Raybaudi Massilia, 1991)



Figure 7. *Pionoconus morrisoni* (G. Raybaudi Massilia, 1991). Holotype 27.5 x 16 mm in MHNG. Type locality: Ashmore Reef, Timor Sea, 610 km north of Broome, N. West Australia, in coarse sand and rubble in channels, 3 - 5 m deep.

The holotype has a size of 27.5 x 16 mm and is stored in MHNG. The Type locality in the Timor Sea is Ashmore Reef, 610 km north of Broome, N. West Australia, (coarse sand and rubble, in channels, 3 - 5 m). This *Pionoconus* seems to be also present in Thevenard Isl., W. Australia.

This small species is comparable in size with *P. hervillardi* n. sp.

However, it differs by its greater relative diameter (0.63 – 0.66, average 0.64), its heavier relative weight (0.93 – 1.2, average 1.0), its bright pink first whorls, and its last whorl pattern and colour. In *P. morrisoni*, the known colours are either bright pink or beige and there are small snow flakes fading in the direction of the lip. Both are unknown in the new species.

4. *P. aff. hervillardi*

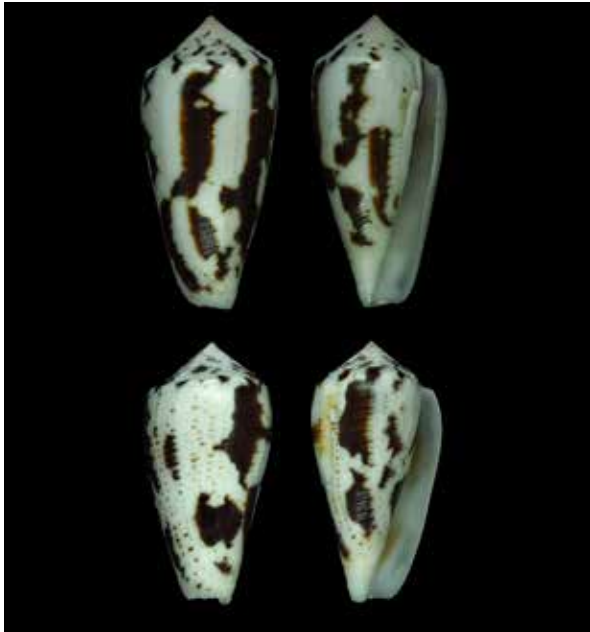


Figure 8. *Pionoconus aff. hervillardi* 28.68 & 34.89 mm, Tukutuk Beach, Efate Isl., Vanuatu, 1-10 m. Coll. GH.

The new species is finally compared with 2 similar specimens from the same locality. These specimens have some spiral rows of small dots that are not present on *P. hervillardi*. For the moment, we prefer not to assimilate these specimens to the new species.

Comparison of the teleoconch sutural ramps

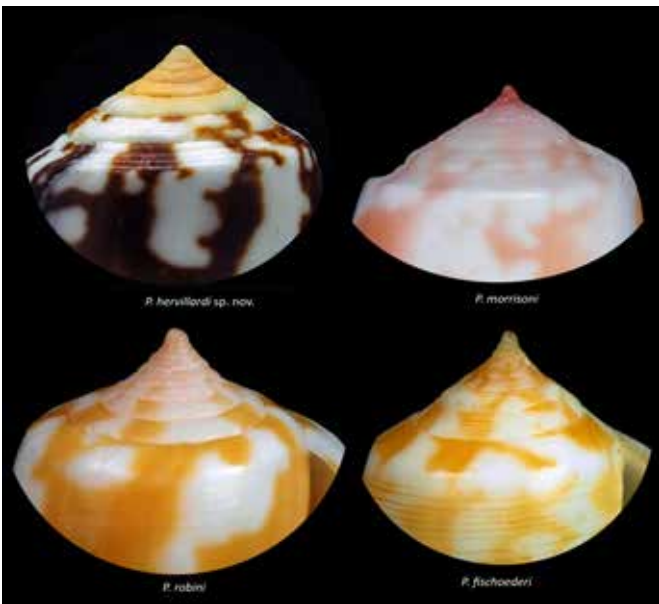


Figure 9. Comparison of the teleoconch sutural ramps on the spires of *Pionoconus hervillardi* sp. nov. and some compared species of *Pionoconus*.

Figure 9 allows us to see the details of the spires and particularly the teleoconch sutural ramps with the spiral grooves of the 4 species compared herein.

The sutural ramp of *P. hervillardi* sp. nov. presents 4 deep spiral grooves that are visibly crossed with growth lines. *P. robini* presents a very smooth sutural ramp with no evidence of any spiral sculpture. *P. fischoederi* presents 5 thin spiral striae barely visible without proper magnification. *P. morrisoni* has 4 spiral grooves, the spiral ribs are angulated with vertical ribs.

II. Morphometric study

1. Morphometric statistic study of *Pionoconus hervillardi* sp. nov. by M.J. Tenorio

P. hervillardi sp. nov. was pairwise compared to *P. fischoederi*, *P. robini*, *P. morrisoni*, *P. aff. hervillardi* and juvenile *P. striatus striatus*. Given the scarce number of specimens of *P. hervillardi* available (N = 4), the results of the present analysis must be taken with due caution. ANCOVA using MD as variable, taxon as factor, and SL as co-variate yielded significant results ($p < 0.05$) in the comparison with *P. robini* and *P. morrisoni*, but the differences were not significant with respect to the other taxa compared. *P. hervillardi* has a MD which is significantly narrower (LS MD mean 19.1 mm) than *P. robini* and *P. morrisoni*. No statistically significant differences were found in the pairwise comparison of the morphometric parameters HMD and SH of *P. hervillardi* with those of the other species. A discriminant function analysis (DFA) using MD, HMD and SH as variables classified correctly only 2 of the 4 specimens in the sample (50% correct), with one of them misclassified as juvenile *P. striatus striatus*, and another as *P. morrisoni*. The overall correct classification rate in the DF analysis was 65.79%.

TAXON 1	TAXON 2	MD		HMD		SH	
		F-score	p	F-score	p	F-score	p
<i>hervillardi</i>	<i>robini</i>	14.35	0.0015	1.78	0.2	1.86	0.19
<i>hervillardi</i>	<i>fischoederi</i>	2.82	0.1124	0.01	0.9428	0.34	0.5697
<i>hervillardi</i>	<i>morrisoni</i>	8.09	0.0294	0.18	0.6834	0.01	0.9311
<i>hervillardi</i>	<i>aff. hervillardi</i>	0.1	0.7673	2.87	0.1887	0.35	0.5982
<i>hervillardi</i>	<i>striatus striatus</i> (juvenile)	0.81	0.3921	0.05	0.8334	0.5	0.4985



2. Morphometric parameters for *P. hervillardi* sp. nov. & 3 compared species

Species	Values	SL (mm)	RD	PMD	RSH	RW(g/cm)	RW'(g/cm³)
<i>P. hervillardi</i> sp. nov.	Our values	24 - 31	0.54 – 0.60	0.71 – 0.86	0.14 – 0.17	0.45 – 0.86	0.37 – 0.49
	Medium value	27.3	0.57	0.83	0.16	0.69	0.42
<i>P. aff. hervillardi</i>	Our values	28 - 35	0.55 – 0.57	0.76 – 0.87	0.15 – 0.16	0.87 – 1.06	0.43 – 0.48
	Medium value	31.8	0.56	0.81	0.15	0.97	0.45
<i>P. robini</i>	Our values	20 - 32	0.58 – 0.66	0.79 – 0.91	0.12 – 0.21	0.5 – 1.3	0.44 – 0.66
	Medium value	24.4	0.62	0.85	0.16	0.8	0.56
<i>P. fischoederi</i>	Our values	24 - 40	0.56 – 0.64	0.75 – 0.89	0.14 – 0.17	0.7 – 2.1	0.42 – 0.58
	Medium value	32.1	0.59	0.82	0.15	1.2	0.50
* (<i>P. robini</i> + <i>P. fischoederi</i>)	RKK	30 - 49	0.54 – 0.62	0.77 – 0.85	0.11 – 0.17	1.0 – 2.2	-
<i>P. morrisoni</i>	Our values	20 - 28	0.63 – 0.66	0.81 – 0.89	0.14 – 0.18	0.93 – 1.2	0.57 – 0.60
	Medium value	25.0	0.64	0.84	0.17	1.0	0.59

Table 2. Morphometric and weight parameters including SL, RD, PMD, RSH, RW & RW' for specimens of *Pionoconus hervillardi* sp. nov., *P. aff. hervillardi*, *P. robini*, *P. fischoederi* and *P. morrisoni*.
* The 2 species *P. robini* and *P. fischoederi* are lumped in RKK

REMARKS

This new species appears in Monnier *et al.* (2018) on page 657 as *Pionoconus* sp. Although only a small bunch of specimens are currently available for study and the statistic morphometric analysis does not show obvious distinction between *P. hervillardi* sp. nov. and the compared species, there appear to be identifiable differences in pattern, spire sculpture and geographical range that help in recognizing the various species. We hope that the present description will reveal more specimens present in collections.

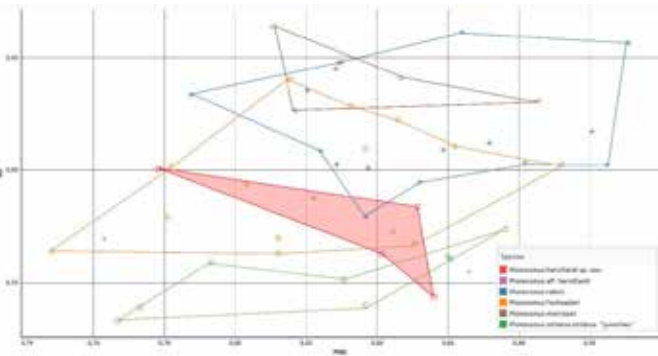


Figure 10. Graph of RD = f(PMD) for compared species. *Pionoconus hervillardi* sp. nov. is figured in red colour.
Figure 10 shows the plotting area of each 5 species represented on the graph: RD = f(PMD).

II. Graphical morphometric comparisons

It appears that *P. hervillardi* sp. nov. has a rather central position in this graph, this new species sharing common morphological points with the other compared *Pionoconus* species

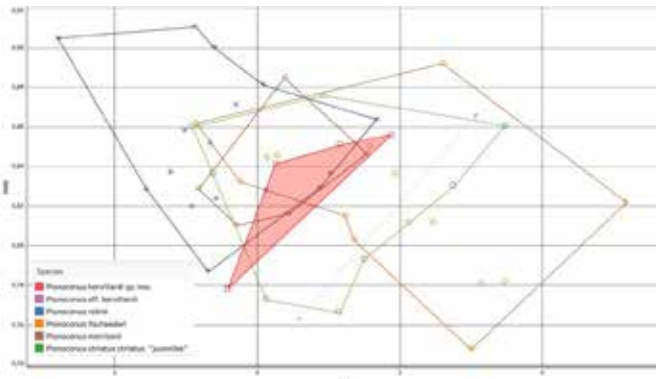


Figure 11. Graph of PMD = f(SH) for some compared species. *Pionoconus hervillardi* sp. nov. is figured in red colour.

Figure 11 shows that the plotting area of the specimens of the related *Pionoconus* species represented on the graph partially overlaps with each other.



B. *Pionoconus samaraiensis* sp. nov. (Plate 3, Figs. 1-16 & Plate 4, Figs. 1-15)



Figure 12. Holotype of *Pionoconus samaraiensis* sp. nov. MNHN-IM-2000-37098

Type material: holotype and 30 paratypes. The holotype is deposited in the Muséum National d'Histoire Naturelle, Paris, France, under the number MNHN-IM-2000-37098 (ex-Eric Monnier's collection). The paratypes are stored in private collections (see Table 3 for details).

Material examined: 31 specimens of *Pionoconus samaraiensis* sp. nov. have been studied.

Type	Institution	Dimensions – Weight SL x MD x W (mm x mm x g)	Locality
Holotype	MNHN-IM-2000-37098	42.30 x 18.12 x 5.3	Samarai Island, PNG
Paratype 1	Coll. FL	42.02 x 17.69 x 3.6	Samarai Island, PNG
Paratype 2	Coll. EM	43.46 x 19.13 x 5.3	Rabaul, PNG
Paratype 3	Coll. EM	41.73 x 19.08 x 5.9	Samarai Island, PNG
Paratype 4	Coll. EM	40.52 x 17.76 x 5.1	Samarai Island, PNG
Paratype 5	Coll. EM	42.14 x 18.71 x 5.0	Samarai Island, PNG
Paratype 6	Coll. EM	50.77 x 21.67 x 9.0	Samarai Island, PNG
Paratype 7	Coll. EM	40.83 x 18.38 x 4.1	Samarai Island, PNG
Paratype 8	Coll. EM	36.94 x 16.45 x 3.5	Samarai Island, PNG
Paratype 9	Coll. EM	47.73 x 19.58 x 6.2	Samarai Island, PNG
Paratype 10	Coll. EM	47.07 x 21.13 x 7.3	Samarai Island, PNG
Paratype 11	Coll. EM	42.03 x 17.96 x 5.1	Samarai Island, PNG
Paratype 12	Coll. EM	41.61 x 17.50 x 4.2	Rabaul, East New Britain, PNG
Paratype 13	Coll. EM	38.53 x 17.59 x 4.2	Samarai Island, PNG
Paratype 14	Coll. EM	42.45 x 19.02 x 5.3	Samarai Island, PNG
Paratype 15	Coll. EM	42.03 x 18.43 x 5.5	Samarai Island, PNG
Paratype 16	Coll. EM	43.96 x 19.74 x 6.3	PNG
Paratype 17	Coll. EM	35.39 x 15.50 x 3.1	Samarai Island, PNG
Paratype 18	Coll. LL 8736	38.36 x 16.21 x 4.0	Samarai Island, PNG
Paratype 19	Coll. LL 7108	43.65 x 19.40 x 5.4	Samarai Island, PNG
Paratype 20	Coll. LL 7108	38.37 x 16.89 x 3.9	Samarai Island, PNG
Paratype 21	Coll. LL 9097	33.84 x 15.90 x 3.3	Samarai Island, PNG
Paratype 22	Coll. LL 9097	33.68 x 14.72 x 2.4	Samarai Island, PNG
Paratype 23	Coll. FL	34.80 x 15.51 x 2.7	Samarai Island, PNG
Paratype 24	Coll. LL 9097	29.08 x 13.44 x 2.2	Samarai Island, PNG
Paratype 25	Coll. LL 9097	31.45 x 13.27 x 2.1	Samarai Island, PNG
Paratype 26	Coll. FP 3542	42.72 x 19.62 x 4.9	Samarai Island, PNG, 20 m
Paratype 27	Coll. FP 3543	42.25 x 18.08 x 5.3	Port Moresby, PNG, 2 m
Paratype 28	Coll. FP 4890	55.25 x 24.94 x 12.6	Rabaul, East New Britain, PNG
Paratype 29	Coll. EM	49.21 x 21.71 x 8.6	Rabaul, East New Britain, PNG
Paratype 30	Coll. EM	52.15 x 22.32 x 10.4	Sudey Island, Milne Bay, PNG

Table 3. Types of *Pionoconus samaraiensis* sp. nov.

Type locality: Samarai Island, Southeast Papua New Guinea

Distribution and habitat: *P. samaraiensis* sp. nov. has been collected from shallow water (about 5 m) in Samarai Island In the Louisiade Archipelago (Kaicher) and Kimbe Bay, New Britain, in the Bismarck Archipelago in Eastern Papua New Guinea. Kaicher (1977) states that the species is found in sandy areas in shallow waters. The new species is probably restricted to this region.



Figure 13. Distribution map of *Pionoconus samaraiensis* sp. nov.

Etymology: The new species is named after Samarai Island from eastern Papua New Guinea which is the type locality.

Description of the shell of *Pionoconus samaraiensis* sp. nov.

Morphometric parameters:

SL = 29 - 56 mm (mean SL = 41.5 mm); RD = 0.47 - 0.54 (mean RD = 0.50); PMD = 0.75 - 0.89 (mean PMD = 0.79); RSH = 0.09 - 0.15 (mean RSH = 0.12); RW = 0.67 - 2.0 g/cm (mean RW = 1.2 g/cm); RW' = 0.29 - 0.44 g/cm³ (mean RW' = 0.38 g/cm³).

Description: Shell moderately small to medium sized, conoid-cylindrical to ventricosely conical in profile. The shell is moderately light to moderately solid in weight. The protoconch was not observed intact in the examined specimens. The shell has more than 10 whorls. Spire is low to moderate (mean RSH = 0.12) with a straight to concave outline. The roughly 5 first tuberculate teleoconch whorls are piled and detached (Fig. 14) and the last ones are juxtaposed. The suture is rather deep and narrow with an undulate line. Teleoconch sutural ramps are flat to slightly concave with about 5 spiral grooves and intervening ribs and fine radial growth threads. The shoulder is subcarinate. The last whorl is smooth with some variable rounded cords on the abapical part. The profile of the last whorl is quite convex. The siphonal lip outline is slightly indented.

The columellar fold is strong and cream coloured. Columellar lip is convex in the adapical part of the last whorl and straight in the abapical one. Aperture lip profile is quite convex and much wider at base than near shoulder. The lip is whitish coloured inside. The profile of the origin of the lip is winged. The ground colour of the last whorl is white widely overlaid with blotches covering almost all the surface of the last whorl. The blotches are very variably coloured (and often bicoloured) in yellow, orange and shades of more or less dark brown. A rather thin band remains mostly white at about the middle of the last whorl. Numerous spiral lines (solid or dashed) are present in the last whorl of many specimens (paratypes 1, 2, 3, 4, 7, ...). The first teleoconch whorls are pale pink in colour and the last five ones are in accordance with the pattern of the last whorl.



Figure 14. spire of *Pionoconus samaraiensis* sp. nov.

Living animal and radula:

Kaicher (1997) states that the animal is “bright red” without other details.

DNA and the morphology of the radula of the new species are not yet known.

The periostracum, partially present on paratype 29, is brown, thin, and semi-transparent (as also stated by Hinton (1975).

COMPARISONS

Pionoconus samaraiensis sp. nov. can be compared with *P. epistomium* (Reeve, 1844) from Indonesia and southern Philippines, *P. carinatus* (Swainson, 1822) and *P. aff. carinatus* from Philippines to Solomon Islands.



Figure 15. Distribution map of *Pionoconus samaraiensis* sp. nov., *P. epistomium*, *P. carinatus* and *P. aff. carinatus*.

Figure 15 shows the geographical repartition of *Pionoconus samaraiensis* sp. nov. and 3 others relative *Pionoconus*.

I. Differentiating features

1. *P. epistomium* (Reeve, 1844)

This species was published in Conch. Icon. 1 (*Conus*): pl. 42, sp. 227, (published Jan), (Proc. zool. Soc. Lond. pt. 11, no. 130: p. 174, not figured, published Jun). The lectotype (C, M & W) is in NHMUK, and it measures 48.2 x 21.1 mm. The type locality Mauritius is very dubious.

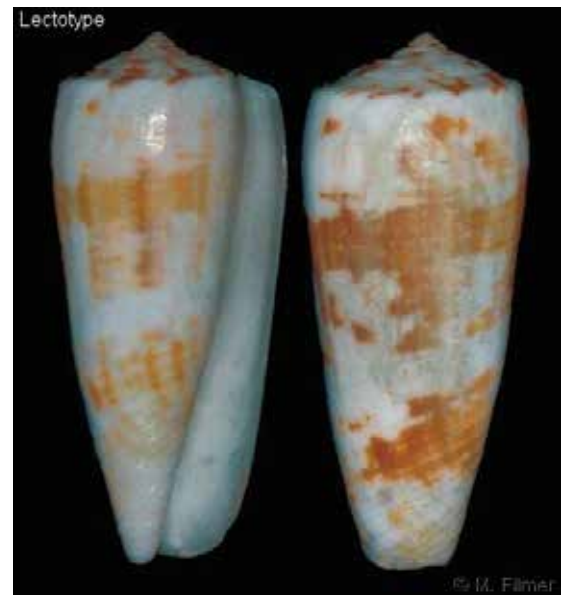


Figure 16. Lectotype of *Pionoconus epistomium*.

Pionoconus samaraiensis sp. nov. reaches a smaller size than *P. epistomium*, the average size for the new species is 41.5 mm instead of 51.1 mm for *P. epistomium*. The new species is less conoid with an average PMD = 0.79 versus 0.85 for *P. epistomium*, with a higher spire (average RSH = 0.12 versus 0.10 for *P. epistomium*) and with a slightly lower relative shell weight (average RW' = 0.38 g/cm³ instead of 0.42 for *P. epistomium*). The pattern of both species is similar but differs by the formation of tents-like white zones in the new species that are not seen in *P. epistomium*. The periostracum of *P. epistomium* is brown, rather thick and opaque while that of *P. samaraiensis* is translucent and thin.

The geographical range of the new species is restricted to the eastern part of Papua New Guinea and is disjunct from that of *P. epistomium* which is collected in Southern Philippines and East Indonesia, more than 1,000 km westwards.

2. *P. carinatus* (Swainson, 1822)

Pionoconus carinatus (Swainson, 1822) was published in Zoological Illustrations (1) 2: pl. 112. Holotype was in collection C. Dubois, present whereabouts unknown, holotype representative (Kohn, 1992) figure in Swainson, pl. 112, measures 69 x 33.5 mm. The type locality “Asiatic Ocean” was restricted by C, M & W to the Philippines.

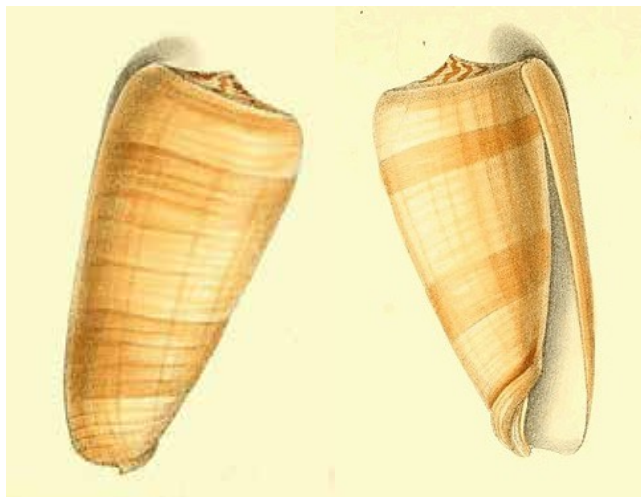


Figure 17. Figure of the holotype of *Pionoconus carinatus*.

Pionoconus samaraiensis sp. nov. reaches a much smaller size than *P. carinatus* (average size for the new species is 41.5 mm versus 61.8 mm for *P. carinatus*), with a slenderer shape (average RD = 0.50 versus 0.53 for *P. carinatus*). The new species is less conoid with an average PMD = 0.79 versus 0.85 for *P. carinatus*, with a higher spire (average RSH = 0.12 versus 0.10 for *P. carinatus*) and with a lower relative shell weight (average RW' = 0.38 g/cm³ versus 0.51 for *P. carinatus*).

The geographical range of the new species is restricted to the eastern part of Papua New Guinea, that of *P. carinatus* is Philippines (and maybe Indonesia) to eastern Papua New Guinea overlapping with the distribution of the new species. The pattern and colours of the new species is much more variable than that of *P. carinatus*.

3. *P. aff. carinatus*

This population similar to *Pionoconus carinatus* (Swainson, 1822) is represented here by a specimen measuring 58.04 x 27.76 mm from Palawan, Philippines, 20 m (Coll. FP).



Figure 18. *Pionoconus aff. carinatus*.

Pionoconus samaraiensis sp. nov. reaches a much smaller size than *P. aff. carinatus* (average size for the new species is 41.5 mm versus 56.8 mm for *P. aff. carinatus*), with a slenderer shape (average RD = 0.50 versus 0.52 for *P. aff. carinatus*). The new species is much less conoid with an average PMD = 0.79 versus 0.89 for *P. aff. carinatus*, with a higher spire (average RSH = 0.12 versus 0.10 for *P. aff. carinatus*) and with a lower relative shell weight (average RW' = 0.38 g/cm³ versus 0.44 for *P. aff. carinatus*).

The geographical range of the new species is restricted to the eastern part of Papua New Guinea, that of *P. aff. carinatus* is Philippines to Vanuatu widely overlapping the distribution of the new species.

The pattern and colours of the new species is much richer and more variable than that of *P. aff. carinatus*.

Comparison of the teleoconch sutural ramps

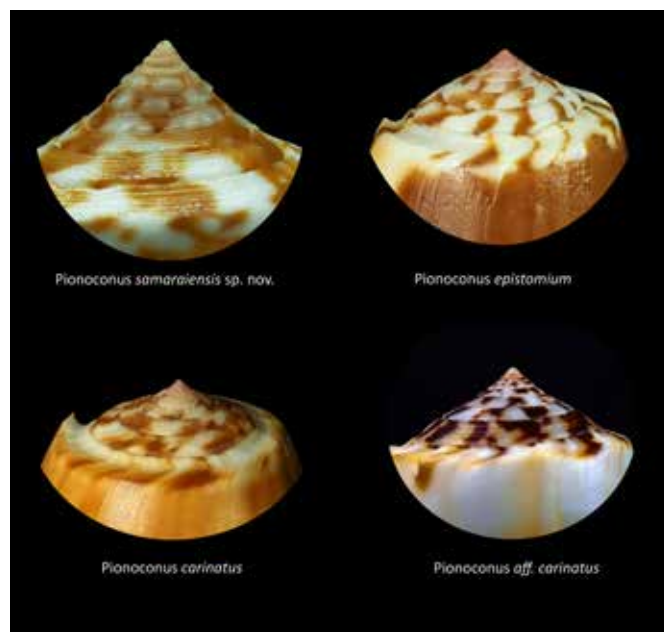


Figure 19. Comparison of the teleoconch sutural ramps on the spires of *Pionoconus samaraiensis* sp. nov., *P. epistomium*, *P. carinatus* and *P. aff. carinatus*.

Figure 19 allows us to see the details of the spire and particularly the teleoconch sutural ramps with the spiral grooves of the 4 species compared here.

The sutural ramp of *P. samaraiensis* sp. nov. is rather flat and presents 5 thin spiral grooves.

P. epistomium has a concave depressed sutural ramp and the spire has 4 to 5 spiral grooves. The ground colour of the first whorls is pink with black stains or fully pink (in shells from Banggai). *P. carinatus* presents a convex depressed sutural ramp with 3 thin reticulated striae. *P. aff. carinatus* has 2 thin striae and presents the same depressed anal notch than *P. carinatus*. Both have pink early whorls.

II. Morphometric study

1. Morphometric statistic study of *Pionoconus samaraiensis* sp. nov. by M.J. Tenorio

P. samaraiensis sp. nov. was compared to *P. epistomium*, *P. carinatus* and *P. aff. carinatus*. In this case, there were sufficient specimens available in the sample for a reliable statistical morphometric analysis (N = 31). ANCOVA on MD as variable yielded statistically significant differences with all compared taxa. *P. samaraiensis* is narrower-bodied (LS MD mean 23.1 mm) than any of the other species (LS MD mean always greater than 24 mm). The same applies to HMD, with *P. samaraiensis* having the lowest value for this parameter (LS HMD mean 37.3 mm) compared to the other species (LS HMD mean greater than 40.3 mm), although the comparison with *P. carinatus* did not yield significant results. SH was also significantly more elevated (LS SH mean 6.33 mm) only in the case of comparison with *P. epistomium*, whereas the differences with the other taxa were found not significant for this parameter. DFA classified correctly 29 out of 31 specimens of *P. samaraiensis* (93.6 %), which indicates that this species can be separated from the other compared taxa on the grounds of the morphometric parameters MD and HMD, and SH in a lesser extent.

TAXON 1	TAXON 2	MD		HMD		SH	
		F-score	p	F-score	p	F-score	p
samaraiensis	epistomium	22.42	0	24.54	0	8.81	0.0044
samaraiensis	carinatus	14.89	0.0004	2.28	0.1389	1.17	0.2856
samaraiensis	aff. carinatus	19.01	0.0001	16.62	0.0002	1.4	0.2441



2. Morphometric parameters for *Pionoconus samaraiensis* sp. nov., *P. epistomium*, *P. carinatus* and *P. aff. carinatus*.

Species	Values	SL (mm)	RD	PMD	RSH	RW(g/cm)	RW'(g/cm³)
<i>P. samaraiensis</i> sp. nov.	Our values	29 - 56	0.47 - 0.54	0.75 - 0.89	0.09 - 0.15	0.67 - 2.0	0.29 - 0.44
	Medium value	41.5	0.50	0.79	0.12	1.2	0.38
<i>P. epistomium</i>	Our values	37 - 64	0.46 - 0.55	0.76 - 0.93	0.06 - 0.13	1.3 - 2.9	0.31 - 0.57
	Medium value	51.1	0.51	0.85	0.10	2.0	0.42
	RKK value	-	0.47	-	-	-	-
<i>P. carinatus</i>	Our values	52 - 69	0.50 - 0.59	0.76 - 0.91	0.06 - 0.15	2.4 - 6.8	0.38 - 0.63
	Medium value	61.8	0.53	0.85	0.10	4.1	0.51
<i>P. aff. carinatus</i>	Our values	50 - 66	0.49 - 0.55	0.81 - 0.93	0.08 - 0.13	1.9 - 3.4	0.39 - 0.53
	Medium value	56.8	0.52	0.89	0.10	2.8	0.44

Table 4. Morphometric and weight parameters including SL, RD, PMD, RSH, RW & RW' for specimens of *Pionoconus samaraiensis* sp. nov., *P. epistomium*, *P. carinatus* and *P. aff. carinatus*.

III. Graphical morphometric comparisons

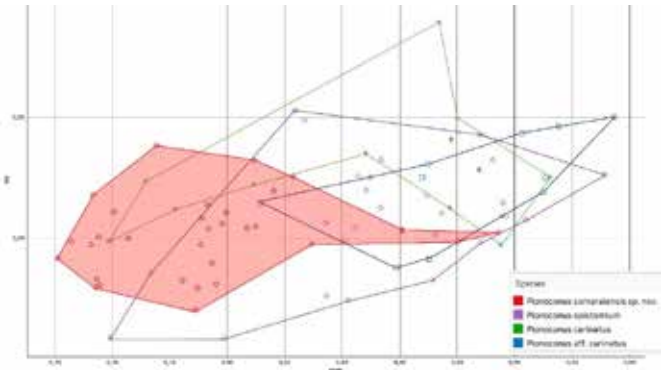


Figure 20. Graph of RD = f(PMD) for *Pionoconus samaraiensis* sp. nov., *P. epistomium*, *P. carinatus* and *P. aff. carinatus*. The new species is figured in red colour.

Figure 20 shows the plotting area of each 4 species represented on the graph: RD = f(PMD). It appears that *P. (P.) samaraiensis* sp. nov. does not have a central position in this graph; however, this new species is sharing common morphological points with some specimens of the compared species.

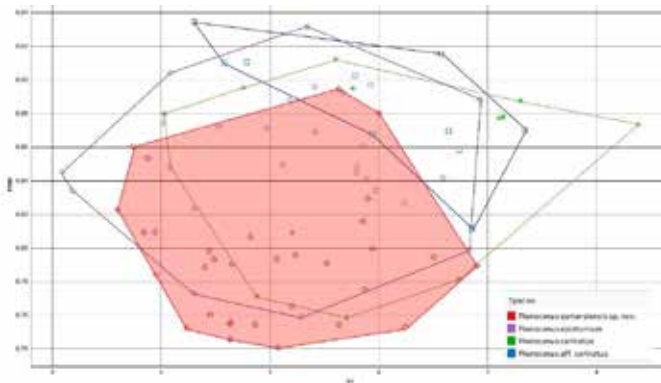


Figure 21. Graph of PMD = f(SH) for *Pionoconus samaraiensis* sp. nov., *P. epistomium*, *P. carinatus* and *P. aff. carinatus*. The new species is figured in red colour.

Figure 21 shows that the new species broadly overlaps *P. epistomium* and *P. carinatus*. Its overlap with *P. aff. carinatus* is very weak.

REMARKS

This new species appears in Monnier *et al.* (2018) on page 653 N° 1 to 3 and 5 to 10 as *Pionoconus aff. epistomium*.

The species was illustrated in RKK in plate 20 Figs 7, 8 and 9 from respectively Port Moresby, New Britain and Nimoa Island. They devote a paragraph to the specimens from Papua New Guinea. They give a short description and state that it “may represent a geographic variant or a closely related distinct species”. They also quote that it is erroneously called “*Conus melancholicus* Lamarck” in literature.

Lamarck introduced this name in “Annales du Muséum National d’Histoire Naturelle”, Vol. XV p. 430 under the number 156. Its locality is not given. Lamarck states that his species is closer to the “*C. bullé*” which is our *Textilia bullata* (Linnaeus, 1758) but is more slender, more cylindrical and has four to five striae on its spire. Its colour is of a fawn or orange red with irregular yellowish blotches forming an interrupted zone in its middle. The spire is described as very short almost flat, somewhat canaliculate, mucronate, striate and blotched with fawn on a yellowish white background. This description may apply to the present species or to several other ones in the genus *Pionoconus*.

Lamarck cites a figure in Martini (1773, pl. LII, fig. 572). This figure shows a specimen of *Pionoconus circumcisis* (Born, 1778) that is still slender and illustrated by Kohn (1992). Lamarck had one shell in his collection that was (according to Kohn, 1992) illustrated by Kiener (1845). Reeve also saw Lamarck’s shell and obtained a drawing of it that was copied in *Conchologia Iconica*.

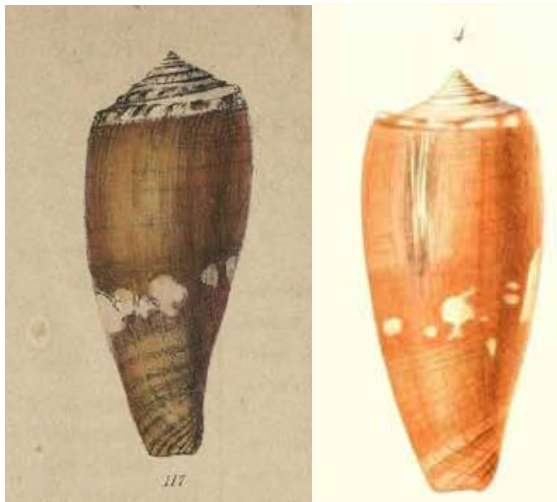


Figure 22b. Lamarck’s *Conus melancholicus*
Reeve Pl. XXI Fig. 117.

Figure 22a. Kiener pl. 45 Fig. 4.

Reeve (*Conchologia Iconica*, Genus *Conus*, 1844 n°117, pl. XXI) gives a good figure of *Conus melancholicus* and a description both in Latin and in English. The pictured shell is stated to be the one from Lamarck’s collection present in the “Musée Royal at Paris” (now MNHN). Reeve explains that he has “attentively examined Lamarck’s” shell in Paris and that he is indebted to M. Valenciennes for allowing him to obtain a drawing of it. Therefore, the figure by Reeve appears to be made from a drawing of the actual Lamarck’s shell.

Kiener (1845) gives a description in Latin and a more detailed one in French. Kiener insists on the remarkable red orange colour and on the existence of spiral bands at periphery and in the middle of the last whorl. The length is given at 52 mm. In the

text Kiener refers to the figure Pl. 45, fig. 3. Unfortunately, this figure is of *Conus nimbosus* that is supposed to be represented on figure 4 of the same plate while it is indeed *Conus melancholicus* that is shown under this number. An interversion of the figures occurred. The representation of Lamarck’s *Conus melancholicus* is on fig. 4. It agrees moderately with Reeve’s figure but seems to be made from the same specimen. This figure is in perfect match with the descriptive text on page 279. Sowerby (*Thesaurus Conchyliorum* n° 353 fig. 547) copies Reeve’s figure. He considers the species valid.

Weinkauff considers that the species is dubious because “*I cannot make up my mind whether to accept the present image as having been taken after a complete shell and must therefore place the species among the dubious ones*” (translated from German). This statement is not surprising as Weinkauff cites the wrong figure from Kiener’s work. In the text and table, he gives uncorrect names: “*melangolicus*” or “*melangelicus*”

Tryon (1884) considers *Conus melancholicus* as a valid species and shows on plate 28, fig. 71 a figure that is a rather poor copy of the engraving in Reeve’s *Conchologia Iconica*.

After many years without citations of the species, Marsh & Rippingale (1974) use the name for a shell from New Ireland that is illustrated in their plate 24 fig. 2. The shell is undoubtedly an orange-brown specimen of *P. samaraiensis* n. sp. They state that the “species shows some relationship with *Conus magus* but appears to be distinct from that species.”

This name was also indicated as a possible one for his *Conus* species by Hinton (1978) on p. 57 for three shells on figs. 7. Two are from Port Moresby and the third from Samarai Island. Hinton writes that he believes this species “to be distinct from” his *Conus magus* (which is in fact a mix of *P. alexisallaryi* and *P. epistomium*). He states that the new species is lighter, smaller and has a different periostracum than his *C. magus*.

Kaicher (1977) illustrates the new species from Louisiade Archipelago in her card N° 1334

Walls (1979) illustrates one specimen (p. 436 below right) from Samarai Island with an unusual pattern of wide axial black streaks.

Da Motta, 1991 cites the species as belonging to the Genus *Hermes* Montfort, 1810, subgenus *Pionoconus* Mörch, 1852 but not as a valid species in the index.

Lamarck’s shell could not be located in MNHN and is considered lost.

Kohn (1992) did not notice the interversion of Kiener’s figures and ignored Reeve’s one. He decided to consider *Conus melancholicus* as a *nomen dubium* because, on one hand, the original shell is lost and on the other hand, the cited figure in Martini and the probable reproduction of Lamarck’s shells in Kiener are not conspecific. Filmer (2001) agrees with Kohn. Walls (1979) has the same opinion.

Our conclusion is that Lamarck’s *Conus melancholicus* cannot unequivocally be assigned to the new species only with Lamarck’s indications. It shall remain a *nomen dubium*.

C. *Pionoconus manusensis* sp. nov.
(Plate 8, Figs. 1-11)

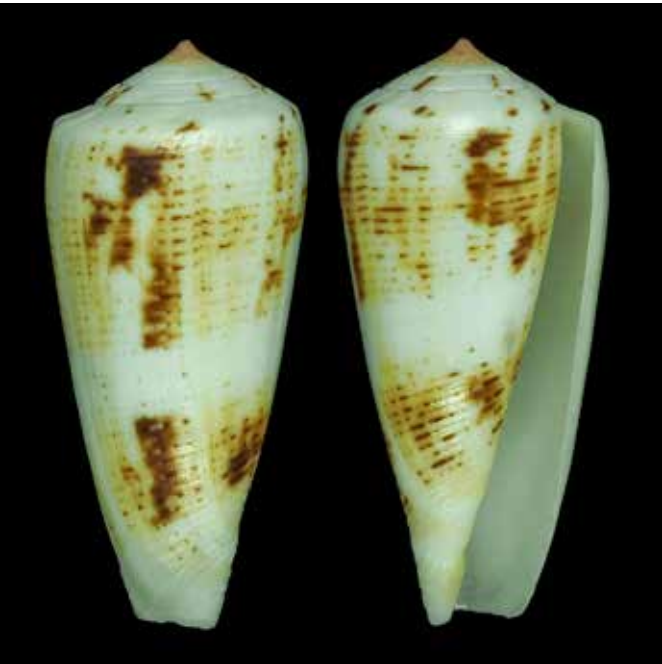


Figure 23. Holotype of *Pionoconus manusensis* sp. nov. MNHN-IM-2000-37127.

Type material: Holotype and 10 paratypes. The holotype is deposited in the Muséum National d’Histoire Naturelle, Paris, France, under the number MNHN-IM-2000-37127 (ex-Eric Monnier’s collection). The paratypes are stored in private collections. (see Table 5 for details)

Material examined: 11 specimens of *Pionoconus manusensis* sp. nov. have been studied.

Type	Institution	Dimensions – Weight SL x MD x W (mm x mm x g)	Locality
Holotype	MNHN-IM-2000-37127	43.16 x 19.48 x 5.6	Manus Isl., PNG
Paratype 1	Coll. LL	42.40 x 19.91 x 6.7	Kimbe Bay, New Britain, PNG
Paratype 2	Coll. EM	39.85 x 18.14 x 5.7	Manus Isl., PNG
Paratype 3	Coll. EM	45.33 x 20.66 x 8.4	Manus Isl., PNG
Paratype 4	Coll. FL	51.56 x 23.36 x 11.6	Manus Isl., PNG
Paratype 5	Coll. FP	44.60 x 21.77 x 11.4	Manus Isl., PNG
Paratype 6	Coll. EM	44.30 x 22.22 x 9.5	Manus Isl., PNG
Paratype 7	Coll. EM	45.16 x 20.71 x 7.4	PNG
Paratype 8	Coll. EM	51.62 x 23.62 x 12.8	New Britain, PNG
Paratype 9	Coll. EM	50.81 x 23.40 x 11.9	Manus Isl., PNG
Paratype 10	Coll. EM	62.51 x 29.53 x 24.6	New Britain, PNG

Table 5. Types of *Pionoconus manusensis* sp. nov.

Type locality: Manus Island, North-East Papua New Guinea.

Distribution and habitat: *P. manusensis* sp. nov. has been collected in the Bismarck Sea from Manus Isl. and Kimbe Bay, New Britain, North-East Papua New Guinea. The new species is probably restricted to this region.

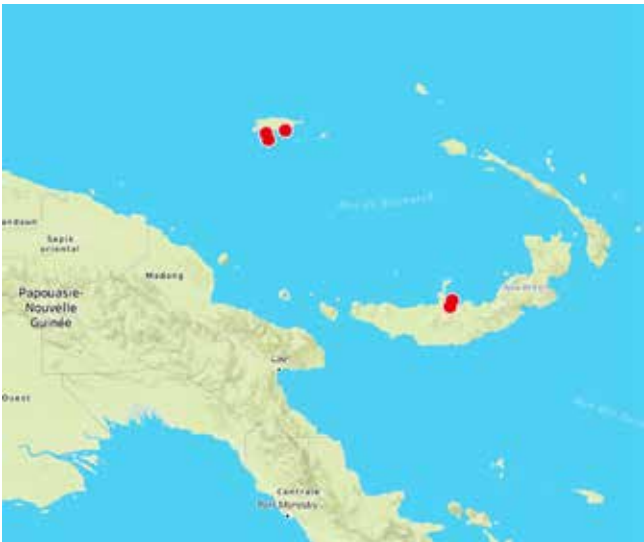


Figure 24. Distribution map of *Pionoconus manusensis* sp. nov.

Etymology: The new species is dedicated to Manus Island from the Bismarck Sea in the East Papua New Guinea where the holotype and the paratypes come from.

Description of the shell of *Pionoconus manusensis* sp. nov.

Morphometric parameters:
SL = 39 – 63 mm (mean SL = 47.4 mm); RD = 0.50 – 0.57 (mean RD = 0.53); PMD = 0.85 - 0.91 (mean PMD = 0.88); RSH = 0.10 – 0.14 (mean RSH = 0.12); RW = 1.3 – 3.9 g/cm (mean RW = 2.1 g/cm); RW’ = 0.36 – 0.56 g/cm³ (mean RW’ = 0.45 g/cm³).

Description: Shell medium sized to moderately large, conical in profile. The shell is moderately solid in weight. The protoconch is not observed intact in the examined specimens. The shell has about 10 to 11 whorls. Spire is low to moderate (mean RSH = 0.12) with a rather straight outline. The teleoconch whorls are rather flat in profile. The suture is deep, wide and undulate for the first teleoconch whorls and smooth in the last ones. Teleoconch sutural ramps are flat with about 5 spiral grooves and intervening ribs and numerous fine radial growth lines and threads. The shoulder is angulate. The last whorl is rather smooth with some spiral ridges on the abapical part. The profile of the last whorl varies from mostly straight to slightly convex. The siphonal lip outline

is rather straight. The columellar fold is strong and ivory to light brown coloured. Columellar lip is slightly convex in the adapical part of the last whorl and almost straight in the abapical one. Aperture lip profile is convex and wider at base than near shoulder. The lip is white coloured inside. The outer lip is convex and the profile of the origin of the lip is receding. The ground colour of the last whorl is ivory overlaid with two or three wide spiral bands varying from yellow to light brown at the adapical third, two-thirds/center and at the base. In few specimens, irregular dark brown spiral lines of dots and dashes are also present inside the bands of the last whorl. The colour of the protoconch and first teleoconch whorls is dark pink, then becomes white. There may

be some scattered dark brown flecks or dashes on the spire.



Figure 25. spire of a paratype of *Pionoconus manusensis* sp. nov.

Living animal and radula:

DNA and the morphology of the radula of the new species are not yet known. As the complete protoconch is unknown, the larval development cannot be ascertained but is likely direct.

COMPARISONS

Pionoconus manusensis sp. nov. can be compared with *P. raphanus* (Hwass in Bruguière, 1792), *P. carinatus* (Swainson, 1822) and *P. aff. carinatus*, all from Philippines to Solomon Islands.



Figure 26. Distribution map of *Pionoconus manusensis* sp. nov., *P. carinatus*, *P. aff. carinatus* and *P. raphanus*.

Figure 26 shows the geographical repartition of *Pionoconus samaraensis* sp. nov., *P. carinatus*, *P. aff. carinatus* and *P. raphanus*.

I. Differentiating features

1. *P. raphanus* (Hwass in Bruguière, 1792)

The species was published in Enc. Méth. 1: p. 722, no. 118, (1798, Tab. Enc. pl. 341, figs 1 & 2). The Lectotype (Kohn) is in MHNG, (61 x 31 mm). Type locality Asiatic Ocean.

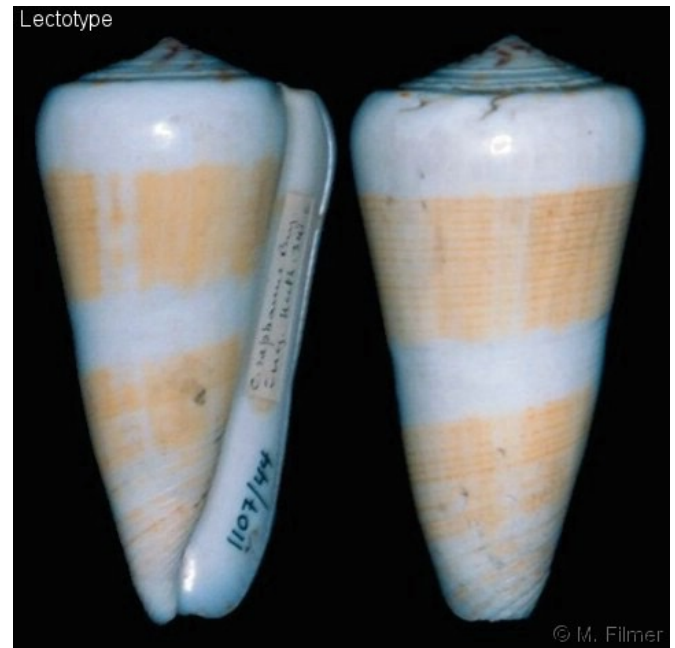


Figure 27. Lectotype of *Pionoconus raphanus*.

Pionoconus manusensis sp. nov. reaches a much smaller size than *P. raphanus* (average size for the new species is 47.4 mm vs 62.6 mm for *P. raphanus*), with a slenderer shape (average RD = 0.53 vs 0.58 for *P. raphanus*). The new species is less conoid with an average PMD = 0.88 vs 0.91 for *P. raphanus* (the shoulder of the new species is less angulate than that of *P. raphanus*). *P. raphanus* has a body whorl with straight sides sometimes constricted in the middle. This character has not been observed in the new species. Moreover, *P. manusensis* sp. nov. is lighter in weight (average RW' = 0.45 g/cm³ vs 0.52 for *P. raphanus*). The pattern and colours of the new species is rather constant, those of *P. raphanus* are quite variable and present a rich range of colours.

The geographical range of the new species is very restricted to East Papua New Guinea, that of *P. raphanus* is wider and includes the distribution of the new species.

Another related species that ranges from Solomon Islands to New Caledonia is *P. alexisallaryi*. It also differs from the new species by its straight sides and a different pattern. The spire is much darker with many dark brown streaks.

2. *P. carinatus* (Swainson, 1822)

Pionoconus manusensis sp. nov. reaches a much smaller size than *P. carinatus* (average size for the new species is 47.4 mm vs 61.8 mm for *P. carinatus*). The new species is slightly more conoid with an average PMD = 0.88 vs 0.85 for *P. carinatus*, with a higher spire (average RSH = 0.12 vs 0.10 for *P. carinatus*) and with a lower relative shell weight (average RW' = 0.45 g/cm³ vs 0.51 for *P. carinatus*).

The geographical range of the new species is restricted to East

Papua New Guinea, that of *P. carinatus* is Philippines to East Papua New Guinea, widely including the distribution of the new species.

The colour patterns of the two species are different. The spire of the new species is mostly white with some dark flecks and streaks. In *P. carinatus* the spire is strongly stained with tan-brown blotches of the same colour than the last whorl. In *P. carinatus* the colour of the last whorl is brown while it is more variable in *P. manusensis* n. sp. and always lacks the spiral lines of dark brown dots and dashes seen in the new species.

Other morphometric characters do not allow do distinguish the two species.

3. *P. aff. carinatus*

Pionoconus manusensis sp. nov. reaches a smaller size than *P. aff. carinatus* (average size for the new species is 47.4 mm vs 56.8 mm for *P. aff. carinatus*). The new species has a higher spire (average RSH = 0.12 vs 0.10 for *P. aff. carinatus*) and a similar relative shell weight.

The geographical range of the new species is restricted to the eastern part of East Papua New Guinea, that of *P. aff. carinatus* is Philippines to Vanuatu widely including the distribution of the new species.

The tip of the spire in *P. aff. carinatus* is paler than that of the new species and is strongly stained with brown. It also lacks the complex pattern on the last whorl seen in the new species.

Other morphometric characters do not allow do distinguish the two species.

Comparison of the teleoconch sutural ramps



Figure 28. Comparison of the teleoconch sutural ramps on the spires of *Pionoconus manusensis* sp. nov., *P. raphanus*, *P. carinatus* and *P. aff. carinatus*.

Fig 28 allows us to see the details of the spires and particularly the teleoconch sutural ramps with the spiral grooves of the four compared species. *P. manusensis* sp. nov. presents 3 smooth grooved lines with narrow intervening ribs and numerous fine radial growth lines and threads. The suture is deep and wide. The shoulder angle is nearly flat. *P. raphanus* presents 3 spiral grooves with a smooth early teleoconch. The first groove is

large followed by 2 narrow ones. The sutural ramp is convex while *P. carinatus* presents a convex depressed sutural ramp with 3 thin coronated striae. *P. aff. carinatus* has 2 thin striae and presents the same depressed anal notch than *P. carinatus*.

II. Morphometric study

1. Morphometric statistic study of *Pionoconus manusensis* sp. nov. by M.J. Tenorio

P. manusensis sp. nov. (N = 11) was compared to *P. carinatus*, *P. aff. carinatus* and *P. raphanus*. ANCOVA only showed statistically significant differences in the case of the comparison of MD between *P. manusensis* and *P. raphanus*, as all the other comparisons yielded insignificant results. As expected, DFA on morphometric parameters did not work well, and a correct classification rate of only 40.2% was obtained. In the case of *P. manusensis*, 8 specimens out of 11 were correctly classified (72.7% correct). According to these data, *P. manusensis* is difficult to separate from *P. carinatus* or *P. aff. carinatus* based upon morphometric parameters.

TAXON 1	TAXON 2	MD		HMD		SH	
		F-score	p	F-score	p	F-score	p
<i>manusensis</i>	<i>carinatus</i>	0.17	0.6831	0.71	0.4098	0.27	0.6075
<i>manusensis</i>	<i>aff. carinatus</i>	0.41	0.5277	1.23	0.2814	0.92	0.3491
<i>manusensis</i>	<i>raphanus</i>	23.52	0	1.17	0.2882	0.01	0.9366



2. Morphometric parameters for *Pionoconus manusensis* sp. nov., *P. raphanus*, *P. carinatus* and *P. aff. carinatus*.

Species	Values	SL (mm)	RD	PMD	RSH	RW(g/cm)	RW'(g/cm ³)
<i>P. manusensis</i> sp. nov.	Our values	39 - 63	0.50 - 0.57	0.85 - 0.91	0.10 - 0.14	1.3 - 3.9	0.36 - 0.56
	Medium value	47.4	0.53	0.88	0.12	2.1	0.45
<i>P. raphanus</i>	Our values	48 - 82	0.55 - 0.63	0.83 - 0.96	0.08 - 0.16	3.1 - 7.7	0.45 - 0.61
	Medium value	62.6	0.58	0.91	0.11	5.1	0.52
<i>P. carinatus</i>	Our values	52 - 69	0.50 - 0.59	0.76 - 0.91	0.06 - 0.15	2.4 - 6.8	0.38 - 0.63
	Medium value	61.8	0.53	0.85	0.10	4.1	0.51
<i>P. aff. carinatus</i>	Our values	50 - 66	0.49 - 0.55	0.81 - 0.93	0.08 - 0.13	1.9 - 3.4	0.39 - 0.53
	Medium value	56.8	0.52	0.89	0.10	2.8	0.44

Table 6. Morphometric and weight parameters including SL, RD, PMD, RSH, RW & RW' for specimens of *Pionoconus manusensis* sp. nov., *P. raphanus*, *P. carinatus* and *P. aff. carinatus*.

3. Graphical morphometric comparisons

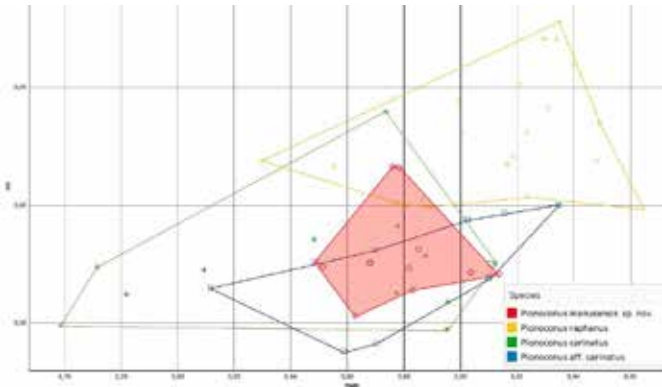


Figure 29. Graph of RD = f(PMD) for *Pionoconus manusensis* sp. nov., *P. raphanus*, *P. carinatus* and *P. aff. carinatus*. The new species is figured in red colour.

Figure 29 shows the plotting area of each 4 species represented on the graph: RD = f(PMD). It appears that *P. manusensis* sp. nov. has a central and rather reduced position in this graph, this new species sharing few morphological points with *Pionoconus raphanus* but being nested within the two others.

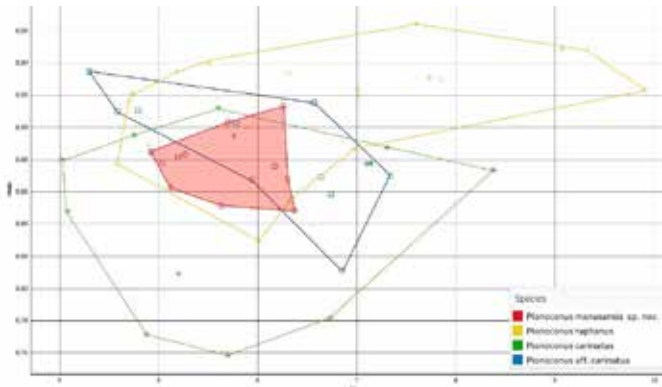
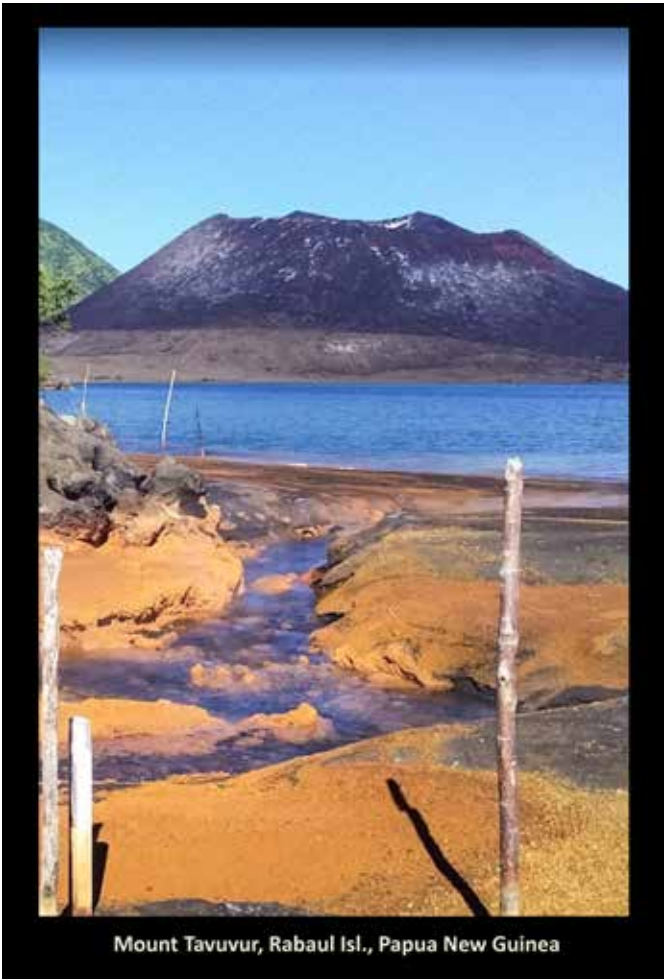


Figure 30. Graph of PMD = f(SH) for *Pionoconus manusensis* sp. nov., *P. raphanus*, *P. carinatus* and *P. aff. carinatus*. The new species is figured in red colour.

Figure 30 shows that the plotting area of the specimens of the 4 related *Pionoconus* species represented on the graph partially overlap with each other. The new species has a restricted and central area but broadly overlaps the 3 compared species.

REMARKS

This new species appears in Monnier *et al.* (2018) on page 653 N° 4 as *Pionoconus aff. epistomium*. Hinton (1972) depicts two shells named “*Conus carinatus* Swainson” from New Britain that appear to belong to the new species. The author points out “one consistent differentiating characteristic is the dark apical point on the spire”. This trait is not present in *P. carinatus* but is indeed present in *P. manusensis* n. sp. He gives an average size of 50 mm that is consistent with our measurements. Hinton later (1978) illustrates two shells on page 57, figs. 8 and 8a that certainly represent this species under the name of “*Conus carinatus* SWAINSON”. The author repeats that “the unmarked white spire and dark apex are distinct”. These characters are diagnostic of the new species.



Mount Tavuvur, Rabaul Isl., Papua New Guinea

D. *Pionoconus vitilevuensis* sp. nov.
(Plate 9, Figs. 1-13 & Plate 10, Figs. 1-12)



Figure 31. Holotype of *Pionoconus vitilevuensis* sp. nov.
MNHN-IM-2000-37099.

Type material: holotype and 19 paratypes
The holotype is deposited in the Muséum National d’ Histoire Naturelle, Paris, France, under the number MNHN-IM-2000-37099 (ex-Eric Monnier’s collection). The paratypes are stored in private collections (See Table 7 for details).

Material examined: 20 specimens of *Pionoconus vitilevuensis* sp. nov. have been studied.

Type	Institution	Dimensions – Weight SL x MD x W (mm x mm x g)	Locality
Holotype	MNHN-IM-2000-37099	49.48 x 23.97 x 12.0	Rattail Reef, Suva, Viti Levu, Fiji Isl., 1-2 m
Paratype 1	Coll. EM	50.31 x 24.48 x 14.3	Fiji Isl.
Paratype 2	Coll. EM	48.52 x 24.55 x 14.1	Rattail Reef, Suva, Viti Levu, Fiji Isl., 1-2 m
Paratype 3	Coll. EM	46.84 x 22.81 x 10.2	Lami Reef, Suva, Viti Levu, Fiji Isl., 1-2 m
Paratype 4	Coll. EM	48.76 x 24.57 x 12.1	Lami Reef, Suva, Viti Levu, Fiji Isl., 1-2 m
Paratype 5	Coll. EM	48.06 x 22.61 x 8.8	Nadi Bay, Viti Levu, Fiji Isl.
Paratype 6	Coll. EM	43.52 x 21.22 x 7.1	Rattail Reef, Suva, Viti Levu, Fiji Isl., 1-2 m
Paratype 7	Coll. EM	46.33 x 22.59 x 9.4	Nadi Bay, Viti Levu, Fiji Isl.
Paratype 8	Coll. EM	41.41 x 21.19 x 6.7	Fiji Isl.
Paratype 9	Coll. EM	45.70 x 22.20 x 10.6	Rattail Reef, Suva, Viti Levu, Fiji Isl., 1-2 m
Paratype 10	Coll. EM	41.51 x 19.18 x 7.1	Fiji Isl.
Paratype 11	Coll. EM	40.60 x 19.81 x 6.7	Wallis-et-Futuna, 5-10 m, muddy sand coral
Paratype 12	Coll. LL 7473	45.80 x 22.75 x 9.3	Nadi Bay, Viti Levu, Fiji Isl.
Paratype 13	Coll. FI	46.18 x 21.42 x 7.3	Nadi Bay, Viti Levu, Fiji Isl.
Paratype 14	Coll. LL 9164	51.34 x 26.58 x 19.2	Suva Point, Suva, Viti Levu, Fiji Isl.
Paratype 15	Coll. FP 3594	43.86 x 20.12 x 7.2	Sesua, Viti Levu, Fiji Isl.
Paratype 16	Coll. FP 3575	47.61 x 24.55 x 12.3	Malolo Lailai Isl., Fiji Isl., 12 m
Paratype 17	Coll. FP 3573	46.52 x 23.83 x 11.2	Nadroga-Navosa, Viti Levu, Fiji Isl., 8 m
Paratype 18	Coll. FP 3572	39.64 x 19.55 x 6.3	Nadroga-Navosa, Viti Levu, Fiji Isl., 8 m
Paratype 19	Coll. FP 3571	39.57 x 19.43 x 5.1	Nadroga-Navosa, Viti Levu, Fiji Isl., 10 m

Table 7. Types of *Pionoconus vitilevuensis* sp. nov.
Type locality: Nadi Bay, Viti Levu, Fiji.

Distribution and habitat: *Pionoconus vitilevuensis* sp. nov. has been collected from shallow water (1-15 m) in Nadi Bay and Lami Reef, Suva, Viti Levu in the Fiji Archipelago. The new species is mostly found in Fiji and probably Wallis and Futuna. Cernohorsky (1964) states that the species lives “under coral, on sand substrate, in shallow water”. He further indicates that “juveniles are found buried in sandy patches”.



Figure 32. Distribution map of *Pionoconus vitilevuensis* sp. nov.

Etymology: The new species is dedicated to Viti Levu Island of the Fiji Archipelago, from where the holotype and almost of the specimens of the new species were collected.

Description of the shell of *Pionoconus vitilevuensis* sp. nov.

Morphometric parameters:
SL = 40 - 52 mm (mean SL = 45.4 mm); RD = 0.52 - 0.60 (mean RD = 0.56); PMD = 0.81 - 0.89 (mean PMD = 0.85); RSH = 0.09 - 0.15 (mean RSH = 0.13); RW = 1.5 – 3.7 g/cm (mean RW= 2.1 g/cm); RW’ = 0.36 - 0.55 g/cm³ (mean RW’= 0.45 g/cm³).

Description: Shell medium sized, ventricose to conical in profile. The shell is moderately solid to solid in weight. The protoconch (not observed intact in the examined specimens) is probably paucispiral with less than 2.5 whorls. The teleoconch has about 10 whorls. Spire is low to moderate height (mean RSH = 0.13) with a rather straight outline. The 5 or 6 first teleoconch whorls are slightly nodose and piled (Fig. 32) and the 4 last ones are piled. The suture is deep and narrow with an undulate line. Teleoconch sutural ramps are slightly concave with about 5 spiral grooves and intervening ribs and fine radial growth lines and threads. The shoulder is angulate to subangulate. The last whorl is rather smooth with a variable number of rounded spiral ribs on the abapical part. The profile of the last whorl is slightly convex. The siphonal lip outline is straight to slightly indented. The columellar fold is strong and cream coloured. Columellar lip is convex in the adapical part of the last whorl and almost straight in the abapical one. Aperture lip profile is convex and wider at base than near shoulder. The lip is white coloured inside. The outer lip is convex and the profile of the origin of the lip is receding. The ground colour of the last whorl is white often tinged by an irregular light grey blue hue band in the adapical part. Its surface is overlaid with brown or greenish axial blotches. The area of these blotches varies from 10 to 90 % of the last whorl total surface. Numerous regularly spaced dark spiral dots and dashes are present mostly inside the blotches. The colour of the first teleoconch whorls is pink. Cernohorsky (1964) describes the periostracum as “light brown, smooth and moderately translucent to opaque in adults, fawn to pale brown, minutely ridged and tufted in juvenile

specimens”.

He also describes the pattern of juvenile specimens as “pale fawn with a minimum of brown blotches”.



Figure 33. spire of *Pionoconus vitilevuensis* sp. nov.

Living animal and radula:

The DNA of the new species is not yet sampled. The radular tooth of the new species was examined by Kohn (Cernohorsky, 1964). According to this it was found to be proportionately longer in relation from the shell length 1/10, than those of specimens from Philippines and Kwajalein (1/13 to 1/15). No illustration of the tooth is given.

As the protoconch is unknown, the larval development cannot be ascertained but is likely direct.

COMPARISONS

Pionoconus vitilevuensis sp. nov. can be compared with *P. magus* (Linnaeus, 1758) from Philippines and Japan to Malaysia and Indonesia, with *P. raphanus* (Hwass in Bruguière, 1792) from Philippines to Solomon Isl. and with *P. alexisallaryi* Cossignani, 2018 from Solomon Isl., New Caledonia, East Papua New Guinea & Fiji.



Figure 34. Distribution map of *Pionoconus vitilevuensis* sp. nov., *P. magus*, *P. raphanus* and *P. alexisallaryi*.

Figure 34 shows the geographical repartition of *Pionoconus vitilevuensis* sp. nov., *P. magus*, *P. raphanus* and *P. alexisallaryi*.

I. Differentiating features

1. *Pionoconus magus* (Linnaeus, 1758)

The neotype (designated by Alan Kohn) is deposited in ZIUU. It measures 43 x 19 mm and the type locality is not known.



Figure 35. neotype of *Pionoconus magus*.

Pionoconus vitilevuensis sp. nov. reaches a much smaller size than *P. magus*: the average size for the new species is 45.6 mm vs 63.2 mm for *P. magus* which can reach a length close to 100 mm. The new species has a rather broader shape (average RD = 0.56 vs 0.53 for *P. magus* and has a slightly more angulate shoulder with a less convex last whorl than that of *P. magus*. Moreover, it has a higher spire (RSH = 0.13 vs 0.11 for *P. magus*) and a rather higher relative shell weight (average RW' = 0.45 g/cm³ vs 0.40 for *P. magus*).

The geographical range of the new species seems restricted to Fiji Islands and Wallis and Futuna. It is disjunct and much further east than that of *P. magus* which is centered on the Philippines and ranges from Ryukyu Archipelago (Southern Japan) south to Indonesia and possibly Northern Australia.

The pattern of the new species is rather constant with its brown blotches and black spiral lines while that of *P. magus* is more variable in colours ranging from yellow to black through all shades of orange, olive and brown. Both species may be marbled with bluish grey patches in the background.

2. *P. raphanus* (Hwass in Bruguière, 1792)

Pionoconus vitilevuensis sp. nov. reaches a much smaller size than *P. raphanus*: average size for the new species is 45.6 mm vs 62.6 mm for *P. raphanus*). It has a rather slenderer shape: average RD = 0.56 vs 0.58 for *P. raphanus*). The new species has a less angulate shoulder than that of *P. raphanus* and is less conoid with an average PMD = 0.85 vs 0.91 for *P. raphanus*. The new species has a higher spire: average RSH = 0.13 versus 0.11 for *P. raphanus*) and a lower relative shell weight (average RW' = 0.45 g/cm³ vs 0.52 for *P. raphanus*).

The geographical range of the new species from Fiji Islands and Wallis and Futuna seems disjunct from the one of *P. raphanus* overall more to the west.

The pattern of the new species is made of blackish or dark olive

brown blotches with black spiral lines while that of *P. raphanus* varies from yellow to chocolate brown with darker brown or white dots set in narrow spiral lines.

3. *P. alexisallaryi* Cossignani, 2018

The holotype is stored in MNHN-IM-2000-34606 and has a size of 59.98 mm. Its type locality is generic: Solomon Islands. *Pionoconus vitilevuensis* sp. nov. reaches a smaller size than *P. alexisallaryi*: the average size for the new species is 45.6 mm vs 54.5 mm for *P. alexisallaryi*. The shape of the last whorl of the new species is roughly similar with an average RD = 0.56 vs 0.57 for *P. alexisallaryi*; nevertheless, it is less conoid with an average PMD = 0.85 vs 0.91 for *P. alexisallaryi*. The new species has a less angulate shoulder with a more convex last whorl than that of *P. alexisallaryi*. Moreover, it has a rather lower spire (RSH = 0.13 vs 0.15 for *P. alexisallaryi*) and a lower relative shell weight (average RW' = 0.45 g/cm³ vs 0.47 for *P. alexisallaryi*). The pattern of the new species is distinct to that of *P. alexisallaryi*. The colour palette of the new species is more bluish and olive brown with a white background than the one of *P. alexisallaryi* who is more orange brown on a yellow cream background.

The geographical range of the new species from Fiji Islands, Wallis and Futuna, is disjunct from that of *P. alexisallaryi* from Solomon Islands, New Caledonia, Vanuatu, East Papua New Guinea and Queensland.



Figure 36. Holotype of *Pionoconus alexisallaryi* 59.98 mm, Solomons Isl. (MNHN-IM-2000-34606).

Comparison of the teleoconch sutural ramps

Figure 37 allows us to see the details of the spires and particularly the teleoconch sutural ramps with the spiral grooves of the 4 main species studied here. The sutural ramp of *P. vitilevuensis* sp. nov. presents 6 spiral punctuated ribs. The sub shoulder area presents 6 spiral grooves linked to the post nuclear sutural ramp giving a rounded shoulder. *P. magus* presents 4 spiral grooves and a concave post nuclear teleoconch sutural ramp with 4 narrow spiral grooves. The early teleoconch is tuberculated and with radial striae. *P. raphanus* presents 3 spiral grooves with a smooth early teleoconch. The first groove

is large followed by 2 narrow ones. The sutural ramp is convex. *P. alexisallaryi* has 3 striae with a very deep and narrow suture. The early teleoconch is smooth.

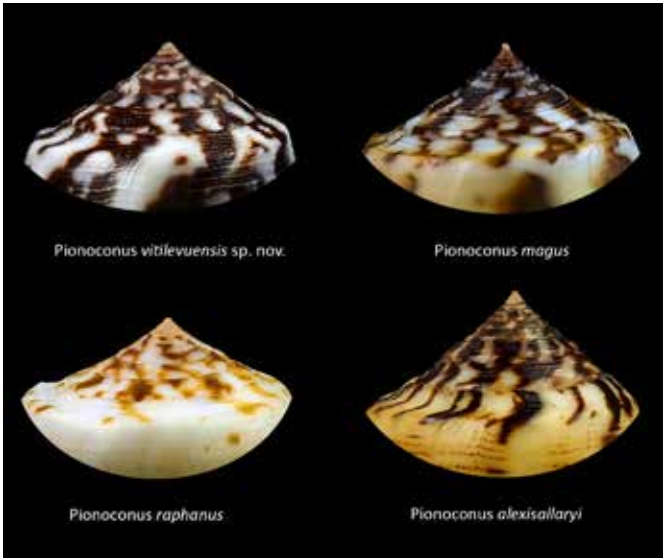


Figure 37. Comparison of the teleoconch sutural ramps on the spires of *Pionoconus vitilevuensis* sp. nov. and *P. magus*, *P. raphanus* and *P. alexisallaryi*.

II. Morphometric study

1. Morphometric statistic study of *Pionoconus vitilevuensis* sp. nov. by M.J. Tenorio

This study was performed with the 20 type specimens plus 5 more ones.

P. vitilevuensis sp. nov. from Fiji was compared to *P. magus*, *P. raphanus* and *P. alexisallaryi*.

P. vitilevuensis differs from *P. raphanus* in its narrower body whorl as reflected in the parameters MD (LS MD mean 23.4 mm versus 25.8 mm in *raphanus*) and HMD (LS HMD mean 35.9 mm versus 39.8 mm in *raphanus*). *P. alexisallaryi* and *P. magus* differ only in their slightly higher SH values. DFA classified correctly the 25 specimens of *P. vitilevuensis*, but 2 specimens of *P. alexisallaryi*, 5 of *P. magus* and 2 of *P. raphanus*

TAXON 1	TAXON 2	MD		HMD		SH	
		F-score	p	F-score	p	F-score	p
vitilevuensis	raphanus	10.27	0.0026	4.89	0.0327	0.76	0.3869
vitilevuensis	alexisallaryi	3.33	0.075	1.56	0.2191	29.08	0
vitilevuensis	magus	0	0.9579	3.02	0.0886	4.78	0.0335



Viti Levu Isl. Fiji

were misclassified as *P. vitilevuensis*. The CVA had a rather poor overall performance of 63.2% correct classification rate.

2. Morphometric parameters for *Pionoconus vitilevuensis* sp. nov. & compared species.

Species	Values	SL (mm)	RD	PMD	RSH	RW (g/cm)	RW' (g/cm³)
<i>P. vitilevuensis</i> sp. nov.	Our values	40 - 52	0.52 - 0.60	0.81 - 0.89	0.09 - 0.15	1.5 - 3.7	0.36 - 0.55
	Medium value	45.6	0.56	0.85	0.13	2.1	0.45
<i>P. magus</i>	Our values	41 - 94	0.49 - 0.57	0.76 - 0.93	0.06 - 0.15	1.4 - 7.4	0.29 - 0.54
	Medium value	63.2	0.53	0.84	0.11	3.4	0.40
<i>*P. magus complex</i>	RKK*	30 - 94	0.47 - 0.69	0.72 - 0.91	0.05 - 0.19	1.0 - 8.3	-
<i>P. raphanus</i>	Our values	48 - 82	0.55 - 0.63	0.83 - 0.96	0.08 - 0.16	3.1 - 7.7	0.45 - 0.61
	Medium value	62.6	0.58	0.91	0.11	5.1	0.52
<i>P. alexisallaryi</i>	Our values	38 - 74	0.53 - 0.63	0.85 - 0.95	0.12 - 0.20	1.3 - 7.3	0.39 - 0.56
	Medium value	54.5	0.57	0.91	0.15	3.2	0.47

Table 8. Morphometric and weight parameters including SL, RD, PMD, RSH, RW & RW' for adult specimens of *Pionoconus vitilevuensis* sp. nov., *P. magus*, *P. raphanus* and *P. alexisallaryi*.
* In RKK all the *P. magus* complex species are lumped.

3. Graphical morphometric comparisons

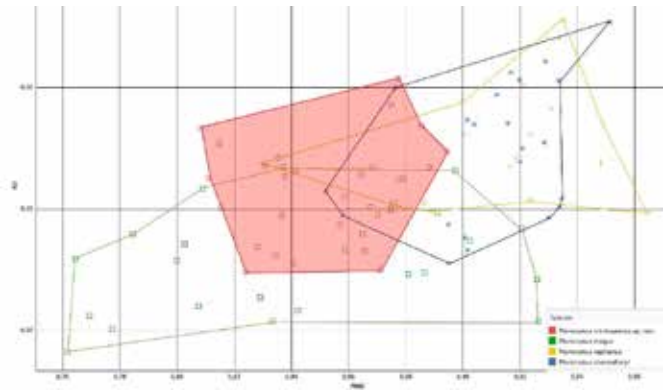


Figure 38. Graph of RD = f(PMD) for *Pionoconus vitilevuensis* sp. nov., *P. magus*, *P. raphanus* and *P. alexisallaryi*. The new species is figured in red colour.

Figure 38 shows the plotting area of the compared species represented on the graph: RD = f(PMD). It appears that *P. vitilevuensis* sp. nov. is sharing common morphological points with the 3 other *Pionoconus* species.

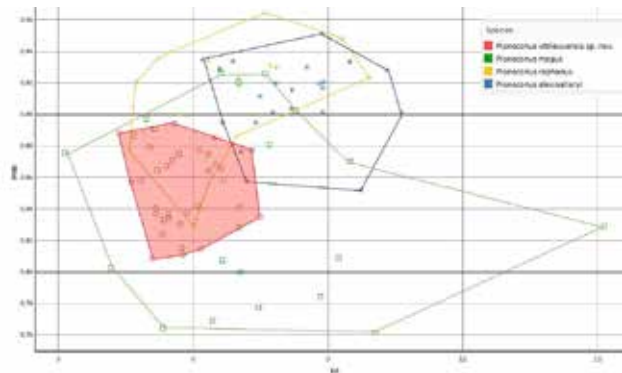


Figure 39. Graph of PMD = f(SH) for *Pionoconus vitilevuensis* sp. nov., *P. magus*, *P. raphanus* and *P. alexisallaryi*. The new species is figured in red colour.

Figure 39 shows that the plotting area of the specimens of the 4 related *Pionoconus* species represented on the graph partially overlap with each other; nevertheless, the overlap between *P.*

vitilevuensis sp. nov. and *P. alexisallaryi* is very weak. The new species, very homogeneous in shape, has a reduced area and a rather central position.

REMARKS

This new species appears in Monnier *et al.* (2018) on page 645 as *Pionoconus aff. magus* 1. It has been illustrated by Cernohorsky (1964) in his monograph on Conidae from Fiji. Although the presence of a member of the “*Pionoconus magus*” complex in Fiji has been known for a long time, its identity never was questioned before our studies on the complex. Its convergence with the typical Filipino shells of *P. magus* certainly was an obstacle in this case. Its isolation from other comparable populations only appeared clearly when shell morphologies were confronted with their geographical occurrences. Similar shells from Northeast Australia and Southeast of Papua New Guinea are present in the authors collections: the presence of the species in these regions needs more confirmations as these occurrences are not confirmed in the consulted literature.



E. *Pionoconus kwajaleinensis* sp. nov.
(Plate 15, Figs1-23)



Figure 40. Holotype of *Pionoconus kwajaleinensis* sp. nov. MNHN-IM-2000-37100.

Type material: holotype and 22 paratypes. The holotype is deposited in the Muséum National d' Histoire Naturelle, Paris, France, under the number MNHN-IM-2000-37100 (ex-Scott Johnson's collection). The paratypes are stored in private collections (See Table 9 for details).

Material examined: 23 specimens of *Pionoconus kwajaleinensis* sp. nov. have been studied.

Type	Institution	Dimensions – Weight SL x MD x W (mm x mm x g)	Locality
Holotype	MNHN-IM-2000-37100	47.25 x 23.28 x 10.8	Elwaj Isl., lagoon side, under rock in sand, Kwajalein Atoll, Marshall Isl., 6 m
Paratype 1	Coll. EM	50.75 x 23.30 x 16.4	Kwajalein Atoll, Marshall Isl., on reef
Paratype 2	Coll. UL	42.87 x 19.95 x 8.5	Kwajalein Atoll, Marshall Isl., on reef
Paratype 3	Coll. UL	52.09 x 24.03 x 16.0	Kwajalein Atoll, Marshall Isl., on reef
Paratype 4	Coll. KP	48.62 x 22.88 x 18.2	Kwajalein Atoll, Marshall Isl.
Paratype 5	Coll. SL	30.75 x 12.61 x 40.0	Emon Beach, Kwajalein Atoll, Marshall Isl., 5 m
Paratype 6	Coll. SL	36.82 x 17.42 x 5.5	Lagoon, Kwajalein Atoll, Marshall Isl., 3-6 m
Paratype 7	Coll. SL	37.20 x 18.52 x 7.0	Ikwa Isl., Kwajalein Atoll, Marshall Isl., 6 m
Paratype 8	Coll. SL	44.25 x 20.48 x 9.5	Lagoon, Kwajalein Atoll, Marshall Isl., 3-6 m
Paratype 9	Coll. SL	64.58 x 33.55 x 39.9	Shall Isl., Kwajalein Atoll, Marshall Isl., 5 m
Paratype 10	Coll. SL	64.20 x 33.58 x 36.4	Kwajalein Atoll, Marshall Isl., 35 m
Paratype 11	Coll. EM	57.88 x 34.88 x 4.1	Lagoon, Kwajalein Atoll, Marshall Isl., 3-6 m
Paratype 12	Coll. EM	35.57 x 16.95 x 4.9	Lagoon, Kwajalein Atoll, Marshall Isl., 3-6 m
Paratype 13	Coll. FL	36.35 x 17.59 x 5.7	Ikwa Isl., Kwajalein Atoll, Marshall Isl., 6 m
Paratype 14	Coll. SL	39.68 x 18.42 x 8.1	Ikwa Isl., Kwajalein Atoll, Marshall Isl., 6 m
Paratype 15	Coll. EM	45.07 x 20.79 x 9.6	Ikwa Isl., Kwajalein Atoll, Marshall Isl., 8 m
Paratype 16	Coll. EM	45.35 x 20.46 x 9.8	Lagoon, Kwajalein Atoll, Marshall Isl., 3-6 m
Paratype 17	Coll. SL	45.99 x 22.08 x 12.4	Lagoon, Kwajalein Atoll, Marshall Isl., 3-6 m
Paratype 18	Coll. EM	58.71 x 27.72 x 28.7	Gugugue, Kwajalein Atoll, Marshall Isl., 8 m
Paratype 19	Coll. EM	67.06 x 28.09 x 25.5	Kwajalein Atoll, Marshall Isl., 35 m
Paratype 20	Coll. EM	67.53 x 31.75 x 42.1	Lagoon, Kwajalein Atoll, Marshall Isl., 3-6 m
Paratype 21	Coll. UL 10048	29.77 x 14.81 x 3.8	Ikwa Isl., Kwajalein Atoll, Marshall Isl., 6 m
Paratype 22	Coll. EM	57.69 x 27.35 x 22.0	Mauve Atoll, Marshall Isl., coral rubble, 2-6 m

Table 9. Types of *Pionoconus kwajaleinensis* sp. nov.

Type locality: Kwajalein, Marshall Archipelago.

Distribution and habitat: The new species is collected in Kwajalein and is probably restricted to the Marshall Archipelago. Brost & Coale (1971) state that the species lives “in sandy areas near or under rocks”. They also give specific places on the atoll where the species was collected.

Scott Johnson gave the following indications about the habitat of the new species: « All specimens were observed inside the Kwajalein Atoll lagoon, all of them along the relatively shallow eastern reef at depths of 3 to a maximum of about 16 meters, mostly buried in sand under rocks although some were exposed

on sand or in algae at night. Most were in the shallower side of that depth range, but we have not seen any in the intertidal. We have also seen quite a number of specimens during the day in lagoon beds of Halimeda and other algae on sandy bottoms, often hidden in the algae or with egg masses attached to the algae».



Figure 41. Distribution map of *Pionoconus kwajaleinensis* sp. nov.

Etymology: The new species is dedicated to Kwajalein Island in the Marshall Archipelago where the new species is collected.

Description of the shell of *Pionoconus kwajaleinensis* sp. nov.

Morphometric parameters:
SL = 42 - 71 mm (mean SL = 54.5 mm); RD = 0.49 - 0.58 (mean RD = 0.53); PMD = 0.82 - 0.95 (mean PMD = 0.90); RSH = 0.09 - 0.15 (mean RSH = 0.12); RW = 2.0 –6.2 g/cm (mean RW= 3.7 g/cm); RW' = 0.50 - 0.67 g/cm³ (mean RW'= 0.57 g/cm³).

Description: Shell medium to moderately large sized, conical to ventricosely conical in profile. The shell is solid to moderately solid. The protoconch (not observed intact in the examined specimens) is probably paucispiral with less than 2.5 whorls. The teleoconch has about 10 whorls in full adult specimens. Spire is low to moderate (mean RSH = 0.12) with a rather straight outline. The teleoconch whorls are juxtaposed and flat in subadult specimens becoming slightly concave in adult ones. The sutural line is undulate with weak tubercles on the early post nuclear whorls. Teleoconch sutural ramps have about 4 spiral grooves and intervening ribs and fine radial growth lines and threads. The shoulder is angulate. The last whorl is rather smooth with a variable number of rounded spiral ribs on the abapical part. The profile of the last whorl is slightly convex. The siphonal lip outline is slightly indented.

The columellar fold is strong and white or cream coloured. Columellar lip is convex in the adapical part of the last whorl and almost straight in the abapical one in the adult shells. Aperture lip profile is convex and wider at base than near shoulder. The lip is white coloured inside. The outer lip is convex in fully adult shells and the profile of the origin of the lip is receding. The anal notch is U shaped. The ground colour of the last whorl is white tinged by 2 light yellow wide bands at the third and two-third. These bands are overlaid with dark brown axial lines, flames, or blotches. Moreover, hardly visible brown and interrupted spiral dots and dashes are present inside the bands. The colour of the apex is pink.



Figure 42. spire of some type of *Pionoconus kwajaleinensis* sp. nov.

Living animal and radula:

Pictures of living specimens of the new species were taken by J. & S. Johnson in the natural environment of this species in Kwajalein Island. Figures 43 a, b, c and the last cover page show the body of the animal with a white dorsum of foot finely sprinkled on the lateral side and on the proboscis by very small black dots. The tip of the siphon is white with a wide black ring. The periostracum is thin, beige and is only partly translucent (as also stated by Brost and Coales, (1971). DNA and the morphology of the radula of the new species are not yet known. The larval development is probably non planktotrophic (in accordance with a probable paucispiral protoconch).



Figure 43a.



Figure 43b.



Figure 43c.

Figure 43. *Pionoconus kwajaleinensis* sp. nov. a, b, c living in Kwajalein Atoll (photos: J. & S. Johnson).

COMPARISONS

Pionoconus kwajaleinensis sp. nov. can be compared with *P. magus* from Philippines and Indonesia, with *P. raphanus* from Philippines to Solomon Isl. and with *P. alexisallaryi* from Solomon, New Caledonia, East Papua New Guinea & Fiji.



Figure 44. Distribution map of *Pionoconus kwajaleinensis* sp. nov., *P. magus*, *P. raphanus* and *P. alexisallaryi*.

Figure 44 shows the geographical repartition of *Pionoconus kwajaleinensis* sp. nov., *P. magus*, *P. raphanus* and *P. alexisallaryi* in the Central Indo-Pacific Region.

I. Differentiating features

1. *Pionoconus magus* (Linnaeus, 1758)

Pionoconus kwajaleinensis sp. nov. reaches a smaller size than *P. magus* as the average size for the new species is 54.5 mm versus 63.2 mm for *P. magus*, a roughly similar shape: average RD = 0.53 vs 0.53 for *P. magus*. The new species is more conoid: average PMD = 0.90 vs 0.84 for *P. magus*, with a more angulate shoulder and a straighter (less convex) last whorl than *P. magus*. It has a rather similar spire height: RSH = 0.12 vs 0.11 for *P. magus* and a higher relative shell weight with an average RW' = 0.57 g/cm³ vs 0.40 for *P. magus*.

The geographical range of the new species probably endemic to Marshall Islands is disjunct and much further east than that of *P. magus*. The pattern and colour of the new species is limited to orange-brown blotches and dark brown axial streaks and flames. There may be some more or less conspicuous brown spiral lines. The new species never shows the bluish grey background patches commonly seen in *P. magus*.

2. *Pionoconus raphanus* (Hwass in Bruguière, 1792)

Pionoconus kwajaleinensis sp. nov. reaches a rather smaller size than *P. raphanus*: average size for the new species is 54.5 mm vs 62.6 mm for *P. raphanus*, with a slenderer shape: average RD = 0.53 vs 0.58 for *P. raphanus*. The new species has a less angulate shoulder than that of *P. raphanus*. The new species has a quite similar spire height: average RSH = 0.12 vs 0.11 for *P. raphanus*, and a higher relative shell weight: average RW' = 0.57 g/cm³ vs 0.52 for *P. raphanus*.

The geographical range of the new species, restricted to Marshall Islands, is disjunct from the one of *P. raphanus* that lives more to the west.

The pattern and the colour of the new species are rather similar to that of *P. raphanus*.

3. *Pionoconus alexisallaryi* Cossignani, 2018

Pionoconus kwajaleinensis sp. nov. has the same size than *P. alexisallaryi*. The shape of the last whorl of the new species is slenderer: average RD = 0.53 vs 0.57 for *P. alexisallaryi*, as conoid as *P. alexisallaryi* with an average PMD = 0.90 vs 0.91 for the second one. Moreover, the new species has a lower spire: RSH = 0.12 vs 0.15 for *P. alexisallaryi* and a higher relative shell weight with an average RW' = 0.57 g/cm³ vs 0.47 for *P. alexisallaryi*.

The geographical range of the new species restricted to Marshall Isl. is disjunct and further north than that of *P. alexisallaryi* from Solomon Isl., New Caledonia, Fiji, Vanuatu, East Papua New Guinea and N. Queensland.

The pattern of the new species (brown blotches on a white base) is quite distinct to that more complex and darker of *P. alexisallaryi*: numerous dark spiral lines on the last whorl and black radial streaks on the spire. The colour of the new species is generally paler than the one of *P. alexisallaryi*: more orange and greener brown.

Comparison of the teleoconch sutural ramps

Figure 45 allows us to see the details of the spires and particularly the teleoconch sutural ramps with the spiral grooves of the 4 species studied here. *P. kwajaleinensis* sp. nov. has 4 spiral grooves. The post nuclear sutural ramp is smooth and rounded. There is no radial groove on the sutural whorls. *P. magus* presents 4 spiral grooves. *P. magus* presents a concave teleoconch sutural ramp with 4 narrow spiral grooves. The early teleoconch is tuberculated with radial striae. *P. raphanus* presents 3 spiral grooves with a smooth early teleoconch. The first groove is large followed by 2 narrow ones. *P. alexisallaryi* has 3 striae with a very deep and narrow suture. The early teleoconch is smooth.



Figure 45. Comparison of the teleoconch sutural ramps on the spires of *Pionoconus kwajaleinensis* sp. nov., *P. magus*, *P. raphanus* and *P. alexisallaryi*.

II. Morphometric study

1. Morphometric statistic study of *Pionoconus kwajaleinensis* sp. nov. by M.J. Tenorio

P. kwajaleinensis sp. nov. was compared to *P. magus*, *P. raphanus* and *P. alexisallaryi*.

P. kwajaleinensis differs statistically from *P. alexisallaryi* in having a narrower body whorl (LS MD mean 22.4 mm vs 23.7 mm in *P. alexisallaryi*) and a lower spire (LS SH mean 6.07 mm vs 7.52 mm in *P. alexisallaryi*). With *P. raphanus* it only differs statistically in MD (LS MD mean 22.4 mm vs 25.8 mm in *P. raphanus*). There are no statistically significant differences with *P. magus* for any of the morphometric parameters considered in the present study. DFA performed poorly, with an overall classification rate of 49.4%. This analysis classified correctly only 13 specimens of *P. kwajaleinensis* out of 17 (76.5 % correct), so separation of these species based upon morphometric parameters is not very accurate in this case.

2. Morphometric parameters for *Pionoconus kwajaleinensis* sp. nov., *P. magus* and *P. alexisallaryi*.

Species	Values	SL (mm)	RD	PMD	RSH	RW (g/cm)	RW' (g/cm ³)
<i>P. kwajaleinensis</i> sp. nov.	Our values	42 - 71	0.49 - 0.58	0.82 - 0.95	0.09 - 0.15	2.0 - 6.2	0.50 - 0.67
	Medium value	54.5	0.53	0.90	0.12	3.7	0.57
<i>P. magus</i>	Our values	41 - 94	0.49 - 0.57	0.76 - 0.93	0.06 - 0.15	1.4 - 7.4	0.29 - 0.54
	Medium value	63.2	0.53	0.84	0.11	3.4	0.40
* <i>P. magus</i> complex	RKK*	30 - 94	0.47 - 0.69	0.72 - 0.91	0.05 - 0.19	1.0 - 8.3	
<i>P. raphanus</i>	Our values	48 - 82	0.55 - 0.63	0.83 - 0.96	0.08 - 0.16	3.1 - 7.7	0.45 - 0.61
	Medium value	62.6	0.58	0.91	0.11	5.1	0.52
<i>P. alexisallaryi</i>	Our values	38 - 74	0.53 - 0.63	0.85 - 0.95	0.12 - 0.20	1.3 - 7.3	0.39 - 0.56
	Medium value	54.5	0.57	0.91	0.15	3.2	0.47

Table 10. Morphometric and weight parameters including SL, RD, RSH, RW & RW' for specimens of *Pionoconus kwajaleinensis* sp. nov., *P. magus*, *P. raphanus* and *P. alexisallaryi*.

* In RKK all the *P. magus* complex species are lumped.

III. Graphical morphometric comparisons

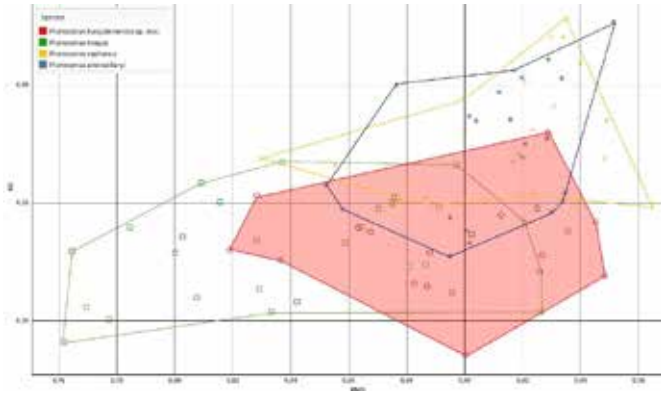


Figure 46. Graph of RD = f(PMD) for *Pionoconus kwajaleinensis* sp. nov. (Figured in red), *P. magus*, *P. raphanus* and *P. alexisallaryi*.

Figure 46. shows the plotting area of each species represented on the graph: RD = f(PMD).

This new species is sharing common morphological points with the 3 other *Pionoconus* species.

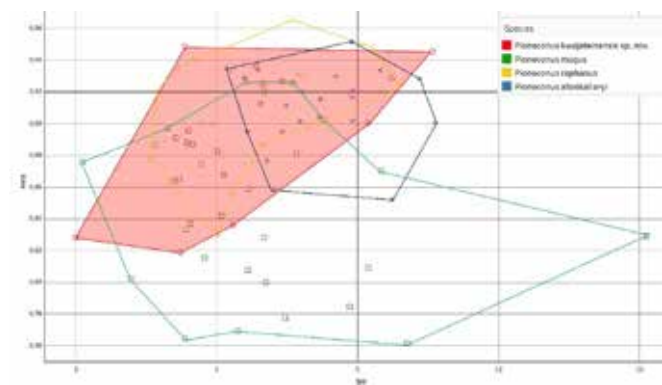


Figure 47. Graph of PMD = f (SH) for *Pionoconus kwajaleinensis* sp. nov. (Figured in red), *P. magus*, *P. raphanus* and *P. alexisallaryi*.

Figure 47 shows that the plotting area of the specimens of the related *Pionoconus* species represented on the graph partially overlap in shape with each other.

REMARKS

This new species appears in Monnier *et al.* (2018) on page 646 as *Pionoconus aff. magus* 2.

In literature it appears in “A guide shell collecting in the Kwajalein Atoll” by Brost & Coale (1971) under the name of *Conus magus*. They picture two typical shells in fig. 12 n° 9 and 10. They give a size range of 1 to 3 inches (from 25 a little more than 75 mm) that is over the maximum size in the sample we studied. The new species is well illustrated on the Website “Kwajalein Underwater” <http://www.underwaterkwaj.com/> by Scott and Jeanette Johnson. The presence of a member of the “*Pionoconus magus*” complex in Marshall Islands has been known for long but not properly recognized in literature. It was only recognized as a distinct taxon when shell morphologies were associated with their distribution ranges in the Tropical Western Pacific.



F. *Pionoconus niasensis* sp. nov.
(Plate 16, Figs. 1-10)



Figure 48. Holotype of *Pionoconus niasensis* sp. nov. MNHN-IM-2000-37128.

Type material: holotype and 14 paratypes. The holotype is deposited in the Muséum National d’ Histoire Naturelle, Paris, France, under the number MNHN-IM-2000-37128 (ex-Eric Monnier’s collection). The paratypes are stored in private collections (See Table 11 for details).

Material examined: 15 specimens of *Pionoconus niasensis* sp. nov. have been studied.

Type	Institution	Dimensions – Weight SL x MD x W (mm x mm x g)	Locality
Holotype	MNHN-IM-2000-37128	30.51 x 16.15 x 4.6	Padang, West Sumatra, Indonesia
Paratype 1	Coll. EM	35.04 x 18.47 x 5.4	Sumatra, Indonesia
Paratype 2	Coll. EM	39.80 x 18.90 x 6.4	Nicobar Isl., India
Paratype 3	Coll. EM	37.08 x 18.02 x 5.3	Nias Isl., West Sumatra, Indonesia, 1 m
Paratype 4	Coll. EM	39.24 x 19.30 x 6.4	Sumatra, Indonesia
Paratype 5	Coll. CR 3670	32.62 x 16.60 x 4.7	Nicobar Isl., India, 10-15 m
Paratype 6	Coll. LL	41.15 x 21.20 x 8.4	Nias Isl., West Sumatra, Indonesia, 1 m
Paratype 7	Coll. FP	46.70 x 21.15 x 7.3	Padang, West Sumatra, Indonesia
Paratype 8	Coll. FL	40.22 x 20.51 x 8.2	West Sumatra, Indonesia
Paratype 9	Coll. EM	34.92 x 17.83 x 5.3	Indonesia
Paratype 10	Coll. EM	40.18 x 19.73 x 5.7	Sumatra, Indonesia
Paratype 11	Coll. EM	43.42 x 22.16 x 10.0	Sumatra, Indonesia
Paratype 12	Coll. EM	34.81 x 16.82 x 3.8	Indonesia
Paratype 13	Coll. EM	38.12 x 19.97 x 8.3	Seribu Island, S.E. Sumatra - N.W. Java, Indonesia, 15-20 m
Paratype 14	Coll. EM	46.49 x 24.92 x 14.8	Seribu Island, S.E. Sumatra - N.W. Java, Indonesia, 15-20 m

Table 11. Types of *Pionoconus niasensis* sp. nov.

Type locality: Padang, West Sumatra, Indonesia.

Distribution and habitat: The new species is collected in the West Sumatra Coast: Nias Island and Padang. It is also found in Nicobar Islands, India. RKK indicate that the species is found “on muddy sand in about 1 to 20 m. at the ocean side of coral reef (Sumatra, Huber pers. comm.).”

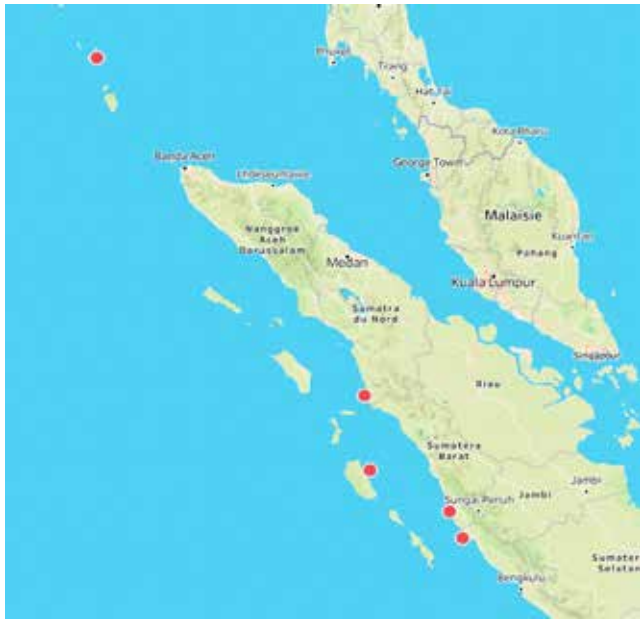


Figure 49. Distribution map of *Pionoconus niasensis* sp. nov.

Etymology: The new species is dedicated to Nias Island in Western Sumatra where the new species is collected.

Description of the shell of *Pionoconus niasensis* sp. nov.

Morphometric parameters:

SL = 30 - 47 mm (mean SL = 38.7 mm); RD = 0.52 – 0.60 (mean RD = 0.57); PMD = 0.85 – 0.93 (mean PMD = 0.89); RSH = 0.09 – 0.14 (mean RSH = 0.12); RW = 1.4 – 3.2 g/cm (mean RW = 1.8 g/cm); RW' = 0.39 – 0.61 g/cm³ (mean RW' = 0.50 g/cm³).

Description: Shell moderately small to medium sized, fully conical in profile. The shell is moderately solid. The protoconch colourless and is paucispiral with less than 2.5 whorls. The shell has about 11 visible whorls in adult specimens. Spire is low to moderate (mean RSH = 0.12) with a rather straight outline. The teleoconch whorls are more or less piled and detached according to the specimens. The suture is deep and wide with a linear line and very weakly nodose. Teleoconch sutural ramps are flat with 5 spiral grooves and intervening ribs and fine radial growth lines and threads. The shoulder is angulate. The last whorl is smooth with basal sculptures made of about 5 spiral grooves and duplicate ribs on the abapical part. The siphonal lip outline is straight.

The columellar fold is strong and yellowish light brown coloured. Columellar lip is straight to slightly convex in the adapical part of the last whorl and straight in the abapical one. Aperture lip profile is almost straight and slightly wider at base than near shoulder. The lip is white coloured inside. The outer lip is straight and the profile of the origin of the lip is slightly winged. The ground colour of the last whorl is white overlaid with very dark brown irregular blotches forming 2 very large spiral bands. The colour of the first two teleoconch whorls is brown in contrast with the white protoconch and then becomes progressively white with scattered dark brown spots.



Figure 50. spire of some types of *Pionoconus niasensis* sp. nov.

Living animal and radula: The animal and the radula of have not been studied.

COMPARISONS

Pionoconus niasensis sp. nov. has been confused and must be compared with *Calibanus furvus* f. *frauenfeldi* although the latter species belongs to another genus! The new species can be also compared with *Pionoconus vitilevuensis* sp. nov.



Figure 51. Distribution map of *Pionoconus niasensis* sp. nov., *Calibanus furvus* f. *frauenfeldi* and *P. vitilevuensis* sp. nov..

Figure 51 shows the geographical repartition of *Pionoconus niasensis* sp. nov., *Calibanus furvus* f. *frauenfeldi* from Philippines, Indonesia, East Papua New Guinea and *P. vitilevuensis* sp. nov. from Fiji Islands.

I. Differentiating features

1. *Calibanus furvus* (Reeve, 1843) f. *frauenfeldi* (Crosse, 1865)

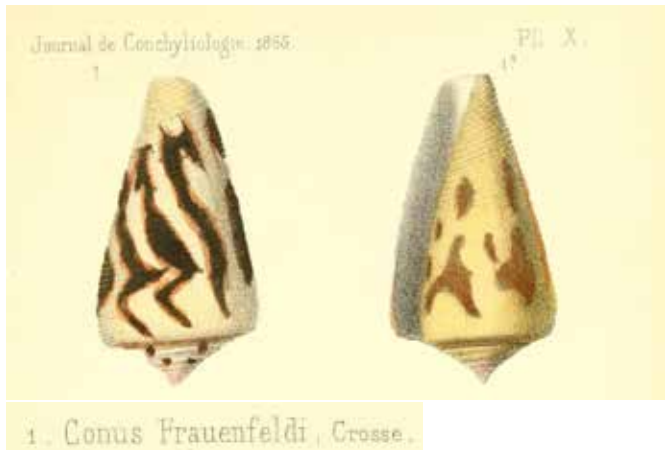


Figure 52. Original figures of the lectotype (right) and paralectotype (left) of *Conus frauenfeldi*.

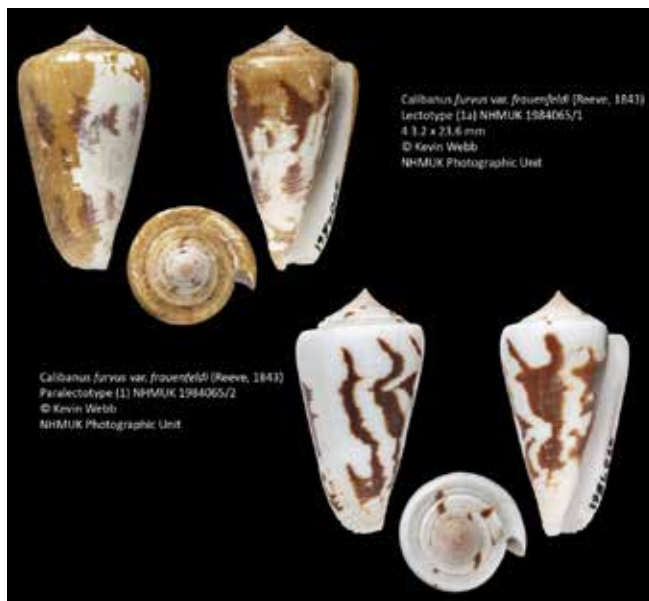


Figure 53. Figure of the lectotypes of *Calibanus furvus* f. *frauenfeldi*.

Pionoconus niasensis sp. nov. reaches a rather smaller size than *Calibanus furvus* f. *frauenfeldi*: average size for the new species is 38.7 mm vs 43.1 mm for *C. furvus* f. *frauenfeldi* with a quite slenderer shape: average RD = 0.57 vs 0.63 for *C. furvus* f. *frauenfeldi*. The new species has a quite similar spire height: average RSH = 0.12 vs 0.11 for *C. furvus* f. *frauenfeldi* but the spire is rather straight in the new species and concave in the compared one. The new species has a lower relative shell weight: average RW' = 0.50 g/cm³ vs 0.58 for *C. furvus* f. *frauenfeldi*.

C. furvus f. *frauenfeldi* has 14 to 15 visible whorls in adult specimens. The sutural ramps are concave and smooth and present no conspicuous threads against the presence of 5 spiral grooves, intervening ribs and fine radial growth lines and threads in *P. niasensis*. Fig. 54 shows these.

The pattern and colour of the new species are rather similar to those of *C. furvus* f. *frauenfeldi*. However – as specified in the original description – the apex of the latter is pale pink while it is conspicuously stained with black on a dark pink background

in *P. niasensis* as can be seen in fig. 54.

The geographical range of the new species from N.W. Sumatra to Nicobar Islands is disjunct from the one of *C. furvus* f. *frauenfeldi* overall more to the east and mainly located in The Philippines waters.

2. *Pionoconus vitilevuensis* sp. nov.

Pionoconus niasensis sp. nov. has a smaller size than *Pionoconus vitilevuensis* sp. nov. with an average size for the former of 38.7 mm vs 45.6 mm for *P. vitilevuensis* sp. nov., and a similar shape: average RD = 0.57 vs 0.56 for *P. vitilevuensis* sp. nov. The new species has a similar spire height: average RSH = 0.12 vs 0.13 for *P. vitilevuensis* sp. nov. and a higher relative shell weight: average RW' = 0.50 g/cm³ vs 0.45 for *P. vitilevuensis* sp. nov. The sutural ramp of *P. vitilevuensis* sp. nov. presents 6 spiral punctate ribs. The sub shoulder area presents 6 spiral grooves linked to the post nuclear sutural ramp giving a rounded shoulder while that of *P. niasensis* sp. nov. has 5 spiral grooves, intervening ribs and fine radial growth lines and threads as depicted in Fig. 54.

The pattern and the colour of the new species (blackish-brown axial flames on white base) is very different to that of *P. vitilevuensis* sp. nov.: brown or greenish blotches with dark spiral dots and dashes on bluish white base. The apex of *P. vitilevuensis* is pink without black staining.

The geographical range of the new species restricted to N.W. Sumatra and Nicobar Isl. in the Indian Ocean is by far disjunct from the one of *P. vitilevuensis* sp. nov. overall, more to the east in the Pacific Ocean.

Comparison of the teleoconch sutural ramps



Figure 54. Comparison of the teleoconch sutural ramps on the spires of *Pionoconus niasensis* sp. nov., *Calibanus furvus* f. *frauenfeldi* and *P. vitilevuensis* sp. nov.

Figure 54 allows us to see the details of the spires and particularly the teleoconch sutural ramps with the spiral grooves of the 3 species studied here. The shoulder is angulate. The last whorl is smooth with basal sculpture made of about 5 spiral grooves and duplicate ribs on the abapical part.

II. Morphometric study

1. Morphometric statistic study of *Pionoconus niasensis* sp. nov. by M.J. Tenorio

This study was carried out for 10 specimens of *P. niasensis* sp. nov.

P. niasensis sp. nov. was compared to *Calibanus furvus frauenfeldi* and *P. vitilevuensis*. There were differences in HMD between *P. niasensis* (LS HMD mean 39.6 mm) and *P. vitilevuensis* (LS HMD mean 38.3 mm). Although there were only three specimens available for comparison, significant differences between *P. niasensis* and *Calibanus furvus frauenfeldi* were found for all of the morphometric parameters: MD, HMD and SH. DFA classified correctly 8 out of 10 specimens of *P. niasensis* (80% correct), with two specimens misclassified as *P. vitilevuensis*. The overall correct classification rate in the DFA was 76.2 %.

2. Morphometric parameters for *Pionoconus niasensis* sp. nov., *Calibanus furvus f. frauenfeldi* and *P. vitilevuensis* sp. nov..

TAXON 1	TAXON 2	MD		HMD		SH	
		F-score	p	F-score	p	F-score	p
<i>niasensis</i>	<i>frauenfeldi</i>	15.91	0.0026	5.65	0.0388	5.62	0.0392
<i>niasensis</i>	<i>vitilevuensis</i>	0.13	0.7229	14.77	0.0005	0.51	0.4784

Species	Values	SL (mm)	RD	PMD	RSH	RW (g/cm)
<i>P. niasensis</i> sp. nov.	Our values	30 - 47	0.52 - 0.60	0.85 - 0.93	0.09 - 0.14	1.4 - 3.2
	Medium value	38.7	0.57	0.89	0.12	1.77
<i>C. furvus f. frauenfeldi</i>	Our values	42.0 - 44.0	0.60 - 0.65	0.87 - 0.95	0.13 - 0.17	2.8
	Medium value	43.1	0.63	0.91	0.15	2.8
<i>C. furvus</i>	RKK*	35 - 71	0.50 - 0.69	0.80 - 0.94	0.03 - 0.23	1.0 - 4.0
<i>P. vitilevuensis</i> sp. nov.	Our values	40 - 52	0.52 - 0.60	0.81 - 0.89	0.09 - 0.15	1.5 - 3.7
	Medium value	45.6	0.56	0.85	0.13	2.1

Table 12. Morphometric and weight parameters including SL, RD, PMD, RSH, RW & RW' for specimens of *Pionoconus niasensis* sp. nov., *Calibanus furvus f. frauenfeldi* and *P. vitilevuensis* sp. nov..



Padang, West Sumatra, Indonesia

3. Graphical morphometric comparisons

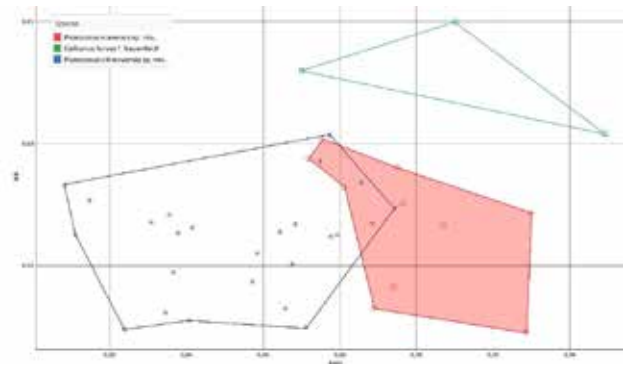


Figure 55. Graph of $RD = f(PMD)$ for *Pionoconus niasensis* sp. nov. (figured in red), *Calibanus furvus f. frauenfeldi* and *P. vitilevuensis* sp. nov.

Figure 55 shows the plotting area of each species represented on the graph: $RD = f(PMD)$.

It appears that *P. niasensis* sp. nov. has a rather separate position in this graph, this new species sharing very few morphological points with the *P. vitilevuensis* sp. nov. and none with *Calibanus furvus f. frauenfeldi* with which the new species has been confused.

Figure 56 below shows that the plotting area of the specimens of new species slightly overlaps *P. vitilevuensis* but not with *Calibanus furvus f. frauenfeldi*.

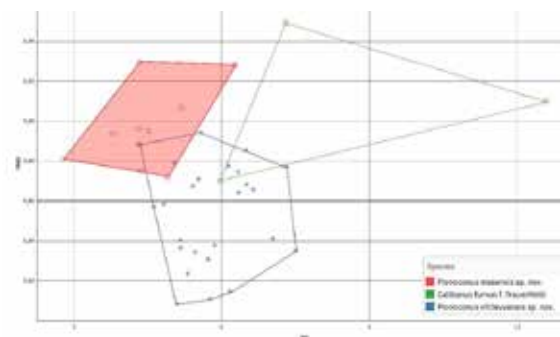


Figure 56. Graph of $PMD = f(SH)$ for *Pionoconus niasensis* sp. nov. (figured in red), *Calibanus furvus f. frauenfeldi* and *P. vitilevuensis* sp. nov.

REMARKS

This new species appears in Monnier *et al.* (2018) on page 656 misidentified as *Pionoconus frauenfeldi* (Crosse, 1865).

The identity of *Conus frauenfeldi* Crosse, 1865 has a long and confusing history. Crosse introduced the species with a long and detailed description accompanied by good figures of the two syntypes that were in Hugh Cuming's collection. The locality was given as Madagascar and the size as 42 mm x 23 mm. The protoconch is described as pink and the first whorls are "coronated with weakly marked granulations". One of the shells has its periostracum which is described as "rather thick and olive yellow". The author compares his species with *Conus magus* and *Conus gubernator*.

The confusion starts Tryon (1884) and Weinkauff (1873) consider it as a variety of *Conus magus*. Sowerby II (Thesaurus Conchyliorum Vol. 5) illustrates one syntype (pl. 22 fig. 525) and places it in synonymy with his *Conus circae* Chemnitz. Tomlin designated as lectotype the specimen in NHMUK that is 43.2 X 23.6 mm. and has its periostracum. Later Walls (1979) also considered that it was a synonym of *Pionoconus magus*. Röckel, Korn & Kohn (1995) have the same point of view. Richard (1981) gives the name of *Conus frauenfeldi* to the species described by Da Motta & Röckel in 1979 as *Conus leehmani*. In 1982 Martin (Hawaiian Shell News Vol. XXX, 7) after comparing the description of both *Conus frauenfeldi* and *Conus leehmani* doubts that the opinion expressed by Richard is correct but does not conclude. In 1983 Richard (*Xenophora*, 27) states that *C. leehmani* may finally be conspecific with *C. raphanus* rather than with *C. frauenfeldi*. Drivas & Jay (1987; pl. 41, fig. 1.) give the name of *C. frauenfeldi* to *Pionoconus mascarenensis* Monnier & Limpalaër, 2019 which may have a similar pattern and was then partly confused with *P. leehmani*. Röckel (1984, card 505) and Tucker (Hawaiian Shell News Vol. XXXII (2)) consider that *C. frauenfeldi* is a synonym of *Conus magus*. Röckel happened to have a different point of view. In a note in Hawaiian Shell News (1981, Vol. XXIX, 7), Leehman quotes a communication by Dieter Röckel in which *Conus frauenfeldi* is stated to be a valid species that "oddly has disappeared for more than 100 years and now has been discovered". This refers to one shell from Davao, Philippines illustrated in the last issue of the same magazine of 1980 (fig. 57 below). The shell is said to be 74 mm in length. Although the picture is not of the best quality, it appears to match with the two types of *Conus frauenfeldi* but it could also be an unusual shell of *Pionoconus raphanus* (Hwass in Bruguière, 1792) or *Pionoconus consors* (G.B. Sowerby I, 1833).



Figure 57. *Calibanus furvus* f. *frauenfeldi*,
Davao, Philippines. 74 mm.

At this point there was no consensus on the identity of *Conus frauenfeldi*.

In the meanwhile, the discovery by Franz Huber of an interesting Sumatran population of black and white Cones led Gabriella Raybaudi Massilia to identify it with Crosse's species in 1992 and to correct the type locality to West Sumatra Indonesia, an erroneous locality. After that publication the taxonomy of *Conus frauenfeldi* was thought to be solved. Monnier & al. adopted that name for the Sumatran species.

We demonstrate herein that *Conus frauenfeldi* is not the species of *Pionoconus* from Sumatra that we finally name *Pionoconus niasensis* n. sp. but is instead an unusual form of *Calibanus furvus* (Reeve, 1843). *Calibanus furvus* is found in the Philippines and adjacent seas in Indonesia and Malaysia.

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BIBLIOGRAPHY

- BRAZIER. J., 1891. Description of a new cone from Mauritius. *Proceedings of the Linnean Society of New South Wales*, series 2, 6., 276. pl. 19 f. 4
- BROST. F. B. & COALE, R. D., 1971 (reprint 1981). A Guide to Shell Collecting in the Kwajalein Atoll. Charles E. Tuttle Company Inc. Rutland (U.S.A.) and Tokyo (Japan). i-xii+ 1-157.
- BRUGUIÈRE. J.G., 1792. Encyclopédie méthodique, Histoire naturelle des vers. Panckouke, imprimeur-libraire. Paris (France)

- CERNOHORSKY. W. O., 1964. The Conidae of Fiji (Mollusca: Gastropoda). The Veliger 7 (2): 61-94 + 7 pls.
- COOMANS. H. E., MOOLEMBEEK, R. G. & WILS E., 1983-1986. Alphabetical revision of the (sub)species in Recent Conidae 6 to 9. *Basteria* 44, 47- 50; 6 maps, 5 pls.
- CROSSE. J. C. H., 1865. Description de cônes nouveaux provenant de la collection Cuming. *Journal de Conchyliologie*, Paris (France) Série 3, 13 (5). 299-315 + 3 col. pls (pls. IX-XI).
- DA MOTTA. A. J., 1985. A discussion of a confusing group of species in the genus *Conus* (Gasteropoda-Conidae), with the description of a new species. *Publicações Ocasionalis da Sociedade Portuguesa de Malacologia*, 5:3-7
- DA MOTTA. A. J., 1991. A systematic classification of the gastropod family Conidae at the generic level. *La Conchiglia* Roma (Italy), 1 – 48.
- DA MOTTA. A. J., 1993a. *Hermes (Pionoconus) magus* (Linnaeus, 1758). Which is a *magus*: which are not and why (I). *World Shells* 4:3-9.
- DA MOTTA. A. J., 1993b. *Hermes (Pionoconus) magus* (Linnaeus, 1758). Which is a *magus*: which are not and why (II). *World Shells* 5:18-21.
- DA MOTTA. A. J., 1993c. *Hermes (Pionoconus) magus* (Linnaeus, 1758). Which is a *magus*: which are not and why (III). *World Shells* 6:18-21.
- DA MOTTA. A. J., 1993d. *Hermes (Pionoconus) magus* (Linnaeus, 1758). Which is a *magus*: which are not and why (IV). *World Shells* 7:28-31.
- DAUTZENBERG. Ph., 1937. Résultats Scientifiques du Voyage aux Indes Orientales Néerlandaises de leurs AA. RR. le Prince et la Princesse Léopold de Belgique. Gastéropodes Marins 3.- Famille CONIDAE. Vol II, fasc. 18. Bruxelles (Belgium). 1-284, 3 pl.
- DELSAERDT. A., 1993. The Conidae of the Solomon Islands Part 4 – Alphabetical review treating the (sub)species from *Conus nussatella* up to *Conus sculptus*. *Gloria Maris* 32 (5-6), 63-86.
- DODGE. H., 1953. A historical review of the mollusks of Linnaeus. Part 2. The class Cephalopoda and the genera *Conus* and *Cypraea* of the class Gastropoda. *Ibid.*, vol. 103,
- DRIVAS, J. & JAY. M., 1988. *Coquillages de La Réunion et de l'île Maurice*. Delachaux et Niestlé, Neuchâtel (Swiss) – Paris (France), 1 -159.
- FILMER. R.M., 2001. A Catalogue of Nomenclature and Taxonomy in the Living Conidae 1758 - 1998. Backhuys Publishers, Leiden (Netherlands). 1-388.
- RUMPHIUS. G. E., 1705. D'Amboinsche Rariteikamer, Georgius 1st edition, T'Amsterdam: Published by François Halma,
- GUALTIERI, N., (1742). *Index testarum conchyliorum quae adservantur in museo Nicolai Gautieri philosophi et medico collegiati florentini et methodice distributae exhibentur*.
- HANLEY. S., 1855. *ipsa Linnaei conchylia: The shells of Linnaeus, determined from his manuscripts and collection*. 586 p. 5 pls. Williams & Norgate, London.
- HINTON. A. G., 1972. Shells of New Guinea and the Central Indo-Pacific. Jacaranda Press (Australia). 1-94.
- HINTON. A.G., 1978. Guide to Shells of Papua New Guinea. Robert Brown & Associates, Port Moresby (Papua New Guinea). 1–68.
- KAICHER. S.D., 1977. Card catalogue of world-wide shells. Packs 14 - Conidae IV, pls. 1329-1434; 106 figs. Arcade Lithographing Co., Bradenton (U.S.A.).
- KIENER. L.C., 1845-1850. Species général et iconographie des coquilles vivantes, comprenant la collection du Muséum d'Histoire naturelle de Paris, la collection Lamarck, celle du Prince Masséna (appartenant maintenant à M. le baron Benjamin Delessert), et les découvertes récentes des voyageurs, vol. 2, Famille des Enroulées. Genre Cône (*Conus* Lin.). J.B. Baillière & Fils, Paris (France).
- KOHN. A. J., 1963. Type specimens and identity of the described species of *Conus*. I. The species described by Linnaeus, 1757–1767. — Journal of the Linnean Society of London, Zoology, 57-3, 185-227
- KOHN. A.J., 1992. A Chronological Taxonomy of *Conus* 1758-1840. Smithsonian Institution Press, Washington (U.S.A.), and London (U.K.). 1 -315.
- KOHN. A.J. & PERRON, F. E., 1994. Life History and Biogeography – Patterns in *Conus*. Oxford Science Publications, Clarendon Press, Oxford (U.K.). i – vi, 1 – 106.
- KÜSTER. H.C. & WEINKAUFF, H.C., 1837-1875. Die Familie des Coneae oder Conidae. 1. Band IV (2): 1-413, 71 pls.
- LAMARCK. J.B.P., 1810. Sur la détermination des espèces. Parmi les animaux sans vertèbres, et particulièrement parmi les mollusques testacés. *Annales du Muséum National d'Histoire Naturelle, Paris (France)* 15: 20-40, 263-286, 422-442.
- LAUER. M.J., Contribution to a Methodology in Conidae Studies. Unpublished results.
- LEEHRMAN. E.G., 1981. Similar but different. *Hawaiian Shell News* XXVIII (12) 252: 9; 1 fig.
- LEEHRMAN. E.G., 1981. A long-lost cone. *Hawaiian Shell News* XXIX (7) 259: 3; 1 fig.
- LIMPALAËR. L. & MONNIER, E., 2012. *Pionoconus robini* (Gastropoda, Conidae) New species from the Southwestern Philippines. *Visaya* 3 (6):49-53.

- LINNAEUS. C., 1758. *Systema Naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis. Editio decima, reformata* [10th revised edition], vol. 1: 824 pp. *Laurentius Salvius: Holmiae*.
- MARSH. J.A. & RIPPINGALE, O.H., 1974. Cone shells of the world. The Jaracanda Press, Brisbane, Australia (Third edition). 185 p., 24 pl.
- MARTIN. R., 1982. Pramparti - Leehmani - Frauenfeldi. *Hawaiian Shell News* XXX (7) 273: 9.
- MONNIER. E., LIMPALAËR, L., ROBIN, A. & ROUX, C., 2018. A Taxonomic Iconography of Living Conidae. Conchbooks, Harxheim (Germany) 2 volumes, 1-1207.
- POPPE. G.T., 2008. Philippines Marine Mollusks Volume II. Conchbooks, Harxheim (Germany), 1-848.
- RAYBAUDI MASSILIA. G., 1992. The rediscovery of *Conus frauenfeldi* Crosse, 1865. *La Conchiglia* XXIV (265): 55-60; 1 tab., 1 fig., 2 col. figs., 1 col. pl.
- REEVE. L. A., 1844. Monograph of the genus *Conus*. Conchologia Iconica, 1. pl. 43. sp. 235.
- RICHARD. G., 1981. Révision systématique des Conidae. Première partie. *Xenophora* 3: 7-12.
- RÖCKEL. D., 1979-1984. Die Familie Conidae: 1-35, 1-510 Darmstadt, privately issued.
- RÖCKEL. D., KORN, W. & KOHN, A.J., 1995. Manual of the living Conidae. Verlag Christa Hemmen, Grillparzerstr, Germany. 1-517.
- SHIKAMA. T., 1977 Description of new and noteworthy Gasteropoda from Western Pacific and Indian Oceans.
- SOWERBY. G.B., 1866. Thesaurus conchyliorum, or, Monographs of genera of shells V3. London, United Kingdom.
- SOWERBY. II G. B., 1887. Second supplement to monograph of the genus *Conus*. In G. B. Sowerby II (ed.), Thesaurus conchyliorum, or monographs of genera of shells. Vol. 5. London, United Kingdom.
- TUCKER. J.K., 1984. Cone shell names III. The species described by da Motta and co-workers. *Hawaiian Shell News* XXXII (2) 290: 5-6.
- TUCKER. J. K. & TENORIO, M. J., 2009. Systematic classification of Recent and fossil Conoidean gastropods, with keys to the genera of cone shells. ConchBooks, Hackenheim, Germany, 1-295.
- TUCKER, J. K. & TENORIO, M. J., 2013. Illustrated catalog of the living cone shells. MdM Publishing, Wellington (US.A.), 1-517.
- WALLS. J.G., 1979. Cones Shells. A synopsis of the living Conidae. T.F.H. Publications, Inc., Neptune City (U.S.A.), 1-1011.
- WoRMS Editorial Board (2021).
- World Register of Marine Species. Available from <http://www.marinespecies.org> at VLIZ. Accessed 2021-02-02. doi:10.14284/170

Annex 1: Measurements and calculations

measured values estimated values calculated values * : subadult specimen																	
N°	SL	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
Pionoconus hervillardi sp. nov.																	
H	30.63	13.97	13.13	25.69	21.69	0.54	0.56	0.16	0.16	0.16	0.16	2.1	0.03	5.62	0.37	Hekarye MNHN	Effat Id., Vanuatu, 1.10 m
1	24.35	11.38	10.70	20.22	17.01	0.56	0.84	0.17	0.17	0.17	0.17	2.1	0.45	2.97	0.37	Coll. EM	Effat Id., Vanuatu, 1.10 m
2	27.53	13.60	12.53	22.95	19.54	0.58	0.85	0.17	0.17	0.17	0.17	2.1	0.76	4.62	0.45	Coll. EM	Effat Id., Vanuatu, 1.10 m
3	26.74	13.78	12.68	22.95	17.66	0.60	0.78	0.14	0.14	0.14	0.14	2.3	0.86	4.67	0.49	Coll. IL 9129	Vanuatu, 10 m
Average	27.3					0.57	0.63	0.16	0.16	0.16	0.16		0.69		0.43		
Extremes	24 - 31					0.54 - 0.60	0.71 - 0.86	0.14 - 0.17					0.45 - 0.86		0.37 - 0.49		
Pionoconus aff. hervillardi																	
1	34.89	16.29	15.30	29.35	25.42	0.55	0.67	0.16	0.16	0.16	0.16	3.7	1.06	8.70	0.43	Coll. GH	Tukukuk Beach, Effat Id., Vanuatu, 1.10 m
2	28.64	13.89	13.10	24.39	18.61	0.57	0.76	0.15	0.15	0.15	0.15	2.5	0.87	5.22	0.48	Coll. GH	Tukukuk Beach, Effat Id., Vanuatu, 1.10 m
Average	31.8					0.56	0.64	0.15	0.15	0.15	0.15		0.97		0.45		
Extremes	28 - 35					0.55 - 0.57	0.76 - 0.87	0.15 - 0.16					0.87 - 1.06		0.43 - 0.48		
Pionoconus samaraiensis sp. nov.																	
H	42.30	18.12	17.20	36.40	30.19	0.50	0.83	0.14	0.14	0.14	0.14	5.3	1.25	13.18	0.40	Hekarye MNHN	Samarai Id., PNG
1	42.02	17.69	16.75	37.62	29.68	0.47	0.79	0.10	0.10	0.10	0.10	3.5	0.86	12.65	0.39	Coll. FL	Samarai Id., PNG
2	43.46	19.13	17.87	38.26	29.19	0.50	0.77	0.12	0.12	0.12	0.12	5.3	1.22	14.86	0.36	Coll. EM	Habau, PNG, intertidal
3	41.71	19.08	17.84	37.79	30.60	0.50	0.81	0.09	0.09	0.09	0.09	5.9	1.41	14.28	0.41	Coll. EM	Samarai Id., PNG
4	40.52	17.76	16.80	34.28	25.82	0.52	0.75	0.15	0.15	0.15	0.15	5.1	1.26	12.09	0.42	Coll. EM	Samarai Id., PNG, dredged
5	42.14	18.71	17.51	37.51	27.97	0.50	0.79	0.11	0.11	0.11	0.11	5.9	1.10	13.61	0.36	Coll. EM	Samarai Id., PNG
6	50.77	21.67	20.38	44.27	35.18	0.49	0.79	0.13	0.13	0.13	0.13	9.0	1.00	22.42	0.40	Coll. EM	Samarai Id., PNG
7	40.83	18.38	17.27	35.77	28.37	0.51	0.79	0.12	0.12	0.12	0.12	4.1	1.00	12.56	0.32	Coll. EM	Samarai Id., PNG
8	36.94	16.45	15.43	32.50	25.94	0.51	0.80	0.12	0.12	0.12	0.12	3.5	0.95	9.38	0.37	Coll. EM	Samarai Id., PNG
9	47.71	19.58	18.73	40.83	32.24	0.48	0.79	0.14	0.14	0.14	0.14	6.2	1.30	17.50	0.35	Coll. EM	Samarai Id., PNG
10	47.07	21.13	19.87	41.55	32.87	0.51	0.79	0.12	0.12	0.12	0.12	7.8	1.55	19.76	0.37	Coll. EM	Samarai Id., PNG
11	42.03	17.96	17.11	37.17	28.65	0.48	0.76	0.12	0.12	0.12	0.12	5.1	1.21	12.62	0.39	Coll. EM	Samarai Id., PNG, dredged
12	41.61	17.90	16.61	36.38	28.96	0.48	0.80	0.13	0.13	0.13	0.13	4.2	1.01	12.09	0.35	Coll. EM	Habau, PNG, intertidal
13	38.53	17.59	16.18	32.65	25.32	0.54	0.78	0.15	0.15	0.15	0.15	4.2	1.09	10.97	0.38	Coll. EM	Samarai Id., PNG, dredged
14	42.45	19.02	17.98	36.60	29.87	0.52	0.82	0.14	0.14	0.14	0.14	5.3	1.25	14.52	0.37	Coll. EM	Samarai Id., PNG, dredged
15	42.03	18.43	17.34	36.09	28.66	0.51	0.80	0.14	0.14	0.14	0.14	5.5	1.31	13.43	0.41	Coll. EM	Samarai Id., PNG
16	43.94	19.74	18.74	38.14	31.58	0.50	0.81	0.11	0.11	0.11	0.11	6.3	1.43	16.26	0.39	Coll. EM	PNG
17	35.39	15.50	14.50	31.16	23.45	0.50	0.75	0.12	0.12	0.12	0.12	3.1	0.88	7.95	0.39	Coll. EM	Samarai Id., PNG, dredged
18	38.36	16.21	15.40	31.72	25.48	0.48	0.76	0.12	0.12	0.12	0.12	4.0	1.04	9.58	0.42	Coll. IL 8736	Habau, PNG
19	43.65	18.13	16.09	36.09	30.84	0.50	0.79	0.11	0.11	0.11	0.11	5.4	1.24	15.52	0.35	Coll. IL 7108	Samarai Id., PNG
20	38.37	16.89	16.20	31.74	25.48	0.50	0.76	0.12	0.12	0.12	0.12	3.9	1.02	10.50	0.37	Coll. IL 7108	Samarai Id., PNG
21	33.84	15.90	15.06	30.24	24.88	0.53	0.82	0.11	0.11	0.11	0.11	3.3	0.98	8.10	0.41	Coll. IL 9097	Samarai Id., PNG, dredged
22	33.68	14.72	13.80	29.20	23.17	0.50	0.79	0.13	0.13	0.13	0.13	2.4	0.71	6.94	0.35	Coll. IL 9097	Samarai Id., PNG, dredged
23	34.80	15.51	14.74	30.35	23.68	0.51	0.76	0.13	0.13	0.13	0.13	2.7	0.78	7.95	0.34	Coll. FL	Samarai Id., PNG, dredged
24	29.08	13.44	12.82	25.24	20.43	0.53	0.81	0.13	0.13	0.13	0.13	2.2	0.76	5.01	0.44	Coll. IL 9097	Samarai Id., PNG, dredged
25	31.45	13.27	12.60	27.50	21.57	0.48	0.78	0.13	0.13	0.13	0.13	2.1	0.67	5.25	0.40	Coll. IL 9097	Samarai Id., PNG, dredged
26	42.72	19.62	17.01	36.98	31.59	0.50	0.86	0.09	0.09	0.09	0.09	4.9	1.15	14.26	0.41	Coll. FP 3542	Samarai Id., PNG, Day Dive 20 M
27	42.25	18.08	16.18	36.25	31.51	0.50	0.88	0.14	0.14	0.14	0.14	5.3	1.25	12.56	0.43	Coll. FP 3543	Port Moresby, PNG, Sooted 2M
28	55.25	24.94	20.89	40.62	44.80	0.50	0.89	0.10	0.10	0.10	0.10	12.6	2.29	28.79	0.44	Coll. FP 4890	Habau, East New Britain, PNG
29	49.21	21.71	20.61	44.11	32.70	0.49	0.74	0.10	0.10	0.10	0.10	8.5	1.75	22.02	0.39	Coll. EM	Habau, East New Britain, PNG
30	52.15	22.32	21.46	46.52	35.69	0.48	0.75	0.11	0.11	0.11	0.11	10.4	1.50	24.68	0.42	Coll. EM	Society Id., Milne Bay, PNG
Average	41.5					0.50	0.79	0.12	0.12	0.12	0.12		1.2		0.38		
Extremes	29 - 56					0.47 - 0.54	0.75 - 0.89	0.09 - 0.15					0.67 - 2.0		0.29 - 0.44		
Pionoconus minusensis sp. nov.																	
H	43.16	19.48	18.65	32.80	31.47	0.51	0.88	0.12	0.12	0.12	0.12	5.5	1.30	15.68	0.36	MNHN - IN 2009-37127	Manus Id., PNG
1	42.40	19.51	18.88	37.48	31.17	0.53	0.89	0.12	0.12	0.12	0.12	6.7	1.58	15.94	0.42	Coll. IL	Kiribati Bay, New Britain, PNG
2	39.85	18.14	17.21	34.06	30.56	0.52	0.88	0.13	0.13	0.13	0.13	5.7	1.43	12.44	0.40	Coll. EM	Manus Id., PNG
3	45.33	20.66	19.43	35.63	35.81	0.52	0.90	0.13	0.13	0.13	0.13	8.4	1.85	18.20	0.40	Coll. EM	Manus Id., PNG
4	31.56	23.36	22.37	46.44	40.07	0.50	0.86	0.10	0.10	0.10	0.10	11.6	2.25	26.94	0.43	Coll. FL	New Britain, PNG
5	44.60	21.77	20.93	38.43	34.68	0.57	0.88	0.14	0.14	0.14	0.14	11.4	2.56	20.32	0.50	Coll. FP	Manus Id., PNG
6	44.90	22.22	20.74	38.26	34.48	0.57	0.88	0.11	0.11	0.11	0.11	9.5	2.14	20.42	0.47	Coll. EM	Manus Id., PNG
7	45.16	20.71	19.50	39.53	33.65	0.52	0.89	0.12	0.12	0.12	0.12	7.8	1.64	18.24	0.41	Coll. EM	PNG
8	51.82	22.62	22.35	45.36	41.45	0.52	0.91	0.12	0.12	0.12	0.12	12.8	2.48	27.25	0.47	Coll. EM	New Britain, PNG
9	50.81	21.91	20.41	44.51	38.64	0.53	0.87	0.12	0.12	0.12	0.12	11.9	2.34	26.05	0.46	Coll. EM	Manus Id., PNG
10	52.51	25.53	23.02	56.14	47.64	0.53	0.85	0.10	0.10	0.10	0.10	24.6	1.34	51.72	0.48	Coll. EM	New Britain, PNG
Average	47.4					0.53	0.88	0.12	0.12	0.12	0.12		2.1		0.45		
Extremes	39 - 63					0.50 - 0.57	0.85 - 0.91	0.10 - 0.14					1.3 - 3.9		0.36 - 0.56		

N°	Sl.	MD	H Height	AM	HMD	RD	PMD	BSH	W	RW = W/SL	V Volume	RPV = W/V	Repository	Locality
<i>Pionoconus vitilevuensis</i> sp. nov.														
H	49.48	23.97	22.45	41.98	35.07	0.57	0.44	0.15	12.0	2.43	26.43	0.45	MOHNSP MNHN	Katani Reef, Suva, Viti Levu, Fiji Isl., 1-2 m
1	50.31	24.48	23.84	42.27	36.41	0.57	0.44	0.14	14.3	2.44	26.36	0.49	Cell. DM	Fiji Isl.
2	48.52	24.55	22.56	42.03	37.22	0.58	0.43	0.14	14.1	2.41	26.87	0.52	Cell. DM	Katani Reef, Suva, Viti Levu, Fiji Isl., 1-2 m
3	48.84	24.81	21.61	41.67	34.86	0.55	0.44	0.13	10.2	2.18	23.69	0.44	Cell. DM	Lami Reef, Suva, Viti Levu, Fiji Isl., 1-2 m
4	48.76	24.57	22.53	42.59	34.70	0.58	0.41	0.13	12.1	2.48	27.49	0.44	Cell. DM	Lami Reef, Suva, Viti Levu, Fiji Isl., 1-2 m
5	48.06	21.61	21.11	42.60	35.55	0.53	0.43	0.11	8.8	1.83	23.65	0.38	Cell. DM	Nadi Bay, Viti Levu, Fiji Isl.
6	49.52	21.22	19.63	37.66	31.55	0.56	0.44	0.13	7.1	1.63	16.13	0.39	Cell. DM	Katani Reef, Suva, Viti Levu, Fiji Isl., 1-2 m
7	46.33	22.59	20.76	40.19	35.27	0.56	0.48	0.13	9.4	2.03	21.73	0.43	Cell. DM	Fiji Isl.
8	41.41	21.19	19.61	36.32	29.36	0.58	0.41	0.12	6.7	1.62	17.21	0.39	Cell. DM	Katani Reef, Suva, Viti Levu, Fiji Isl., 1-2 m
9	42.70	22.20	20.54	39.36	34.02	0.56	0.46	0.14	10.6	2.32	20.84	0.51	Cell. DM	Fiji Isl.
10	41.51	19.18	18.60	36.35	30.56	0.53	0.44	0.12	7.1	1.71	14.73	0.48	Cell. DM	Katani Reef, Suva, Viti Levu, Fiji Isl., 1-2 m
11	40.60	19.81	18.66	34.88	28.98	0.57	0.46	0.14	6.7	1.65	14.93	0.45	Cell. DM	Wallis and Futuna, 5-10m, muddy sand coral
12	45.80	22.75	21.65	40.97	31.17	0.56	0.46	0.13	9.3	2.03	22.56	0.41	Cell. LI 7473	Nadi Bay, Viti Levu, Fiji Isl.
13	46.18	21.42	20.60	40.87	31.67	0.52	0.42	0.11	7.3	1.68	20.28	0.36	Cell. F.	Nadi Bay, Viti Levu, Fiji Isl.
14	51.34	25.18	25.70	44.03	31.63	0.57	0.48	0.14	19.2	2.94	18.97	0.35	Cell. LI 9144	Bev Point, Suva, Viti Levu, Fiji Isl.
15	41.86	16.12	17.41	38.31	31.19	0.53	0.47	0.13	7.2	1.44	15.16	0.47	Cell. PP 3154	Suva, Viti Levu, Fiji Isl.
16	47.61	24.55	21.58	43.27	38.44	0.57	0.49	0.15	12.3	2.58	15.22	0.49	Cell. PP 3375	Makoto Laila Isl., Fiji Isl., Dwe, 12 m
17	46.52	23.83	21.29	40.19	35.16	0.57	0.47	0.14	11.2	2.41	13.60	0.47	Cell. PP 3373	Nadragh-Nadua, Viti Levu, Fiji Isl., 8 m
18	39.84	18.55	17.51	34.07	30.47	0.57	0.49	0.14	6.3	1.59	15.37	0.46	Cell. PP 3372	Nadragh-Nadua, Viti Levu, Fiji Isl., 8 m
19	39.57	18.43	17.18	34.53	30.16	0.56	0.48	0.13	5.1	1.49	13.21	0.39	Cell. PP 3371	Nadragh-Nadua, Viti Levu, Fiji Isl., 10 m
Average	45.6					0.56	0.45	0.13	2.1			0.45		
Extremes	40 - 52					0.52 - 0.60	0.41 - 0.49	0.09 - 0.15		1.5 - 3.7		0.36 - 0.55		
<i>Pionoconus kwajaleinsensis</i> sp. nov.														
H	47.25	21.28	20.23	41.24	36.4	0.52	0.48	0.13	10.8	2.39	20.34	0.53	Helopse MNHN	Green Island lagoon, under rock in sand, Kwajalein Atoll, Marshall Isl., 6 m
1	50.75	21.90	22.19	40.27	40.15	0.51	0.49	0.13	16.4	2.33	26.36	0.42	Cell. DM	Kwajalein Atoll, Marshall Isl., on reef
2	42.87	19.95	18.42	37.64	30.82	0.53	0.42	0.12	4.5	1.38	15.92	0.53	Cell. LI 34795	Kwajalein Atoll, Marshall Isl., on reef
3	52.03	24.01	22.89	45.69	38.21	0.53	0.48	0.12	16.0	2.91	28.42	0.56	Cell. LI 34795	Kwajalein Atoll, Marshall Isl., on reef
4	48.62	22.88	20.83	43.25	38.40	0.53	0.49	0.11	11.2	2.71	23.17	0.57	Cell. PP 3546	Kwajalein Atoll, Marshall Isl.
5	79.75	32.61	31.66	60.16	56.87	0.54	0.51	0.15	40.5	5.72	72.81	0.56	Cell. SI	Green Beach, exposed at night, Kwajalein Atoll, Marshall Isl., 5 m
6*	38.82	17.42	16.17	32.64	28.63	0.53	0.48	0.11	5.5	1.48	10.37	0.53	Cell. SI	Lagoon, under rock in sand, Kwajalein Atoll, Marshall Isl., 3-6 m
7*	37.20	18.57	17.38	33.93	30.30	0.55	0.49	0.09	7.0	1.88	12.91	0.58	Cell. SI	Green Island lagoon, under rock in sand, Kwajalein Atoll, Marshall Isl., 6 m, openulum
8	41.25	20.48	19.09	38.10	31.05	0.54	0.47	0.14	6.5	2.15	17.16	0.55	Cell. SI	Lagoon, under rock in sand, Kwajalein Atoll, Marshall Isl., 3-6 m
9	64.58	31.55	29.97	57.61	51.29	0.55	0.53	0.13	39.9	6.18	61.66	0.65	Cell. SI	Lagoon, under rock in sand, Kwajalein Atoll, Marshall Isl., 3-6 m
10	64.20	31.58	30.07	54.47	50.58	0.58	0.53	0.15	36.4	5.67	60.97	0.60	Cell. SI	Kwajalein Atoll, Marshall Isl., 15 m
11*	32.98	14.88	13.53	27.71	25.33	0.54	0.51	0.16	4.1	1.44	8.84	0.60	Cell. DM	Lagoon, under rock in sand, Kwajalein Atoll, Marshall Isl., 15 m
12*	35.57	16.95	15.51	30.14	27.61	0.56	0.52	0.15	4.9	1.48	9.59	0.53	Cell. DM	Lagoon under rock in sand, Kwajalein Atoll, Marshall Isl., 3-6 m, openulum
13*	35.34	17.19	16.39	31.72	27.86	0.54	0.48	0.13	5.7	1.57	10.24	0.56	Cell. F.	Green Island lagoon, under rock in sand, Kwajalein Atoll, Marshall Isl., 3-6 m, openulum
14*	39.68	18.62	17.85	35.02	30.94	0.53	0.48	0.12	6.1	2.04	13.18	0.61	Cell. PP	Blow Island lagoon, under rock in sand, Kwajalein Atoll, Marshall Isl., 9 m, openulum
15	40.07	20.79	19.10	38.15	34.81	0.54	0.51	0.15	9.6	2.13	18.08	0.53	Cell. DM	Alge-Meck reef, Kwajalein Atoll, Marshall Isl., 8 m
16	43.35	20.46	19.25	39.95	35.78	0.51	0.49	0.12	9.8	2.16	17.46	0.55	Cell. DM	Lagoon, under rock in sand, Kwajalein Atoll, Marshall Isl., 3-6 m, openulum
17	45.39	22.08	21.13	40.92	35.33	0.54	0.48	0.13	12.4	2.70	21.44	0.58	Cell. PP	Gargage sand spit, dead on sand, Kwajalein Atoll, Marshall Isl., 8 m
18	58.71	27.72	26.51	53.39	50.63	0.52	0.53	0.15	28.7	4.89	43.14	0.57	Cell. DM	Kwajalein Atoll, Marshall Isl., 15 m
19	67.08	28.69	26.92	57.86	51.10	0.59	0.49	0.14	23.5	3.60	50.72	0.50	Cell. DM	Kwajalein Atoll, Marshall Isl., 15 m
20	62.53	31.75	30.61	60.13	55.71	0.55	0.53	0.13	42.1	6.23	65.63	0.64	Cell. DM	Kwajalein Atoll, Marshall Isl., 15 m
21*	29.77	14.81	13.65	26.78	22.18	0.53	0.53	0.10	3.8	1.28	6.02	0.63	Cell. SI	Lagoon sand spit, dead on sand, Kwajalein Atoll, Marshall Isl., 6 m
22	57.69	27.16	26.29	50.84	47.27	0.54	0.54	0.12	22.3	3.87	41.50	0.54	Cell. DM	Green Island lagoon, under rock in sand, Kwajalein Atoll, Marshall Isl., 6 m, openulum, peristomium
Average	54.5					0.53	0.49	0.12	3.7			0.57		
Extremes	42 - 71					0.49 - 0.58	0.42 - 0.55	0.09 - 0.15		2.0 - 6.2		0.50 - 0.67		
<i>Pionoconus nilasensis</i> sp. nov.														
H	38.51	18.15	15.24	37.73	24.43	0.58	0.48	0.09	4.6	1.51	7.51	0.53	MNHM-2003-37128	Padang, W. Sumatra, Indonesia
1	38.06	18.47	17.14	40.08	25.23	0.55	0.48	0.12	3.4	1.54	12.99	0.49	Cell. DM	Sumatra, Indonesia
2	38.00	18.76	17.15	39.19	25.27	0.55	0.48	0.12	3.4	1.54	12.99	0.49	Cell. DM	Sumatra, Indonesia
3	38.20	18.76	17.15	39.19	25.27	0.55	0.48	0.12	3.4	1.54	12.99	0.49	Cell. DM	Nias Isl., W. Sumatra, Indonesia, 2m
4	38.24	18.10	16.50	34.02	30.81	0.57	0.51	0.13	4.4	1.53	13.46	0.48	Cell. DM	Sumatra, Indonesia
5	37.82	16.40	15.26	28.11	25.16	0.59	0.50	0.14	4.7	1.44	8.36	0.57	Cell. CR 3870	Nicarba Isl., Banta, 10-15 m
6	41.13	21.40	18.29	38.84	31.02	0.58	0.49	0.10	8.4	2.05	15.98	0.53	Cell. LI 3935	Nias Isl., W. Sumatra, Indonesia, 2m
7	48.79	21.13	18.55	40.43	37.54	0.52	0.51	0.13	7.3	1.93	18.72	0.39	Cell. PP 4891	Padang, W. Sumatra, Indonesia
8	40.22	16.73	16.02	35.89	31.37	0.57	0.53	0.13	4.2	2.03	14.48	0.55	Cell. P.	W. Sumatra, Indonesia
9	34.92	17.83	16.73	30.02	26.17	0.59	0.47	0.14	5.3	1.52	16.42	0.51	Cell. DM	Indonesia
10	40.18	19.73	18.40	36.67	31.21	0.54	0.53	0.15	5.7	1.42	14.59	0.39	Cell. DM	Sumatra, Indonesia
11	43.42	22.16	20.45	37.96	33.28	0.58	0.53	0.13	10.0	2.40	16.66	0.50	Cell. DM	Sumatra, Indonesia
12	36.81	16.82	15.73	29.82	27.38	0.56	0.42	0.14	3.4	1.59	9.21	0.41	Cell. DM	Indonesia
13	38.12	19.97	19.03	33.16	28.06	0.60	0.53	0.13	6.3	2.18	14.49	0.57	Cell. DM	Seribu Island, S.E. Sumatra - N.W. Java, Indonesia, 15-20 m
14	46.49	24.92	23.70	41.69	35.80	0.57	0.49	0.10	14.8	3.18	27.46	0.54	Cell. DM	Seribu Island, S.E. Sumatra - N.W. Java, Indonesia, 15-20 m
Average	38.2					0.57	0.49	0.12	1.77			0.50		
Extremes	30 - 47					0.52 - 0.60	0.45 - 0.53	0.09 - 0.14		1.4 - 3.1		0.39 - 0.61		

N°	SL	MD	H-height	AD	HMd	RD	PMD	BDH	W	EW/L	V Volume	EW + W/V	Repository	Locality
<i>Pionoconus roblini</i> Limpalaër & Monnier, 2012														
H	26.18	13.36	12.85	22.18	19.52	0.60	0.88	0.15	2.6	0.99	4.45	0.58	Holotype MNIN 24816	Barabac Isl., Palawan, Philippines
1	31.91	16.60	15.77	26.24	24.06	0.59	0.85	0.12	4.3	1.31	8.45	0.51	Coll. BM	Cuyo Isl., Palawan, Philippines
2	30.73	15.19	14.47	26.22	21.94	0.58	0.84	0.15	3.0	0.88	8.75	0.44	Coll. BM	Philippines
3	27.40	14.42	13.44	23.69	19.32	0.61	0.82	0.14	2.6	0.95	5.31	0.49	Coll. BM	Cuyo Isl., Palawan, Philippines
4	26.47	14.43	13.55	22.77	17.93	0.63	0.79	0.14	2.9	1.10	5.17	0.54	Paratype S, Coll. BM	Cuyo Isl., Palawan, Philippines
5	24.11	12.75	12.70	19.67	16.32	0.65	0.83	0.18	2.1	0.87	3.75	0.54	Paratype 13, Coll. BM	Barabac Isl., Palawan, Philippines
6	22.21	11.31	10.44	18.82	15.76	0.60	0.84	0.15	1.2	0.51	2.72	0.44	Coll. BM	Philippines
7	21.00	11.10	10.38	17.46	14.32	0.64	0.82	0.17	1.4	0.67	2.42	0.58	Coll. BM	Philippines
8	22.56	11.72	11.07	17.72	15.31	0.64	0.80	0.21	1.6	0.71	2.33	0.55	Paratype 11, Coll. BM	Philippines
9	22.16	11.68	11.15	18.10	14.99	0.65	0.83	0.18	1.7	0.77	2.85	0.59	Coll. BM	Philippines
10	23.70	12.15	10.68	19.85	17.30	0.61	0.87	0.16	1.7	0.71	3.08	0.53	Coll. FP 1384	Kudat N. Borneo, Malaysia, 18-20 m
11	21.10	10.74	9.45	17.40	15.67	0.62	0.80	0.18	1.2	0.55	2.14	0.54	Coll. FP 1388	Palawan, Philippines, dive 20 - 25m
12	25.34	13.31	11.95	21.85	18.76	0.63	0.86	0.14	2.6	1.04	4.93	0.65	Coll. FP 1657	Philippines ?
13	22.01	11.88	10.63	19.71	16.31	0.60	0.83	0.14	1.6	0.70	2.80	0.54	Coll. FP 1910	Barabac Isl., Palawan, Philippines, 20-25 m
14	22.17	12.22	10.69	18.61	16.35	0.66	0.91	0.16	1.9	0.85	2.90	0.64	Coll. FP 2387	Mactan Isl., Philippines
15	20.01	10.53	9.16	17.45	15.79	0.60	0.90	0.13	1.2	0.61	1.93	0.44	Coll. FP 2383	Kudat N. Borneo, Malaysia, 18-20 m
Average	24.4					0.62	0.85	0.16		0.8		0.56		
Extremes	20 - 32					0.58 - 0.66	0.79 - 0.91	0.12 - 0.21		0.5 - 1.3		0.44 - 0.66		
<i>Pionoconus fiscoederi</i> (Röckel & de Motta, 1983)														
H	33.70	16.40	15.70	28.91	24.58	0.57	0.85	0.14	8.2	2.13	14.35	0.58	Holotype NMZ 216128	Cuyo Isl., Palawan, Philippines
1	38.43	19.68	18.72	32.69	28.56	0.60	0.78	0.15	8.2	2.13	14.35	0.58	Coll. BM	Cuyo Isl., Palawan, Philippines
2	36.45	17.89	17.28	31.39	25.49	0.57	0.81	0.14	5.6	1.54	11.27	0.56	Coll. BM	Cuyo Isl., Palawan, Philippines, 18-20 m
3	35.41	17.29	16.18	29.85	23.31	0.58	0.78	0.16	4.2	1.19	9.93	0.42	Coll. BM	Orange Isl., Cebu, Philippines, 20 m
4	39.48	19.79	18.53	32.82	26.98	0.59	0.82	0.17	7.3	1.85	14.08	0.57	Coll. BM	Cuyo Isl., Palawan, Philippines, 20-25 m
5	33.27	18.35	17.70	28.65	21.98	0.64	0.82	0.14	5.7	1.71	10.81	0.53	Coll. BM	Philippines
6	33.04	16.04	15.13	28.44	21.28	0.64	0.75	0.16	4.1	1.31	8.24	0.50	Coll. BM	Cuyo Isl., Palawan, Philippines, 5-10 m
7	29.82	15.15	14.18	24.85	20.79	0.61	0.84	0.17	3.0	1.01	6.41	0.47	Coll. BM	Cuyo Isl., Palawan, Philippines, 10-12 m
8	26.11	13.97	12.90	22.23	18.51	0.63	0.83	0.15	2.4	0.92	4.71	0.51	Coll. BM	Cuyo Isl., Palawan, Philippines, 5-10 m
9	27.94	13.67	12.77	23.87	20.16	0.57	0.84	0.15	2.3	0.82	4.88	0.47	Coll. BM	Cuyo Isl., Palawan, Philippines, 5-10 m
10	24.89	12.92	12.13	20.75	17.55	0.62	0.85	0.17	2.1	0.84	3.89	0.54	Coll. BM	Cuyo Isl., Palawan, Philippines
11	30.24	14.09	12.65	25.01	20.31	0.56	0.81	0.13	2.3	0.76	5.39	0.43	Coll. FP 1370	Cuyo Isl., Palawan, Philippines, 20 - 25 m
12	30.64	13.42	12.38	23.90	20.35	0.59	0.80	0.15	2.3	1.09	4.42	0.42	Coll. FP 2369	Cuyo Isl., Palawan, Philippines, 10 m
13	31.77	15.57	17.18	27.87	24.97	0.60	0.89	0.14	5.9	1.57	12.85	0.48	Coll. FP 2368	Cuyo Isl., Palawan, Philippines, 10 m
14	24.22	12.63	11.00	20.65	17.80	0.61	0.86	0.15	1.8	0.73	3.16	0.53	Coll. FP 2376	Cuyo Isl., Palawan, Philippines
Average	32.1					0.59	0.82	0.15		1.2		0.59		
Extremes	24 - 40					0.56 - 0.64	0.75 - 0.89	0.14 - 0.17		0.7 - 2.1		0.42 - 0.58		
RKK	30 - 49					0.54 - 0.62	0.77 - 0.85	0.11 - 0.17		1.1 - 1.7				
<i>Pionoconus morrisoni</i> (G. Raybaudi Massilia, 1991)														
H	27.50	15.70	-	23.65	19.17	0.60	0.81	0.14	-	-	-	-	MNIN 18122 Coll. BM	Admiralty Reef, Northern Territory, N.W. Australia, 3-5 m
1	27.30	14.45	13.85	22.54	19.08	0.64	0.85	0.17	3.3	1.21	5.48	0.62	Coll. BM	Admiralty Reef, Northern Territory, N.W. Australia, 3-5 m
2	25.27	13.90	12.49	21.08	18.96	0.63	0.89	0.17	2.4	0.93	4.70	0.57	Coll. BM	Timor Sea
3	34.81	12.93	12.11	20.60	16.82	0.63	0.82	0.17	2.3	0.91	3.84	0.54	Coll. BM	Admiralty Reef, Northern Territory, N.W. Australia, 3 m
4	20.01	10.44	-	16.43	13.62	0.65	0.83	0.18	-	-	-	-	Coll. PK	Admiralty Reef, Northern Territory, N.W. Australia
Average	25.0					0.64	0.84	0.17		1.0		0.59		
Extremes	20 - 28					0.63 - 0.66	0.81 - 0.89	0.14 - 0.18		0.93 - 1.2		0.57 - 0.60		

N°	SL	MD	H Height	AI	HMD	RD	PMO	BSH	W	RW = W/SL	V Volume	g/cm ³	Repository	Locality
Pionoconus epistomium (Reeve, 1844)														
1	41.43	19.37	36.93	38.25	31.91	0.51	0.83	0.08	5.19	1.25	13.57	0.38	Coll. PP 3570	Sulawesi, Indonesia, dive 12 m
2	45.47	22.17	39.22	41.61	35.52	0.53	0.85	0.08	6.94	1.53	19.38	0.36	Coll. PP 3569	Sulawesi, Indonesia, dive 12 m
3	52.45	22.69	20.27	45.52	40.43	0.50	0.89	0.11	9.27	1.77	23.83	0.39	Coll. PP 2618	Sulawesi, Indonesia, Dive 12 m
4	44.77	20.76	36.27	39.43	36.73	0.53	0.81	0.12	7.56	1.78	16.78	0.47	Coll. PP 2619	Kapukhar Bangkalan, Indonesia, single nets 10 m
5	37.79	18.52	16.22	33.49	27.18	0.53	0.82	0.11	6.12	1.62	11.35	0.54	Coll. PP 2690	Kapukhar Bangkalan, Indonesia, single nets 10 m
6	48.38	23.82	20.77	45.29	38.29	0.53	0.85	0.09	9.79	2.02	23.94	0.39	Coll. PP 3217	Bergat Isl., Central Sulawesi, Indonesia, single nets 15 m
7	57.09	25.17	21.99	52.12	45.41	0.48	0.87	0.09	12.26	2.15	31.60	0.39	Coll. PP 3218	Bergat Isl., Central Sulawesi, Indonesia, single nets 15 m
8	50.07	22.49	39.74	44.15	39.61	0.51	0.90	0.12	9.40	1.88	22.23	0.42	Coll. PP 3219	Bergat Isl., Central Sulawesi, Indonesia, single nets 15 m
9	53.93	24.67	22.23	48.53	41.46	0.51	0.90	0.10	11.71	2.17	29.90	0.39	Coll. PP 3210	Bergat Isl., Central Sulawesi, Indonesia, single nets 15 m
10	50.03	23.66	20.77	46.14	39.17	0.51	0.85	0.08	11.53	2.30	24.59	0.47	Coll. PP 3211	Bergat Isl., Central Sulawesi, Indonesia, single nets 15 m
11	49.75	23.35	20.17	45.73	39.99	0.51	0.87	0.08	10.78	2.17	23.23	0.46	Coll. PP 3212	Bergat Isl., Central Sulawesi, Indonesia, single nets 15 m
12	55.41	25.89	22.66	49.61	42.89	0.52	0.85	0.10	14.26	2.57	32.43	0.44	Coll. PP 3213	Bergat Isl., Central Sulawesi, Indonesia, single nets 15 m
13	55.50	24.76	21.73	49.63	41.73	0.50	0.84	0.11	12.61	2.27	29.83	0.42	Coll. PP 3214	Bergat Isl., Central Sulawesi, Indonesia, single nets 15 m
14	53.75	24.69	21.38	48.23	41.84	0.50	0.87	0.08	13.29	2.47	28.37	0.47	Coll. PP 3215	Bergat Isl., Central Sulawesi, Indonesia, single nets 15 m
15	51.91	25.08	21.84	45.88	37.77	0.55	0.83	0.12	10.717	2.07	27.78	0.39	Coll. PP 3216	Bergat Isl., Central Sulawesi, Indonesia, single nets 15 m
16	49.90	23.04	20.51	44.49	38.68	0.52	0.87	0.11	9.48	1.90	23.58	0.40	Coll. PP 3217	Bergat Isl., Central Sulawesi, Indonesia, single nets 15 m
17	49.31	23.96	20.97	44.13	39.18	0.54	0.89	0.11	14.217	2.88	34.78	0.57	Coll. PP 3218	Bergat Isl., Central Sulawesi, Indonesia, single nets 15 m
18	55.49	26.11	22.55	51.41	46.48	0.51	0.90	0.07	14.918	2.69	32.67	0.46	Coll. PP 3219	Bergat Isl., Central Sulawesi, Indonesia, single nets 15 m
19	50.20	23.72	20.65	44.53	39.74	0.53	0.89	0.11	10.103	2.01	24.59	0.41	Coll. PP 3310	Bergat Isl., Central Sulawesi, Indonesia, single nets 15 m
20	56.23	24.94	22.88	50.26	41.94	0.48	0.83	0.10	11.8	2.10	30.80	0.38	Coll. EM	Philippines
21	50.76	23.71	21.67	45.14	38.16	0.53	0.85	0.10	10.1	2.01	25.82	0.39	Coll. EM	Bergat Isl., Central Sulawesi, Indonesia, 5-10 m
22	49.26	21.99	20.16	43.41	36.66	0.56	0.84	0.12	6.7	1.36	21.66	0.31	Coll. EM	Zamboanga, Mindanao, Philippines, 3-5 m
23	51.63	21.27	20.33	46.35	35.19	0.46	0.76	0.10	9.6	1.86	22.30	0.43	Coll. EM	Bergat Isl., Central Sulawesi, Indonesia, 5-10 m
24	47.80	21.12	19.46	41.95	36.12	0.45	0.86	0.12	8.8	1.84	18.65	0.45	Coll. EM	Bergat Isl., Central Sulawesi
25	47.06	20.78	19.17	42.76	31.97	0.45	0.77	0.09	7.3	1.55	18.83	0.39	Coll. EM	Bergat Isl., Central Sulawesi, Indonesia
26	61.48	25.06	23.57	54.55	43.66	0.45	0.80	0.11	13.0	2.11	36.31	0.36	Coll. EM	Bergat Isl., Central Sulawesi, Indonesia, 10-15 m
27	63.07	26.80	24.26	56.48	47.56	0.47	0.84	0.10	15.2	2.41	42.13	0.36	Coll. EM	Bergat Isl., Central Sulawesi, Indonesia, 10-15 m
Average	51.1					0.51	0.85	0.10		2.0		0.42		
Extremes	37.64					0.46 - 0.55	0.76 - 0.93	0.06 - 0.13		1.3 - 2.9		0.31 - 0.57		
RNK						0.47								
Pionoconus magus (Linnaeus, 1758)														
1	81.16	38.63	35.17	74.15	61.41	0.53	0.83	0.09	59.85	2.32	111.09	0.53	Coll. PP 4840	Philippines
2	85.66	31.45	27.32	58.98	50.44	0.53	0.80	0.10	22.14	3.52	56.42	0.41	Coll. PP 4842	Philippines
3	66.97	34.91	28.55	61.54	51.51	0.57	0.84	0.08	20.72	3.09	56.75	0.31	Coll. PP 4851	Philippines
4	86.29	38.04	23.98	53.15	45.18	0.55	0.89	0.09	17.3	3.08	37.85	0.46	Coll. PP 4813	Philippines
5	81.67	30.48	25.86	56.47	48.83	0.54	0.86	0.08	19.8	3.21	48.68	0.41	Coll. PP 4844	Philippines
6	74.53	34.96	30.37	66.83	54.87	0.52	0.88	0.10	38.4	5.15	79.13	0.48	Coll. PP 4855	Negros, Philippines
7	71.02	33.68	29.97	62.74	54.62	0.54	0.90	0.12	30.4	4.28	71.69	0.42	Coll. PP 4816	Philippines
8	45.10	22.72	20.94	40.14	34.81	0.57	0.90	0.11	7.8	1.72	20.53	0.38	Coll. PP 4811	Philippines
9*	32.38	16.03	13.97	22.40	24.73	0.48	0.90	0.15	3.5	1.09	7.35	0.49	Coll. PP 4812	Philippines
10	49.27	21.70	19.15	41.96	38.57	0.52	0.91	0.15	8.5	1.73	20.47	0.42	Coll. PP 4870	Philippines
11	61.27	27.51	23.92	54.60	50.58	0.50	0.91	0.11	14.3	2.34	40.29	0.35	Coll. PP 4873	Philippines
12	65.50	31.70	27.37	58.49	53.84	0.54	0.92	0.11	23.11	3.53	56.83	0.41	Coll. PP 4842	Philippines
13	49.70	25.77	22.33	46.56	40.77	0.55	0.88	0.09	12.20	2.45	28.54	0.43	Coll. PP 3615	Maubie, Philippines
14*	18.12	8.97	7.79	15.95	12.74	0.60	0.85	0.17	0.71	0.39	1.27	0.56	Coll. PP 3650	Maubie, Philippines
15*	18.93	15.20	13.61	25.06	21.70	0.63	0.87	0.13	3.50	1.21	5.98	0.58	Coll. PP 4877	Bohol, Philippines
16	56.57	27.18	22.89	51.88	45.99	0.52	0.89	0.08	33.14	2.32	15.26	0.37	Coll. PP 4875	Philippines
17	70.31	33.30	31.46	60.81	52.82	0.55	0.87	0.14	39.9	3.67	78.92	0.54	Coll. EM	Zamboanga, Philippines
18	87.02	31.40	28.90	58.19	45.65	0.54	0.78	0.13	21.9	3.27	40.82	0.36	Coll. EM	Philippines
19	63.91	30.54	27.78	54.28	44.24	0.56	0.81	0.14	16.8	2.63	54.22	0.31	Coll. EM	Maubie, Philippines
20	48.06	23.30	21.80	42.38	37.08	0.55	0.87	0.12	10.1	2.10	24.41	0.41	Coll. EM	Philippines
21	46.23	22.29	20.68	40.49	33.62	0.55	0.82	0.12	6.7	1.45	21.32	0.31	Coll. EM	Philippines
22	41.32	19.90	18.54	37.15	23.82	0.54	0.80	0.10	5.7	1.38	15.24	0.37	Coll. EM	Socoron, Philippines
23	84.22	36.43	33.83	74.17	56.49	0.49	0.91	0.12	34.3	4.07	103.79	0.33	Coll. EM	Sampag, Philippines
24	68.85	31.89	29.72	62.75	53.84	0.51	0.84	0.09	29.7	4.31	65.25	0.46	Coll. EM	Olango, Cebu, Philippines, 20 m
25	67.28	30.79	28.53	60.85	48.82	0.51	0.77	0.10	17.4	3.59	59.07	0.39	Coll. EM	Maubie, Philippines
26	83.91	28.20	26.84	57.26	46.24	0.51	0.81	0.10	23.9	3.74	50.13	0.48	Coll. EM	Philippines
27	49.07	26.99	26.78	54.74	41.85	0.53	0.78	0.09	16.3	2.71	46.09	0.33	Coll. EM	Bicol, Philippines, 12 m
28	46.86	21.05	19.86	39.31	31.85	0.53	0.80	0.15	6.8	1.45	19.59	0.35	Coll. EM	Camp Kue Reef, Minawa
29	53.76	24.39	22.48	46.14	40.34	0.50	0.83	0.10	10.0	1.86	29.48	0.34	Coll. EM	Cuyo, Philippines
30	89.02	40.82	39.15	83.56	63.40	0.50	0.78	0.08	61.0	6.85	242.26	0.43	Coll. EM	Bohol, Philippines, 2-20 m
31	93.43	40.20	38.23	78.27	64.89	0.53	0.83	0.16	58.9	6.39	242.78	0.41	Coll. EM	Maubie, Philippines, 20 m
Average	63.2					0.53	0.84	0.11		3.4		0.40		
Extremes	41 - 94					0.49 - 0.57	0.76 - 0.93	0.06 - 0.15		1.4 - 7.4		0.29 - 0.54		
RNK	30 - 94					0.47 - 0.69	0.72 - 0.91	0.05 - 0.19		1.0 - 8.3		-		

N°	SL	MD	P-Height	AH	HWD	RD	PMO	ROH	W	RW = WxL	V Volume	RW = WxV	Repository	Locality
	mm	mm	mm	mm	mm				μ	μm	cm ³	μm ³		
<i>Pionoconus raphanus</i> (Hwass in Brugulère, 1792)														
1*	33.17	15.67	13.82	29.06	26.26	0.54	0.20	0.12	3.5	1.04	7.18	0.48	Coll. RP 3564	Cebu, Philippines, dive 20 m
2*	30.38	18.39	12.62	32.15	30.22	0.57	0.24	0.12	5.02	1.37	10.51	0.48	Coll. RP 3563	Cebu, Philippines, dive 20 m
3	40.71	26.30	22.80	42.19	39.59	0.52	0.33	0.13	17.2	3.53	29.21	0.59	Coll. RP 3562	Cebu, Philippines, dive 20 m
4	43.60	32.88	26.08	56.19	52.26	0.58	0.32	0.11	34.7	5.45	60.81	0.57	Coll. RP 3561	Zamboanga, Philippines, dive 25 m
5	73.36	43.34	34.36	67.85	63.78	0.51	0.34	0.08	55.4	7.55	116.09	0.50	Coll. RP 3558	Jeddah, Bahari, Philippines, 15 m
6	33.59	21.80	19.05	59.05	55.99	0.57	0.35	0.14	35.6	5.21	98.44	0.52	Coll. LL 1215	Urdine Reef, Queensland, Australia
7	46.37	32.27	22.54	62.54	59.35	0.58	0.35	0.13	43.67	6.10	84.53	0.52	Coll. RP 3556	Bohol, Philippines, 15 m
8	52.08	39.45	31.69	66.89	63.84	0.53	0.38	0.10	34.23	4.65	19.40	0.41	Coll. LL 1511	Portland Road, Queensland, Australia
9	70.61	30.04	33.64	68.70	63.45	0.55	0.42	0.13	48.82	6.21	100.59	0.49	Coll. RP 3554	Maculan, Philippines, 15 m
10	41.22	40.37	35.78	73.62	71.02	0.55	0.36	0.09	56.9	7.40	117.32	0.48	Coll. RP 3553	Maculan, Bohol, Philippines, 25 m
11	78.89	41.02	39.19	71.87	66.01	0.57	0.32	0.09	61.0	7.73	126.82	0.48	Coll. RP 3553	Palawan, Philippines, 10 m
12	61.71	32.35	26.16	57.01	52.25	0.52	0.32	0.08	32.4	5.26	60.21	0.54	Coll. RM	Sulu Sea, Philippines
13	37.41	30.93	27.30	51.78	46.57	0.58	0.30	0.10	21.8	3.40	17.07	0.46	Coll. RM	Palawan, Philippines, 74 m
14	50.72	29.57	28.11	53.82	47.85	0.55	0.29	0.08	24.9	4.24	48.01	0.51	Coll. DM	Abay Gulf, Philippines
15	48.94	25.50	24.27	41.09	38.20	0.52	0.33	0.16	15.1	3.39	30.28	0.50	Coll. DM	Rabaul, PNG
16	54.99	26.53	21.13	48.02	42.57	0.55	0.30	0.13	18.6	3.10	36.64	0.51	Coll. DM	Samar, Philippines, 40-60 m
17	49.46	26.01	24.33	43.77	39.37	0.59	0.30	0.12	16.5	3.22	31.43	0.53	Coll. DM	Bohol, Philippines
18	55.34	27.76	24.19	49.02	41.92	0.57	0.36	0.12	18.0	3.25	40.23	0.55	Coll. DM	Cebu, Philippines, 8 m
19	62.39	32.07	30.77	56.18	46.78	0.55	0.33	0.10	32.7	5.24	61.57	0.53	Coll. RM	Nicosian, Philippines, 2-10 m
20	59.80	30.43	24.89	55.22	48.46	0.55	0.30	0.08	28.3	4.73	52.97	0.54	Coll. RM	Indonesia ?
21	63.49	32.97	30.73	59.76	51.93	0.59	0.33	0.12	30.9	4.37	64.33	0.48	Coll. DM	Bungin Isl., Sumbawa, Indonesia, 5-10 m
22	62.56	34.83	31.96	57.82	53.34	0.50	0.32	0.08	41.3	5.59	74.16	0.56	Coll. DM	Cebu, Philippines, 10 m
Average	61.8					0.58	0.31	0.11	51			0.52		
Extremes	48 - 82					0.55 - 0.63	0.23 - 0.44	0.08 - 0.16	3.1 - 7.7			0.41 - 0.61		
<i>Pionoconus carinatus</i> (Swainson, 1822)														
1	65.75	30.23	28.17	59.02	46.14	0.51	0.78	0.10	27.2	4.14	55.99	0.49	Coll. RM	Manist Isl., PNG
2	52.78	25.09	23.05	47.90	36.95	0.52	0.77	0.09	13.0	2.40	30.52	0.43	Coll. DM	New Britain, PNG
3	57.20	25.69	21.93	51.10	39.07	0.50	0.76	0.10	13.5	2.16	35.16	0.36	Coll. DM	New Britain, PNG
4	48.49	33.07	30.85	63.19	51.22	0.52	0.81	0.08	37.1	5.42	69.87	0.53	Coll. RM	Bulake, S. Palawan, Philippines
5	47.87	31.91	28.84	60.17	52.59	0.53	0.80	0.11	44.8	5.14	62.28	0.56	Coll. DM	Mindanao, Philippines
6	60.32	28.29	24.47	55.37	49.78	0.51	0.90	0.08	19.5	3.24	41.78	0.47	Coll. LL 7555	Philippines ?
7	66.43	32.08	28.11	59.29	52.05	0.54	0.88	0.11	38.9	5.85	59.90	0.65	Coll. LL 9910	Philippines
8	55.39	27.47	23.73	51.31	43.52	0.54	0.85	0.07	20.2	3.65	36.11	0.56	Coll. LL 7960	Cebu, Philippines
9	61.81	27.84	23.64	56.05	50.17	0.50	0.90	0.09	15.5	2.50	40.77	0.38	Coll. LL 7960	Cebu, Philippines
10	59.34	26.89	23.74	52.44	46.01	0.51	0.88	0.12	19.4	3.27	38.01	0.51	Coll. LL 7960	Cebu, Philippines
11	63.32	30.33	26.14	57.22	52.65	0.53	0.91	0.09	25.6	4.44	50.20	0.51	Coll. LL 9919	Philippines
12	57.13	28.74	24.91	48.15	42.58	0.58	0.87	0.15	23.4	4.10	40.90	0.57	Coll. LL 7318	Rabaul, Philippines
13	40.11	35.73	30.51	64.08	56.39	0.55	0.88	0.04	46.4	6.41	73.21	0.63	Coll. LL 7741	Philippines
Average	61.8					0.53	0.85	0.10	41			0.51		
Extremes	52 - 69					0.50 - 0.59	0.76 - 0.91	0.06 - 0.15	2.4 - 6.8			0.38 - 0.63		
<i>Pionoconus aff. carinatus</i>														
1	52.27	23.38	21.08	45.42	36.86	0.51	0.81	0.13	11.6	2.22	26.98	0.43	Coll. RM	Alas, Solomon Isl.
2	43.81	27.84	24.44	57.07	49.01	0.59	0.86	0.11	19.7	3.49	46.97	0.42	Coll. DM	Orange Cebu, Philippines, 20 m
3	55.85	26.22	24.61	49.31	43.31	0.53	0.87	0.11	17.9	3.21	36.04	0.50	Coll. DM	Tout Tout, Philippines
4	50.07	25.18	21.82	45.77	42.78	0.53	0.93	0.09	12.6	2.51	27.51	0.46	Coll. RP 3520	Kakoro-Ulawa, Solomon Arch., 12 m
5	50.68	24.10	20.46	45.89	41.79	0.53	0.91	0.09	9.6	1.90	24.99	0.39	Coll. RP 3521	Hidaway Isl., Vanuatu, 5 m
6	55.70	27.14	23.75	49.32	45.06	0.54	0.90	0.10	18.9	3.40	35.90	0.53	Coll. RP 3521	Cebu, Philippines, dive 20 m
7	50.04	27.76	23.24	53.46	46.65	0.52	0.91	0.08	16.6	2.85	37.44	0.44	Coll. RP 3523	Palawan, Philippines, dive 30 M
8	45.48	32.11	27.56	59.13	54.11	0.55	0.92	0.10	22.6	3.46	58.49	0.39	Coll. RP 3523	Palawan, Philippines, dive 15 m
9	61.37	26.55	25.32	54.03	47.02	0.59	0.97	0.12	15.6	2.64	41.26	0.38	Coll. RM	Atoll Bay, Solomon Isl.
10	44.14	24.72	21.98	47.10	41.11	0.51	0.97	0.12	14.7	3.08	32.21	0.32	Coll. RM	Caribbean, Philippines, 13-20 m, sp.
Average	56.8					0.52	0.89	0.10	2.8			0.44		
Extremes	50 - 66					0.49 - 0.55	0.81 - 0.93	0.08 - 0.13	1.9 - 3.4			0.39 - 0.53		

N°	SL	MD	Ht Height	AH	HMD	RD	PMO	ROH	W	RW = W/VL	V Volume	RW = W/V	Repository	Locality
Pionoconus alexisallaryi Cossignani, 2018														
	mm	mm	mm	mm	mm				g	g/cm	cm³	g/cm³		
1	62.32	30.72	28.54	53.42	48.19	0.58	0.92	0.14	26.3	4.22	54.44	0.48	Coll. EM	Menus Isl., PNG
2	60.93	30.85	29.18	52.75	47.68	0.58	0.90	0.13	26.4	4.33	54.45	0.48	Coll. EM	Port Bick, New Caledonia
3	56.85	26.87	25.45	46.54	43.21	0.58	0.93	0.18	18.0	3.17	38.88	0.46	Coll. EM	New Caledonia
4	64.07	28.75	27.13	53.42	48.11	0.54	0.90	0.17	22.1	3.45	49.97	0.44	Coll. EM	Rahau, PNG
5	57.54	29.39	27.83	48.73	44.82	0.60	0.92	0.15	23.2	4.63	47.86	0.49	Coll. EM	New Caledonia
6	45.18	23.57	21.69	38.59	35.84	0.41	0.93	0.15	13.1	2.48	28.10	0.52	Coll. EM	New Caledonia
7	64.17	32.08	29.78	54.34	51.83	0.57	0.92	0.12	28.4	4.43	61.30	0.46	Coll. EM	New Caledonia ?
8	54.37	28.52	27.10	45.50	41.29	0.53	0.95	0.16	21.3	3.52	42.92	0.51	Coll. EM	New Caledonia
9	51.04	27.47	21.16	42.16	38.01	0.53	0.90	0.17	9.4	1.84	24.27	0.39	Coll. EM	Solomon Arch.
10	48.52	22.62	20.97	41.33	35.46	0.55	0.86	0.15	9.1	1.88	23.92	0.40	Coll. EM	New Caledonia
11	46.05	22.46	21.52	38.28	34.51	0.59	0.90	0.17	10.4	2.26	22.26	0.47	Coll. EM	New Caledonia
12	48.81	23.65	21.58	40.41	37.00	0.59	0.92	0.17	12.8	2.39	24.81	0.51	Coll. EM	New Caledonia
13	49.81	22.84	21.41	40.68	34.15	0.56	0.86	0.10	11.3	2.27	23.83	0.47	Coll. EM	Menus Island, Solomon Arch.
14	49.27	22.77	21.11	41.88	37.48	0.54	0.89	0.15	10.6	2.15	23.48	0.45	Coll. EM	Viti Levu Isl., Fiji Arch.
15 *	34.28	16.91	15.84	28.92	25.49	0.58	0.88	0.12	5.0	1.46	9.18	0.54	MNHM IM 2007 30791	Second Channel, Luganville, Vanuatu, 8-15 m, (DNA sequenced)
16	57.89	30.49	26.75	50.82	44.54	0.60	0.88	0.16	22.9	3.55	47.22	0.48	Coll. FP 859	Queensland, Australia Day, 12 m
17	45.56	20.53	18.07	38.91	34.82	0.53	0.89	0.15	5.9	1.30	16.90	0.35	Coll. FP 3579	Guadalcanal, Solomon Isl., 8 m
18 *	26.92	14.95	13.39	21.31	19.40	0.64	0.83	0.13	3.3	1.23	5.39	0.62	Coll. FP 3546	Port Bick, New Caledonia, 15 m
19	72.81	38.78	33.59	64.32	60.05	0.60	0.93	0.13	53.8	2.39	96.15	0.54	Coll. FP 1131	Prény Bay, New Caledonia
20 *	20.84	10.84	9.38	19.02	16.91	0.57	0.89	0.09	1.2	0.57	2.32	0.56	Coll. FP 3575	Camps Australia, 12 m
21	69.83	36.95	33.65	60.95	55.88	0.61	0.92	0.13	43.7	6.25	86.82	0.50	Coll. FP 4102	Prény Bay, New Caledonia, 8 m
22	58.02	27.04	23.48	49.49	44.02	0.55	0.93	0.15	14.2	2.45	36.84	0.39	Coll. FP 4103	Prény Bay, New Caledonia, 10 m
23	38.16	17.82	15.22	32.15	30.05	0.55	0.93	0.16	5.2	1.35	10.40	0.50	Coll. FP 3577	Mirapa Isl., Solomon Isl., 8 m
24	48.23	22.78	20.08	41.35	38.61	0.55	0.93	0.14	9.9	2.64	22.86	0.45	Coll. FP 3579	Guadalcanal, Solomon Isl., 25 m
25	48.17	24.89	21.80	41.69	38.01	0.60	0.91	0.15	13.2	3.49	36.48	0.50	Coll. FP 3546	Port Bick, New Caledonia, 20 m
Average	54.5					0.57	0.91	0.15	3.2			0.47		
Extremes	38 - 74					0.53 - 0.63	0.85 - 0.95	0.12 - 0.20	1.3 - 7.3			0.39 - 0.56		
Pionoconus striatus striatus (Linnaeus, 1758) "juveniles"														
1	22.37	10.25	9.54	18.98	15.88	0.54	0.84	0.16	1.1	0.49	2.22	0.50	Coll. EM	Vanuatu, 10 m
2	25.48	12.32	11.49	21.94	18.87	0.56	0.86	0.14	2.3	0.90	3.61	0.64	Coll. GH	Tukunuk Beach, Efate Isl., Vanuatu, 1-10 m
3	27.81	13.4	12.56	23.35	20.46	0.57	0.88	0.16	2.6	0.93	4.68	0.56	Coll. GH	Tukunuk Beach, Efate Isl., Vanuatu, 1-10 m
4	29.65	13.92	12.95	24.9	21.75	0.56	0.79	0.16	3.1	1.65	5.34	0.58	Coll. GH	Tukunuk Beach, Efate Isl., Vanuatu, 1-10 m
5	30.51	14.26	13.42	26.45	22.45	0.54	0.77	0.13	3.5	1.35	5.84	0.60	Coll. GH	Tukunuk Beach, Efate Isl., Vanuatu, 1-10 m
6	34.87	16.22	15.43	28.93	24.9	0.56	0.86	0.17	5.3	1.53	8.68	0.61	Coll. GH	Tukunuk Beach, Efate Isl., Vanuatu, 1-10 m
7	34.93	16.3	15.40	29.56	24.55	0.55	0.83	0.15	4.2	1.20	8.77	0.48	Coll. GH	Tukunuk Beach, Efate Isl., Vanuatu, 1-10 m
8	36.35	16.95	16.21	31.78	24.37	0.53	0.77	0.13	5.9	1.42	9.99	0.59	Coll. GH	Tukunuk Beach, Efate Isl., Vanuatu, 1-10 m
Average	30.3					0.55	0.82	0.15	1.1			0.57		
Extremes	22 - 37					0.53 - 0.57	0.77 - 0.88	0.13 - 0.17	0.49 - 1.6			0.48 - 0.64		
RKK (adults)	55 - 129					0.47 - 0.62	0.78 - 0.82	0.00 - 0.14	0.24 - 1.1			-		
Calibanus furvus f. frauenfeldi (Crosse, 1865)														
Lectotype 1	42.00	23.00	-	36.62	31.95	0.63	0.87	0.13	-	-	-	-	NHMUK	Philippines, Original & G. Roysaudi corrected data are erroneous
Lectotype 2	43.20	23.60	-	36.26	32.89	0.65	0.91	0.16	-	-	-	-	NHMUK	Philippines, Original & G. Roysaudi corrected data are erroneous
1	44.01	22.18	21.65	36.71	34.85	0.60	0.85	0.17	12.3	2.39	21.13	0.58	Coll. EM	Balabac, Palawan, Philippines
Average	43.10					0.63	0.91	0.15	2.8			0.58		
Extremes	42 - 44					0.60 - 0.65	0.87 - 0.95	0.13 - 0.17						
RKK	35 - 71					0.50 - 0.69	0.80 - 0.94	0.03 - 0.23	1.0 - 4.0			-		

ANNEX 2. Morphometric graphs

A. Morphometric parameters for *P. hervillardi* sp. nov. & 5 compared species

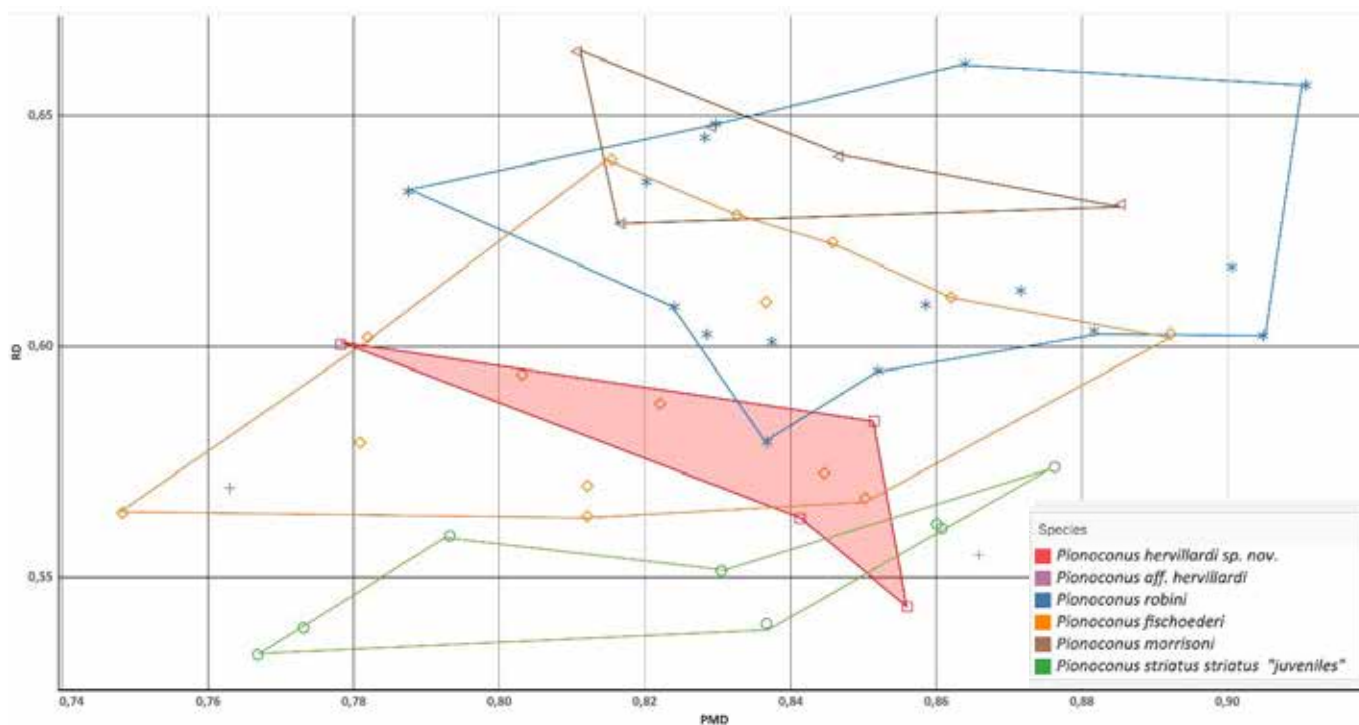


Figure 10. Graph of $RD = f(PMD)$ for compared species. *Pionoconus hervillardi* sp. nov. is figured in red colour.

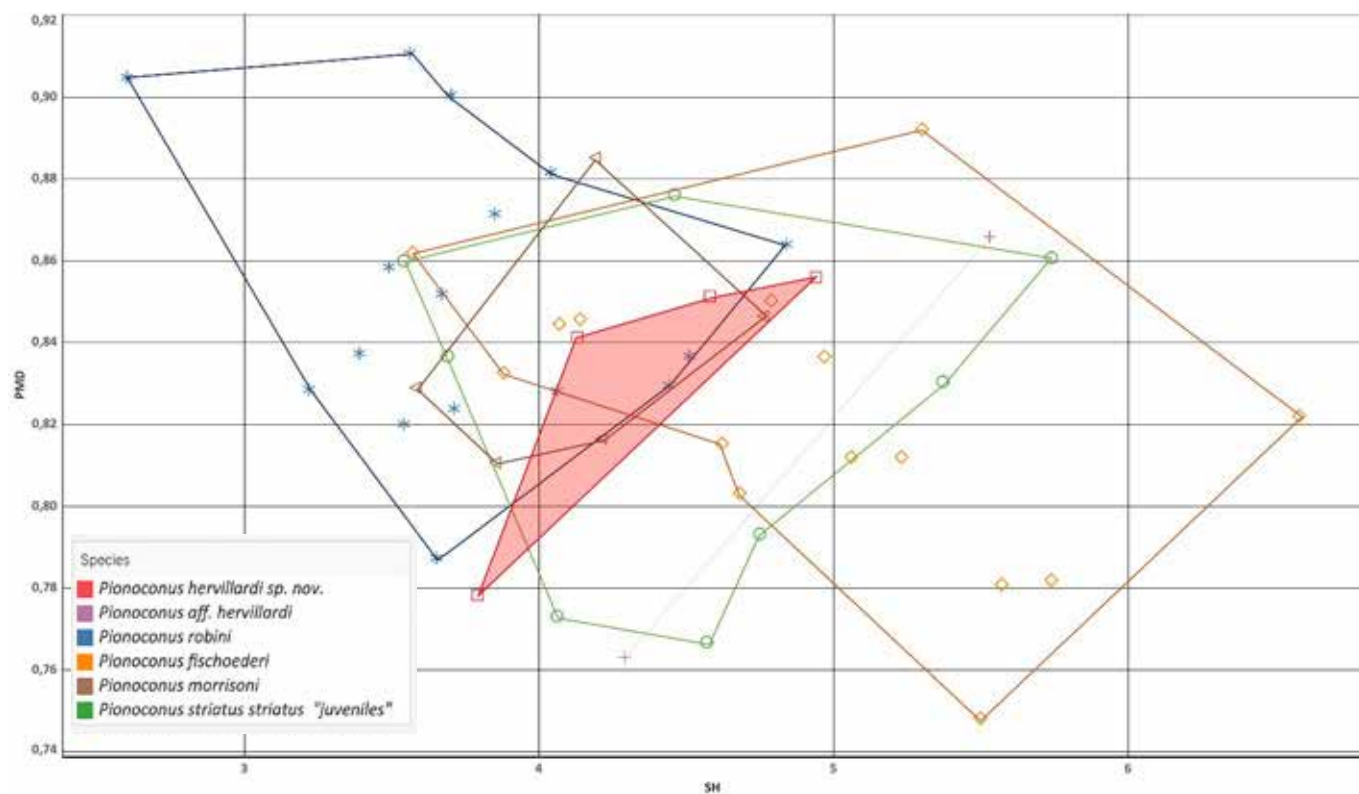


Figure 11. Graph of $PMD = f(SH)$ for some compared species. *Pionoconus hervillardi* sp. nov. is figured in red colour.

B. Morphometric parameters for *Pionoconus samaraiensis* sp. nov. & 3 compared species

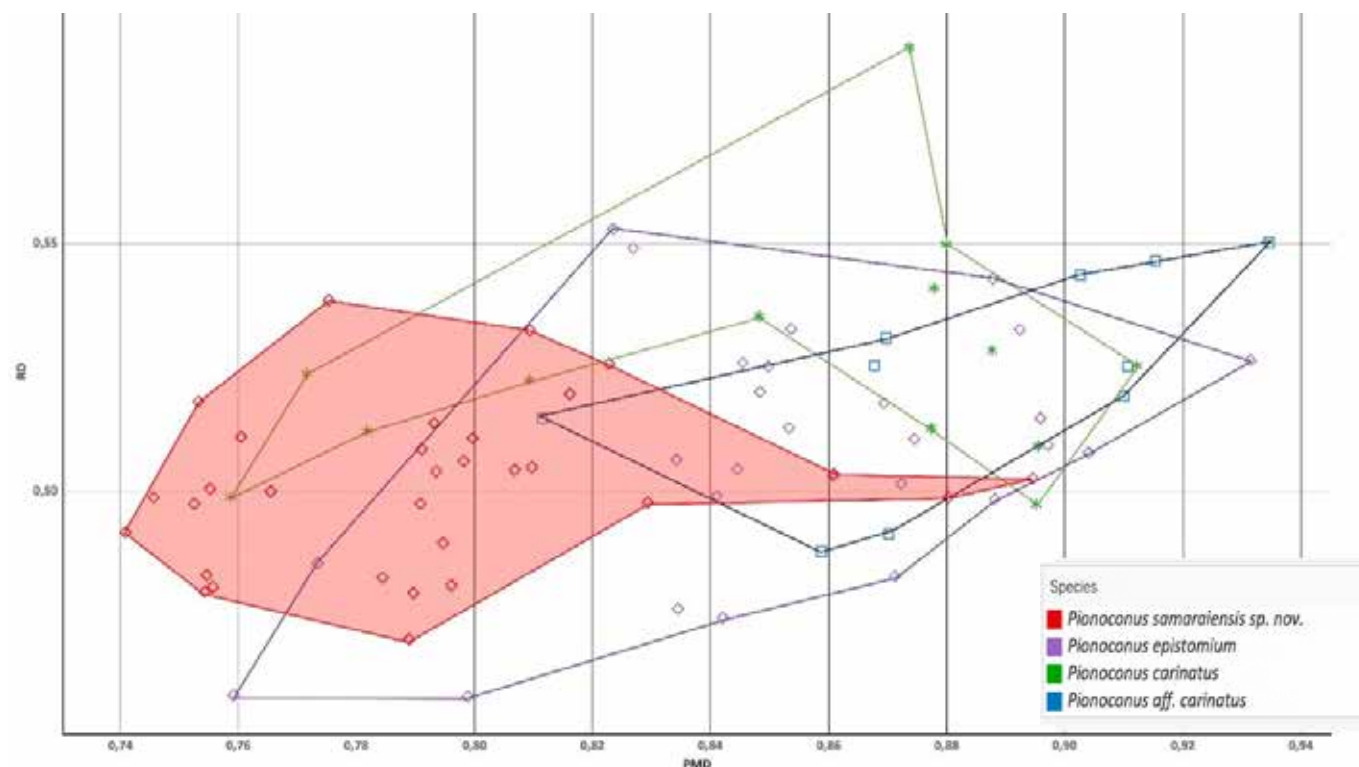


Figure 20. Graph of RD = f(PMD) for some compared species. *Pionoconus samaraiensis* sp. nov. is figured in red colour

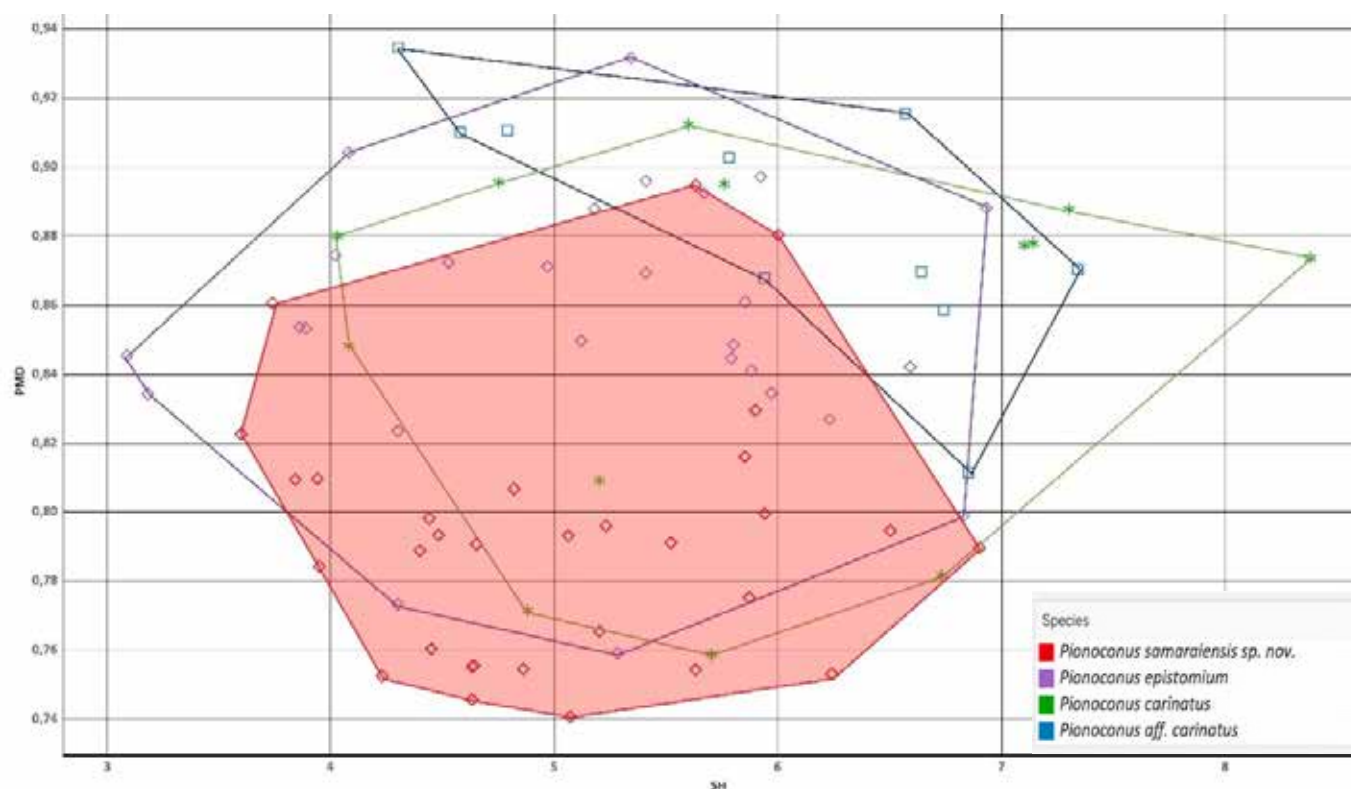


Figure 21: Graph of PMD = f(SH) for some compared species. *Pionoconus samaraiensis* sp. nov. is figured in red colour

C. Morphometric parameters for *Pionoconus manusensis* sp. nov. & 3 compared species

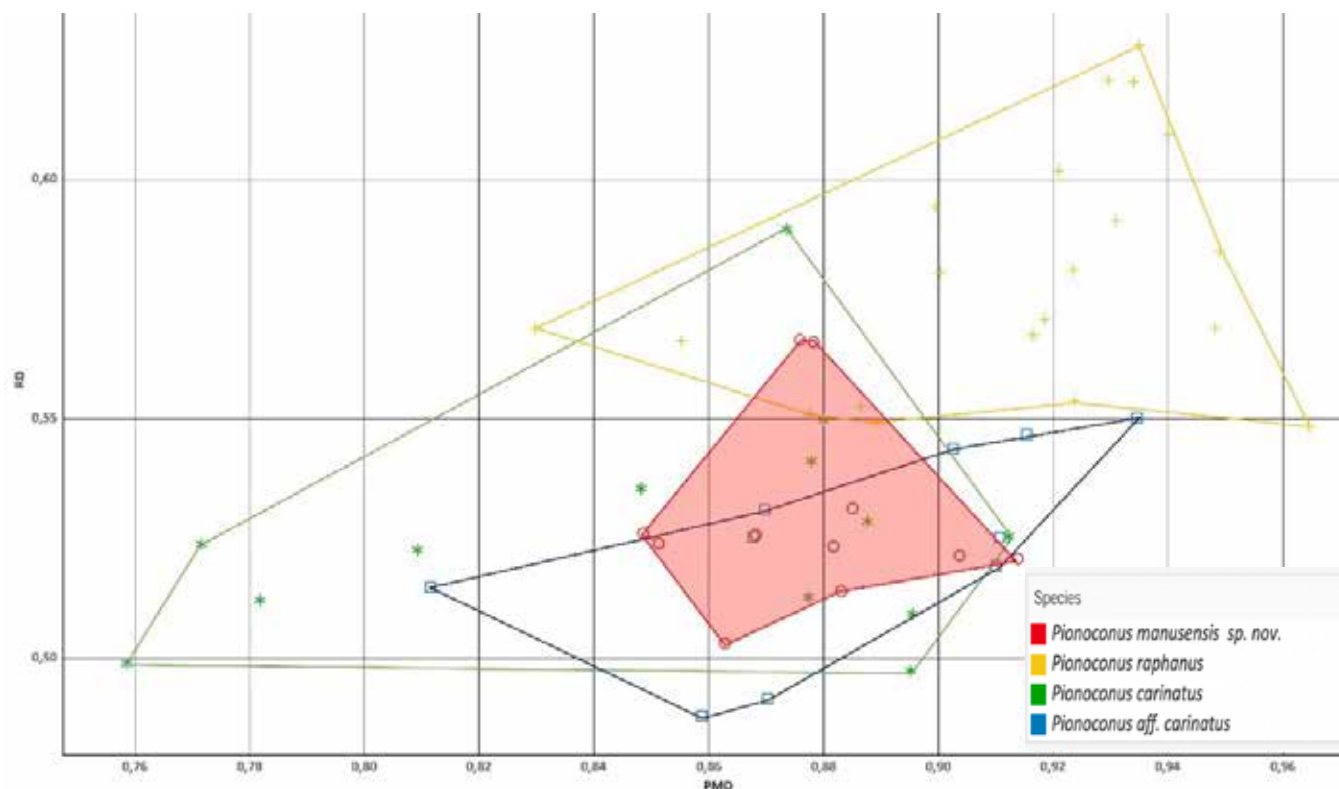


Figure 29. Graph of $RD = f(PMD)$ for some compared species. *Pionoconus manusensis* sp. nov. is figured in red colour

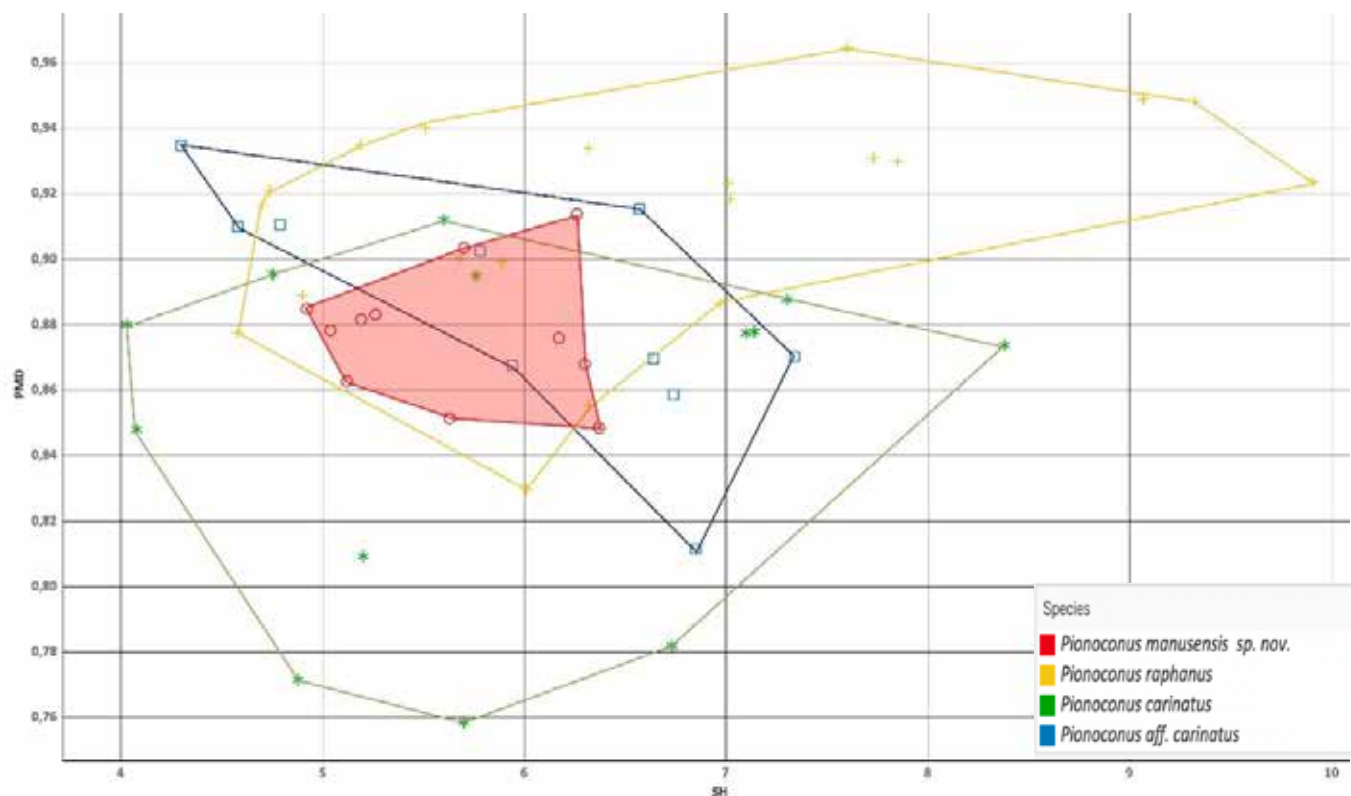


Figure 30. Graph of $PMD = f(SH)$ for some compared species. *Pionoconus manusensis* sp. nov. is figured in red colour

D. Morphometric parameters for *Pionoconus vitilevuensis* sp. nov. & compared species

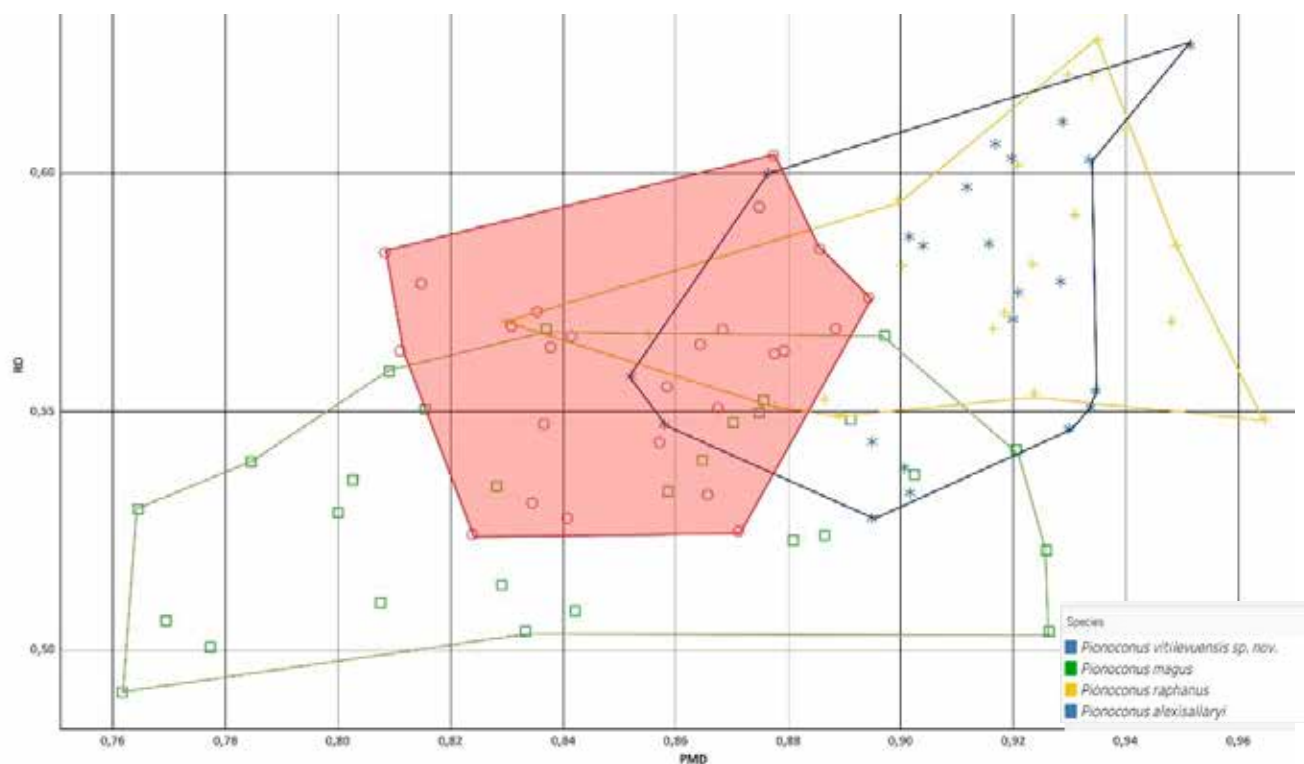


Figure 38. Graph of $RD = f(PMD)$ for some compared species. *Pionoconus vitilevuensis* sp. nov. is figured in red colour

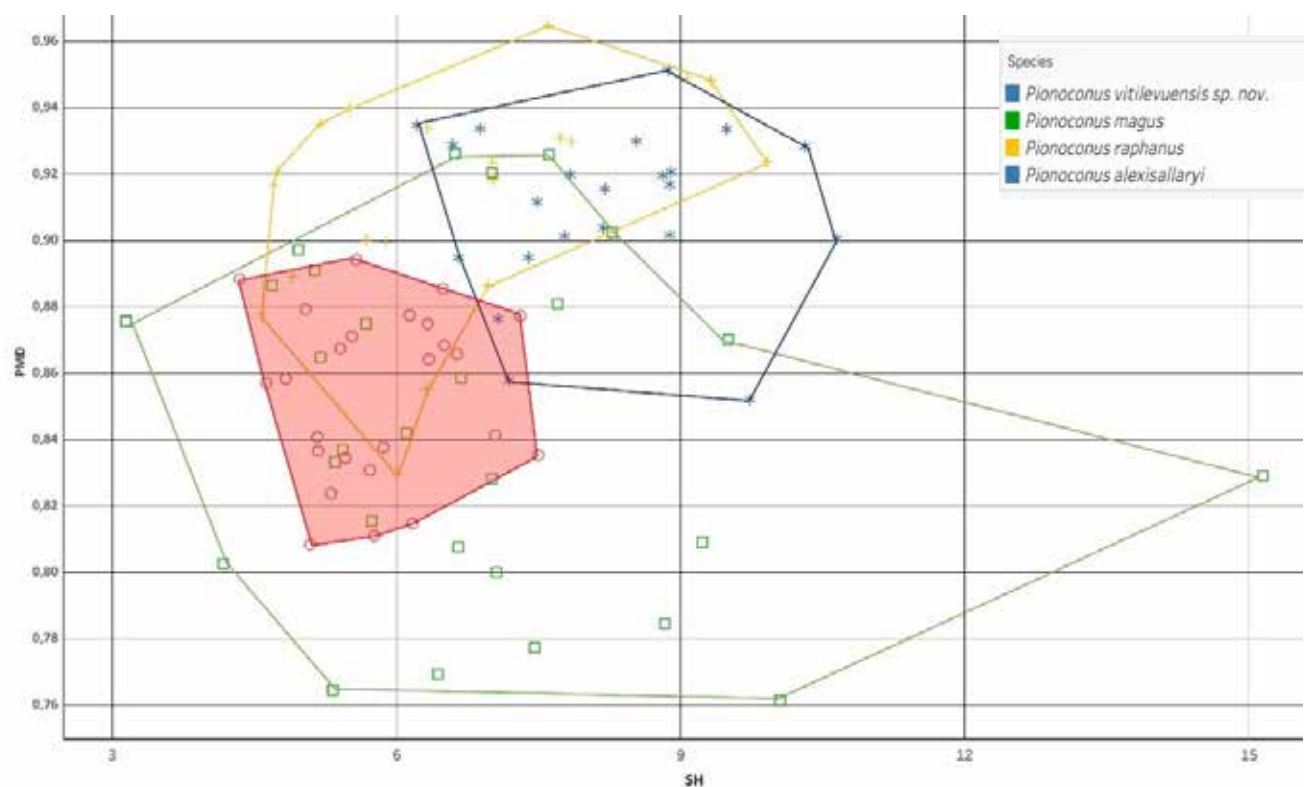


Figure 39. Graph of $PMD = f(SH)$ for some compared species. *Pionoconus vitilevuensis* sp. nov. is figured in red colour

E. Morphometric parameters for *Pionoconus kwajaleinensis* sp. nov. & compared species

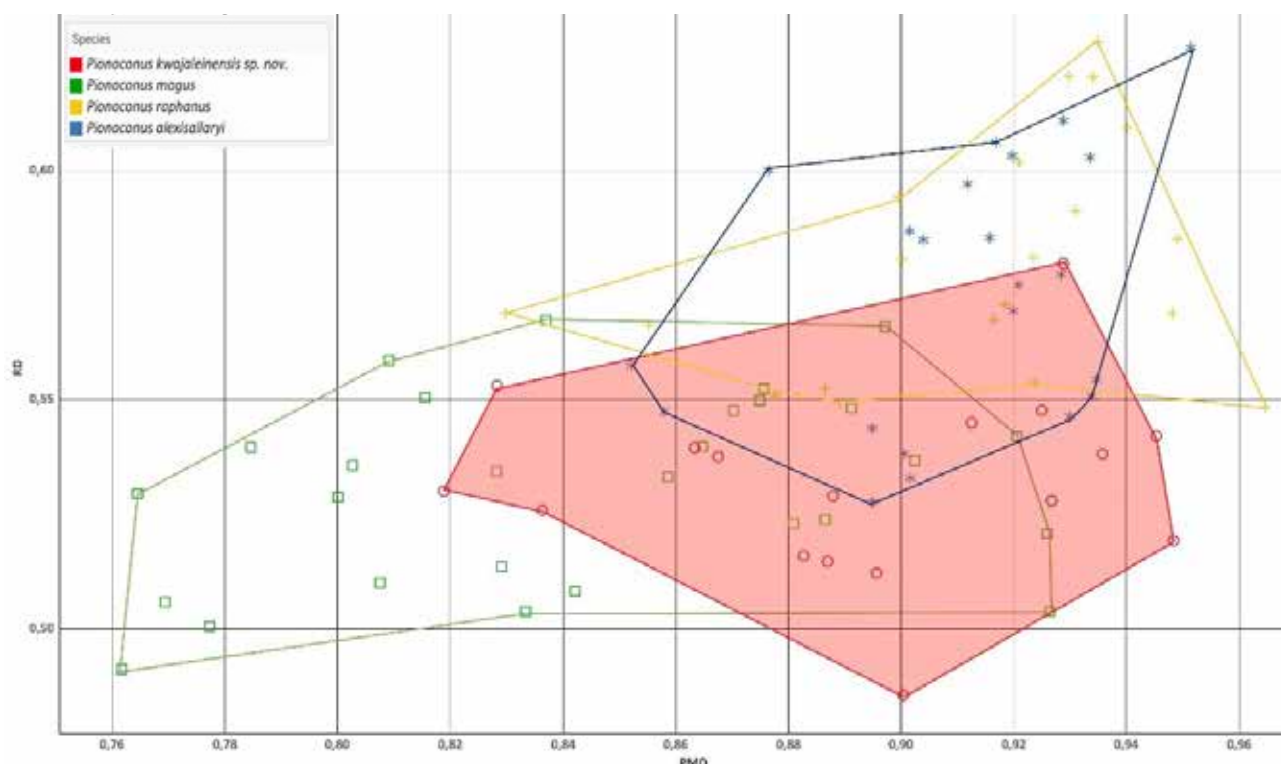


Figure 46. Graph of RD = f(PMD) for some compared species. *Pionoconus kwajaleinensis* sp. nov. is figured in red colour

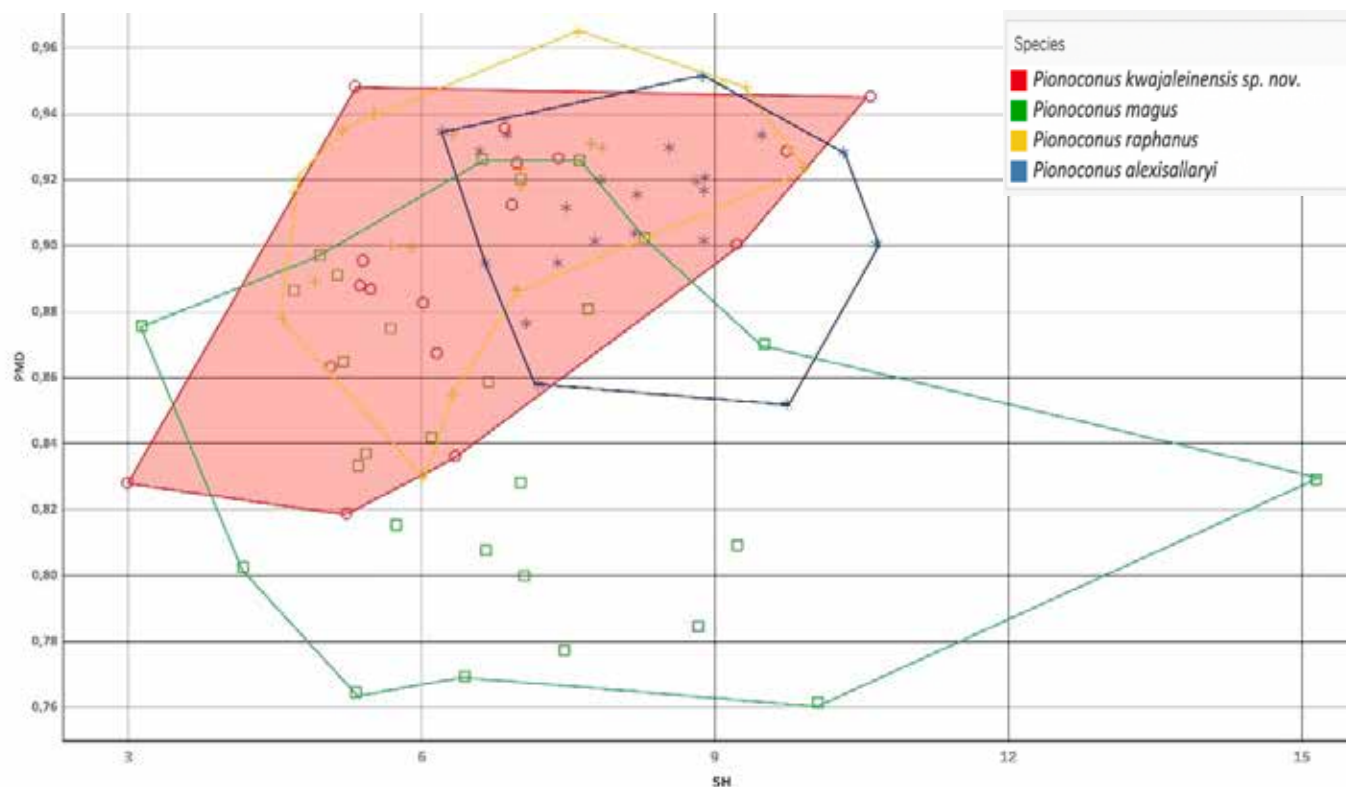


Figure 47. Graph of PMD = f(SH) for some compared species. *Pionoconus kwajaleinensis* sp. nov. is figured in red colour

F. Morphometric parameters for *Pionoconus niasensis* sp. nov. & compared species

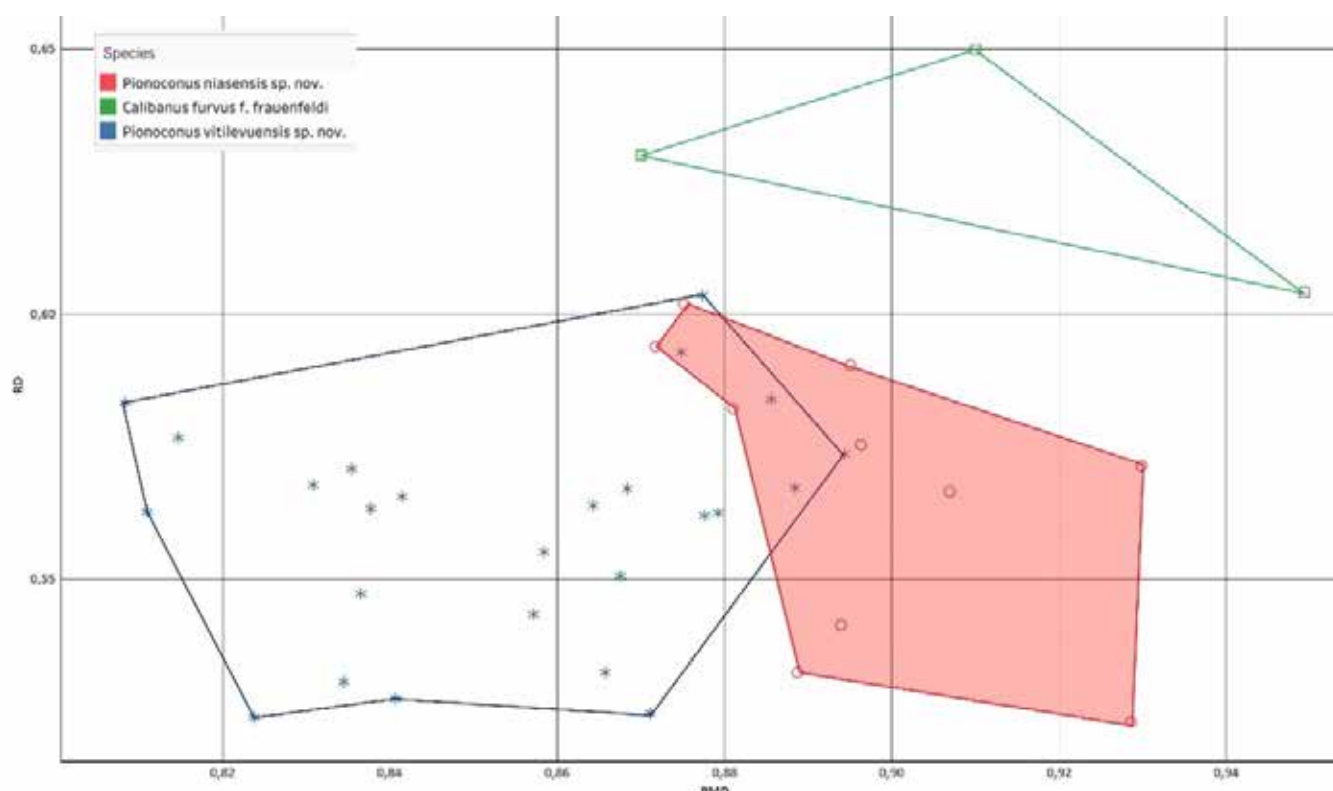


Figure 55. Graph of $RD = f(PMD)$ for some compared species. *Pionoconus niasensis* sp. nov. is figured in red colour

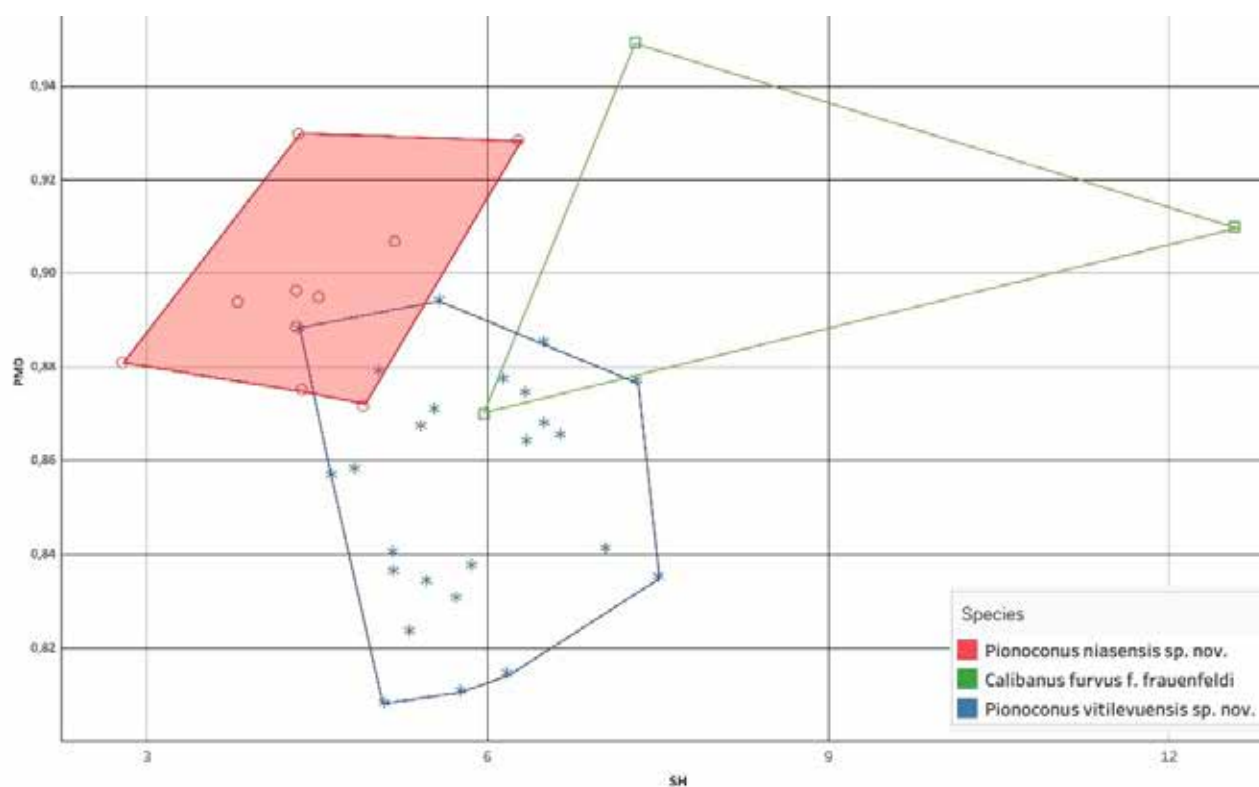


Figure 56. Graph of $PMD = f(SH)$ for some compared species. *Pionoconus niasensis* sp. nov. is figured in red colour

PLATE 1. *Pionoconus hervillardi* sp. nov., *Pionoconus* aff. *hervillardi* sp. nov., *Pionoconus robini*



- 1ab *hervillardi* Holotype MNHN-IM-2000637097 30.63 mm Vanuatu
 2 *P. hervillardi* Paratype 1: 24.35 mm Efaté Isl., Vanuatu, 1-10 m Coll. EM
 3 *P. hervillardi* Paratype 2: 27.53 mm Efaté Isl., Vanuatu, 1-10 m Coll. EM
 4 *P. hervillardi* Paratype 3: 26.74 mm Vanuatu Coll. LL # 9109
 5 *P. aff. hervillardi* 34.89 mm Tukutuk Beach, Efaté Isl. Coll. GH
 6ab *P. aff. hervillardi* 28.68 mm Tukutuk Beach, Efaté Isl. Coll. GH
 7 *P. robini* Holotype MNHN-IM-24816 26.18 mm Philippines
 8 *P. robini* 31.91 mm Cuyo Isl. Philippines Coll. EM
 9 *P. robini* 30.73 mm Philippines Coll. EM
 10 *P. robini* 27.40 mm Cuyo Isl. Philippines Coll. EM
 11 *P. robini* 26.42 mm Paratype 9 Coron Isl. Philippines Coll. EM
 12 *P. robini* 24.11 mm Paratype 10 Philippines Coll. EM
 13 *P. robini* 22.21 mm Philippines Coll. EM
 14 *P. robini* 21.00 mm Philippines Coll. EM
 15 *P. robini* 22.56 mm Paratype 11 Philippines Coll. EM
 16 *P. robini* 22.16 mm Philippines Coll. EM
 17 *P. robini* 23.70 mm Malaysia, 10-20 m Coll. FP 2384
 18 *P. robini* 21.10 mm Palawan Philippines Coll. FP 3188
 19 *P. robini* 25.34 mm New Britain PNG Coll. FP 2657
 20 *P. robini* 22.93 mm Balabac Philippines Coll. FP 3190
 21 *P. robini* 22.17 mm Mactan Philippines Coll. FP 2387
 22 *P. robini* 24.22 mm Palawan Philippines Coll. FP 2376

PLATE 2. *Pionoconus fischoederi*, *Pionoconus morrisoni*, *Pionoconus striatus*.



1. *P. fischoederi* Holotype NMSF 256228 33,70 mm Philippines
2. *P. fischoederi* 38.43 mm Cuyo Isl. , Philippines Coll. EM
3. *P. fischoederi* 36.45 mm Cuyo Isl. , Philippines Coll. EM
4. *P. fischoederi* 35.42 mm Olango isl. , Philippines Coll. EM
5. *P. fischoederi* 39.40 mm Philippines Coll. EM
6. *P. fischoederi* 33.27 mm Cuyo isl. , Philippines Coll. EM
7. *P. fischoederi* 33.94 mm Philippines Coll. EM
8. *P. fischoederi* 29.82 mm Cuyo isl. , Philippines Coll. EM
9. *P. fischoederi* 26.11 mm Cuyo isl. , Philippines Coll. EM
10. *P. fischoederi* 27.94 mm Cuyo isl. , Philippines Coll. EM
11. *P. fischoederi* 24.89 mm Cuyo isl. , Philippines Coll. EM
12. *P. fischoederi* 30.24 mm Coron isl. , Philippines Coll. FP 2370
13. *P. fischoederi* 30.64 mm Cuyo isl. , Philippines Coll. FP 2369
14. *P. fischoederi* 37.77 mm Cuyo isl. , Philippines Coll. FP 2368
15. *P. fischoederi* 24.22 mm Cuyo isl. , Philippines Coll. FP 2376
16. *P. morrisoni* Holotype 27.50 mm MHNG 16152 Coll. BdM
17. *P. morrisoni* 27.30 mm Ashmore Reef, Australia Coll. EM
18. *P. morrisoni* 25.27 mm Timor sea Coll. EM
19. *P. morrisoni* 24.81 mm Ashmore Reef, Australia Coll. EM
20. *P. morrisoni* 20.01 mm Ashmore Reef, Australia Coll. PK
21. *P. striatus* 22.67 mm Vanuatu Coll. EM
22. *P. striatus* 22.67 mm Vanuatu Coll. EM
23. *P. striatus* 29.65 mm Vanuatu Coll. GH

PLATE 3. *Pionoconus samaraiensis* sp. nov.



1ab Holotype MNHN-IM-2000637098 42.30 mm Samarai PNG

2 Paratype 1 42.02 mm Samarai Isl. PNG Coll EM

3 Paratype 2 43.46 mm Rabaul PNG Coll EM

4 Paratype 3 41.73 mm Samarai Isl. PNG Coll EM

5 Paratype 4 40.52 mm Samarai Isl. PNG Coll EM

6 Paratype 5 42.14 mm Samarai Isl. PNG Coll EM

7 Paratype 6 50.77 mm Samarai Isl. PNG Coll EM

8 Paratype 7 40.83 mm Samarai Isl. PNG Coll EM

9 Paratype 8 36.94 mm Samarai Isl. PNG Coll EM

10 Paratype 9 47.73 mm Samarai Isl. PNG Coll EM

11 Paratype 10 47.07 mm Samarai Isl. PNG Coll EM

12 Paratype 11 42.03 mm Samarai Isl. PNG Coll EM

13 Paratype 12 41.61 mm Rabaul Isl. PNG Coll EM

14 Paratype 13 38.53 mm Samarai Isl. PNG Coll EM

15 Paratype 14 42.45 mm Samarai Isl. PNG Coll EM

16 Paratype 15 42.03 mm Samarai Isl. PNG Coll EM

PLATE 4. *Pionoconus samaraiensis* sp. nov.



1. Paratype 16: 43.96 mm PNG Coll. EM
2. Paratype 17: 35.39 mm Samarai Isl. , PNG Coll. EM
3. Paratype 18: 38.36 mm Rabaul, PNG Coll. LL 8736
4. Paratype 19: 43.65 mm Samarai Isl. , PNG Coll. LL 7108
5. Paratype 20: 38.37 mm Samarai Isl. , PNG Coll. LL 7108
6. Paratype 21: 33.84 mm Samarai Isl. , PNG Coll. LL 9097
7. Paratype 22: 33.68 mm Samarai Isl. , PNG Coll. LL 9097
8. Paratype 23: 34.80 mm Samarai Isl. , PNG Coll. LL 9097

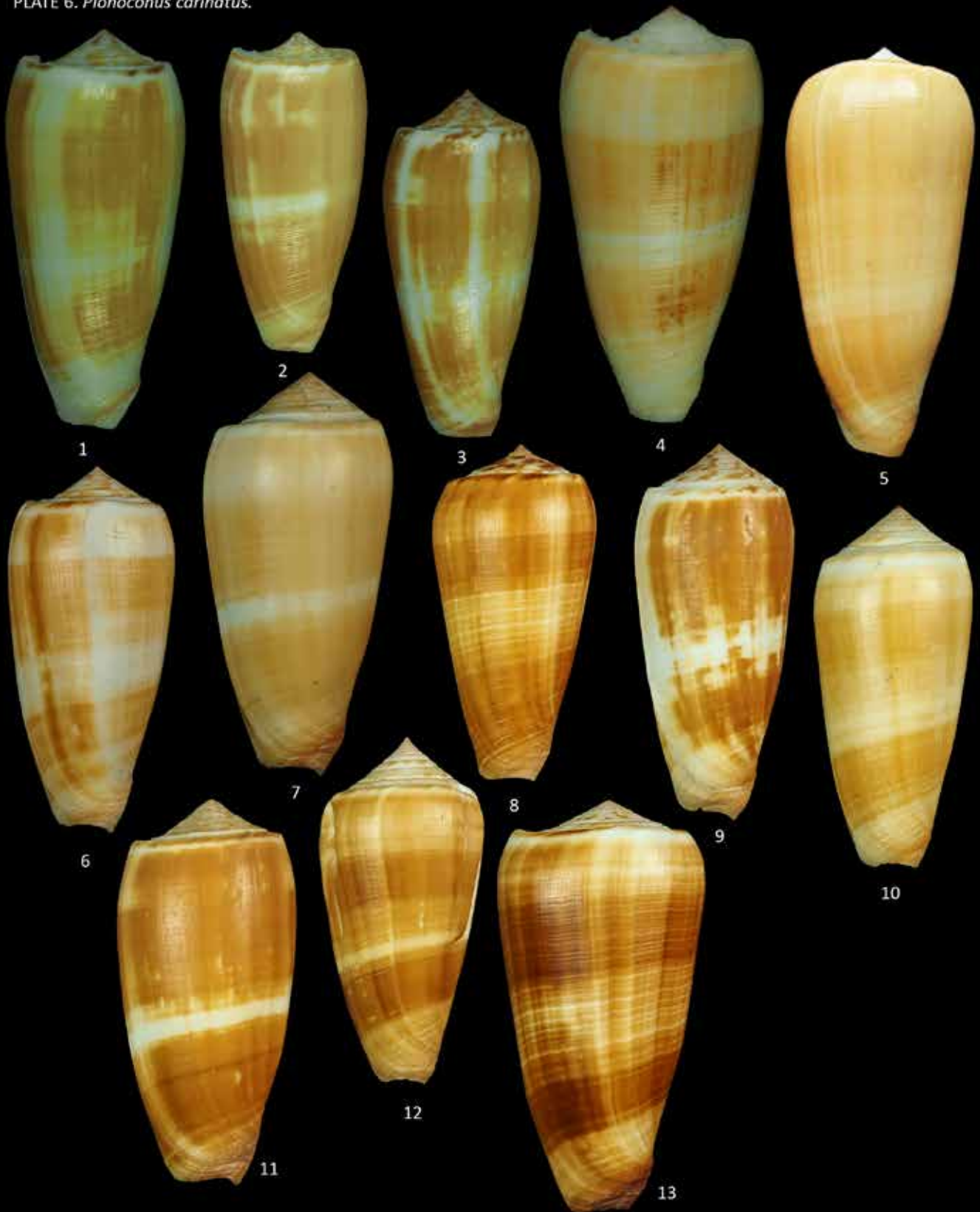
9. Paratype 24: 29.08 mm Samarai Isl. , PNG Coll. LL 9097
10. Paratype 25: 31.45 mm Samarai Isl. , PNG Coll. LL 9097
11. Paratype 26: 42.72 mm Samarai Isl. , PNG Coll. FP 3542
12. Paratype 27: 42.25 mm Samarai Isl. , PNG Coll. FP 3543
13. Paratype 28: 55.25 mm Samarai Isl. , PNG Coll. FP 4890
14. Paratype 29: 49.21 mm Rabaul, PNG Coll. EM
15. Paratype 30: 52.15 mm Sudesy, PNG Coll. EM

PLATE 5. *Pionoconus epistomium*



1. 41.43 mm Sulawesi, Indonesia, Diver -12 m Coll. FP 3570
2. 45.47 mm Lembata, Indonesia, Snorkel -5 m Coll. FP 3569
3. 52.45 mm Kapubatem Bangkalan, Indonesia Coll. FP 2688
4. 44.77 mm Kapubatem Bangkalan, Indonesia Coll. FP 2689
5. 37.79 mm Kapubatem Bangkalan, Indonesia Coll. FP 2690
6. 48.38 mm Banggai Isl. , Sulawesi, Indonesia Coll. FP 3287
7. 57.09 mm Banggai Isl. , Sulawesi, Indonesia Coll. FP 3288
8. 50.07 mm Banggai Isl. , Sulawesi, Indonesia Coll. FP 3289
9. 53.92 mm Banggai Isl. , Sulawesi, Indonesia Coll. FP 3290
10. 50.03 mm Banggai Isl. , Sulawesi, Indonesia Coll. FP 3291
11. 49.75 mm Banggai Isl. , Sulawesi, Indonesia Coll. FP 3292
12. 55.41 mm Banggai Isl. , Sulawesi, Indonesia Coll. FP 3293
13. 55.50 mm Banggai Isl. , Sulawesi, Indonesia Coll. FP 3294
14. 53.75 mm Banggai Isl. , Sulawesi, Indonesia Coll. FP 3295
15. 51.91 mm Banggai Isl. , Sulawesi, Indonesia Coll. FP 3296
16. 49.90 mm Banggai Isl. , Sulawesi, Indonesia Coll. FP 3297
17. 49.31 mm Banggai Isl. , Sulawesi, Indonesia Coll. FP 3298
18. 55.49 mm Banggai Isl. , Sulawesi, Indonesia Coll. FP 3299
19. 50.20 mm Banggai Isl. , Sulawesi, Indonesia Coll. FP 3300
20. 56.23 mm Philippines Coll. EM
21. 50.26 mm Banggai Isl. , Sulawesi, Indonesia Coll. EM
22. 49.20 mm Zamboanga, Mindanao, Phillipines Coll. EM
23. 51.63 mm Banggai Isl. , Sulawesi, Indonesia Coll. EM
24. 47.80 Kangean, Indonesia Coll. EM
25. 63.07 mm Banggai Isl. , Sulawesi, Indonesia Coll. EM

PLATE 6. *Pionoconus carinatus*.



1. 65.75 mm Manus Isl. , PNG Coll. EM
2. 52.78 mm New Britain, PNG Coll. EM
3. 57.20 mm New Britain, PNG Coll. EM
4. 68.49 mm Balabac, Philippines Coll. EM
5. 67.60 mm Mindanao, Philippines Coll. EM
6. 60.32 mm Coll. LL 7555

7. 66.43 mm Philippines Coll. LL 9950
8. 55.39 mm Cebu, Philippines Coll. LL 7900
9. 61.81 mm Cebu, Philippines Coll. LL 7900
10. 59.54 mm Cebu, Philippines Coll. LL 7900
11. 63.32 mm Philippines Coll. LL 9949
12. 56.93 mm Bohol, Philippines Coll. LL 7318
13. 68.11 mm Philippines Coll. LL 5761

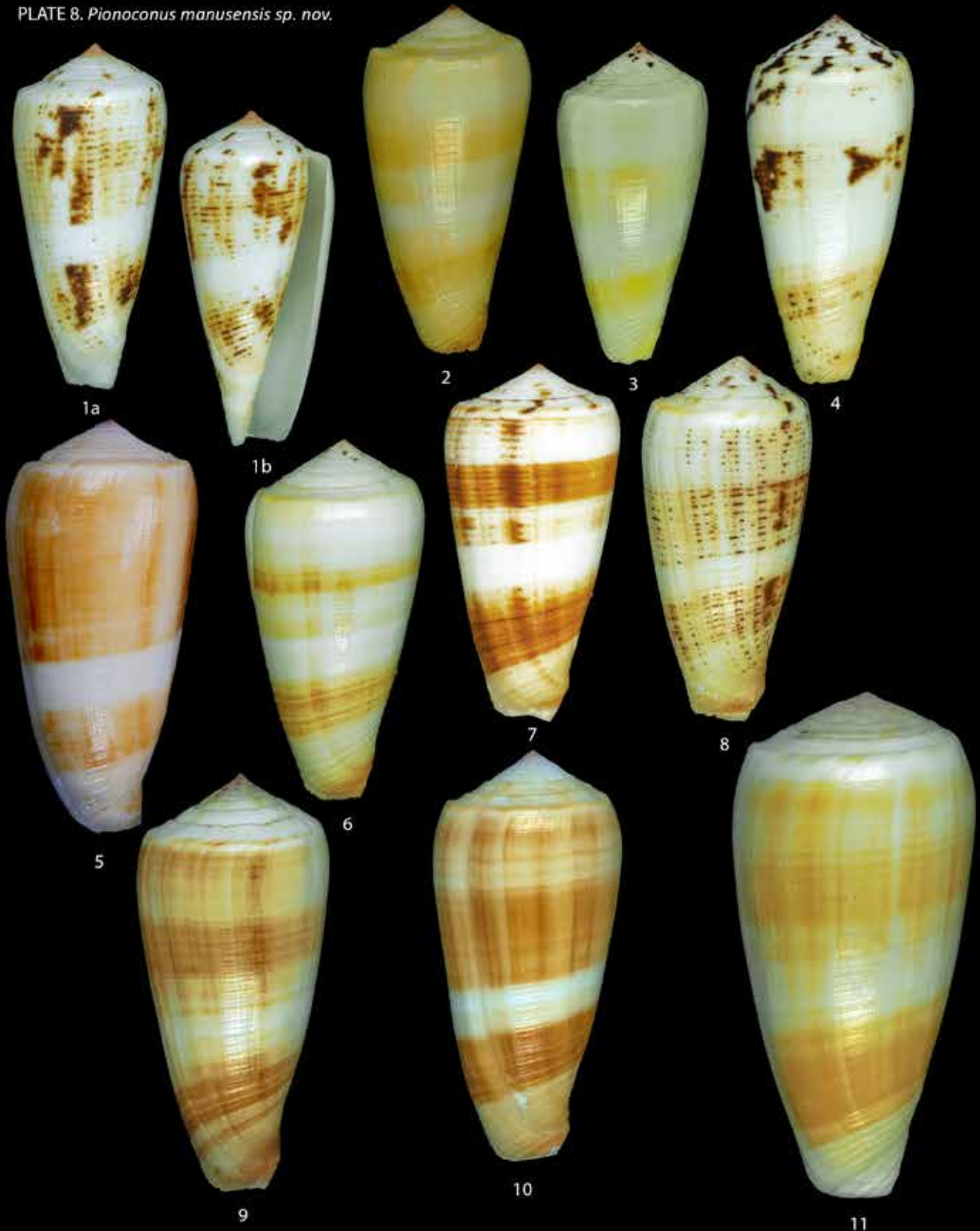
PLATE 7. *Pionoconus* aff. *carinatus*



1. 52.27 mm Ataa, Solomon Isl. Coll. EM
2. 63.81 mm Olango Isl. , Philippines, 20 m Coll. EM
3. 55.85 mm Tawi Tawi, Philippines Coll. EM
4. 50.07 mm Makira-Ulawa, Solomon Arch. , -12 m Coll. FP 3520
5. 35.20 mm Hideaway Isl, Vanuatu, 5 m Coll. FP 3521

6. 55.70 mm Cebu, Philippines, 20 m Coll. FP 3522
7. 58.04 mm Palawan, Philippines, 20 m Coll. FP 3523
8. 65.68 mm Palawan, Philippines 20 m Coll. FP 3524
9. 61.37 mm Aola Bay, Solomon Isl. Coll. EM
10. 54.14 mm Calituban, Philippines 10-20 m Coll. EM

PLATE 8. *Pionoconus manusensis* sp. nov.



1ab. Holotype MNHN-IM-2000-37127 43.16 mm Manus Isl. , PNG

2. Paratype 1: 42.40 mm Kimbe Bay, New Britain Coll. LL

3. Paratype 2: 39.85 mm Manus Isl. , PNG Coll. EM

4. Paratype 3: 45.33 mm Manus Isl. , PNG Coll. EM

5. Paratype 4: 51.56 mm New Britain, PNG Coll. EM

6. Paratype 5: 44.60 mm Manus Isl. , PNG Coll. FP

7. Paratype 6: 44.30 mm Manus Isl. , PNG Coll. EM

8. Paratype 7: 45.16 mm PNG Coll. EM

9. Paratype 8: 51.62 mm New Britain, PNG Coll. EM

10. Paratype 9: 50.81 mm Manus Isl. , PNG Coll. EM

11. Paratype 10: 62.51 mm New Britain, PNG Coll. EM

Plate 9. *Pionoconus vitilevuensis* sp. nov.



1 ab. Holotype: MNHN-IM-2000-37099 49.48 mm Nadi Bay, Viti Levu, Fiji.

2. Paratype 1: 50.31 mm Fiji Coll. EM

3. Paratype 2: 48.52 mm Rattail Reef, Viti Levu Fij Coll. EM

4. Paratype 3: 46.84 mm Lami Reef, Viti Levu Fij Coll. EM

5. Paratype 4: 48.76 mm Lami Reef, Viti Levu Fij Coll. EM

6. Paratype 5: 48.06 mm Nadi Bay, Fiji Coll. EM

7. Paratype 6: 43.52 mm Rattail reef, Fiji Coll. EM

8. Paratype 7: 46.33 mm Nadi Bay, Fiji Coll. EM

9. Paratype 8: 41.41 mm Fiji Coll. EM

10. Paratype 9: 45.70 mm Rattail reef, Fiji Coll. EM

11. Paratype 10: 41.51 mm Fiji Coll. EM

12. Paratype 11: 40.60 mm Wallis & Futuna Coll. EM

PLATE 10. *Pionoconus vitilevuensis* sp. nov



1. Paratype 12: 45.80 mm Nadi Bay, Viti Levu Fiji Coll. LL
 2. Paratype 13: 46.18 mm Nadi Bay, Viti Levu Fiji Coll. LL
 3. Paratype 14: 51.34 mm Suva Point, Fiji Coll. LL

4. Paratype 15: 43.86 mm Fiji Coll. FP 3594
 5. Paratype 16: 47.61 mm Laila Isl. , Fiji Coll. FP 3575
 6. Paratypa 17: 46.52 mm Nadroga, Fiji Coll. FP 3573
 7. Paratype 18: 39.64 mm Nadroga, Fiji Coll. FP 3572
 8. Paratype 19: 39.57 mm Nadroga, Fiji Coll. FP 3571

PLATE 11. *Pionoconus raphanus*



- | | |
|--|---|
| 1. 33.17 mm Cebu, Philippines Coll. FP 4564 | 12. 61.71 mm Sulu Sea, Philippines Coll. EM |
| 2. 36.58 mm Cebu, Philippines Coll. FP 3563 | 13. 57.41 mm Palawan, Philippines Coll. EM |
| 3. 48.71 mm Cebu, Philippines Coll. FP 3562 | 14. 58.72 mm Albay Gulf, Philippines Coll. EM |
| 4. 63.60 mm Zamboanga, Philippines Coll. FP 3561 | 15. 48.94 mm Rabaul, PNG Coll. EM |
| 5. 73.36 mm Jetafe, Boho, Philippines Coll. FP 3558 | 16. 54.99 mm Samal, Philippines Coll. EM |
| 6. 68.37 mm Undine Reef, Queensland, Australia Coll. LL 8105 | 17. 49.66 mm Bohol, Philippines Coll. EM |
| 7. 71.61 mm Bohol, Philippines, Coll. FP 3556 | 18. 55.34 mm Cebu, Philippines Coll. EM |
| 8. 52.08 mm Portland Road, Queensland, Australia Coll. LL 5551 | 19. 62.39 mm Nocnocan, Philippines Coll. EM |
| 9. 78.61 mm Mactan, Philippines Coll. FP 3554 | 20. 59.80 mm Indonesia Coll. EM |
| 10. 81.22 mm Inabanga, Bohol, Philippines Coll. FP 3553 | 21. 63.49 mm Bungin Isl., Sumbawa, Indonesia Coll. EM |
| 11. 78.89 mm Palawan, Philippines Coll. EM | 22. 62.66 mm Cebu, Philippines Coll. EM |

PLATE 12. *Pionoconus magus*



- 1ab. 81.07 mm Albay Gulf, Philippines Coll. FP 4840
 2. 65.66 mm Albay Gulf, Philippines Coll. FP 4842
 3. 66.97 mm Albay Gulf, Philippines Coll. FP 4851
 4. 56.29 mm Albay Gulf, Philippines Coll. FP 4852
 5. 61.67 mm Albay Gulf, Philippines Coll. FP 4844
 6. 74.53 mm Negros, Philippines Coll. FP 4855
 7. 71.66 mm Palawan, Philippines Coll. FP 4856
 8. 45.10 mm Luzon Isl., Philippines Coll. FP 4861

9. 32.38 mm Luzon Isl., Philippines Coll. FP 4862
 10. 49.27 mm Bohol, Philippines Coll. FP 4870
 11. 61.45 mm Palawan, Philippines Coll. FP 4873
 12. 65.50 mm Nocnocan Isl., Philippines Coll. FP 4842
 13. 49.70 mm Masbate, Philippines Coll. FP 3615
 14 a.b. 18.12 mm Masbate, Philippines Coll. FP 3600
 15. 28.93 mm Bohol, Philippines Coll. FP 4877
 16. 56.57 mm Siargao Isl., Philippines Coll. FP 4875

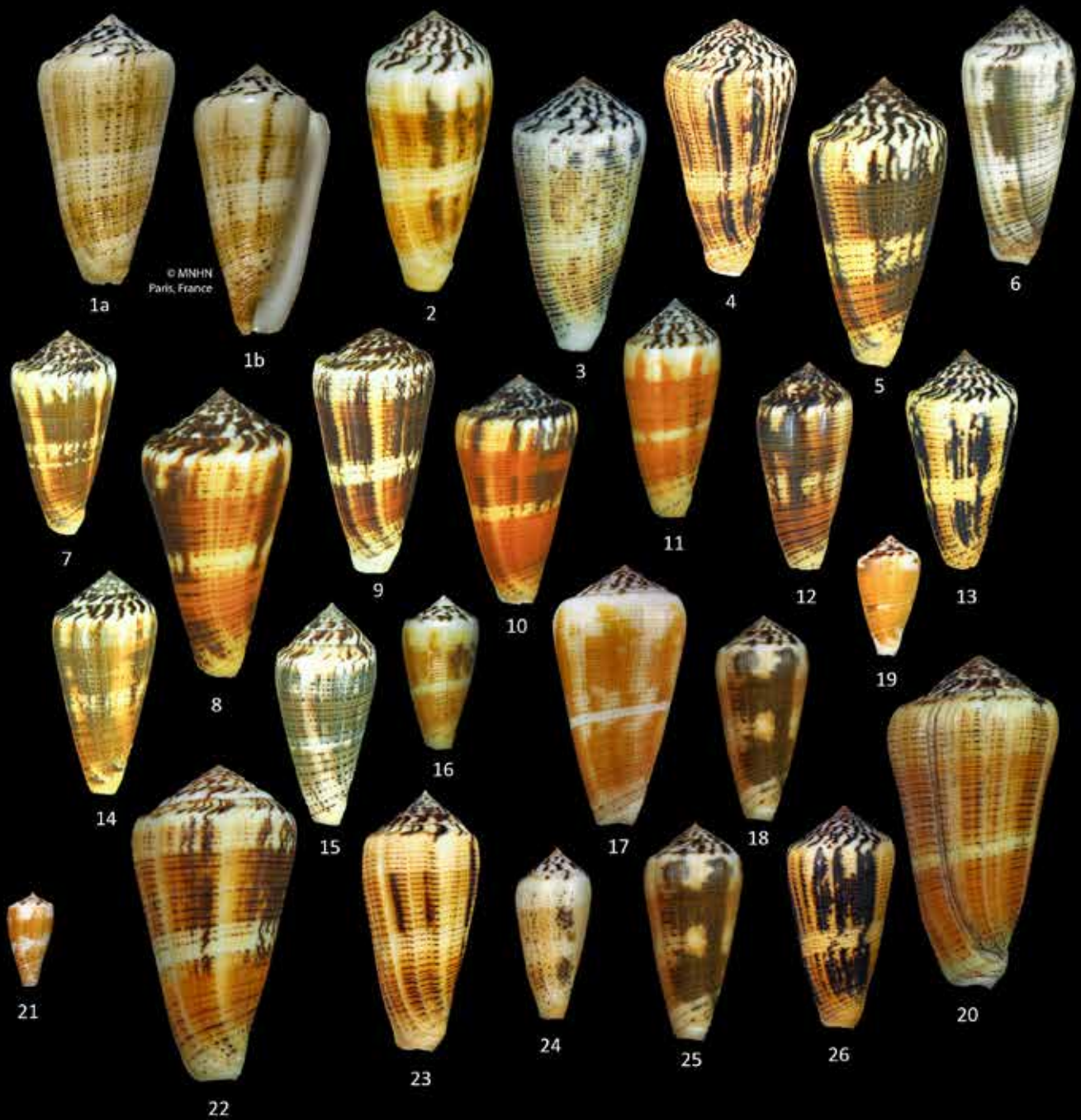
PLATE 13. *Pionoconus magus*



1. 70.31 mm Zamboanga, Philippines Coll. EM
2. 67.02 mm Philippines Coll. EM
3. 63.91 mm Masbate Philippines Coll. EM
4. 48.06 mm Philippines Coll. EM
5. 46.23 mm Philippines Coll. EM
6. 41.32 mm Sorsogon, Philippines Coll. EM
7. 84.22 mm Siargao, Philippines, Coll. EM

8. 68.85 mm Olango, Cebu, Philippines Coll. EM
9. 67.29 mm Masbate Philippines Coll. EM
10. 63.91 mm Philippines, Coll. EM
11. 60.07 mm Bicol, Philippines Coll. EM
12. 46.86 mm Cam Kue reef, Okinawa, Japan Coll. EM
13. 53.76 mm Cuyo, Philippines Coll. EM
14. 89.02 mm Bohol, Philippines Coll. EM

PLATE 14. *Pionoconus alexisallaryi*



1. Holotype MNHN-IM-2000-34606 49.5 mm Salomon Isl.
2. 62.32 mm Manus Isl., PNG Coll. EM
3. 60.93 mm Port Boisé, New Caledonia Coll. EM
4. 56.85 mm New Caledonia Coll. EM
5. 64.07 mm Rabaul, PNG Coll. EM
6. 57.54 mm New Caledonia Coll. EM
7. 45.18 mm New Caledonia Coll. EM
8. 64.17 mm New Caledonia Coll. EM
9. 54.37 mm New Caledonia Coll. EM
10. 51.04 mm Solomon Arch. Coll. EM
11. 48.52 mm New Caledonia Coll. EM
12. 46.05 mm New Caledonia Coll. EM
13. 48.61 mm New Caledonia Coll. EM
14. 49.81 mm Marau Sound, Solomon Arch. Coll. EM
15. 49.27 mm Viti Levu Isl., Fiji Arch. Coll. EM
16. 34.28 mm MNHN IM 2007 30791 Vanuatu (DNA Sequenced)
17. 57.89 mm Queensland, Australia Coll. FP 859
18. 45.56 mm Guadalcanal, Solomon Arch. Coll. FP 3579
19. 26.92 mm Juvenil, Port Boisé, New Caledonia Coll. FP 3566
20. 73.81 mm Prony Bay, New Caledonia Coll. FP 4101
21. 20.84 mm Cairns, Australia Coll. FP 3575
22. 69.83 mm Prony Bay, New Caledonia Coll. FP 4102
23. 58.02 mm Prony Bay, New Caledonia Coll. FP 4103
24. 38.36 mm Marapa Isl., Solomon Arch. Coll. FP 3577
25. 48.23 mm Guadalcanal, Solomon Arch. Coll. FP 3579
26. 49.17 mm Port Boisé, New Caledonia Coll. FP 3546

Plate 15. *Pionoconus kwajaleinensis* sp. nov.



1ab. Holotype 47.25 mm MNHN-IM-2000637100 Kwajalein Atoll

2. Paratype 1: 50.75 mm, Kwajalein Atoll, Marshall Isl., Coll. EM

3. Paratype 2: 42.87 mm, Kwajalein Atoll, Marshall Isl., Coll. LL 34705

4. Paratype 3: 52.03 mm, Kwajalein Atoll, Marshall Isl., Coll. LL 34705

5. Paratype 4: 48.62 mm, Kwajalein Atoll, Marshall Isl., Coll. FP 3586

6. Paratype 5: 70.75 mm, Emmon beach, Kwajalein Atoll, Coll. SJ

7. Paratype 6: 36.82 mm, Kwajalein Atoll, Marshall Isl. Coll. SJ

8. Paratype 7: 37.20 mm, Ebwaj Island, Marshall Isl. Coll. SJ

9. Paratype 8: 44.25 mm, Kwajalein Atoll, Marshall Isl. Coll. SJ

10. Paratype 9: 64.58 mm, Shell Isl., Kwajalein Atoll, Coll. SJ

11. Paratype 10: 64.20 mm, Kwajalein Atoll, Coll. SJ

12. Paratype 11: 32.98 mm, Kwajalein Atoll, Coll. SJ

13. Paratype 12: 35.57 mm, Kwajalein Atoll, Coll. SJ

14. Paratype 13: 36.34 mm, Kwajalein Atoll, Coll. SJ

15. Paratype 14: 39.68 mm, Kwajalein Atoll, Coll. FP

16. Paratype 15: 45.07 mm, Kwajalein Atoll, Coll. SJ

17. Paratype 16: 45.35 mm, Kwajalein Atoll, Coll. FP

18. Paratype 17: 45.99 mm, Kwajalein Atoll, Coll. SJ

19. Paratype 18: 58.71 mm, Kwajalein Atoll, Coll. SJ

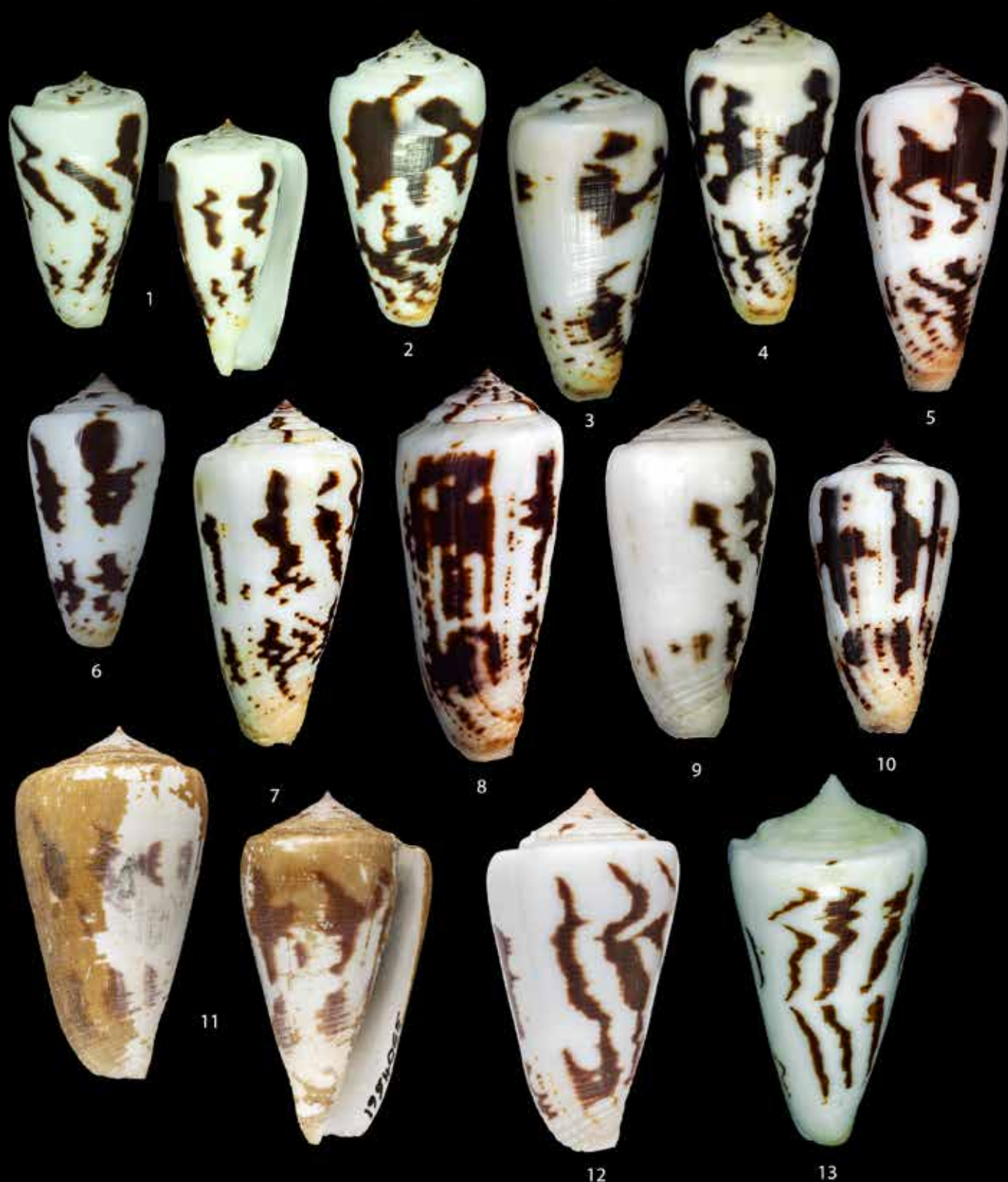
20. Paratype 19: 67.08 mm, Kwajalein Atoll, Coll. SJ

21. Paratype 20: 67.53 mm, Kwajalein Atoll, Coll. SJ

22. Paratype 21: 29.77 mm, Kwajalein Atoll, Coll. SJ

23. Paratype 22: 57.69 mm, Majuro Atoll, Coll. EM

PLATE 16. *Pionoconus niasensis* sp. nov., *Calibanus furvus* var. *frauenfeldi*



1. Holotype MNHN-IM-2000-37128 30.51 mm West Sumatra Indonesia
2. 35.04 mm Paratype 1 Sumatra, Indonesia Coll. EM
3. 39.80 mm Paratype 2 Nicobar Isl. , India Coll. EM
4. 37.08 mm Paratype 3 Nias Isl. , Sumatra, Indonesia Coll. EM
5. 39.24 mm Paratype 4 Sumatra, Coll. EM
6. 32.62 mm Paratype 5 Nicobar Isl. , India Coll. CR 3670
7. 41.15 mm Paratype 6 Nias Isl. , Indonesia Coll. LL 9565
8. 46.70 mm Paratype 7 Padang, Indonesia Coll. FP 4891
9. 40.22 mm Paratype 8 Sumatra, Indonesia Coll. FP 3559
10. 34.92 mm Paratype 9 Indonesia Coll. EM
11. *C. furvus* var. *frauenfeldi* MNHUK 1984065/1 43.20 mm Phil.
12. *C. furvus* var. *frauenfeldi* MNHUK 1984065/2 42.00 mm Phil.
13. *C. furvus* var. *frauenfeldi* 44.01 mm Cuyo Isl. Phil. Coll. EM

Plate 17. *Pionoconus circae*, *metcalfi*



1. *P. circae* 60.21 mm Zamboanga, Philippines Coll. EM
2. *P. circae* 44.32 mm Philippines Coll. EM
3. *P. circae* 55.63 mm Zamboanga, Philippines Coll. FP 3544
4. *P. circae* 56.61 mm Zamboanga, Philippines Coll. FP 3545
5. *P. metcalfi* 38.25 mm Balut, Philippines Coll. EM
6. *P. metcalfi* 47.06 mm Lombok, Indonesia Coll. FP 3580

7. *P. metcalfi* 39.50 mm Philippine Coll. FP 3616
8. *P. metcalfi* 43.61 mm Palawan, Philippines Coll. FP 3537
9. *P. metcalfi* 30.97 mm Lombok, Indonesia Coll. FP 3534
10. *P. metcalfi* 45.10 mm Palawan, Philippines Coll. EM
11. *P. metcalfi* 31.48 mm Lombok, Indonesia Coll. FP 3532
12. *P. metcalfi* var. *cernohorskyi* 55.05 mm Australia Coll. EM

Plate 18. *Pionoconus consors*, *daullei*



1. *P. consors* 73.15 mm Banacol Isl. , Philippines Coll. EM
2. *P. consors* 60.47 mm Mactan, Philippines Coll. EM
3. *P. consors* 90.82 mm Phuket, Thailand Coll. FP 3609
4. *P. consors* 96.77 mm Palawan, Pilippines Coll. FP 3613
5. *P. consors* var. *turschi* 69.48 mm Philippines Coll. EM
6. *P. consors* var. *turschi* 68.19 mm Thailand Coll. EM
7. *P. consors* var. *turschi* 77.55 mm Thailand Coll. FP 3607
8. *P. consors* var. *poehlianus* 61.33 mm P. Moersby PNG Coll. EM
9. *P. daullei* 64.85 mm Nacala, Mozambique Coll. FP 3525
10. *P. daullei* 71.35 mm Zanzibar, Tanzania Coll. FP 3526
11. *P. daullei* 69.26 mm Nosy-be, Madagascar Coll. FP 3527

Plate 19. *Pionoconus quasimagus*, *ustulatus*



1. *P. quasimagus* 55.87 mm Zamboanga, Philippines, Dive 25 m Coll. FP 3565
2. *P. quasimagus* 59.39 mm Mindanao, Philippines, Dive 20 m Coll. FP 2390
3. *P. quasimagus* 58.23 mm Zamboanga, Philippines, Dive 25 m Coll. FP 4444
4. *P. quasimagus* 67.67 mm Sulu, Philippines Coll. EM
5. *P. ustulatus* 47.61 mm Palawan, Philippines Coll. EM
6. *P. ustulatus* 63.02 mm Surigao, Philippines Coll. FP. 3503
7. *P. ustulatus* 57.05 mm Inabanga, Philippines Coll. FP 3507
8. *P. ustulatus* 44.48 mm Palawan, Philippines Coll. FP. 3512
9. *P. ustulatus* 15.19 mm Masbate, Philippines Coll. FP 3599

Plate 20. Top views of studied *Pionoconus*



Plate 21. *Pionoconus magus* common variation comparison



NOTES: