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Notes on *Profundiconus smirna* (Bartsch & Rehder, 1943) with description of a new species: *Profundiconus smirnoides* sp. nov. (Gastropoda, Conilithidae)

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ABSTRACT

The taxon *Profundiconus smirna* (Bartsch & Rehder, 1943) from Hawaii is reviewed. The new species *Profundiconus smirnoides* sp. nov. is described from material taken off New Caledonia (Chesterfield Reef, Grand Passage, Loyalty Islands and New Hebrides Arc, Norfolk Ridge), and northern New Zealand (Wanganella Bank, Kermadec Ridge), in depths ranging from 80 to 1150 m. The new species is compared to *P. smirna*, and to *Profundiconus profundorum* (Kuroda, 1956) from Japan.

RESUME

Le taxon *Profundiconus smirna* (Bartsch & Rehder, 1943) d'Hawaii est révisé. Une nouvelle espèce *Profundiconus smirnoides* sp. nov. est décrite à partir de matériels collectés au large de la Nouvelle-Calédonie (Îles Chesterfield, Grand Passage, Îles Loyauté et Arc des Nouvelles-Hébrides, Norfolk Ridge), et du nord de la Nouvelle-Zélande (Wanganella Bank, Kermadec Ridge), à des profondeurs allant de 80 à 1150 m. La nouvelle espèce est comparée à *P. smirna* et à *Profundiconus profundorum* (Kuroda, 1956) du Japon.

INTRODUCTION

In 1943, Bartsch & Rehder described a remarkable, large, deep water cone snail species based on a single specimen dredged by the U.S. Bureau of Fisheries steamer *Albatross* near Kauai, in the Hawaiian Islands, at 470 to 571 m. The species was named *Conus smirna* Bartsch & Rehder, 1943 (Plate 1, Fig. 4a-b), and described thus:

"Shell rather large, slender for the genus, very regularly biconic. The spire is well elevated with straight sloping sides almost equal to one-quarter of the entire height of the shell. The surface is covered by a thin, yellow-ochre-colored, smooth periostracum with a broad, slightly lighter zone about halfway between the angled shoulder and the base, and of about equal width at the base. Interior of the aperture bluish white. The early whorls bear strong and equally spaced, nodules at the shoulder which are separated by spaces a little wider than the nodules. These nodules become gradually and successively weakened on the succeeding whorl and disappear completely on the last turn. In addition to the nodules, the summit of the whorls is marked by fine incremental lines and equally fine spiral lirations. These consist of very fine hair lines on the posterior part which gradually increase in strength anteriorly, forming rather string spiral threads basally. Aperture moderately broad, of almost the same width throughout. Outer lip thin, slightly excised on the shoulder".

Since the unique specimen still had its periostracum intact, the color of the shell was not mentioned, and the color pattern was not described in detail. The authors stated "We know of no closely related species", and no comparison with other taxa was included in the original description. MacNeil (1961) suggested conspecificity with the taxon *Conus comatosaeformis* Yokoyama 1928, a fossil from the Miocene-Pliocene of Okinawa. Kohn & Weaver (in Weaver 1962) remarked "*Conus smirna* resembles in some ways the new deep water Japanese species *Conus profundorum* Kuroda" (Plate 1, Fig. 6a-b). Walls (1979) treated *C. profundorum* from Japan as a geographic subspecies of *C. smirna*, with the nominate subspecies *C. smirna smirna* distributed around the Hawaiian Islands. Marshall (1981) interpreted *C. smirna* and *C. profundorum* as conspecific, whereas Severns (2011) treated them as distinct species, with *Profundiconus smirna* endemic to Hawaii. Da Motta (1991) and Tucker & Tenorio (2009, 2013) placed *smirna* in the genus *Profundiconus* Kuroda, 1956. This genus is included in the family Conilithidae Tucker & Tenorio, 2009.

Following the discovery of the holotype of *P. smirna*, a number of additional specimens were collected by dredging in deep water in several locations along the Hawaiian Chain. Some of these were figured by Walls (1979 - specimen from south-west of Midway Id, page 609, figs. top left and right) and in Röckel, Korn & Kohn (1995 - specimen from Oahu, pl. 27, figs. 8, 9). These shells differ from the holotype of *P. smirna* mainly in their broader and ventricosely conical to conical last whorls, their darker brown spiral bands, pale brown aperture, and less distinct shoulder edge. A few additional specimens have reached institutions, shell dealers and private collectors, most of which were collected off Islands and atolls in the Hawaiian chain. In 2002, a living specimen was taken at Bank 66, Eastern French Frigate Shoals, by the submersible *Pisces 4* from R/V *Kaimikai-O-Kanaloa* at 250 m depth. This specimen (Plate 1, Fig. 1a-b) was found crawling on a mostly sediment covered, low relief, carbonate (submerged reef) bottom. Moffitt (2002) provided a detailed account of the capture of this particular specimen.

Marshall (1981) published a report about new records of cone snails inhabiting deep waters off northern New Zealand, based on specimens taken by R/V *Tangaroa*, which included specimens identified as *Conus smirna*. Although similar in overall shape, these shells differ from Hawaiian specimens in having irregular, pale yellowish-brown or white axial bands extending across the entire last adult whorl. Similar specimens have been dredged during several expeditions carried out by the Muséum National d'Histoire Naturelle (Paris) (MNHN) in waters around New Caledonia. They were also identified as *C. smirna* (Richer de Forges & Estival, 1986; Richard, 1990;

Röckel, Richard & Moolenbeek, 1995). According to Röckel, Korn & Kohn (1995), these shells resemble *C. smirna* in relative diameter and outline of the last whorl, in size and in relative spire height, but differ in their more ventricose shape, the absence of spiral grooves on the ramp, and in the axial as well as spiral arrangement of their color patterns. They concluded that the assignment of shells from New Caledonia and possibly New Zealand to *C. smirna* was doubtful, and further research was needed in order to disentangle the complex.

As result of many research cruises by MNHN off New Caledonia, a number of specimens of this *P. smirna*-like species have been dredged. Whereas the state of preservation of the specimens is variable, with many dead specimens among the lots, a number of living individuals were also obtained. Preserved material has been used for study of radular morphology and for DNA sequencing. The availability of numerous specimens in good condition has facilitated detailed morphometric study. Thanks to the generous loan of one preserved specimen of *P. smirna* from Hawaii, it has been possible to compare for the first time the morphology of the radular teeth of specimens from Hawaii and New Caledonia. Study of shell and radular morphology reveals significant differences between the New Caledonian and New Zealand form and Hawaiian *P. smirna* and Japanese *P. profundorum*. As result, this form is now introduced as a new species, hereby described with the name *Profundiconus smirnoides* sp. nov.

MATERIAL AND METHODS

Taxonomy follows Tucker & Tenorio (2009) with the updates and modifications based on Tucker & Tenorio (2013). Most specimens were collected by dredging in deep water during different campaigns carried out by the MNHN off New Caledonia, mostly from R/V *Alis*, between the years 1985 and 2008, at 80–1150 m, most between 450 and 600 m. Some specimens were taken on the slope of Wanganella Bank, West Norfolk Ridge, east of northern New Zealand from a depth of 422–437 m by R/V *Tangaroa*.

Description of shell morphology follows the terminology established in Röckel, Korn & Kohn (1995). For morphometric comparisons, adult shells (MNHN), were measured with digital calipers, with measurements rounded to the nearest 0.1 millimeter. The specimens of *P. smirna* and *P. profundorum* measured were from private as well as from institutional collections (USNM). All the measurements are in a spreadsheet, deposited as supporting information at <https://dl.dropboxusercontent.com/u/30741402/BIBLIOGRAPHY/XT7/Profundiconus%20smirnoides.xlsx>. For comparison of shell morphometry, analysis was performed using covariance (ANCOVA) for shell parameters maximum diameter (MD), height of the maximum diameter (HMD) and spire height (SH), using species hypotheses as factor, and aperture height (AH) as covariate. Mean values of S_L were compared statistically (*t*- and *F*-tests). Statistical tests were carried out using STATGRAPHICS 5.1 or PAST3 (Hammer et al., 2001), once all the measurement sets passed the normality tests.

RADULAR PREPARATIONS

Terminology for radular morphology follows Tucker & Tenorio (2009), with abbreviations following Kohn et al. (1999). The number of individuals for which the entire radula

was examined is indicated in the description. Specimens of shells containing the dried animal inside were rehydrated by treatment with 70 % alcohol, which was progressively diluted with water over a period of 24 h or more, depending on size and condition of the specimen. Once the animal was soft enough, it was removed from the shell. The soft parts containing the radular sac were digested in concentrated aqueous KOH for 24 h. The resulting mixture was then placed in a Petri dish and examined with a binocular microscope. The entire radula was removed with fine tweezers and rinsed with distilled water, then mounted on a slide using Aquatex (Merck) Mounting Medium, and examined under a compound microscope. Photographs were obtained with a CCD camera attached to the microscope.

Samples of individual radular teeth for Scanning Electron Microscopy (SEM) were allowed to dry in the air after rinsing with distilled water, and then mounted on stubs covered with double-sided carbon tape. SEM studies were carried out at the MNCN-CSIC using a FEI INSPECT scanning electron microscope equipped with a secondary and retro-dispersed electrons detector, and an OXFORD INSTRUMENTS analytical-INCA integrated analysis system.

Abbreviations

Museums and institutions

MNHN: Muséum National d'Histoire Naturelle, Paris, France.

MNCN: Museo Nacional de Ciencias Naturales, Madrid, Spain.

NMNZ: Museum of New Zealand Te Papa Tongarewa, New Zealand.

CSIC: Consejo Superior de Investigaciones Científicas, Spain.

USNM: National Museum of Natural History, Washington D.C., USA.

MJT: Manuel J. Tenorio reference coll.

WJF: William J. Fenzan reference coll.

<i>Shell morphometry</i>	
SL maximum shell length	AH aperture height
MD maximum diameter	RD relative diameter (= MD/AH)
SH spire height	RSH relative spire height (= SH/SL)
HMD height of maximum diameter	PMD relative position of the maximum diameter (= PMD/AH)

<i>Radular morphometry</i>	
SL/TL shell length/radular tooth length	
TL/APL radular tooth size/anterior portion length	
100BL/APL 100 x blade length/anterior portion length	

RESULTS**SYSTEMATICS**

Family CONILITHIDAE Tucker & Tenorio, 2009

Subfamily CONILITHINAE Tucker & Tenorio, 2009

Genus *Profundiconus* Kuroda, 1956*Profundiconus smirnooides* sp. nov. (Plate 2, Figs. 1-6; Plate 3 Figs. 1-6)

Conus smirna.- Marshall, 1981: 499, fig. 3 H, I; Richer de Forges & Estival, 1986: 16, unnumbered fig.; Röckel, Richard & Moolenbeek, 1995: 563, fig. 21; Röckel, Korn & Kohn, 1995, plate 27, figs. 6, 7; Moolenbeek, Röckel & Bouchet, 2008, plate 3, fig. 26; Puillandre et al., 2015: 4 (not *C. smirna* Bartsch & Rehder, 1943)

Type material: Holotype and 11 paratypes. See table 1 for details

TABLE 1

Type	Institution	Dimensions (mm)	Locality
Holotype	MNHN-IM-2009-18220	71.8 x 26.3	Off Ile des Pins, New Caledonia TERRASSES, stn DW 3125, 22°55.5'S, 167°17.1'E, 480–500 m
Paratype 1	MNHN-IM-2009-18223	73.7 x 27.0	Norfolk Ridge, Banc Jumeau Est, New Caledonia TERRASSES, stn DW 3053, 23°45.04'S, 168°16.31'E, 410–440 m
Paratype 2	MNHN-IM-2007-30914	81.5 x 31.0	Coral Sea, South Lansdowne, New Caledonia EBISCO, stn DW 2635, 21°03'S, 160°45'E, 80–397 m
Paratype 3	MNHN-IM-2000-30054	79.7 x 27.4	Norfolk Ridge, Banc Introuvable, New Caledonia NORFOLK 1, stn DW 1699, 24°40'S, 168°40'E, 581–600 m
Paratype 4	MNHN-IM-2000-30055	76.9 x 29.6	Norfolk Ridge, Banc Stylaster, New Caledonia NORFOLK 1, stn DW 1659, 23°37'S, 167°41'E, 449–467 m
Paratype 5	MNHN-IM-2000-30056	52.0 x 19.8	Norfolk Ridge, New Caledonia BATHUS 3, stn DW 819, 23°45'S, 168°16'E, 478–486 m
Paratype 6	MNHN-IM-2000-30057	63.4 x 24.7	Grand Passage, New Caledonia MUSORSTOM 4, stn DW 197, 18°51'S, 163°21'E, 550 m
Paratype 7	MNHN-IM-2000-30058	81.4 x 31.9	Norfolk Ridge, New Caledonia SMIB 8, stn DW 169, 23°37'S, 167°42'E, 447–450 m
Paratype 8	MNHN-IM-2000-30059	75.4 x 29.8	Norfolk Ridge, New Caledonia SMIB 8, stn DW 187, 23°17'S, 168°06'E, 390–540 m
Paratype 9	MNHN-IM-2000-30060	97.9 x 35.0	Off Ile des Pins, New Caledonia SMIB 4, stn DW 65, 22°55'S, 167°15'E, 400–420 m
Paratype 10	MNCN	75.3 x 29.9	Off Ile des Pins, New Caledonia SMIB 4, stn DW 63, 22°59'S, 167°21'E, 580 m
Paratype 11	NMNZ-M234154	84.3 x 34.8	Wanganella Bank eastern slope, West Norfolk Ridge, New Zealand stn 886, 32°35.30'S, 167°41.80'E, 422–437 m

Material examined: 51 specimens, both live and dead collected, have been studied:

Norfolk Ridge, S of New Caledonia R/V *Alis*, BATHUS 3: stn DW 819, 23°45'S, 168°16'E, 478–486 m, 1 lv; S of New Caledonia, R/V *Alis*, BERYX 11: stn DW 35, 23°33'S, 167°16'E, 550–570 m, 1 dd; New Caledonia, R/V *Cyana*, CALSUB1989: 20°53'S, 167°03'E, 256 m, 1 dd; S of New Caledonia, R/V *Coriolis*, CHALCAL 2: stn DW 75, 24°39'S, 168°40'E, 600 m, 1 dd; Coral Sea, South Lansdowne, New Caledonia, R/V *Alis*, EBISCO:

stn DW 2635, 21°03'S, 160°45'E, 80–397 m, 1 lv; S of New Caledonia, R/V *Alis*, LITHIST: stn CP08, 24°54'S, 168°21.3'E, 540 m, 1 lv; stn DW 13, 23°45'E, 168°16.7'E, 400 m, 1 dd; Grand Passage, north of New Caledonia, R/V *Alis*, MUSORSTOM 4: stn DW 197, 18°51'S, 163°21'E, 550 m, 1 dd; Norfolk Ridge, S of New Caledonia, R/V *Alis*, NORFOLK 1: stn DW 1659, 23°37'S, 167°41'E, 449–467 m, 1 lv; stn DW 1684, 24°55'S, 168°22'E, 508–541 m, 1 dd; stn DW 1691, 24°54'S, 168°22'E, 509–513 m, 1 dd; stn DW 1699, 24°40'S, 168°40'E, 581–600 m, 1 lv; stn DW 1701, 24°40'S, 168°40'E, 564–586 m, 1 dd; stn DW 1732, 23°20.5'S, 168°16'E, 347–1063 m, 1 lv; NORFOLK 2: stn CP 2111, 23°49'S, 168°17'E, 500–1074 m, 1 dd; stn DW 2037, 23°40'S, 167°40'E, 517–570 m, 4 dd, 1 lv; stn DW 2060, 24°40'S, 168°38'E, 582–600 m, 4 dd; stn DW 2067, 25°16'S, 168°56'E, 614–690 m, 2 dd; stn DW 2070, 25°23'S, 168°57'E, 630–1150 m, 1 dd; stn DW 2081, 25°54'S, 168°22'E, 500–505 m, 2 dd; stn DW 2084, 24°52'S, 168°22'E, 586–730 m, 2 dd; S of New Caledonia, R/V *Alis*, SMIB 3: stn DW 1, 24°56'S, 168°22'E, 520 m, 2 dd; stn DW 9, 24°42'S, 168°08'E, 265 m, 1 dd; stn DW 21, 22°59'S, 167°19'E, 525 m, 2 dd; SMIB 4: stn DW 63, 22°59'S, 167°21'E, 580 m, 2 dd; stn DW 65, 22°55'S, 167°15'E, 400–420

m, 1 dd; SMIB 8: stn DW 150, 24°54'S, 168°22'E, 519–530 m, 1 dd; stn DW 167, 23°38'S, 167°43'E, 430–452 m, 1 dd; stn DW 169, 23°37'S, 167°42'E, 447–450 m, 1 lv; stn DW 187, 23°17'S, 168°06'E, 390–540 m, 1 dd; stn DW 193–196, 22°59'S to 23°S, 168°21'E to 168°23'E, 491–558 m, 1 dd; S of New Caledonia, R/V *Alis*, TERRASSES: stn CP 3068, 23°16'S, 167°57'E, 790 m, 1 dd; stn DW 3053, 23°45.04'S, 168°16.31'E, 410–440 m, 1 lv; stn DW 3069, 23°18'S, 168°05'E, 300–320 m, 1 dd; stn DW 3125, 22°55.5'S, 167°17.1'E, 480–500 m, 1 lv; Wanganella Bank

eastern slope, West Norfolk Ridge, New Zealand, R/V *Tangaroa*: stn BS 886, 32°35.30'S, 167°41.80'E, 422–437 m, 2 lv, 1 dd.

Type locality: Off Ile des Pins, southern New Caledonia, 22°55.5'S, 167°17.1'E, 480–500 m.

Distribution and habitat: (Fig. 1) Coral Sea (Chesterfield Plateau), New Caledonia including Grand Passage, Loyalty Islands and New Hebrides Arc, Norfolk Ridge, and northern New Zealand (Wanganella Bank, and possibly Kermadec Ridge), in depths between 80–1150 m, most between 450 and 600 m (confirmed live specimens between 80 and 600 m, and possibly beyond). There is a report of a dead specimen collected off Fiji (Moolenbeek, Röckel & Bouchet, 2008; <http://coldb.mnhn.fr/catalognumber/mnhn/im/2008-1324>). The species is not present in French Polynesia (not recorded from the Marquesas by Moolenbeek, Zandbergen & Bouchet (2008); not recorded from the Society / Tuamotu by Rabiller & Richard (2014)). There are no records of this species from other Archipelagos in the SW Pacific (i.e. Tonga, Vanuatu, Solomons, Papua New Guinea, etc). This is one of the deepest-living species among the known cone snails, as specimens have been taken from depths as great as 1150 m. The confirmed deepest live specimen is from 600 m. One specimen, most likely live, was taken from 347–1063 m.

Etymology: The name of the species alludes to its resemblance to *P. smirna*.

Description of shell: Morphometric parameters: $S_L = 52\text{--}98$ mm; average $S_L = 76.1$ mm; $RD = 0.46\text{--}0.56$; $RSH = 0.25\text{--}0.36$; $PMD = 0.76\text{--}0.83$. Shell narrowly conoid-cylindrical, moderately large to large-sized. Spire high to very high, straight or slightly convex in profile, with pointed apex (when present). Sutural ramps flat or very slightly concave, with very fine, almost indistinct striae and arcuate threads becoming obsolete or absent in late sutural ramps. Protoconch 3.0–3.5 whorls, brown, smooth, with maximum diameter of 1.1 mm (Fig. 2). Tubercles on first 5–6 teleoconch whorls, absent thereafter. Shoulder rounded and rather indistinct in adults, angulated in younger specimens. Sides of shell very slightly convex below shoulder, straight abapically, becoming very slightly concave near abapical extremity. Last adult whorl smooth and shiny apart from very fine striae around basal quarter, more evident in younger specimens. Posterior notch shallow, C-shaped. No anterior notch.

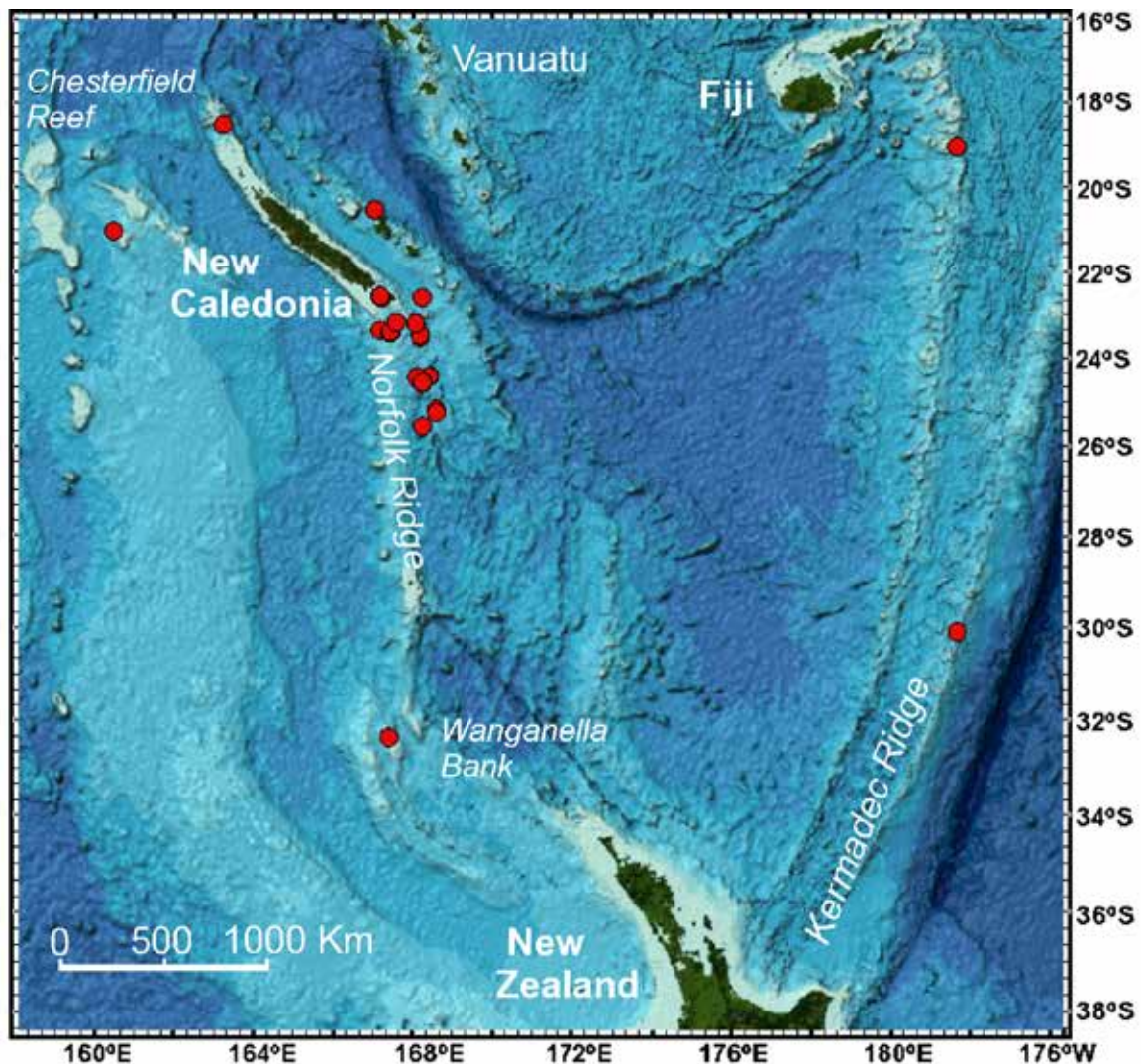


Fig. 1.- Distribution map for *Profundiconus smirnoides* sp. nov. Red circles (●) indicate the points where the species has been collected, either dead or alive.

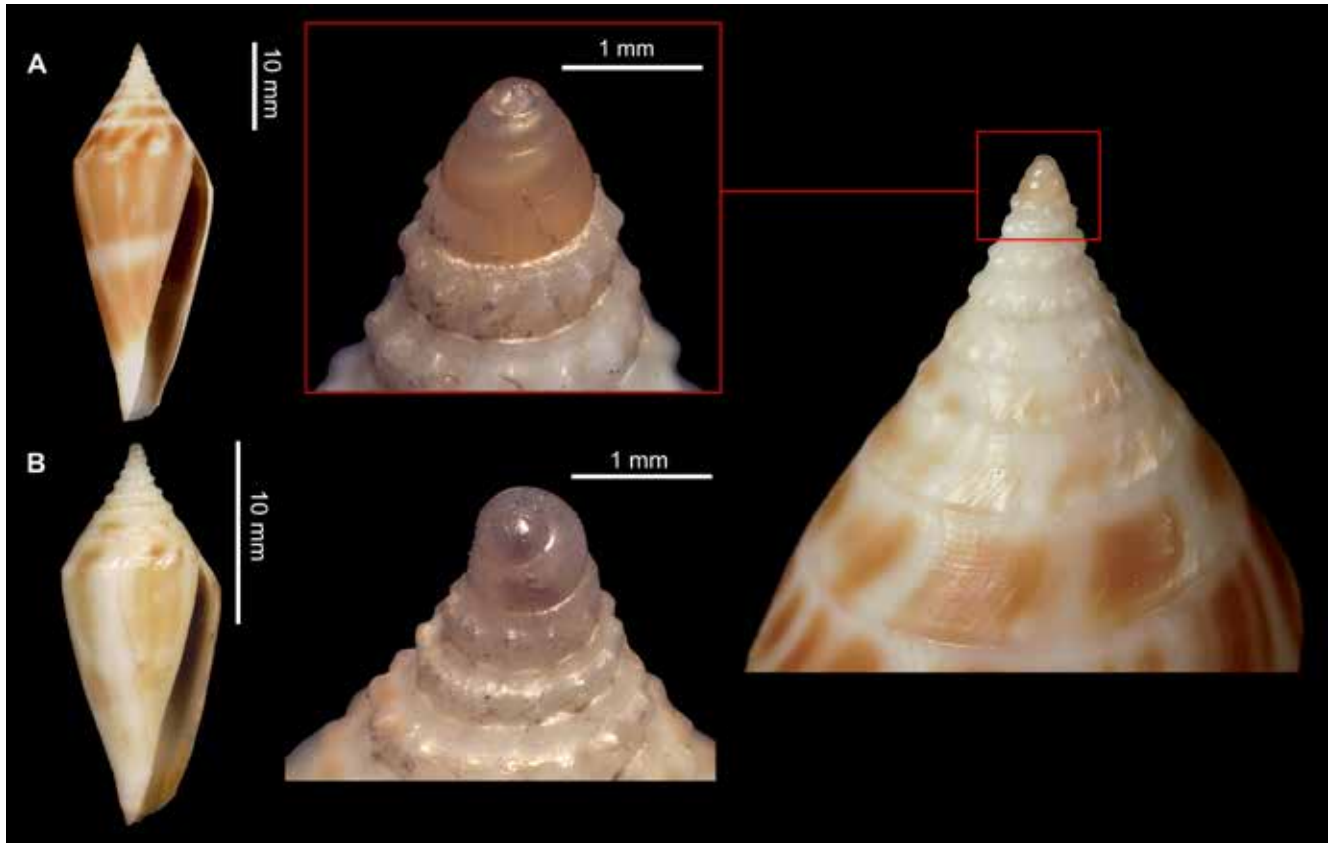


Fig. 2.- Whole shells, protoconchs and early teleoconchs. (A) *P. smirnoides* sp. nov. (S_L 39.9 mm, New Caledonia, Norfolk Ridge, Banc Eponge, LITHIST, Stn CP08, 24°54.2'S, 168°21.3'E, 540 m, R/V Alis); (B) *P. vaubani* (S_L 20.3 mm, New Caledonia, Norfolk Ridge, Banc Stylaster, NORFOLK 2, Stn DW 2035, 23°40'S, 167°40'E, 515–540 m, R/V Alis)

Background color white to pale yellow-brown. Last whorl with axial brown streaks forming two broad spiral bands leaving a narrow, pale spiral band slightly below midpoint. In some specimens axial brown streaks crowded and fused to form solid brown spiral bands with sparse white axial streaks (i.e., Plate 2, Figs. 3, 5 and 6a; Plate 3, Fig. 2a). In other specimens pattern of axial streaks of alternating brown and white or pale yellow-brown color predominates (i.e. Plate 2, Figs. 1, 4a; Plate 3, Figs. 3b, 4, 5). Another narrow, pale spiral band is present at height of shoulder. Spire variably patterned with brown radial flecks or blotches on a white or pale yellow-brown ground. Interior of aperture typically white, pale brown in some specimens. Columella white or very pale yellow-brown. Periostracum yellow-brown, smooth, translucent. Operculum (Fig. 3) elongated, margin serrate, length about one quarter of aperture height.



Fig. 3.- Operculum of *P. smirnoides* sp. nov. Top: Paratype 3 (S_L 79.7 mm); Bottom: Paratype 5 (S_L 52 mm)

Living animal and radula:

Details about the living animal are unknown. The operculum and radular apparatus of *P. smirnoides* sp. nov. have been previously figured and described in Rolán & Raybaudi (1994) (text Fig. 2, considered *P. smirna* from New Caledonia). According to these authors, the proboscis has a large distal muscular prominence, with the apical part ending like a narrow tongue, and with a radular tooth held firmly in place. The venom bulb is medium-sized, larger than in typical vermivorous species, and about half the size than in molluscivorous and piscivorous species. The radular tooth (Fig. 4B-C, 5) was examined for 5 specimens, including paratypes 5, 4 and 7, plus two additional specimens. 16 to 24 teeth in radular sac. Radular tooth medium to large-sized ($S_L/T_L = 39-55$), very elongated, with the anterior section longer than the half of the total tooth length in adult specimens ($T_L/AP_L = 1.7-1.8$). In young individuals, the anterior section is shorter than the posterior section ($T_L/AP_L = 2.6$). Waist indistinct. Barb present. Blade pointed, covering less than one quarter of the anterior portion ($100B_L/AP_L = 15-25\%$). In juvenile specimens, given the fact that the anterior portion is shorter, the extension covered by blade is larger (up to 40%). Serrations absent. Adapical opening with a relative size of 13 to 25 % of the length of the anterior portion of the tooth AP_L (7 to 14 % of T_L). There is an external cusp starting at the base of the adapical opening, almost equal in size to the blade on the opposite side of the tooth; at variance with the teeth of other *Profundiconus* species (Tenorio, 2015), this external cusp is short, pointed and non-serrated (Fig. 5); its relative length represents approximately 20 to 30 % of the AP_L of the tooth. Immediately below the indistinct waist, there is a small oblique fringe, more developed and evident in juvenile specimens,

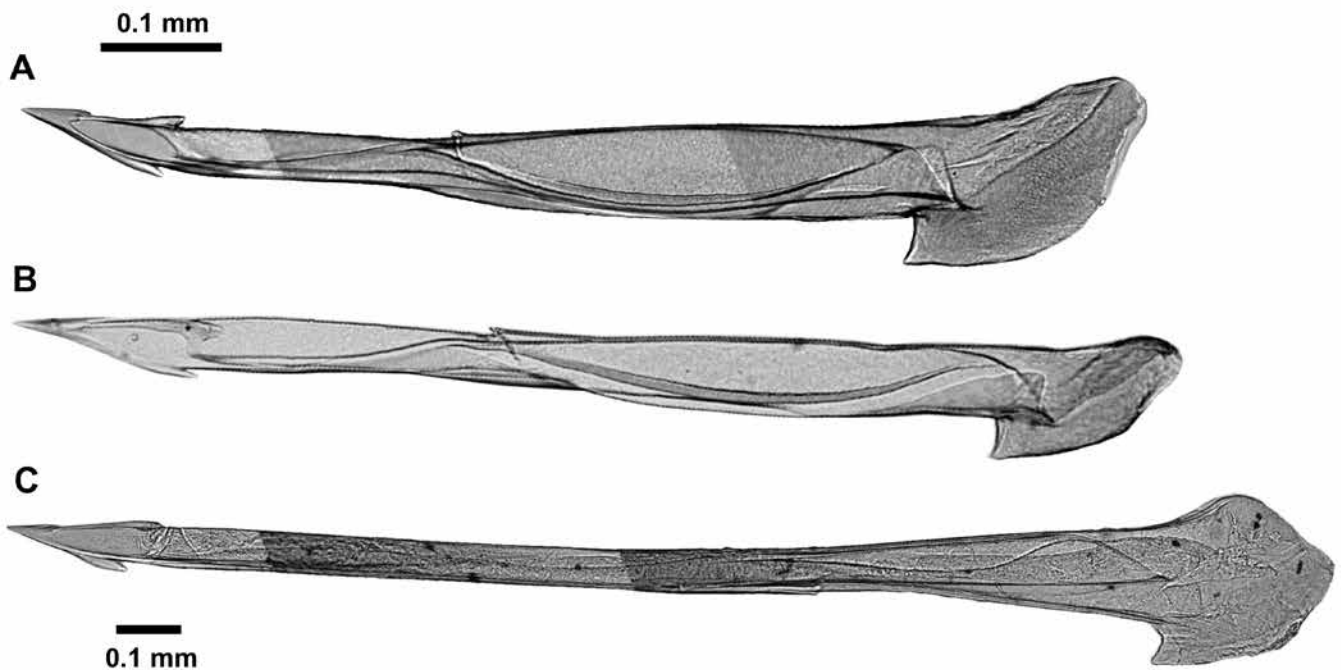


Fig. 4.- Optical photomicrographs of the radular teeth of: A) *P. smirna* (S_L 74.4 mm, Robert Moffitt coll., Bank 66, Eastern French Frigate Shoals, Hawaiian Chain, 23°50.561'N, 165°46.909'W, 250 m); B) *P. smirnoides* sp. nov. (S_L 52.4 mm, New Caledonia, MNHN coll.); C) *P. smirnoides* sp. nov. (S_L 81.4 mm, Paratype 7, MNHN IM-2000-30058). A and B are shown at the same scale; for C, scale is reduced x 0.5

with a serrated edge consisting of 4–5 blunt denticles pointing towards the anterior portion. A shaft fold is present, although difficult to detect in adults due to the elongation of the tooth. Slanted base, with a large basal spur present.

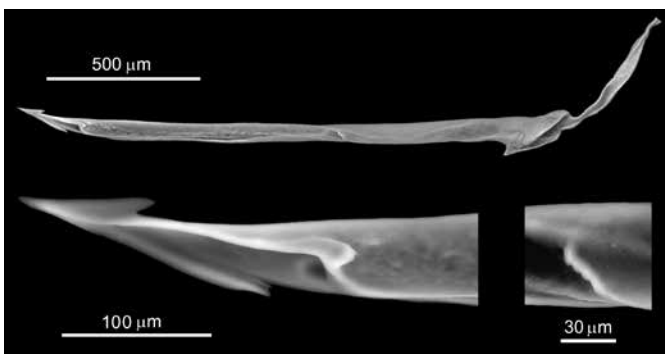


Fig. 5.- SEM photomicrographs of the radular tooth of *P. smirnoides* sp. nov. (paratype 4, S_L 76.9 mm, MNHN-IM-2000-30055). Top: entire radular tooth. Bottom left: enlarged detail of the apical portion, showing the barb, blade and external cusp. Bottom right: enlarged detail of the waist area, showing the serrated fringe.

REMARKS

The shell of *P. smirnoides* sp. nov. shows little degree of variability in shape and pattern among adult individuals. Differences are usually on the presence of a more or less dense pattern of axial streaks, or eventual changes on relative diameter or spire height in some cases. The very few specimens examined from Wanganella Bank, New Zealand, seem to have an apparent larger relative diameter compared to specimens from New Caledonia, but this difference is most probably non-significant.

The dietary habits of *P. smirnoides* sp. nov., and of other *Profundiconus* are unknown. They are presumably vermivorous species. However, the beaks of a small cephalopod

were found inside the stomach of an adult specimen (identified as *smirna*) from Wanganella Bank, New Zealand, suggesting that this species produces a toxin of sufficient potency to rapidly immobilize a fast-moving prey (Marshall, 1981). This important observation seems to have been overlooked in the recent literature.

Profundiconus smirnoides sp. nov. is obviously most similar to *P. smirna* (Plate 1, Figures 1-6), a species restricted to the Hawaiian chain. Both *P. smirnoides* sp. nov. and *P. smirna* are also similar to *Profundiconus profundorum* (Kuroda, 1956), mainly from Japan and China, but also reported occasionally from the Philippines (Balut Island) or the Solomon Islands (i.e., <http://coldb.mnhn.fr/catalognumber/mnhn/im/2007-30337>) (Fig. 6).

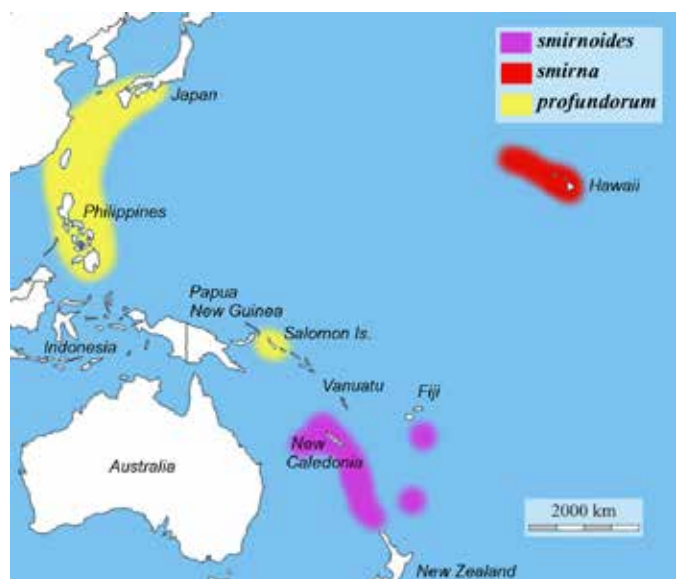


Fig. 6.- Known distribution ranges for *P. smirnoides* sp. nov., *P. smirna* and *P. profundorum*.

Marshall (1981) and Walls (1979) considered *P. profundorum* to be closely related to, or even conspecific with *P. smirna*. I have compared the shell length and the morphometric parameters of the shells of the three species using a sample of 30 specimens: 10 *P. profundorum* from Japan, eight *P. smirna* from Hawaii, and 12 *P. smirnoides* sp. nov. (11 from New Caledonia plus 1 from New Zealand). Although there were more specimens of *P. smirnoides* sp. nov. available for measurement, due to their extreme scarcity I have been able to locate only eight specimens of *P. smirna*, and about a dozen *P. profundorum*. For a balanced number of specimens for each group for the analysis only 12 specimens of *P. smirnoides* sp. nov. were selected from among adults with well-preserved shell features. The three species differ significantly in mean shell length S_L ($F = 6.244$, $p = 0.0059$). The mean S_L of *P. smirna* (62 ± 6 mm) is significantly smaller than mean S_L for *P. smirnoides* sp. nov. (76 ± 7 mm; $t = 3.148$, $p = 0.0055$) and *P. profundorum* (74 ± 5 mm; $t = 3.498$; $p = 0.00297$). However, the differences in mean S_L between *P. smirnoides* sp. nov. and *P. profundorum* are not significant ($t = -0.4198$; $p = 0.679$). ANCOVA indicates significant differences between *P. profundorum* and *P. smirnoides* sp. nov. in MD ($F = 14.51$, $p = 0.00118$), HMD ($F = 10.63$, $p = 0.0041$) and SH ($F = 7.702$, $p = 0.012$) when corrected for differences in AH (covariate). In analogous fashion, when compared to *P. smirna*, *P. profundorum* differs significantly in MD ($F = 21.34$, $p = 0.00033$), but not in HMD ($F = 0.341$, $p = 0.568$) or SH ($F = 2.051$, $p = 0.173$). ANCOVA (with AH as covariate) indicates significant differences between *P. smirnoides* sp. nov. and *P. smirna* in HMD ($F = 6.496$, $p = 0.021$), but not in MD ($F = 0.0091$, $p = 0.925$) or SH ($F = 0.333$, $p = 0.571$). Hence, the species *P. smirnoides* sp. nov., *P. profundorum* and *P. smirna* can be separated by shape and size. A canonic variate analysis (also known as discriminant function analysis) using S_L and the parameters MD, HMD and SH as variables and species hypothesis as a factor, correctly classified 93.33 % of the species (2 incorrect out of 30). In the jackknifed test the correct assignment rate was 90 %: one specimen of *smirnoides* incorrectly classified as *smirna*, one *smirnoides* incorrectly classified as *profundorum*, and one *smirna* incorrectly classified as *smirnoides*. The function CV1 gave approximately equal weights to S_L , MD and HMD, and very little to SH, whereas in function CV2 the variable S_L represents the strongest component (Fig. 7).

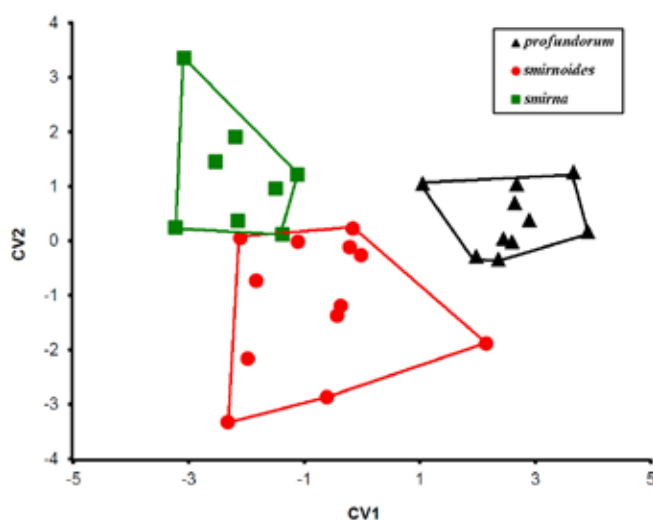


Fig. 7.- 2D Scatter plot for the Canonical Variate Analysis (CVA) of *P. profundorum* (▲), *P. smirnoides* sp. nov. (●) and *P. smirna* (■). S_L , MD, HMD and SH were used as variables in the analysis.

From these morphometric analyses, we can conclude that *P. smirnoides* sp. nov. has a larger mean shell length than *P. smirna*, and a lower HMD. This means that the shells of *P. smirna* have a more conical profile, whereas in *P. smirnoides* sp. nov. the profile is conoid cylindrical to narrowly conoid cylindrical. *P. profundorum* and *P. smirnoides* sp. nov. have similar mean S_L . However, the shell of *P. profundorum* has a broader, more conical last whorl, and a lower spire than *P. smirnoides* sp. nov. The latter also differs from *P. smirna* and *P. profundorum* in shell pattern. Whereas in these two species the shell pattern is simple, consisting essentially of two broad brown spiral bands separated by a lighter-colored spiral band on the midbody, *P. smirnoides* sp. nov. has a characteristic pattern constituted by alternating brown and white or pale yellow-brown axial streaks. As to other shell characters, the shoulder ridge and the nodules in the spire whorls appear usually more developed in *P. smirna*. In *P. smirnoides* sp. nov. nodules are restricted to the early teleoconch whorls, and the shoulder ridge is well marked in juveniles only, tending to become rounded and indistinct in adults. Fine cords are often present on the sutural ramp of *P. smirna*, and on the early teleoconch whorls of *P. profundorum*, but are obsolete or indistinct in the case of *P. smirnoides* sp. nov.

The morphology of the radular tooth of *P. profundorum* from Japan is unknown, preventing comparison with the new species. The radular tooth of a taxon usually identified as *Profundiconus profundorum* from New Caledonia (Rolán & Raybaudi, 1994; Röckel, Richard & Moolenbeek, 1995; Röckel, Korn & Kohn, 1995) is being studied at present, and it is most likely non-conspecific with *P. profundorum* from Japan and China. The results of this research will be reported later (Tenorio, M. J., manuscript in preparation). We have been able to compare the radular teeth of *P. smirnoides* sp. nov. and *P. smirna* from Hawaii (Fig. 4). At first glance, the teeth of these two taxa are similar, and indeed they present similar features which include barb, blade, external cusp, shaft fold and strong basal spur. In fact, the tooth of an adult specimen of *P. smirna* with a S_L of 74.4 mm (Fig. 4A) is almost identical to the tooth of a juvenile specimen of *P. smirnoides* sp. nov. (Fig. 4B). In both species, the anterior portion of the tooth is shorter than the posterior portion ($T_L/AP_L = 2.76$ for *smirna*, and 2.56 for juvenile *smirnoides*), and both exhibit clearly the characteristic fringe just below the still apparent waist. But even in this case, the relative tooth sizes are very different: $S_L/T_L = 81$ for *P. smirna*, and 55 for juvenile *P. smirnoides*. When it comes to adult specimens of *P. smirnoides* sp. nov., the relative size of the tooth is relatively much larger (Fig. 4C), with S_L/T_L in the range 39 to 46, i.e. almost double that for *P. smirna*. The aspect of the tooth becomes much elongated, with an indistinct waist and an anterior portion much longer than the posterior portion ($T_L/AP_L = 1.75$ – 1.85). The blade and external cusp occupy now a more elevated position due to the elongation of the anterior portion ($100B/AP_L$ 16 to 19 % versus 36 % in *P. smirna*). Hence, the radular tooth of *P. smirnoides* sp. nov. is much larger and elongated than the tooth of similarly sized *P. smirna*, which however is strikingly similar to the tooth of the juvenile *P. smirnoides* sp. nov. The number of teeth present in the radula also differs: 16–24 in *P. smirnoides* sp. nov.; 51 in *P. smirna*. We can therefore suggest that the radular tooth in *P. smirna* could be neotenic, i.e., retains juvenile characters in the adulthood. Such observation is not unusual in Conidae. One of the most striking examples is the case of the cryptic species *Virroconus ebraeus* (L. 1758) and *Virroconus judaeus* (Bergh, 1895). The

two species have almost identical shell morphology, but they are genetically distinct (Duda et al., 2009) and exhibit different radular tooth morphology: The teeth of *V. judaeus* are about twice as large as those from equal sized specimens of *V. ebraeus* and have well developed serrations and a distinct terminating cusp, features that are not present in the teeth of *V. ebraeus* teeth, which are considered neotenic (Tucker & Tenorio, 2013).

Another species that might bear some resemblance to juveniles of *P. smirnooides* sp. nov. in shell shape and pattern is *Profundiconus vaubani* (Moolenbeek & Richard, 1995) (Fig. 2B). This species lives in sympatry with *P. smirnooides* sp. nov. with a similar bathymetric range. *P. vaubani* can be easily separated from *P. smirnooides* sp. nov. by its paucispiral instead of multispiral protoconch. They also differ in adult shell length (much larger in the case of *P. smirnooides* sp. nov.), in the presence of cords on the sutural ramp of *P. vaubani*, and in the morphology of their respective radular teeth.

Several specimens of *P. smirnooides* sp. nov. from New Caledonia (i.e. those identified as *smirna* in Puillandre et al., 2014), including the holotype and paratype 1, have been sequenced (COI GenBank Accession Numbers KJ550446, KJ550447, KJ550448, registered as “*Conus smirna*”). A Bayesian Inference (BI) tree of a fragment of the COI gene for this species provides support for its inclusion in the *Profundiconus* clade, although the relationships with other *Profundiconus* species (i.e. *Profundiconus teramachii* (Kuroda, 1956)) were not resolved satisfactorily (Puillandre et al., 2014). Unfortunately, attempts to obtain COI sequences from the available sample of *P. smirna* from Hawaii have been so far unsuccessful, preventing comparison with the sequences obtained from New Caledonian material.

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Plate 1.- **1-5, 7** *Profundiconus smirna* (Bartsch & Rehder, 1943), Hawaiian Chain. **1a-b**. Dorsal and ventral views, 74.4 x 25.8 mm, Robert Moffitt coll., Bank 66, Eastern French Frigate Shoals, 23°50.561'N, 165°46.909'W, 250 m, taken by Submersible *Pisces 4* aboard R/V *Kaimikai-O-Kanaloa* during 2002 NWHI cruise. **2**. 61.3 x 22.7 mm, USNM 807648 (shell 2 in lot), Vicinity of French Frigate Shoals, dredged by R/V *David Starr Jordan*. **3**. 57.0 x 20.8 mm, USNM 807648 (shell 1 in lot), Vicinity of French Frigate Shoals, dredged by R/V *David Starr Jordan*. **4a-b**. Holotype, dorsal and ventral views, 61.0 x 23.0 mm, USNM 173226, dredged near Kauai Island by R/V *Albatross*, 470–571 m. **5**. 52.2 x 20.7 mm, WJF coll., off Midway Island, trawled at 183 m by coral hunters. **7**. 61.0 x 24.2 mm, WJF coll., off Midway Island, dredged at 150 m by Navy research vessel. **6a-b**. *Profundiconus profundorum* (Kuroda, 1956). 75.0 x 33.7 mm, MJT coll., Okeezoko, Kochi Prefecture, Japan, 350 m. Photo credits: **2, 3** : Yolanda Villacampa (USNM); **4** : from a plate made by Ellen Strong (USNM); **5, 7** : William J. Fenzan.



Plate 2.- **1-5** *Profundiconus smirnoides* sp. nov. New Caledonia. All specimens from MNHN. **1.** Paratype 1, 73.7 x 27.0 mm, IM-2009-18223, Norfolk Ridge. **2a-b.** Holotype, dorsal and ventral views, 71.8 x 26.3 mm, IM-2009-18220, off Ile des Pins. **3.** Paratype 2, 81.5 x 31.0 mm, IM-2007-30914, Coral Sea, South Lansdowne. **4a-b.** Paratype 3, dorsal and ventral views, 79.7 x 27.4 mm, IM-2000-30054, Norfolk Ridge, Banc Introuvable. **5.** Paratype 4, 76.9 x 29.6 mm, IM-2000-30055, Norfolk Ridge, Banc Stylaster. **6a-b.** Paratype 5, 52.0 x 19.8 mm, IM-2000-30056, Norfolk Ridge.



Plate 3.- **1-5** *Profundiconus smirnoides* sp. nov. All specimens from MNHN coll. unless otherwise stated. **1a-b**. Paratype 6, dorsal and ventral views, 63.4 x 24.7 mm, IM-2000-30057, Grand Passage, New Caledonia. **2a-b**. Paratype 7, dorsal and ventral views, 81.4 x 31.9 mm, IM-2000-30058, Norfolk Ridge, New Caledonia. **3a-b**. Paratype 8, dorsal and ventral views, 75.4 x 29.8 mm, IM-2000-30059, Norfolk Ridge, New Caledonia. **4**. Paratype 9, 97.9 x 35.0 mm, IM-2000-30060, off Ile des Pins, New Caledonia. **5**. Paratype 10, 75.3 x 29.9 mm, MNCN, off Ile des Pins, New Caledonia. **6**. Paratype 11, 84.3 x 34.8 mm, NMNZ M.234154, Wanganella Bank, New Zealand. Photo credit: **6**: Dr Jean-Claude Stahl (NMNZ).

Revision of the *Kioconus caillaudi* complex. Description of two new endemic *Kioconus* (Gastropoda, Conidae): *K. hoarai* n. sp., from La Réunion and *K. malcolmi* n. sp., from the Red Sea

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KEY WORDS

Taxonomy, new species, Conidae, endemism, *Kioconus*, *caillaudi*, *hoarai*, *malcolmi*, La Réunion, Red Sea

ABSTRACT

Kioconus hoarai n.sp., an endemic species of Conidae from La Réunion Island and *Kioconus malcolmi* n.sp., an endemic species from the Red Sea are named. The former is compared with *K. caillaudi* (Kiener, 1845) from Cargados Carajos Bank (Saint-Brandon) and Saya de Malha Bank and the latter with *K. typhon* (Kilburn, 1975), *K. caillaudi* (Kiener, 1845), *K. parvulus parvulus* (Link, 1807), *K. parvulus meyeri* (Walls, 1979) and *Lividoconus biliosus* (Röding, 1798).

Abbreviations used in all the tables of types

L : Length
MD : Maximum Diameter
HMD : Height of Maximum Diameter
AH : Aperture Height
RD = MD / AH : Relative Diameter of last whorl
PMD = HMD / AH : Position of Maximum Diameter of last whorl
RSH = (L-AH) / L : Relative Spire Height
j : juvenile
s : subadult
° : estimated values
() : values from RKK

SYSTEMATICS

Family Conidae Fleming, 1822
Genus *Kioconus* da Motta, 1991
Type species: *Kioconus reclusianus* (Bernardi, 1853)

Kioconus hoarai n.sp.



Fig.1 - *Kioconus hoarai* n.sp. Holotype MNHN IM-2000-30026

Type material:

Studied specimens:

(measurements: L, MD, HMD, AH are given in millimeters; RD, PMD, RSH are without dimension).

	L	MD	HMD	AH	RD	PMD	RSH	Deposition
Holotype	29.28	13.30	22.31	24.26	0.548	0.920	0.171	MNHN IM-2000-30026
Paratype 1	32.88	16.02	28.16	29.07	0.551	0.969	0.116	MNHN IM-2000-30027
Paratype 2-7 ^j	5.60 - 11.52	-	-	-	-	-	-	MNHN IM-2000-30027
Paratype 8 ^s	19.33	9.30	15.36	17.01	0.547	0.903	0.120	MNHN IM-2000-30028
Paratype 9	34.77	16.12	28.62	28.97	0.556	0.988	0.167	MNHN
Paratype 10	28.49	13.65	23.16	25.08	0.544	0.923	0.120	MNHN
Paratype 11	24.64	10.77	19.74	21.25	0.507	0.929	0.138	Coll. GH
Paratype 12	34.42	14.17	27.92	29.24	0.485	0.955	0.150	Coll. GH
Paratype 13	36.16	16.51	28.71 °	30.13 °	0.548	0.953	0.167	Coll. JC
Paratype 14 ^s	17.80	8.20	13.58 °	14.99 °	0.547	0.906	0.158	Coll. WF
Paratype 15 ^s	17.52	8.35	13.76 °	14.68 °	0.569	0.937	0.162	Coll. TJ
Averages	(adults) 31.5	(adults) 14.4	(adults) 25.5	(adults) 26.9	0.54 (0.54-0.56)	0.94 (0.84-0.94)	0.15 (0.13-0.16)	

Types:

The Holotype of the new species (fig.1) is deposited in the Muséum National d'Histoire Naturelle (Paris): dredged September 2nd, 1982 by the French research vessel "Marion Dufresne" during the campaign MD32, Station DC 126: 20°52'S, 55°38'E, 110 m, off Ste Suzanne, La Réunion. Bouchet, Warén & Métivier coll. MNHN IM-2000-30026.

Paratypes 1 to 7 (1 adult + 6 juveniles): same data as the holotype, MNHN IM-2000-30027.

Paratype 8 (subadult): dredged on August 20th, 1982 by the French research vessel "Marion Dufresne", campaign MD32, Station DR 47: 21°23'S, 55°37'E, 205 - 215 m, off St Joseph, La Réunion. Bouchet, Warén & Métivier coll. MNHN IM-2000-30028.

Paratypes 9 and 10: off La Réunion, donation by J.B.Lozet in 1978 to MNHN.

Other Paratypes are in various private collections.

Type locality: off Sainte-Suzanne, North of La Réunion Island: 20° 52 ' S, 55° 38' E, 110 m. deep.

Description:

Shell moderately small (25 to 36 mm, average: 31.5 mm for the adult specimens), conical to narrowly conical shell with almost straight sides below the rounded periphery (slightly convex adapically giving a sigmoid outline). The shoulder is subangulate and irregularly undulated. The protoconch of 2 whorls is paucispiral and variously colored (cream to dark pink or violet). Adult shells have about 11 whorls. The spire is moderately elevated, mucronate with the last ramps being straight to sigmoid. The relative spire height varies between 0.12 and 0.17 (average RSH = 0.15). The position of the maximum diameter is 90 to 99 % of the aperture length of the shell (average PMD = 0.94). The relative diameter of the last whorl varies from 0.49 to 0.57 (average RD = 0.54). The teleoconch whorls are slightly detached and heavily tuberculate with 11 to 12 strong rather acute cream knobs per whorl. The spiral suture is undulate. Sutural ramp is flat with 4 to 5 subsutural ridges and spiral grooves and without radial threads. Body whorl with a smooth shining surface, decorated with 11 to 15 reddish brown spiral bands evenly spaced on a light yellow to cream tan background. Those brown bands, 1 to 2 mm. broad, are wider than the paler gaps and decreasing in size towards the plain cream white anterior end. The spire is intensely reddish chocolate brown colored with yellow cream streaks. The aperture is uniformly narrow in width, with an almost straight inner lip. The outer lip is whitish to pale blue purple within. The anal notch is rather V shaped and the origin of the lip has a receding profile. The siphonal lip outline is straight with a whitish fasciole. Some very weak spiral grooves at base. From the observation of the type lot, the ontogeny of the pattern appears. The reddish brown spiral bands start to appear in the pattern of the last whorl when the shell is larger than roughly 6 mm. They are almost three times narrower than the gaps between them and we could count 11 of them on paratype 7. They become progressively wider with growth as may be observed on our plates 1 and 2.

Living animal:

The soft parts of the species are presently unknown.

Derivatio nominis:

Named after the late Guy Hoarau friend, diver and shell lover who collected several specimens around La Réunion Island and made them available to the authors for study.



Fig.2 - Guy Hoarau
(1936 - 2013)

Species range:

Known only from deep water off La Réunion Island.

Habitat:

Unknown

Comparisons:

K. hoarui n. sp. can only be compared with *K. caillaudi* Kiener, 1846. The new species was included by Röckel, Korn & Kohn (1995) within their concept of the latter (together with *K. malcolmi* n. sp.). They stated that their species is "unmistakable because of its combination of spirally lineate colour pattern and undulate to tuberculate shoulder".



Fig. 3 - Original Figure of *Conus caillaudi* Kiener, 1846



Fig. 4 - Holotype of *Conus caillaudi* (MHNN)

We have estimated and calculated independently the measurements and ratios of shells of *K. caillaudi* from two populations: Cargados, Carajos Bank (type locality) and Saya de Malha Bank.

(measurements: L, MD, HMD, AH are given in millimeters; RD, PMD, RSH are without dimension).

Species	L	MD	HMD	AH	RD	PMD	RSH	Deposition
<i>K. caillaudi</i> "Cargados" Holotype	51.50	24.80	44.00 °	47.88 °	0.518	0.919	0.070	MHNN
<i>K. caillaudi</i> Cargados	47.84	23.44	39.68 °	42.99 °	0.545	0.923	0.101	Coll. JPVC
<i>K. caillaudi</i> "Mauritius"	34.40	15.90 °	27.66 °	30.43 °	0.523	0.909	0.115	SMNS
<i>K. caillaudi</i> Cargados	49.00	23.52 °	42.86 °	45.18 °	0.521	0.949	0.078	Col. WF
Averages <i>K. caillaudi</i> Cargados	45.7	21.9	38.6	41.6	0.53 (0.47-0.54)	0.92 (0.84-0.94)	0.09 (0.08-0.12)	
<i>K. cf. caillaudi</i> Saya de Malha	29.88	14.94	24.18 °	26.74 °	0.559	0.904	0.105	Coll. JPVC
<i>K. cf. caillaudi</i> Saya de Malha	27.90	14.02 °	22.73 °	24.73 °	0.567	0.919	0.114	Coll. TJ
Averages <i>K. cf. caillaudi</i> Saya de Malha	28.9	14.5	23.5	25.7	0.56 (0.57-0.58)	0.91 (0.84-0.94)	0.11 (0.12-0.13)	

K. hoarui n. sp. differs from the typical *K. caillaudi* from Cargados Carajos in having a very distinct pattern composed of 11 to 15 large brown spiral bands on a cream, tan or pale yellow background, as compared to the 24 to 27 very narrow spiral bands on a vivid to pale yellow background (the pale yellow being in some cases the result of colour fading of old shells). The early whorls and the shoulder are knobbed with more prominent coronations in the new species and the spire is higher than in *K. caillaudi*: average RSH of *K. hoarui* n. sp. is 0.15 and is only 0.09 in *K. caillaudi*. The new species is smaller in size: average length for adult specimens is 31.5 mm for *K. hoarui* n. sp. (moderately small) and 45.7 mm (medium sized) for typical *K. caillaudi*. The last whorl of the new species is less elongated: average RD is 0.54 for *K. hoarui* and 0.53 for the typical *K. caillaudi*. Average PMD seems higher in *K. hoarui* n. sp.: 0.94 than in *K. caillaudi*: 0.92. The aperture in *K. caillaudi* is wider than in the new species who has a quite narrow aperture. Outline is slightly sigmoid in *K. hoarui* and with almost straight sides in *K. caillaudi*.

The population referred to *K. caillaudi* found in the Saya de Malha Bank is only known from a very limited number of specimens (two pictured here and one in RKK). They seem to differ from the shells from Cargados Carajos Shoals by their wider last whorl (RD: 0.56 against 0.53) and higher spire (RSH: 0.11 against 0.09). More specimens are needed to evaluate the relationships between the two populations and the possibility that the population from Saya de Malha Bank could be specifically distinct. However it differs from the shells collected in La Réunion Island by the outline of the spire that is

not sigmoid but concave and the pattern that is either devoid of spiral bands or has narrow ones.

***Kioconus malcolmi* n.sp.**

Fig.5 - *Kioconus malcolmi* n.sp. Holotype NHMUK 20150016

Type material:**Studied specimens**

	L	MD	HMD	AH	RD	PMD	RSH	Deposition
Holotype	38.90	20.60	29.78	32.20	0.640	0.925	0.172	NHMUK 20150015
Paratype 1	44.90	22.60	34.37	37.81	0.598	0.909	0.158	NHMUK 20150016
Averages	41.9	21.61	32.1	35.0	0.62 (0.58-0.62)	0.92 (0.84-0.94)	0.16 (0.13-0.14)	

Types:

The only two known specimens, originally illustrated in Red Sea Shells by Doreen Sharabati, are stored in the type collection in NHMUK.

Type locality:

South Tower Reef, near Jeddah, Saudi Arabia, East coast of the Red Sea.

Description:

Medium sized shells (38.9 to 44.9 mm, average: 41.9 mm). The shape is conical with adapically convex sides becoming straight anteriorly. The shoulder is carinate and undulate. The protoconch is not visible on the two studied specimens. Shells have about 10 whorls. The spire is slightly concave and moderately elevated: average RSH = 0.16. The position of the maximum diameter is about 92 % of the aperture length of the shell. The relative diameter of the last whorl varies from 0.60 to 0.64. The teleoconch whorls are slightly detached and tuberculate with 9 to 10 whitish large knobs per whorl. The spiral suture is fairly undulate. Sutural ramp is flat with 4 to 6 weak spiral cords and grooves and weak radial threads. The body whorl has a smooth surface, decorated with more than 60 orange brown spiral lines rather regularly spaced on a white to yellow cream background. Those numerous very narrow bands are undulate in the adapical first third of the last whorl and less tight in the center of the last whorl, near the base and below shoulder showing variably broad paler spiral bands. Moreover some scarce faint axial orange brown dashes are more apparent in the paler bands and particularly on the

shoulder of the holotype. The anterior end is uniformly stained with chestnut brown and appears to be darker than the other parts of the last whorl. The spire is orange brown colored with large dull whitish nodules. The aperture is white and uniform in width, with a quite sinusoidal inner lip. The anal notch is V shaped and the origin of the lip has a slightly winged profile.

Living animal:

The soft parts of the animal were not recorded.

Derivatio nominis:

Named after Gavin Malcolm, well known British cone collector who has contributed greatly to making available many online cone publications.

Species range:

Only known from the type locality.

Habitat:

Unknown but found in moderately deep water, collected in February 1984.

Comparisons:

K. malcolmi n. sp. can be compared to some *Kioconus* and one *Lividoconus* species.

- ***Kioconus caillaudi* (Kiener, 1845)** from Cargados Carajos Bank is narrower and more elongated than *K. malcolmi* (average RD is 0.53 for the typical *K. caillaudi* versus 0.62 for *K. malcolmi*) and the spire is more elevated in the new species (average RSH is 0.16 for *K. malcolmi* and 0.09 in typical *K. caillaudi*). The population of *K. cf. caillaudi* from Saya de Malha has intermediate ratio values between the 2 former species. The pattern differs strongly in the number of spiral lines (24 – 27 against 60) and in the absence of dark staining on base in *K. caillaudi*. Finally *K. caillaudi* is only known with certainty from the Cargados Carajos while the new species has only been collected in the Red Sea.

- ***Kioconus hoarui* n. sp.** differs from *K. malcolmi* n. sp. by the outline of the spire: mucronate and sigmoid against concave for the Red Sea endemic. The spiral bands are much wider and less numerous in *K. hoarui* n. sp. than in *K. malcolmi*.

- ***Kioconus typhon* (Kilburn, 1975)** from Mozambique can reach a larger size (up to 91 mm. according to RKK, 1995) than *K. malcolmi* n. sp. (44.9 mm.) and unlike the latter species has a more pointed apex and a spire without knobs. *K. typhon* has a deep and linear suture unlike *K. malcolmi*.

The pattern is also different: much less spiral bands in *K. typhon* (some specimens are even patternless) and the anterior end of the shell is white in *K. typhon* while it is chestnut brown in *K. malcolmi* n. sp.

- *Kioconus parvulus parvulus* (Link, 1807) from tropical West Pacific and East Indian Oceans (Queensland, Papua, Philippines & Indonesia, etc.) and *Kioconus parvulus meyeri* (Walls, 1979) from South Western Indian Ocean (South Africa, Mozambique & Madagascar) have roughly the same shape than *K. malcolmi* n.sp., nevertheless the latter species has less numerous tubercles on shoulder: 9 to 10 instead of 11 to 13 for *K. parvulus*. The last whorl of *K. malcolmi* is smooth unlike the one of *K. parvulus* whose surface is covered with spiral ribs and ribbons (especially in *K. parvulus parvulus*). The pattern of the spire is different with black dots or spots between the spire knobs in *K. parvulus* instead of irregular brown streaks in the new species. Both species have dark stained anterior ends. Unlike *K. malcolmi*, the last whorl of *K. parvulus* has a greyish blue background with spiral bands of tan, olive or violet brown or pink and the sutural ramp is violet to brown colored ; moreover some specimens of *K. parvulus meyeri* have dark brown irregular axial flames throughout the whole shell.

- *Lividoconus biliosus* (Röding, 1798) from India and Sri Lanka. *K. parvulus* is often confused with *Lividoconus biliosus*. The latter has a restricted range in southern India and Sri Lanka while the former has a much wider geographical range. *K. parvulus* has a dark anterior end while *L. biliosus* has this part of its last whorl coloured in the same way than the upper parts. The distinction of these two species and their generic position within Conidae is a complex and confused question that need developments, one major difference between the *Lividoconus* and the *Kioconus* lie in the shape of the radular teeth. *K. malcolmi* differs in the same ways from *L. biliosus* than from *K. parvulus parvulus* and *K. parvulus meyeri*.

Discussion:

Spelling of *K. caillaudi* Kiener, 1846

Kiener published in 1846 the plate (see above Fig. 3) where the species appears for the first time under the name “*Conus caillaudi*” with one “i” only. In the text published in 1849, the name is “*Conus caillaudii*” with two “i”. Subsequent authors (Coomans, Moolenbeek & Wils, Walls, RKK, eg.) generally retained the name given in the text although it is more recent by three years from the one given in the plate. Filmer (2001) accepts the older spelling as correct. We agree with Filmer. To make things more difficult the correct spelling of the namesake of the species is “Mr Caillaud” after whom a species was named by Jay in 1847 as “*Conus caillaudii*”. The latter is altogether a synonym of *Lautoconus ventricosus* (Gmelin, 1791) and a homonym of *K. caillaudi* (Kiener, 1846) because it is named after the same person.

Literature review:

Conus caillaudi Kiener, 1846 was first published in a plate of «*Spécies Général et Iconographie des Coquilles Vivantes*» Vol.2: pl. 55, fig. 5. The text was only issued later in 1849 (p. 285, no. 251, with the name spelt *caillaudii*). Kiener describes his species as being of a quite vivid orange yellow (“un jaune orange assez vif”). The type locality was not mentioned by Kiener. The size of the shell is stated to be of 50 mm. The holotype is nowadays stored in the MHNN (Nantes, France) and its dimensions are indeed of 51.5 x 24.8 mm. The shell is glued on cardboard and can only be seen from apertural view. The label accompanying the holotype indicates “Nlle Calédonie” as locality.

In the great monographs of the Nineteenth century only limited new information is given. Reeve (1849, fig. 181b) illustrates

another shell from the Crotch collection which differs only from the holotype by its more regularly spaced shoulder tubercles. Reeve compares the species with *Conus caledonicus* Hwass in Bruguière, 1792 which shows comparable spiral reddish lines on a yellowish background. The latter was identified long after as a colour form of *Tenorioconus cedonulli* (Linnaeus, 1767). Sowerby (Thesaurus Conchyliorum pl. II, fig. 34) illustrates a specimen but does not give its whereabouts. Tryon (1884) sums up the scarce information available under the name “*caillaudi*” sic and copies Kiener’s figure. Finally Weinkauff (Conchylien Cabinet, 1875, P. 360, pl. 66 fig. 12) also copies Kiener’s figure and states “I have never seen this species” in the comments of the species.

A specimen from Saint Brandon – the other name for Cargados Carajos – was pictured in *Of Sea and Shore*, Winter 1973. The shells were in the collection of Vic Chakowa, then renowned shell dealer in Mauritius who collected it.

Walls (1979) illustrated a specimen of the typical *K. caillaudi* said to originate from Mahébourg, Mauritius of 47.3 mm. He compares the species with *Conus typhon*. He gives the geographical range as “Southern Indian Ocean Islands”.

Coomans, Moolenbeek & Wils, 1983 designated the type locality as Cargados, Carajos Bank. They illustrate the holotype and another typical specimen present in IRSNB (KBIN) in figs. 318 and 319.

Doreen Sharabati in her book “Red Sea Shells” (1984) illustrates in the plate 30 two shells identified as *Conus cf. typhon* that are the two types of *K. malcolmi* n. sp. Only limited information is given: “found in moderately deep water. 49 mm.” The size given does not match with the measurements performed by NHMUK during the course of the preparation of this paper. The label accompanying the shells gives a more precise locality.

Röckel & Korn in *Acta Conchyliorum* n°2 (1990) present a number of Conidae dredged by Soviet biologists and stored in Mr Danila’s collection. Among these a shell of 45 mm. is shown (pl. 10, row 3, figs. 2 – 3) that belongs to the Saya de Malha Bank population. Its size is 45 mm. X 22.5 mm. It has been dredged in 160m.

In *La Conchiglia* Vol. XXIII, n°262 (1992), Dieter Röckel illustrates the same specimen of *K. cf. caillaudi* from the Saya de Malha Bank (p. 36 fig. 6). He states that an unknown number of this species have been dredged. He also describes the pattern as being “uniformly orange brown coloured and with no pattern elements”.

Röckel, Korn & Kohn (1995) recognized only one valid species: *Conus caillaudii* (sic). Nevertheless in the description and discussion of the species, they separate the shells from four different localities and suggested that some of these populations are possibly different species:

- Cargados Carajos bank (Saint Brandon) illustrated with two shells (pl. 4, figs 19 and 20) from NMWC and da Motta’s collection (now in SMNS, our fig. 2),
- Saya de Malha Bank illustrated by the same specimen from Danila’s collection (pl. 4, fig. 21),
- La Réunion Island illustrated with two specimens from MNHN: pl. 4, fig. 22 is the paratype 9 of *K. hoarai* n. sp. and fig. 23 is the holotype.
- Red Sea illustrated in pl. 4, figs 24 and 25 that show respectively the holotype and paratype of *K. malcolmi* n. sp., these shells are housed in NHMUK.

Geographical range and ecology:

Few specimens of *K. hoaraui* n. sp. are known. They are mainly present in MNHN and in a few private collections. On the label found in MNHN collection, the specimens were named “*cf. caillaudi*” or “*pseudocaillaudi*” and were reported as being studied by G. Richard and R. Moolenbeek. These authors did not publish anything about these shells.

RKK noticed in their chapter on *C. caillaudi* that the specimens from La Réunion had a different pattern.

K. hoaraui n. sp. has a paucispiral protoconch (our pl. 1 figs. 5 to 8), and therefore most probably has a non planktotrophic direct development. This explains its endemism in La Réunion Island. *K. hoaraui* has not been collected in Mauritius as far as we know. Specimens of the typical *K. caillaudi* with documented data all originate from Cargados Carajos Shoals. No shell has been collected in Mauritius itself (J. P. Vaulbert de Chantilly pers. comm.).

The depth of occurrence of the typical *K. caillaudi* is not documented while shells of *K. hoaraui* were collected in 110 or 120 m. and the shell from Saya de Malha bank in Danila's collection is from 160 m. deep.

K. malcolmi n. sp. seems even rarer (than *K. hoaraui* n. sp.) with only 2 specimens known in NHMUK. We could not locate any other specimen up till now. The available information about the circumstances of their collection is limited to the locality.



Fig. 6 - Distribution of the *Kioconus caillaudi* complex in the Western Indian Ocean

Abbreviations:

IRSNB: Institut Royal de Sciences Naturelles de Belgique, Brussels, Belgium

MNHN: Muséum National d'Histoire Naturelle, Paris, France.

MHNN: Muséum d'Histoire Naturelle de Nantes, Nantes, France

NHMUK: Natural History Museum, London, England.

SMNS: Staatliches Museum für Naturkunde, Stuttgart, Germany.

RKK: Manual of the Living Conidae, Vol. 1. Röckel, D., Korn, W. & Kohn, A.J.

GR: Georges Richard

JC: Jacques Colomb

GH: Guy Hoarau

TJ: Thierry Joly

JPVC: Jean Pierre Vaulbert de Chantilly

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The following Natural History Museums: MNHN (Virginie Héros, Philippe Bouchet), NHMUK (Kathie Way) & SMNS (Ira Richling) and collectors: Jacques Colomb, Philippe Potier, Thierry Joly and Jean Pierre Vaulbert de Chantilly for the loan or permission to study and photograph some specimens.

Gavin Malcolm for his kind help in photographing, measuring and obtaining all available data about the two known specimens of *K. malcolmi* in NHMUK and in revising this work. Georges Richard for fruitful discussions and advices.

Alain Robin for his help and photographs of most of the specimens.

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1 *K. hoarai* 11.5 mm La Réunion Paratype 7 MNHN
 2 *K. hoarai* 29.3 mm La Réunion Holotype MNHN
 3 *K. hoarai* 28.5 mm La Réunion Paratype 10 MNHN
 4 *K. hoarai* 34.7 mm La Réunion Paratype 9 MNHN

5 *K. hoarai* 5.6 mm La Réunion Paratype 2 MNHN
 6 *K. hoarai* 6.1 mm La Réunion Paratype 3 MNHN
 7 *K. hoarai* 6.5 mm La Réunion Paratype 4 MNHN
 8 *K. hoarai* 7.2 mm La Réunion Paratype 5 MNHN



1



2

3

4



5

- 1 *K. hoaraui* 17.0 mm St Paul, La Réunion 120 m Paratype 14 Coll. WF
 2 *K. hoaraui* 24.6 mm La Réunion Paratype 11 Coll. GH
 3 *K. hoaraui* 34.4 mm La Réunion Paratype 12 Coll. GH

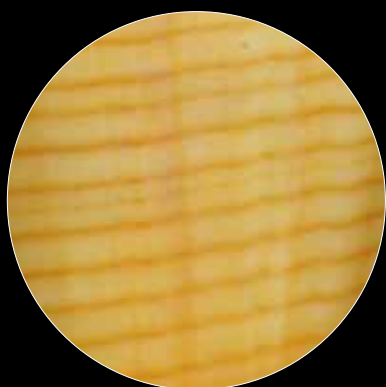
- 4 *K. hoaraui* 17.5 mm La Réunion Paratype 15 Coll. TJ
 5 *K. hoaraui* 36.0 mm La Réunion Paratype 13 Coll. JC



1



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5



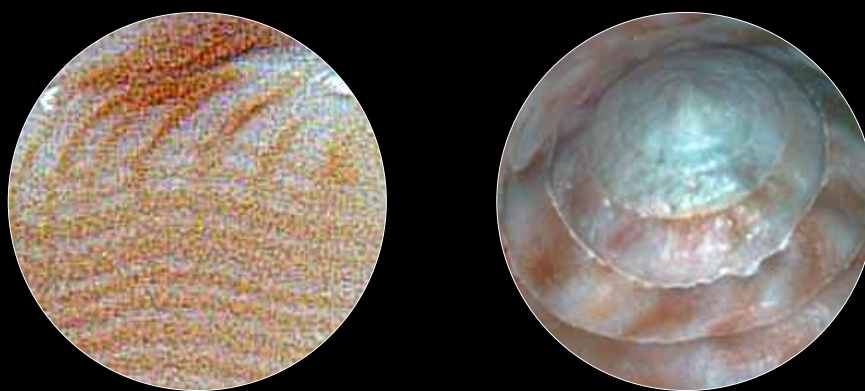
6

- 1 *K. caillaudi* 51.5mm Holotype MHNN
 2 *K. caillaudi* 34.4 mm "Mauritius" SMNS
 3 *K. caillaudi* 49.0 mm Cargados Coll. WF

- 4 *K. caillaudi* 47.8 mm Cargados Coll. JPVC
 5 *K. cf caillaudi* 29.9 mm Saya de Malha ? Coll. JPVC
 6 *K. cf caillaudi* 27.9 mm Saya de Malha Coll. TJ



1



2

1 *K. malcolmi* 39.0 mm Jeddah, Saudi Arabia
Holotype NHMUK

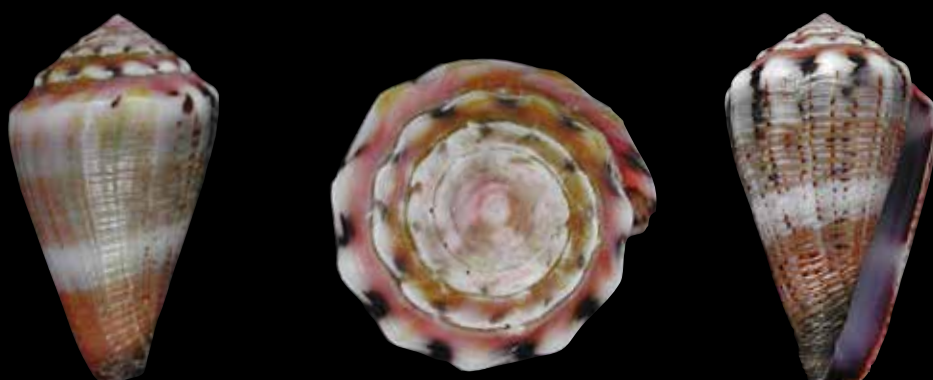
2 *K. malcolmi* 45.0 mm Jeddah, Saudi Arabia
Paratype 1 NHMUK



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4

- 1 *K. typhon* 37.3 mm Mozambique Coll.EM
- 2 *K. parvulus parvulus* 38.9 mm Palawan, Philippines Coll. EM
- 3 *K. parvulus meyeri* 37.8 mm Lavanono, Madagascar Coll. EM
- 4 *L. biliosus* 48.4 mm India Coll. EM

Additional informations on *Lividoconus conco* (Puillandre, Stöcklin, Favreau, Bianchi, Perret, Rivasseau, Limpalaër, Monnier, Bouchet, 2015) a new endemic cone from the Marquesas Islands

ERIC MONNIER & LOÏC LIMPALAËR

INTRODUCTION

Depuis plus de 250 ans, de nouvelles espèces animales sont décrites et peu de familles ont récemment autant attiré l'attention des chercheurs que les cônes. La découverte relativement récente des conopeptides et de leurs applications thérapeutiques fait que de plus en plus de scientifiques s'intéressent à cette famille. Si on estime que chaque espèce possède environ 200 toxines qui lui sont propres et qu'il existe environ un millier d'espèces de cônes, on arrive au nombre impressionnant d'environ 200 000 conopeptides ayant un potentiel pharmacologique; seules les araignées auraient plus de toxines que les Cônes, les serpents étant loin derrière.

Des spécimens originaires des Iles Marquises et d'une espèce voisine de *Lividoconus lividus* (Hwass in Bruguière, 1792) et de *L. sanguinolentus* (Quoy & Gaimard, 1833), ont attiré l'attention d'Eric Monnier, Loïc Limpalaër et Felix Lorenz qui ont décidé de le décrire; les caractéristiques conchyliologiques de ces coquilles laissant penser qu'elles constituait très vraisemblablement une espèce nouvelle.

Sous l'impulsion de Philippe Bouchet et sous la conduite de Nicolas Puillandre (MNHN), des spécimens récoltés vivants et congelés par Reto Stöcklin et son laboratoire Atheris ainsi que des coquilles vides provenant de nos collections personnelles, ont été étudiés sous différents aspects et par différentes méthodes : morphologie des coquilles, biogéographie, séquences ADN, ARN messager et acides aminés des conotoxines.

Il s'agit là d'une véritable première. Aucune espèce de mollusque n'avait jusqu'alors fait l'objet d'une étude intégrant autant de critères permettant de la différencier d'espèces voisines.

Toutes les méthodes utilisées convergent pour démontrer la validité d'une nouvelle espèce *Lividoconus conco* Puillandre & Al., 2015, endémique des Iles Marquises. Ces travaux ont été publiés dans un article paru dans *Molecular Phylogenetics and Evolution* de novembre 2014¹ par des chercheurs du Muséum d'Histoire Naturelle de Paris, du Laboratoire Atheris à Bernex-Genève, ainsi que les auteurs du présent article, complété par la publication originale du nouveau cône en janvier 2015. Proche de *Lividoconus lividus* et de *L. sanguinolentus*, cette nouvelle espèce en aurait divergé il y a environ 3 millions d'années.

Il nous a paru intéressant d'apporter à tous nos lecteurs et particulièrement aux amateurs des cônes des compléments d'information sous la forme d'une re-description de cette nouvelle espèce.

1 Nicolas Puillandre, Reto Stöcklin, Philippe Favreau, Estelle Bianchi, Frédéric Perret, Audrey Rivasseau, Loïc Limpalaër, Eric Monnier, Philippe Bouchet.

When everything converges: Integrative taxonomy with shell DNA and venom data reveals *Conus conco*, a new species of cone snails (Gastropoda: Conoidea) [Mol. Phylogenet. Evol. Vol. 80 (2014) 186-192]

INTRODUCTION

During the last 250 years, many new species have been described but few groups have recently attracted as much attention from researchers as cones. The relatively recent discovery of conopeptides and their therapeutic applications is of more and more interest to scientists. If we estimate that each species has about 200 toxins that are specific to it, that there are about a thousand species of cones, we reach the impressive number of nearly 200,000 conotoxins: only spiders have more toxins than Conidae, snakes being far behind.

Specimens from the Marquesas Islands belonging to the complex *Lividoconus lividus* (Hwass in Bruguière, 1792) and close to *L. sanguinolentus* (Quoy & Gaimard, 1833), drew the attention of Eric Monnier, Loïc Limpalaër and Felix Lorenz. Conchological characteristics of these shells led them to think it was an undescribed species.

Under the leadership of Philippe Bouchet (MNHN) and Nicolas Puillandre (MNHN), live specimens collected by Atheris Laboratories headed by Reto Stöcklin and dry shells from our own collections were studied from different aspects and with different methods: shell morphology, biogeography, DNA sequences, mRNA and amino acid conotoxins.

This is a real first. No species of mollusk had hitherto been the subject of such a study incorporating all criteria to differentiate it from its congeners.

The results of all the methods used, converged to demonstrate the validity of a new species *Conus conco* (Puillandre et al., 2015), endemic to the Marquesas Islands. These results were presented in an article published in *Molecular Phylogenetics and Evolution* of November 2014 by a team from the Natural History Museum of Paris (DNA) and Atheris Laboratory Bernex-Geneva (conotoxins) and the authors of this article. The original description of this new cone has been published in a supplementary paper dated January 2015 by the same publishing house.

The new species was included in the Genus *Conus* Linnaeus, 1758 in its original description. This is in cohesion with the recently published classification of the Conidae by Puillandre & al.² However, we consider that it is useful to recognize more genera in the family Conidae as it allows one to distinguish clades with different diets, ecology or geographical range. The genus *Lividoconus* Wils, 1970 is one clade that is recognized in molecular phylogenies, all the known radular teeth are similar, the diet is vermivorous, the range is mostly tropical Indo-Pacific with one species living in the tropical Eastern Pacific. Our concept of the genus also contains the species placed by Tucker & Tenorio (2009, 2013) in *Calamiconus* Tucker & Tenorio, 2009 as they have the same kind of radula and belong to the same molecular clade.

Close to *Lividoconus lividus* and *Lividoconus sanguinolentus* (Quoy & Gaimard, 1833), this new species diverged from

2 Puillandre, Duda, Meyer, Olivera & Bouchet 2014

them some 3 million years ago. Additional information, not in the original description has been edited and we use this opportunity to bring to our readers this additional information in the form of an updated, more comprehensive description of the new cone.

Abbreviations:

AL	Atheris Laboratories, Geneva
EM	Eric Monnier
FL	Felix Lorenz
LL	Loïc Limpalaër
MNHN	Muséum d'Histoire Naturelle, Paris

ABSTRACT. *Lividoconus conco* a new species belonging to the genus *Lividoconus* Wils, 1970 (Gastropoda, Conidae) is named. The shell is described. This species is endemic from the Marquesas Archipelago where it is common in shallow water. The new species is compared with other members of *Lividoconus*: *sanguinolentus* (Quoy & Gaimard, 1833), *lividus* (Hwass in Bruguière, 1792) and *diadema* (Sowerby I & II, 1834). We also distinguish the new species from *Virgiconus moreleti* (Crosse, 1858).

Lividoconus conco (Puillandre, Stöcklin, Favreau, Bianchi, Perret, Rivasseau, Limpalaër, Monnier, Bouchet, 2015)

Types: studied specimens

The measurements are given in millimeters.

N°	Length L	Deposition
1	52.12	Holotype MNHN (ex AL) Marquesas
2	45.67	Paratype 1 Coll. FL Nuku Hiva
3	45.56	Paratype 2 Coll. LL Tahuata
4	48.30	Paratype 3 Coll. LL Nuku Hiva
5	56.84	Paratype 4 Coll. LL Nuku Hiva
6	51.74	Paratype 5 Coll. LL Nuku Hiva
7	46.68	Paratype 6 Coll. LL Nuku Hiva
8	49.75	Paratype 7 Coll. EM Nuku Hiva
9	55.72	Paratype 8 Coll. EM Nuku Hiva
10	49.53	Paratype 9 Coll. EM Nuku Hiva
11	45.30	Paratype 10 Coll. EM Ua Pou
12	49.26	Paratype 11 Coll. FL Nuku Hiva
13	45.42	Paratype 12 coll. FL Nuku Hiva
14	41.35	Paratype 13 Coll. FL Nuku Hiva
15	37.40	Paratype 14 Coll. FL Nuku Hiva
16	45.92	Paratype 15 Coll. FL Nuku Hiva
17	49.72	Paratype 16 Coll. AL Nuku Hiva
Average	48.02	
Variance	4.787	

Type material:

Holotype:

The holotype is deposited in the Muséum National d'Histoire Naturelle de Paris : MNHN 23355 (ex Atheris MA 071111AF).

Paratypes:

The specimens numbered from 2 to 17 are the 16 paratypes of the new species.

Re-description:

Shell:

The shell is of medium size, ranging from 37.4 mm to 56.8 mm at adult stage. The shape of the last whorl is conical, very constant in PMD (average 0.96) and RD (average 0.63).

The spire is low, strongly tuberculate: the average RSH is 0.12. The number of tubercles on the last whorl varies from 10 to 11. The protoconch is eroded in all studied sample and the number of whorls remains unknown. From the best preserved specimens, it appears to be deep pink in color.

The adult shell has around 11 or 12 teleoconch whorls. The spire outline is straight with a pointed apex. The sutural ramp shows up to six irregular shallow spiral striae.

The last whorl profile is very slightly convex in the upper part of the last whorl and straight below. The shoulder is angular and tuberculate. The aperture slightly widens abapically.

The shell is smooth on the posterior half of the last whorl and is sculptured by widely separated narrow cords on the anterior part. The structure of the cords varies and in some specimens the shell is almost completely smooth. In others, the cords may be granulose.

The external color of the shell is almost constant. The spire is lavender to purple. The first teleoconch whorls may have brown dots between the tubercles. The last whorl has a lavender to mauve ground color overlaid with a plain beige coat missing in a wide diffuse mid-body pinkish band (3 to 6 mm broad) and at periphery. The anterior extremity is darker than the rest of the body whorl. The aperture is deep violet or blue with a paler band in the middle becoming lighter towards the interior.

Periostracum:

The periostracum is smooth, translucent and golden brown in color.

Living animal:

Although many specimens have been collected live and preserved, no description of the soft parts of the living animal is available.

Radula:

Radular teeth were extracted by Manuel Jimenez Tenorio from two specimens of the new species. One of these is the holotype. They are typical for the genus *Lividoconus* being long and narrow without visible serration.

Derivatio nominis:

The specific name is a masculine noun. It is taken from the "Conco" European Project which focuses on the study of the marine cone snail species *Conus consors* Sowerby I, 1833. This program aims at the production of innovative biomedical drugs. Atheris Laboratories, directed by Reto Stöcklin, coordinator of the program "Conco", provided the holotype and other specimens used in the toxicological and molecular studies.

Geographic range and habitat:

Type locality: In addition to Taioha'e bay, Nuku Hiva, Marquesas

Islands, the type locality, *Lividoconus conco* has also been collected in Ua Pou, Tahuata, and Ua Huka, and appears to be endemic to the Marquesas archipelago.

Habitat:

L. conco has been collected under stones in 8 meters depth in Tahuata and in crevices between 15 and 30 m. in Nuku Hiva (Alain Gaspard, pers. comm.)

Comparisons:

The new species belongs to the *Lividoconus lividus* (Hwass in Bruguière, 1792) complex together with *Lividoconus sanguinolentus* (Quoy & Gaimard, 1834) and *Lividoconus diadema* (Sowerby I & II, 1834). It is also similar to *Virgiconus moreleti* (Crosse, 1858).

Three of these species are widely distributed in the Indo-Pacific while *L. conco* is restricted to the Marquesas. *L. diadema* lives in the tropical Eastern Pacific.

We made measurements from sixteen specimens of *Lividoconus lividus* and fifteen specimens of *Lividoconus sanguinolentus* from various localities. After comparison with those of the new species we found that they cannot be separated by their overall shapes as shown in the graphs below.

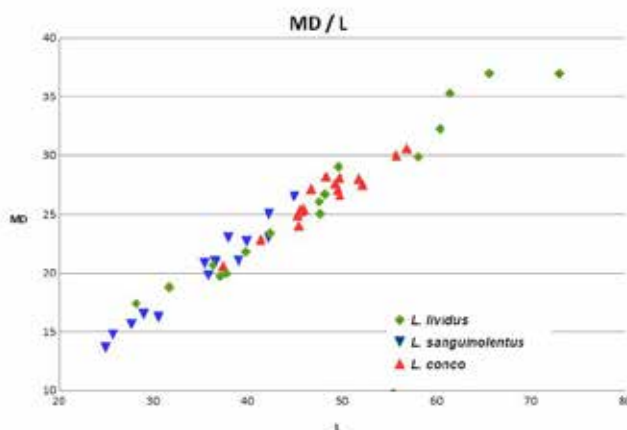


Fig. 1 - Maximum diameter / total length

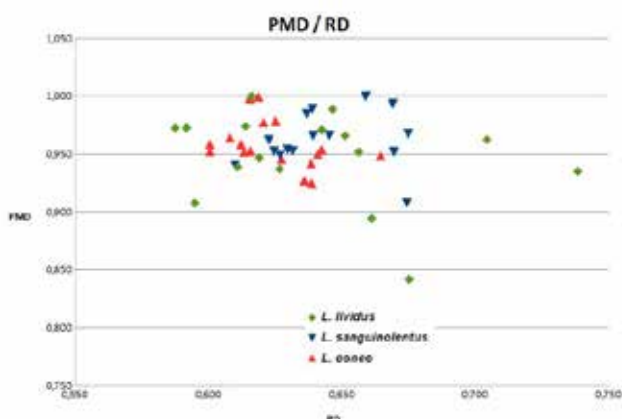


Fig.2 - Position of maximum diameter / Relative diameter

The only significant morphometric parameter that separates the three species is the adult size: *L. sanguinolentus* is the smallest species (average size of 35 mm.) while *L. lividus* reaches

bigger sizes up to 73 mm in our sample and 81 mm as maximal size in literature (Röckel Korn & Kohn, 1995). Our sample of *L. conco* is quite homogeneous in size with an average of 48 mm. One specimen illustrated in Röckel Korn & Kohn (1995 plate 4 fig. 12) reaches 61 mm.

The table below lists the size ranges (in mm.) of our samples: *L. lividus* differs from the *L. conco* by its color. The former is olive or yellowish brown. The spire and the shoulder are completely white. No shell of *L. lividus* shows a lavender to purple background color.

Species	L	MD	HMD	PMD	RSH
<i>conco</i>	48.02	26.44	40.55	0.96	0.12
<i>lividus</i>	47.79	26.25	39.20	0.95	0.13
<i>sanguinolentus</i>	35.22	20.06	30.02	0.96	0.12

L Length
MD Maximum Diameter
HMD Height of Maximum Diameter
PMD Position of Maximum Diameter of last whorl
PMD = HMD / AH
RSH Relative Spire Height RSH = (L-AH) / L

We could not find any indisputable reference to *Lividoconus lividus* in the Marquesas Archipelago where *L. sanguinolentus* is sympatric with *L. conco*.

L. sanguinolentus is generally smaller than *L. conco*. It also has brown spots between the spire tubercles. Pustules are more often present in the abapical cords. It never has the lavender to purple background color seen in the new species.

Lividoconus diadema is smaller than the new species: the size ranges from 25 to 53 mm (Walls, 1979). The shell texture is waxy and the colour is brown without any lavender or purple tinge. The interspaces between the tubercles of the spire are brown unlike *L. conco*. By its colour and size, *L. diadema* appears to be closer to *L. sanguinolentus* than to the new species. Finally, their distributional ranges are completely separate: the new species only occurs in the Marquesas Archipelago while *L. diadema* is a Panamic species ranging from the Gulf of California south to the Galapagos.

Virgiconus moreleti is distantly related to the new species. Radular characters and molecular studies place it into *Virgiconus* (Tucker & Tenorio, 2009; Duda & Kohn, 2005). The shell is consistently narrower with 13 to 15 crowded tubercles on the spire. Granulation is absent on the anterior part of the last whorl which is stained with a violet blotch. This species never has a lavender to purple background color.

Discussion:

The new species has been known for long and confused with *L. sanguinolentus* (in Röckel, Korn & Kohn, 1995) or *L. lividus* (in Richard, 1985 and Richard, 1990). It is sometimes sold by shell dealers under the name of *Conus unicolor* Sowerby I, 1833 which is also compared with *V. moreleti* by some authors. In the past, *L. conco* was also offered for sale under the name of *Conus prytanis* Sowerby III, 1882.

Conus unicolor Sowerby II, 1833. This taxon was named and figured in “Conchological Illustrations” without description and type locality. There is no type shell known. The type figure cannot be unambiguously identified with an extant population. In “Thesaurus Conchyliorum” Sowerby II gives a new illustration of the same shell (plate IV fig. 83) and publishes a diagnose under the number 18. The text describes the shell as elongate, “tinged with purple” and “crowned with distant nodules”.

It is unlikely that Sowerby could have Marquesan material at hand in 1833. Trondle and Von Cosel (2005) give a short history of the malacological exploration of the Marquesas Islands. The first visit by English explorers was that of Captain James Cook in 1774. There has been no report on the shells collected on that occasion and the material was sold when the ships returned in England. The next visit of an English expedition is that of Captain Edward Belcher in 1840. The shells collected during this expedition were described by Hinds in 1844. There is no mention of a member of the *Lividoconus* genus in Hinds’ reports. At the time when Sowerby described *C. unicolor* he could not have Marquesan material.

Kohn (1992) concluded that *C. unicolor* is a nomen dubium.

A different point of view is given by Richard (1985) who finds similarities between the type figure and shells originating from the Marquesas that are generally assigned to *V. moreleti*.

Our conclusion is that the type figure of *C. unicolor* agrees neither with *L. conco* which is not an elongated shell nor with *V. moreleti* which has crowded nodules on the spire.

In 1834, Sowerby II described another shell under the name of *unicolor*. It was renamed in 1841 as *Conus concolor* by the same author. This species has no relation to the present discussion.

Conus moreleti Crosse, 1858. The name was introduced as a nomen novum for *Conus elongatus* Reeve, 1843 which was preoccupied five times through different authors (see Filmer, 2001). Reeve renamed it *Conus oblitus* in 1849 in its supplement to the *Conus* monograph but this name was itself preoccupied by another fossil introduced two years before by Michelotti. Finally Crosse proposed an available name for the species in 1858. The lectotype figure is therefore the specimen illustrated in Reeve’s *Conchologia Iconica*. It is olive brown with a paler midbody band and a bluish white spire. Specimens with a brighter orange brown last whorl and lacking the paler band are also found throughout the species range and notably in the Marquesas Archipelago. These are sometimes called « *Conus unicolor* ». In our opinion these shells belong to *V. moreleti*. All these morphs are easily distinguished from *L. conco*.

Conus sanguinolentus Quoy & Gaimard, 1834.

The name was introduced on the basis of the description of the soft parts of a juvenile specimen collected in Carteret, today Kavieng, New Ireland, Papua New Guinea. The shell is not present in MNHN where the Quoy and Gaimard collection is preserved. Kohn (1992) stated that Quoy and Gaimard confused *Virgiconus flavidus* (Lamarck, 1810) with *L. lividus*. Their description of the shell and the animal of *Conus sanguinolentus* does not allow a clear separation from the true *L. lividus*. However, Kohn designates the figure of Quoy and Gaimard (Voyage de découvertes de l’Astrolabe, Atlas, pl. 53 fig. 18) as representation of the lectotype of *L. sanguinolentus*. He then concludes that *L. sanguinolentus* is a valid species referring to the species redescription by Cernohorsky (1964). In this work it is characterized by the plain brown colour without pale

midbody band (in most shells) on the last whorl, the purple interior of aperture without white midbody band and a spire with white tubercles separated by brown areas.

Richard (1985, 1990) considers that *C. sanguinolentus* is a strict synonym of *L. lividus* from a nomenclatorial point of view: his opinion is that the young animal studied by Quoy and Gaimard is indeed an individual of *L. lividus*. He also considers that there is only one species involved from the taxonomic perspective, the differences in shell characters and pattern being insufficient to recognize two taxa.

From the material we examined, we concur with Kohn and Cernohorsky that their concept of *Lividoconus sanguinolentus* is a distinct species. It is very constant in shape and colour pattern throughout its range which covers the entire Indo-Pacific including the Marquesas Archipelago where it is sympatric with *L. conco*.

However it is easily distinguished by its smaller size, the different color of the last whorl and the presence of brown spots between the spire tubercles. We have not seen any intermediate shell from any locality. The species is distributed across the entire Indo-Pacific.

Conus lividus Hwass in Bruguière, 1792. This species is clearly defined by the existence of a lectotype deposited in MHNG. None of the synonyms usually attributed to this species (Walls, 1979; Röckel, Korn & Kohn, 1995) would represent the new species. It is distributed across the whole Indo-Pacific. Among the material we examined we did not identify any shell belonging to this species originating from the Marquesas.

Walls (1979 p. 399) explains that the Marquesan variant of *L. lividus* – which is our *L. conco* – was commonly sold by dealers under the name of *Conus prythanis* Sowerby III, 1882. From the original description and examination of the type figure, this taxon is synonymous with *L. diadema*. More interesting is the fact that Walls had already noticed the peculiar population of *L. lividus* from the Marquesas to which he devotes 5 lines of text within the discussion of *L. diadema*. His conclusion is that it is only a variant of the former.

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1 *Lividoconus conco* 52.1 mm Nuku Hiva , Marquesas Islands
Holotype MNHN
2 *L. conco* 45.3 mm Ua Pou Paratype 10 Coll. EM

3 *L. conco* 55.7 mm Nuku Hiva Paratype 8 Coll. EM
4 *L. conco* 17.2 mm Nuku Hiva subadult Coll. EM
5 *L. conco* 49.5 mm Nuku Hiva Paratype 9 Coll. EM
6 *L. conco* 49.8 mm Nuku Hiva Paratype 7 Coll. EM



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|---|--|
| 1 <i>L. lividus</i> 39.8 mm Sainte Marie Island, Madagascar Coll.EM | 5 <i>L. sanguinolentus</i> 52.8 mm Taiohae, Nuku Hiva Coll. EM |
| 2 <i>L. lividus</i> 28.2 mm Tahiti Coll.EM | 6 <i>L. sanguinolentus</i> 39.2 mm Marquesas Isl. Coll. EM |
| 3 Holotype figured of <i>L. sanguinolentus</i> | 7 <i>L. sanguinolentus</i> 34.7 mm Solomon Islands Coll. EM |
| 4 <i>L. sanguinolentus</i> 35.4 mm Tahiti Coll. EM | 8 <i>L. sanguinolentus</i> 42.2 mm Ste Marie Isl., Madagascar Coll. EM |



- 1 *Virgiconus moreleti* 41.2 mm Marquesas Isl.
- 2 *Virgiconus moreleti* 33.3 mm Marquesas Isl. Coll. EM
- 3 *Virgiconus moreleti* 36.6 mm Marquesas Isl. Coll. EM

- 4 *Lividoconus diadema* 42.2 mm Jalisco, Mexico Coll. EM

Le groupe *Volvarina angustata* (Sowerby, 1846) dans l'Océan Indien septentrional

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MOTS-CLÉ

Marginellidae, *Volvarina*, *Prunum*, Océan Indien septentrional, faune téthysienne, radiation, espèces jumelles.

RÉSUMÉ

Les espèces *Volvarina angustata* (Sowerby, 1846), *V. verreauxi* (Jousseaume, 1875) et *V. mabellae* (Melvill & Standen, 1901), sont révisées et associées dans un groupe *V. angustata*. Trois espèces nouvelles sont décrites dans ce même groupe : *V. cingalica* sp. nov., *V. bifurcata* sp. nov. et *V. somwangi* sp. nov. Le groupe d'espèces *V. angustata* semble constituer une radiation restreinte à l'Océan Indien septentrional, des côtes occidentales de la péninsule indienne jusqu'au détroit de Malacca. Les affinités de ce groupe avec la faune atlantique sont soulignées.

ABSTRACT

The species *Volvarina angustata* (Sowerby, 1846), *V. verreauxi* (Jousseaume, 1875) and *V. mabellae* (Melvill & Standen, 1901), are revised and gathered in a group *V. angustata*. Three new species are described in this same complex: *V. cingalica* sp. nov., *V. bifurcata* sp. nov. and *V. somwangi* sp. nov. The complex *V. angustata* seems to be a radiation restricted to the northern Indian Ocean, from the east coast of India to the Malacca Straits. Affinities of this group with the Atlantic fauna are highlighted.

INTRODUCTION

Si l'on excepte la région périphérique d'Afrique du Sud, d'ailleurs largement autonome sur le plan biogéographique, la faune des Marginellidae de l'Océan Indien reste très peu documentée et n'a fait l'objet d'aucun travail de révision jusqu'aux récents travaux de l'auteur sur quelques groupes représentatifs de *Glabella* (BOYER, 2014) et de *Volvarina* (BOYER, 2015a) de l'Océan Indien occidental, ainsi que sur les *Hydroginella* des Mascareignes (BOYER, 2015b). Dans sa révision du « complexe *Volvarina micans* », BOYER (2015a) signalait l'étude entreprise sur un « groupe *V. angustata* (Sowerby, 1846) », bien différencié des autres groupes de *Volvarina* représentés dans l'Océan Indien et confiné dans la partie septentrionale de celui-ci. Le présent article rend compte de cette étude sur le groupe *V. angustata*.

Trois espèces anciennement décrites et partiellement sympatriques sont réunies ici dans un groupe de formes affines supposées entretenir des relations phylétiques plus ou moins étroites, et font l'objet d'une révision : *V. angustata* (Sowerby, 1846), *V. verreauxi* (Jousseaume, 1875) et *V. mabellae* (Melvill & Standen, 1901). Dans le cours de l'étude, trois espèces nouvelles ont par ailleurs

été reconnues dans ce groupe et elles sont décrites ici.

Le placement générique de *V. angustata* est resté controversé jusqu'à très récemment. Décrite par SOWERBY (1846) dans le genre indiscriminé *Marginella*, l'espèce a connu par la suite plusieurs affectations. JOUSSEAUME (1875) l'a placée dans son genre *Bullata* lors de la création de celui-ci, à côté d'un assemblage hétéroclite de 11 autres taxa relevant pour la plupart d'entre eux de genres aussi divers que *Gibberula* Swainson, 1840, *Granulina* Jousseaume, 1888 ou *Ovaginella* Laseyron, 1957. Parmi ces 12 taxa, seuls *Voluta bullata* Born, 1778 (espèce-type de *Bullata* Jousseaume, 1875 par tautonymie) et son synonyme *Marginella cuvieri* Deshayes, 1855 (fide TOMLIN, 1917 : 261) semblent pouvoir être valablement maintenus dans le genre *Bullata*, dont *V. bullata* Born est l'espèce-type. *Marginella angustata* Sowerby, 1846 et *Bullata verreauxi* Jousseaume, 1875, dont les caractères morphologiques de la coquille diffèrent notablement de ceux attribués à *Bullata*, ne semblent pas pouvoir être maintenus dans ce genre, malgré la similitude présentée dans le système de décoration et qui pourrait résulter d'une simple convergence, ou bien constituer un caractère ancestral non-significatif d'une parenté proche au sein du complexe *Volvarina/Prunum*.

Dans leur révision des radulas du type « *Volvarina/Prunum* » (plaques radulaires en peigne à cuspides subégales ou « type 6 »), COOVERT & COOVERT (1990 : 3-4) placent *M. angustata* dans le genre *Cryptospira* Hinds, 1844, alors que la radula de cette espèce ne diffère en rien des radulas les plus communes dans les genres *Volvarina* Hinds, 1844 et *Prunum* Herrmannsen, 1852. Bien que sa motivation ne soit pas explicitée, il semble que ce placement dans *Cryptospira* soit dû aux ressemblances du système de décoration de *M. angustata* avec le système représenté chez certaines espèces de *Cryptospira*, notamment chez *C. elegans* (Gmelin, 1791), distribuée autour de la péninsule malaise. Comme en ce qui concerne la comparaison avec le genre *Bullata*, les caractères morphologiques de la coquille de *M. angustata* diffèrent notablement de ceux attribués à *Cryptospira* (espèce-type : *M. tricineta* Hinds, 1844), qui constitue de ce point de vue un groupe très homogène. Pour cette raison, le placement de *M. angustata* dans le genre *Cryptospira* ne semble pas pouvoir être maintenu, malgré les similitudes représentées dans le système de décoration, qui là encore ne sont pas nécessairement significatives d'une parenté proche.

Dans leur révision du genre *Bullata*, DE SOUZA & COOVERT (2001 : 2) confirment le placement de *M. angustata* dans *Cryptospira*, en attribuant implicitement à la coquille de cette espèce les « caractères partagés » représentatifs du

genre *Cryptospira*. Force est de constater que cette démonstration allusive ne tient pas, dans la mesure où plusieurs de ces prétendus « caractères partagés » ne sont pas partagés (comme les plis columellaires plus forts, plus nombreux et occupant plus de la moitié de l'ouverture, représentatifs des *Cryptospira* mais non de *M. angustata*, ou le cal étendu sur le dernier tour dans le prolongement de la varice labiale, qui est représenté chez *M. angustata* mais jamais chez les *Cryptospira*), ou partagés entre plusieurs genres et constituant de manière évidente un caractère ancestral non-significatif d'une relation proche (comme le fort cal fasciolaire souvent présent chez *M. angustata*, parfois présent chez certaines *Cryptospira*, et tout aussi fréquemment présent chez divers *Prunum* de la province ouest-africaine, de la province caraïbe ou de la province panaméenne).

Dans sa révision du genre *Cryptospira*, WAKEFIELD (2010 : 5) exclut formellement *M. angustata* et *M. mabellae* de ce genre, principalement sur la base de leurs plis columellaires jugés typiques des genres *Volvarina* et *Prunum*, et foncièrement différents de la morphologie et du positionnement des plis columellaires chez *Cryptospira*.

Dans la littérature, *M. angustata* comme *M. mabellae* sont souvent placées dans le genre *Volvarina* ou dans le genre *Prunum*, sans démonstration à l'appui. La différenciation entre les genres *Volvarina* et *Prunum* restant imprécise (BOYER, 2015a : 1-2), on propose de placer à titre provisoire *M. angustata* et les espèces affines dans le genre *Volvarina*, qui est le plus anciennement créé et mérite la préséance à ce titre.

V. verreauxi est rarement citée ou représentée dans la littérature, et elle est le plus souvent considérée, de manière tacite ou explicite, comme un synonyme de *V. angustata*. La description de JOUSSEAUME (1875 : 88-89) livre pourtant une diagnose comparative très claire sur l'originalité de *V. verreauxi*, dont le statut de bonne espèce est confirmé ci-dessous.

MATERIEL ET METHODES.

Les collections publiques consultées dans le cadre de cette étude sont celles du Muséum d'Histoire Naturelle de Paris, du British Museum et du Mauritius Institute.

Outre la collection de l'auteur, plusieurs importantes collections privées ont été consultées, et différents contributeurs cités en fin d'article ont consenti des prêts de matériel ainsi que la communication de documents utiles.

L'étude du groupe *V. angustata* n'a pas donné lieu à des investigations de terrain, et le chromatisme des animaux vivants n'a pas pu être documenté. La seule espèce du groupe documentée pour la radula est *V. angustata* (opus cité).

Abréviations:

MNHN : Muséum national d'Histoire naturelle, Paris.

NHM : British Museum, Londres.

Coq = coquille collectée vide

Spm = spécimen collecté vivant

Ad = adulte

Juv = juvénile.

L = longueur.

CFB : collection de l'auteur.

SYSTEMATIQUE.

Genre *Volvarina* Hinds, 1844

Espèce-type : *Marginella nitida* Hinds, 1844 (désignation subséquente par Redfield, 1874), synonyme plus récent de *Voluta mitrella* Risso, 1826.

Volvarina angustata (Sowerby, 1846) (Figs 1-3, 5-10, 29-31, 35-40).

Références originales :

Marginella angustata Sowerby, 1846, Thes. Conch., I, p. 399, pl. 77, figs 169-170. Origine : From the East Indies.

Matériel type :

Le matériel type n'a pas été localisé au British Museum. Il ne peut toutefois être considéré comme disparu avant un examen approfondi d'autres collections britanniques où il pourrait avoir été déposé, de façon éventuellement non-intentionnelle ou non-répertoriée.



Fig. 1 - *V. angustata*, 3 coq. ad. Sur plaquette (L = 22,2 mm ; 25,0 mm ; 21,0 mm), "Indian Ocean", NHM.

Autre matériel examiné :

MNHN : nombreux spécimens de différentes collections, « Indes » ou sans localité.

NHM : nombreux spécimens, attribués aux « East Indies », ou à « India », ou sans localité. Le lot apparemment le plus ancien est constitué par 3 coquilles montés sur une tablette (Fig. 1) qui porte deux mentions de localité contradictoires : « Indian Ocean » et « Brazils », la seconde paraissant être la plus ancienne. Le sujet présenté en face ventrale pourrait avoir servi de modèle aux figures de REEVE (1864 : pl. 13, figs 55 a & b), qui attribue précisément la localité « Brazil, Mus. Cuming » à sa *Marginella angustata*.

Mauritius Institute : 1 coq ad, Port Louis, Maurice, "from excavated sediments".

CFB : 7 spm ad, Gulf of Mannar, nord-ouest Ceylan, chalutages par 20-40 m (Figs 8-10) ; 2 coq ad, Jaffna, nord Ceylan (Figs 35-37 et 38-40) ; 2 coq ad, Trincomalee, nord-est Ceylan ; 1 spm ad, Kadar, Cuddalore, 20 m (Figs 3, 5-7) ; 2 spm ad, Cuddalore ; 6 cod ad, Madras ; 3 coq ad, Madras ; 1 cod ad, Port Blair, Andaman Island ; 6 spm ad, Mergui Archipelago, Myanmar, 10-15 m in muddy sand ; 1 coq ad, Phuket, 20 m (Figs 29-31).

Collection Maurice Jay : plusieurs spécimens collectés

par 40 m sous blocs en plongée-bouteille, ouest de la Réunion (Fig. 2).



Fig. 2 - *V. angustata* (L = 17,0 mm), La Réunion, 40 m, collection M. Jay.

Localité-type :

Compte-tenu des mentions les plus fréquentes dans les collections publiques, il paraît approprié de considérer que « East Indies » constitue une localité-type valide.

Description originale :

« *M. elongato-ovali, pallidè rubrâ vel crimeâ, lineis rubris interruptis fasciatim cinctâ ; spirâ celatâ ; aperturâ elongatâ, ad apicem extensâ ; columellâ posticâ et anticâ callosâ, plicis tribus, quarum anticâ unicâ magnâ, penè duplicatâ ; labio externo crasso, albo, extûs rubro, latè et tenuiter expanso.*

From the East Indies ».



Fig. 3 - *V. angustata*, détail (23,8 x 13,5 mm), Kadar, Cud-dalore, 20 m, CFB.

Animal :

Non-documenté.

Radula rachiglosse modifié du type 6, plaques en peigne et cuspides subégaux, classique du complexe *Volvarina/Prunum* (COOVERT & COOVERT, 1990 : 3-4).

Distribution et bathymétrie :

V. angustata semble être abondante dans le sud-est de l'Inde et dans le nord de Ceylan, de la ligne de marée basse jusqu'à 40 m, enfouie dans le sable sous blocs ou en milieu sablo-vaseux. L'espèce semble être moins abondante dans les zones périphériques de sa distribution, avec des signalements jusqu'à Goa (DAVID, 2013) et Bombay à l'ouest, et jusqu'aux Andaman, la Birmanie, Phuket et Singapour à l'est. La présence de l'espèce au sud de Ceylan reste à confirmer. Les localités aberrantes sont discutées ci-dessous.

Remarques :

La morphologie du labre est originale chez *V. angustata* et elle constitue un caractère distinct important qui n'a pas été pris en compte dans la description originale. Ce labre présente dans sa section une rupture de pente très anguleuse, formant une crête séparative entre le méplat ventral lisse et blanc et un cal de couleur beige à orangée qui s'étend en nappe sur le revers dorsal (Figs 3, 6, 30, 36, 39). Un sillon longitudinal en forme de gouttière profonde borde la crête du labre, et quelques autres sillons en gouttière moins prononcés sont parfois distribués sur le reste du cal.

L'espèce se montre remarquablement homogène sur le plan conchyliologique dans l'ensemble de sa zone de distribution. La taille de la coquille varie de 12,5 mm à 25 mm pour les sujets adultes. Il semble que les formes à bandes beiges, grises ou gris-bleu sur fond blanchâtre ou beige-rosé (Figs 5-7, 35-40) soient représentatives des zones centrales de la distribution : elles correspondent à la forme typique de l'espèce, parfaitement représentée par les trois coquilles illustrées du British Museum (Fig. 1). Une forme jaune-crème prévaut dans la partie méridionale du Golfe de Mannar (nord-ouest de Ceylan) (Figs 8-10) et une forme crème-rosé prévaut au large de la Birmanie.

Des spécimens censés provenir « d'Afrique de l'Est » ont été observés dans certaines collections : ces spécimens sont parfaitement conformes à la forme type rencontrée dans le sud-est de l'Inde et leur origine prétendue n'est pas probante. En revanche, l'espèce a été collectée avec certitude dans les Mascareignes. Si la coquille examinée au Mauritius Institute a été indubitablement collectée dans les darses de Port-Louis, il n'est pas certain qu'elle constitue le reste d'un animal qui a vécu dans le secteur. On ne peut exclure en effet que la coquille ait fait l'objet d'un transport accidentel dans une cargaison en provenance de Colombo ou du sud-est de l'Inde, qui entretiennent des échanges maritimes intensifs avec Maurice. Mais la récolte de spécimens vivants par 40 m en plongée-bouteille au large de la Réunion a bien été vérifiée par Maurice Jay et ne fait aucun doute. De par leur coloris jaunâtre (Fig. 2), ces spécimens de la Réunion rappellent la population rencontrée dans le nord-ouest de Ceylan, et ils pourraient provenir de Colombo ou de la côte occidentale de l'Inde. On doit considérer que *V. angustata* peut essaimer grâce aux transports maritimes et faire souche localement, au moins pour un certain temps.

***Volvarina verreauxi* (Jousseaume, 1875) (Figs 4, 14-16).**

Références originales :

Bullata verreauxi Jousseaume, 1875, Coquilles..., pp. 88-89, pl. 8, fig. 3. Origine : Ceylan.

Matériel type :

Cinq syntypes MNHN : sont désignés ici un lectotype MNHN-IM-2000-1463 (Fig. 4), 12,15 x 6,10 mm, et quatre paralectotypes MNHN-IM-2000-30030 (12,10 x 6,10 mm, 11,00 x 5,85 mm, 11,10 x 5,85 mm, 10,65 x 5,55 mm).

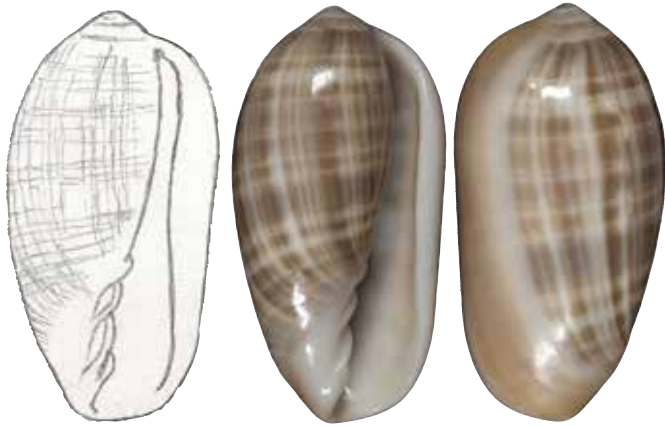


Fig. 4 - *V. verreauxi*, lectotype MNHN (12,15 x 6,10 mm), sans localité (Photos MNHN).

Autre matériel examiné :

MNHN : 2 spm ad, sans localité, collection Jousseaume ; 2 spm ad étiquetés « var. major », sans localité, collection Jousseaume ; 1 coq ad, Ceylan, collection Letellier ; 3 coq ad, Andaman Is, East Indies, collection Staadt ; 3 coq ad, Ceylan, anonyme.

CFB : 6 spm ad, Trincomalee, nord-est Ceylan, sur sable ; 1 coq ad, Jaffna ; 2 coq ad, Inde ; 3 coq ad, Port Blair, Andaman.

Localité-type :

Ceylan.

Description originale :

« Testa ovato-oblonga, solidiuscula, laevigata, cinereo-alba caerulescente-griseo strigata et fasciata ; spira parva, parum exserta, anfractibus 4 superne declivi-tumidis ; apertura angustata, labro latissime calloso, purpureo-fuscescente in medium inflexo, columella quadriplicata. Long. 12 ; larg. 6 ; épais. 5 mill.

Hab. Ceylan ».

Animal :

Non-documenté.

Distribution et bathymétrie :

V. verreauxi semble détenir une distribution plus restreinte que celle de *V. angustata*, avec laquelle elle est régulièrement collectée en sympatrie. *V. verreauxi* n'est connue que du nord/nord-est de Ceylan, du sud-est de l'Inde et des Andaman, à l'exclusion des autres zones dans lesquelles *V. angustata* est rencontrée. Néanmoins

V. verreauxi constitue une espèce jumelle de *V. angustata*, difficile à séparer de celle-ci si l'on s'en tient à la silhouette générale et au système de décoration en treillis du dernier tour, et il est donc très probable que des spécimens de *V. verreauxi* détenus dans les collections ou cités dans la littérature ont été identifiés sous le nom plus ancien et plus usité de *V. angustata*. Il est possible de ce fait que la fréquence de *V. verreauxi* comme l'étendue de sa distribution restent sous-estimées.

La bathymétrie de *V. verreauxi* n'est pas documentée, mais les éléments détenus suggèrent que l'espèce est confinée dans les petits fonds.

Remarques :

Dans le commentaire de sa description, JOUSSEAUME (1875 : 89) compare la nouvelle espèce *V. verreauxi* avec *V. angustata*, en indiquant quelques points de différence importants : « Obs. – Cette espèce se distingue de la Marg. *angustata* par sa taille plus petite, sa spire apparente, son bord externe plus mince ne présentant jamais sur la callosité le sillon longitudinal que l'on observe dans la Marg. *angustata* ».

Le facteur de taille n'apparaît en réalité pas être un facteur réellement discriminant entre les deux espèces. Il est vrai que la taille moyenne de *V. angustata* est sensiblement supérieure à celle de *V. verreauxi*, mais la plage de variation de la taille se recouvre partiellement pour les deux espèces (L = de 12,5 à 25 mm pour *V. angustata*, versus L = 9,4 à 18,5 mm pour *V. verreauxi*). C'est-à-dire que certains sujets attribuables à *V. verreauxi* sont plus grands que certains sujets attribuables de *V. angustata*, y compris dans des situations de syntopie. Par exemple dans notre matériel de Jaffna, où le spécimen de *V. verreauxi* (L = 18,5 mm) est plus grand que les deux spécimens de *V. angustata* (L = 17,4 et 17,6 mm) collectés en syntopie. A l'inverse de notre matériel des Andaman, où le spécimen de *V. angustata* (L = 14,9 mm) est plus grand que les trois spécimens de *V. verreauxi* (L = de 11,7 à 14,0 mm) collectés en syntopie.

En revanche les deux autres caractères indiqués par Jousseaume sont réellement discriminants.

Les spécimens de *V. verreauxi* possèdent une spire courte en téton, bien dégagée et jamais ennoyée, même partiellement, par l'insertion du labre ou par le cal dorsal qui accompagne celui-ci (Figs 4, 14, 16). Les spécimens de *V. angustata* ne montrent jamais de spire apparente, la spire étant déprimée et la protoconque étant recouverte par une insertion du labre placée très haut. Aucun spécimen examiné ne présente de caractère intermédiaire.

D'autre part, la partie externe du labre de *V. verreauxi* présente une forme très arrondie dans le sens spiral, sans cal étendu en direction du dos et sans aucun sillon longitudinal (Fig. 15). Sur certains sujets de *V. verreauxi*, deux très faibles ruptures de pente sont discernables dans la section du labre externe, l'une d'elles étant homologue à la crête observée chez *V. angustata*, et l'autre étant homologue à l'embranchement classiquement observé à



Figs 5-7 : *V. angustata* (23,8 x 13,5 mm), Kadar, Cuddalore, 20 m, CFB.

Figs 8-10 : *V. angustata* (23,6 x 13,7 mm), Gulf of Mannar, nord-ouest Ceylan, 20-40 m, CFB.

Figs 11-13 : *V. mabellae* (27,3 x 11,5 mm), Gulf of Mannar, nord-ouest Ceylan, CFB.



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Figs 14-16 : *V. verreauxi* (12,8 x 7,0 mm), Trincomalee, nord-est Ceylan, CFB.

Figs 17-19 : *V. cingalica* sp. nov., holotype MNHN (16,8 x 8,9 mm), Mirissa, sud Ceylan.

Figs 20-22 : *V. bifurcata* sp. nov., holotype MNHN (16,3 x 9,6 mm), Gulf of Mannar, nord-ouest Ceylan, 20-40 m.



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Figs 23-25 : *V. somwangi* sp. nov., holotype MNHN (12,8 x 6,8 mm), Racha Island, Phuket, 25 m.

Figs 26-28 : *V. somwangi* sp. nov. (12,9 x 6,8 mm), Racha Island, Phuket, CFB.

Figs 29-31 : *V. angustata* (17,5 x 9,8 mm), Phuket, 20 m, CFB.



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34



35



36



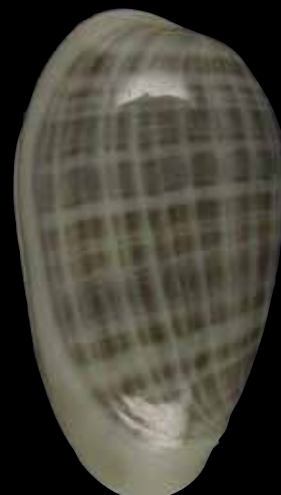
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Figs 32-34 : *V. somwangi* sp. nov. (16,5 x 8,7 mm), Jaffna, nord Ceylan, CFB.

Figs 35-37 : *V. angustata* (17,3 x 9,8 mm), Jaffna, nord Ceylan, CFB.

Figs 38-40 : *V. angustata* (17,2 x 9,8 mm), Jaffna, nord Ceylan, CFB.

la jonction du bourrelet labial externe et de la surface du dernier tour chez la plupart des groupes de Marginellidae. On note aussi que *V. verreauxi* présente une moitié supérieure du labre régulièrement arquée, là où *V. angustata* présente une rupture de pente plus ou moins prononcée. On note enfin que la tendance à la formation d'un cal important à gauche des plis columellaires et dans la partie postérieure de la face ventrale, souvent observée chez *V. angustata*, n'est jamais exprimée chez *V. verreauxi*. La coloration de la coquille se montre beaucoup moins variable chez *V. verreauxi* que chez *V. angustata*, et les coloris relatés par Jousseume demandent à être corrigés. Le labre externe de *V. verreauxi* tire sur le crème ou l'orangé plutôt que sur le brun-violet, le reste du dernier tour présentant un treillis bistre ou gris-kaki plutôt que gris-bleu, sur fond blanchâtre gris-beige. On n'observe pas de différences significatives entre les deux espèces pour ce qui concerne la forme et l'organisation des plis columellaires.

***Volvarina mabellae* (Melvill & Standen, 1901) (Figs 11-13).**

Références originales :

Marginella (Cryptospira) mabellae Melvill & Standen, 1901, The Mollusca of the Persian Gulf..., p. 425, pl. 23, fig. 20. Origine : Arabian Sea, off Indian coast.

Matériel type :

Un spécimen-type au NHM (L = 16,55 mm), Reg. N° 1901.12.9.141, étiqueté « mabellae Melv + Stand Arabian Sea ». Le commentaire des auteurs induit que l'espèce a été fondée sur un seul spécimen. La morphologie de la coquille-type correspondant assez correctement à la figure-type de Melvill et Standen, et la taille de cette coquille correspondant parfaitement à la taille donnée dans la description, le type du NHM doit être considéré comme l'holotype de l'espèce.

Autre matériel examiné :

CFB : 4 spm ad (Figs 11-13), Mannar, nord-ouest Ceylan, chalutage par 20-40 m ; 2 spm ad, au large de Pondichéry, + 100 ft (35-40 m), dans coquilles vides remontées par filets.

Localité-type :

Ici désignée comme « Côte occidentale de l'Inde ».

Description originale :

« *M. testa nitida, oblonga, pallide straminea, solida ; anfractibus quatuor, supernis callositate fere celatis, ultimo obscurissime spiraliter bicincto ; apertura angusta, oblonga, straminea, labro extus fere recto, albo, nitidissimo, callositate crassa ochracea dorsaliter marginata ; columella alba, late callo tenui nitente contecta, quadriplicata.* »
Long. 16,50, lat. 6mm.
Hab. Arabian Sea, off Indian coast, lat. 18° 43' N., long. 71° 43' E ».

Animal :

Non-documenté.

Distribution et bathymétrie :

V. mabellae est signalée de la façade occidentale jusqu'au sud-est de l'Inde, mais la distribution de l'espèce reste mal documentée, du fait que celle-ci est manifestement cantonnée dans l'infralittoral inférieur (20-40 m) et n'atteint pas les petits fonds. La localité type est située au large de Bombay, où le spécimen-type a été récolté à l'état d'épave cimentée sur un vieux câble de télégraphe. C'est apparemment la localité la plus occidentale mentionnée pour l'espèce.

Remarques :

La variabilité de *V. mabellae* reste mal documentée. Les populations connues du Golfe de Mannar et du sud-est de l'Inde se montrent très homogènes sur le plan de la morphologie et de la décoration (Figs 11-13), ainsi que pour la dimension des coquilles adultes (22,0 à 23,0 mm). Pour la partie nord-est de la Mer d'Arabie, l'holotype de l'espèce semble attester de la présence d'une population de bien plus petite taille (L = 16,55 mm) et qui présente une forte callosité sur la face ventrale, celle-ci formant une varice longitudinale prononcée sur le bord gauche. Ce port « étalé » de la face ventrale dans la forme typique de *V. mabellae* est homologue à ce qui est observé chez plusieurs espèces de *Volvarina/Prunum* atlantiques.

V. mabellae montre des affinités évidentes avec *V. angustata*, particulièrement avec la forme de *V. angustata* observée du Golfe de Mannar (Figs 8-10). Celle-ci présente comme *V. mabellae* une couleur de fond jaune-crème pâle, avec une décoration en treillis brun-orangé léger peu soutenue d'où émergent deux bandes spirales plus nettes, dans la même position que les deux bandes suggérées chez certains spécimens de *V. mabellae* (Figs 11-13). La population de *V. angustata* du Golfe de Mannar présente aussi un cal labial externe orangé étendu et épais, qui s'interrompt sur le dernier tour en formant un effet de marche assez net, au contraire de ce qui est observé dans les populations de *V. angustata* du Golfe du Bengale, dont le cal labial externe est moins épais et s'amincit progressivement vers son bord (Figs 5-7, 35-40). *V. mabellae* se distingue de cette population de *V. angustata* du Golfe de Mannar par quelques caractères constants : une silhouette plus étroite et plus cylindrique, le haut du labre plus relevé, un cal ventral important, le cal labial plus épais et plus étendu sur la partie antérieure du dos, une base plus arrondie, les deux premiers plis columellaires plus forts que chez *V. angustata* et non-fusionnés, les deux plis suivants plus menus que chez *V. angustata*, un contraste des couleurs plus important, avec un dos blanc crème portant deux bandes spirales orangées à peine suggérées et un dessin longitudinal pratiquement obsolète, un cal ventral blanc porcelainé et un labre externe d'un orange soutenu. On note que des spécimens entièrement blancs existent chez *V. mabellae* (un spécimen in CFB).

Compte tenu, d'une part des affinités observées entre *V. mabellae* et la population de *V. angustata* du Golfe de Mannar, d'autre part de la distribution géographique des deux espèces, centrée sur le sud-ouest de l'Inde pour *V. mabellae* et centrée sur le Golfe du Bengale occidental pour *V. angustata*, il paraît très probable que *V. mabellae* et cette population de *V. angustata* dérivent l'une de l'autre, et que l'isolement reproductif propice à la spéciation ait pu être favorisé par les périodes de fermeture du détroit du « Pont d'Adam » qui borde le Golfe de Mannar au nord-est et contrôle une grande partie des échanges faunistiques entre le sud-ouest et le sud-est de l'Inde.

On observe par ailleurs des similitudes notables de *V. mabellae* avec plusieurs groupes de *Prunum* atlantiques, en particulier avec le groupe *P. marginatum*, dans lequel les espèces *P. cinctum* (Kiener, 1834), distribué dans la région sénégalaise, et *P. marginatum* (Born, 1778), distribué de la région guyanaise jusqu'au Venezuela, semblent constituer avec *V. mabellae* un cline de formes relativement continu.

***Volvarina cingalica* sp. nov. (Figs 17-19).**

Matériel type :

Un holotype MNHN-IM-2000-28393 (16,8 x 8,9 mm) (Figs 17-19), 9 paratypes CFB (L = 15,5 à 18,2 mm) et 5 paratypes Collection D. Gratecap (L = 15 à 17 mm), tous de la localité-type.

Autre matériel examiné :

CFB : 3 spm ad, Tangale, sud-Ceylan (L = 17,6 à 19,6 mm).
Collection A. Wakefield : 2 spm ad, Tangale, sud-Ceylan (L = 18,4 et 18,6 mm).

Localité-type :

Mirissa, sud-Ceylan, anse-Est, 2 m sous blocs.

Description originale :

Coquille ovale élancée, spire très basse, apex faiblement bombé, base arrondie, labre très peu flexueux, quasi-rectiligne, les deux premiers plis columellaires sont fusionnés, le premier étant beaucoup plus petit, plus fin et presque caché sous le second pli, les deux plis supérieurs, obliques et bien séparés, sont de taille décroissante ; cal labial externe peu protubérant, large, arrondi et parfaitement lisse, sa section présentant une très faible rupture de pente au niveau de sa crête, et une rupture de pente insignifiante à la jonction du labre et de la surface dorsale, sans phénomène d'embranchement. La spire est parme clair, la protoconque est ambrée, le dernier tour porte un très fin treillis rose parme vineux sur fond mauve crème clair, avec trois bandes spirales mauve-brun larges et plus soutenues, la zone des plis columellaires est blanchâtre, le labre externe porte la même décoration que le dernier tour, avec une zone longitudinale rose crème soutenue et assez large courant de part et d'autre de la crête labiale.

Animal :

Non-documenté.

Distribution et bathymétrie :

V. cingalica sp. nov. n'est connue que des petits fonds sur les côtes méridionales de Ceylan. Il s'agit néanmoins d'une région très peu prospectée, que ce soit en snorkeling ou en plongée-bouteille, et d'où ne sont pas rapportées de récoltes par dragage ou par chalutage. La distribution bathymétrique de *V. cingalica* reste donc à documenter.

En revanche, il semble acquis que l'espèce n'est pas représentée sur les côtes de la moitié nord de Ceylan, sa forme n'étant pas signalée dans les quelques récoltes connues de Colombo, de Mannar, de Jaffna et de Trincomalee. *V. cingalica* présente ainsi les caractères d'un endémisme assez restreint.

Remarques :

V. cingalica n'est connue qu'à travers deux populations distantes d'environ 40 km en ligne directe, toutefois la coquille de l'espèce apparaît comme étant remarquablement homogène sur le plan morphologique comme sur le plan de la décoration.

V. cingalica présente des similitudes évidentes avec *V. verreauxi* (Figs 14-19), notamment par la présence d'une spire dégagée et d'un bourrelet labial de section à près lisse et arrondie. Néanmoins *V. cingalica* présente des différences importantes et constantes avec *V. verreauxi*, dont elle se distingue par un apex émoussé et coloré, versus un apex blanc en téton, une silhouette plus cylindrique versus subpyriforme, une base arrondie versus une base légèrement tronquée, un labre quasi-rectiligne versus un labre flexueux, une coloration générale tirant sur le parme vineux avec crête labiale rose crème, versus gris-kaki sur fond blanchâtre pour le corps et blanc cassé à blanc jaunâtre pour le bourrelet labial, et trois bandes spirales régulièrement disposées sur le dernier tour de *V. cingalica*, versus un grand nombre de lignes et de bandes irrégulières chez *V. verreauxi*.

Si de manière évidente *V. verreauxi* et *V. cingalica* présentent plus de caractères partagés entre elles qu'avec *V. angustata*, il semble que *V. verreauxi* soit plus proche parente avec *V. angustata*, avec qui elle partage le même système de décoration et les mêmes coloris. Compte tenu de ces éléments et de l'endémisme restreint constaté pour *V. cingalica* au sud de Ceylan, il est vraisemblable que celle-ci soit une descendante isolée en position méridionale de l'espèce *V. verreauxi* apparemment confinée dans la moitié occidentale du Golfe du Bengale.

Etymologie :

D'après le nom de l'île de Ceylan dont l'espèce paraît être endémique.

***Volvarina bifurcata* sp. nov. (Figs 20-22).**

Matériel type :

Un holotype MNHN-IM-2000-30031 (16,3 x 9,6 mm) (Figs 20-22) et 6 paratypes CFB (L = 14,5 à 19,0 mm), tous de la localité-type.

Autre matériel examiné :

Néant.

Localité-type :

Golfe de Mannar, nord-ouest de Ceylan, 20-40 m.

Description originale :

Coquille épaisse et inflatée, silhouette ovale arrondie, spire concave, entièrement recouverte par l'insertion du labre, labre épais, non-flexueux, les deux premiers plis columellaires sont subégaux, fusionnés et forme une excroissance saillante dans l'ouverture, le premier légèrement plus petit et situé sur le même plan que le second, les deux plis supérieurs, obliques et bien séparés, sont nettement plus petits et de taille décroissante ; bourrelet labial massif, boursoufflé, formant un emmarchement important au-dessus de la surface du dernier tour. Le dernier tour est corne crème clair tirant sur le rosé et porte trois bandes spirales corne-orangé peu soutenues et de largeur modérée, les deux premiers plis columellaires et la partie ventrale du labre jusqu'à sa crête sont blanc porcelainé, la partie dorsale du labre et le sillon étroitement incisé qui le borde sont orange léger.

Animal :

Non-documenté.

Distribution et bathymétrie :

V. bifurcata sp. nov. n'est connue que de la localité type. Elle n'a jamais été signalée dans les récoltes des petits fonds et semble donc restreinte à l'infralittoral inférieur. Compte-tenu de l'absence de signalement de cette forme originale dans le matériel chaluté dans le sud-ouest comme dans le sud-est de l'Inde, il semble que la distribution de l'espèce soit limitée au Golfe de Mannar.

Remarques :

Malgré l'originalité de ses caractères conchyliologiques dans l'Océan Indien, *V. bifurcata* présente quelques caractères qui la rattache de manière claire, bien qu'indirecte, à *V. angustata*. Les caractères partagés sont principalement l'insertion du labre recouvrant la spire en formant un cal épais, et les deux premiers plis columellaires fusionnés, la fusion étant moins complète chez *V. bifurcata* et le premier pli étant moins ténu et plus dégagé. Pour les autres caractères, les différences entre les deux espèces sont notables, s'agissant notamment du bourrelet labial épais et boursoufflé avec fort emmarchement dorsal chez *V. bifurcata*, versus labre à méplat ventral, crête saillante, cal dorsal étendu et sillons longitudinaux en large gout-

tière chez *V. angustata*. En outre *V. angustata* présente une tendance marquée à la formation d'un cal épais à gauche des plis columellaires, caractère apparemment absent chez *V. bifurcata*. Enfin *V. angustata* présente un système de décoration en treillis qui n'est pas suggéré chez *V. bifurcata*.

La forme jaune pâle de *V. angustata* collectée en sympatrie avec *V. bifurcata* dans le Golfe de Mannar présente un treillis faiblement marqué et une teinte de fond crème jaunâtre peu éloignée de la teinte de fond crème rosé rencontrée chez *V. bifurcata*. Cette ressemblance superficielle pourrait procéder d'une convergence adaptative pour des espèces soumises au même type de pression dans le même milieu de plateau sablonneux, et ne rend pas nécessairement compte d'une grande proximité phylogénétique, même si les deux espèces sont manifestement apparentées et si la population de *V. angustata* du Golfe de Mannar est la candidate la plus vraisemblable à un débranchement initial avec la lignée de *V. bifurcata*.

La ressemblance de *V. bifurcata* avec les espèces du genre *Closia* Gray, 1857 représentées dans l'Océan Indien semble n'être que superficielle. La ressemblance porte essentiellement sur la silhouette trapue, inflatée et arrondie de la coquille, le cal protubérant formé à l'arrière de la face ventrale, le bourrelet labial fort et boursoufflé, une couleur de fond allant du corne beige au rose crème ou au jaune orangé, avec bandes spirales peu nombreuses, assez larges et mais peu prononcées. Les différences principales entre *V. bifurcata* et les *Closia* de l'Océan Indien résident dans une morphologie de coquille plus déprimée dans le sens dorso-ventral chez *V. bifurcata* que chez les *Closia*, les deux premiers plis columellaires bifides et protubérants chez *V. bifurcata*, alors qu'ils sont nettement séparés et non-protubérants chez les *Closia*, et l'absence de dents labiales chez *V. bifurcata*, toujours présentes et prononcées chez les *Closia*. On observe néanmoins que l'espèce brésilienne *Bullata largillieri* (Kiener, 1841), bien que présentant un système de décoration en flocons blancs sur fond beige corne, détient pour le reste des caractères conchyliologiques intermédiaires entre *V. bifurcata* et les *Closia* de l'Océan Indien, la morphologie générale de sa coquille, y compris les fines dents labiales et la forme du cal ventral postérieur, la rapprochant fortement des *Closia*, mais la forme des plis columellaires la rapprochant fortement de *V. bifurcata*. Bien que des phénomènes de convergence adaptative ne soit pas à exclure dans le cas précis, l'hypothèse d'espèces relictées provenant d'une même lignée téthysienne méritera d'être testée, à travers un travail comparatif portant notamment sur la morphologie des animaux, leur anatomie et leur signature moléculaire.

Etymologie :

D'après l'organisation bifide semi-fusionnée des deux premiers plis columellaires.

***Volvarina somwangi* sp. nov. (Figs 23-28, 32-34).**

Matériel type :

Un holotype MNHN-IM-2000-28391 (12,8 x 6,8 mm) (Figs 23-25) et 2 paratypes CFB (L = 11,9 et 13,2 mm), tous de la localité-type.

Autre matériel examiné :

CFB : 3 spm ad, Racha Island, Phuket, plongée-bouteille (Figs 26-28) ; 1 coq ad, Jaffna (Figs 32-34) ; 1 coq ad, Magaa Kandu, Ari Atoll, Maldives, 25 m dans grotte. Collection H. Dekker : 4 spm ad, Racha Island, Phuket. Collection A. Nora : 2 spm ad, Racha Island, Phuket.

Localité-type :

Racha Island, Phuket, Thaïlande, 25 m.

Description originale :

Coquille légère, subovale et élancée, atténuée vers la base, spire très courte et menue, en téton, partiellement ennoyée par l'insertion latérale du labre, labre fin, non-flexueux, les deux premiers plis columellaires sont fusionnés, le second beaucoup plus fort que le premier et cachant presque celui-ci, les deux plis supérieurs, obliques et bien séparés, sont nettement plus petits que le second pli et de taille décroissante ; labre très mince, limité à un méplat ventral, non-épaissi et interrompu sans emmarchement au niveau d'une rupture de pente marquée qui forme une crête longitudinale tout le long de la coquille. Le dernier tour est beige très clair et porte huit lignes ou bandes spirales brun-rosé, la cinquième à partir du haut étant nettement plus large que les autres et se trouvant située en position médiane sur la face ventrale, le méplat labial est blanc.

Animal :

Non-documenté.

Distribution et bathymétrie :

V. somwangi sp. nov. présente une distribution étendue, qui s'étend des Maldives jusqu'à la partie orientale du Golfe du Bengale. L'espèce semble être plutôt implantée dans l'infra-littoral intermédiaire et elle semble n'être que rarement ou jamais présente dans les petits fonds. La coquille examinée de Jaffna pourrait tout aussi bien avoir été ramassée en épave sur une plage ou récoltée en snorkeling dans les petits fonds que remontée de fonds plus importants par des filets de pêcheurs.

Remarques :

V. somwangi présente des caractères conchyliologiques très proches de ceux de *V. angustata*, dont elle pourrait être considérée être une espèce jumelle de plus petite taille. *V. somwangi* partage avec *V. angustata* la silhouette générale de la coquille, la forme des plis columellaires et la silhouette biseautée du labre. Elle s'en différencie par une coquille beaucoup plus légère et de taille inférieure,

un apex partiellement dégagé et une insertion du labre plus basse, un labre plus mince dont le cal ne se prolonge pas sur le dos de la coquille et ne porte pas de sillons en gouttière, des plis columellaires plus fins et un système de bandes spirales plus étroites, non-recoupées par des fascies longitudinales.

Certains spécimens de *V. somwangi* peuvent néanmoins présenter une taille, une morphologie et un système de décoration qui les rapprochent de spécimens de *V. angustata* collectées en sympatrie : c'est le cas dans le matériel étudié de Jaffna (Figs 32-40), où une coquille de *V. somwangi* de grande taille (L = 16,5 mm) à l'apex ennoyé, montrant un léger voile calleux sur le dernier tour dans le prolongement du labre et présentant quelques lignes de croissance éparses, pourrait être aisément confondue avec un spécimen de *V. angustata* de taille peu supérieure, présentant une insertion du labre quasiment identique et portant une décoration rose-brun avec lignes de croissance dispersées. Néanmoins, même dans ce cas, la coquille de *V. somwangi* (Figs 32-34) se distingue de sa jumelle chez *V. angustata* (Figs 35-37) par une coquille plus légère à la silhouette plus étroite et plus élancée, des plis columellaires nettement plus fins, une simple rupture de pente avec très léger emmarchement mais sans sillon en gouttière derrière la crête labiale, l'absence de cal épais débordant sur le dernier tour, et un système de bandes spirales globalement plus étroites, plus espacées et disposées plus régulièrement. Le spécimen rosé de *V. angustata* se montre en définitive plus proche d'un spécimen conspécifique d'allure classique collecté en sympatrie (Figs 38-40) que de la grande coquille de *V. somwangi* (Figs 32-34).

De manière habituelle, les spécimens de *V. somwangi* sont nettement divergents de ceux de *V. angustata* collectés en sympatrie, comme c'est par exemple le cas à Phuket (comparer les spécimens de *V. somwangi* des Figs 23-28 avec le spécimen de *V. angustata* des Figs 29-31).

On observe une importante variation de *V. somwangi* dans la taille, tout au moins au plan géographique. Les tailles extrêmes connues s'échelonnent de 10,0 mm (coquille des Maldives) à 16,5 mm (Jaffna).

Etymologie :

D'après le nom de Somwang Patamakanthin (Phuket, Thaïlande), qui a découvert l'espèce dès 1982 et a communiqué les premiers spécimens à Henk Dekker et à Antonio Nora en 2000, puis des compléments documentaires à l'auteur en 2002.

DISCUSSION.

Les six espèces révisées ou décrites ici de l'Océan Indien septentrional offrent toutes les caractéristiques d'un groupe d'espèces prochainement apparentées, qui semble détenir plus d'affinités avec certaines espèces et certains groupes atlantiques qu'avec d'autres groupes de l'Indo-Pacifique. On fait ici l'hypothèse d'une radiation articulée en plusieurs périodes et organisée de part et d'autre de

la péninsule cingalaise au gré des régressions marines, des périodes d'isolement de stocks, et des déplacements de faune. *V. angustata* possède le plus de traits partagés avec les autres espèces du groupe et pourrait constituer l'espèce-pivot de celui-ci. Pour le Récent, on distingue deux sous-groupes de plus grande affinité : un sous-groupe occidental composé de la forme jaune de *V. angustata*, de *V. mabellae* et de *V. bifurcata* ; un sous-groupe oriental composé de la forme grise de *V. angustata*, de *V. verreauxi*, de *V. cingalica* et de *V. somwangi*. La divergence des espèces actuelles semble être plus ancienne dans le sous-groupe occidental et plus récente dans le sous-groupe oriental, où la filiation *V. angustata*/*V. somwangi* et la filiation *V. verreauxi*/*V. cingalica* semblent être assez directes.

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