New data on the endemic Cones (Gastropoda, Conidae) of Angola, with the description of new species

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ABSTRACT
Recent researches along the South Angolan coast has allowed for a better understanding of a number of *taxa* and populations of endemic cone snails, and brought to light some previously undescribed species, three of which are described in the present paper: *Varioconus inesae* sp. nov., *Varioconus medvedevi* sp. nov. and *Varioconus petuchi* sp. nov. Additionally, a redescription of the *taxon Varioconus variegatus* (Kiener, 1845) is presented and documented with direct field observations.

INTRODUCTION
Rolán & Röckel (2000) have pointed out the scarcity of information on Angolan endemic Cones, reflected in the total absence of descriptions of such species from 1758 to mid-19th century (the first described *taxon* for an endemic Angolan Cone was *Conus bulbus* Reeve, 1843); before the 20th century, less than ten such *taxa* were described, by Reeve, Kiener, Sowerby and Melvill. Even these descriptions were quite poor as for localities, specimens having probably been brought to Europe by sailors, without precise information as to their actual places of collection. In 1905, Sowerby described yet another new species and then we had to wait until the mid-1970s for others to be published by Trovão (two new *taxa* described by Paes da Franca (1957) proved to be synonyms of previously described ones). Trovão's descriptions were based on samples collected by diving expeditions organized in the 1960s by the Centro Português de Actividades Subaquáticas (CPAS). Further information was obtained during the following decade, mainly through the efforts of Francisco Fernandes, a keen diver and collector who lived in Luanda for many years until his untimely death. This added information enabled Rolán & Röckel (2000, 2001) to publish a revision of the endemic Angolan Cones, in which a total of 25 species were considered valid, including 9 described as new.

There are several reasons for the overall difficulty in obtaining samples from Angolan populations that would allow for a fuller understanding of the local endemics. Angola has a long coastline of about 1600 km, with many relatively sheltered bays where different populations thrive. Human population density in the entire territory is low (about 15 inhabitants per square kilometre, in a country that extends for about 1,250,000 km^2) and more than half of the entire population live in the cities, the capital, Luanda alone counting about 5 million inhabitants. On the other hand, the succession of armed conflicts that raged in the country from the beginning of the 1960s to 2002, obviously made travelling to and within the territory rather hazardous.

More recently, a number of collectors – such as David Pirinhas, José Rosado and Christfried Schoenherr – have once again started to explore the coastal waters of Angola, particularly along the provinces of Namibe and Benguela, looking for populations of Cones. Inevitably, several previously unknown species have been found, while new data enable us to shed a new light on the distribution and variation of known ones.

Most endemic species of Cones from Angola are included in genus *Varioconus* da Motta, 1991a, the only exception being *Pseudonoduloconus carnalis* (G. B. Sowerby III, 1879), ascribed to the monotypic genus *Pseudonoduloconus* Tucker & Tenorio, 2009.

The shell of species in genus *Varioconus* are characterised by whorl tops that do not have cords; the body is not very elongated; the shoulders are rounded and not very distinct; the anal notch is shallow; periostracum is smooth and thin; operculum is moderate to small in size; the protoconch is paucispiral. In the radular tooth of *Varioconus* species a basal spur is present; the blade is long, almost as long as the anterior section of the tooth; the anterior section of the tooth is usually shorter than the posterior section of the tooth; serrations usually form only one or two rows; the barb is short (adapted from Tucker & Tenorio (2009)).

In the present paper *Varioconus inesae* sp. nov., *Varioconus medvedevi* sp. nov. and *Varioconus petuchi* sp. nov. are described as new species and compared to other endemic *Varioconus* species found along the Angolan coast. Additionally, an accurate redescription of *Varioconus variegatus* (Kiener, 1845) is included.

MATERIAL AND METHODS
The supraspecific taxonomy used in the present article follows Tucker & Tenorio (2009).

ABBREVIATIONS

Museums and Institutions

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

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

MNHNA: Museu Nacional de História Natural de Angola, Luanda, Angola.

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

Other

AJM: António J. Monteiro reference collection, Lisboa, Portugal.

CMLA: Carlos M. L. Afonso reference collection, Algarve, Portugal.

MJT: Manuel J. Tenorio reference collection, Jerez, Spain.

JR: José Rosado reference collection, Maputo, Mozambique.

DP: David Pirinhas reference collection, Algarve, Portugal.
ER: Emilio Rolán, Vigo, Spain.

Shell morphometry		*Radular morphometry*	
L	maximum shell length	**D**	teeth present in radular sac
RD	relative diameter	**LC/DR**	shell length/radular tooth length
RSH	relative spire height	**DR/PA**	radular tooth size/anterior section length
HMD	height of the maximum diameter	**100F/PA**	100 x blade length/anterior section length
PMD	relative position of the maximum diameter	**d in S**	number of denticles in serration.

Sampling

All specimens were sampled by snorkel or while scuba diving in shallow water, 0.5 to 12 m depth. Specimens were preserved in 96% ethanol for further analyses.

Morphometric analyses of the shell

We describe shell morphology using the terminology established in Röckel, Korn & Kohn (1995). For morphometric comparisons, a number of shells of the new species, randomly selected among specimens in the type series and in the reference collections of the authors, were measured with a digital caliper to the nearest 0.1 millimeter. For comparison purposes, morphometric parameters for the new species and other related *taxa* from Angola taken from Rolán & Röckel (2000) and Rolán & Röckel (2001) are listed in Table 1. The differences among the morphometric parameters of the shells of the different species were not statistically tested.

Radular preparations

We use the terminology for radular morphology of Tucker & Tenorio (2009), and abbreviations from Rolán (1992), Rolán & Raybaudi-Massilia (1994a, 1994b), and Rolán & Raybaudi-Massilia (2002). The dissected radular sac, or the entire specimen preserved in ethanol was digested in concentrated aqueous KOH for 24 h. The resulting mixture was then placed in a petri dish and examined with the binocular microscope. The entire radula was removed with fine tweezers and rinsed with distilled water, mounted on a slide using Aquatex (Merck) Mounting Medium, and examined under the optical microscope. Photos were obtained with a CCD camera attached to the microscope. Line drawings were made from the photos. For comparison purposes, the radular teeth of a number of other endemic Angolan cones were studied. Many other radulae from *Varioconus* species are illustrated in Monteiro *et al*. (2004). Most of these radular studies were from the radula collection of Dr. Emilio Rolán (Vigo, Spain). For comparison purposes, morphometric parameters of the radular teeth for the new species and other related *taxa* from Angola are listed in Table 2. The differences among the morphometric parameters of the radular teeth of the different species were not statistically tested.

SYSTEMATIC STUDY

Family CONIDAE Fleming, 1822

Genus *Varioconus* da Motta, 1991a

Varioconus inesae sp. nov. (Plate 1, Figs. 1 – 6)

Type material: Holotype: 31.0 x 16.7 mm (Plate 1, Figs. 2a – 2b), MNCN; Paratype 1: 27.8 x 15.1 mm (Plate 1, Figs. 1a – 1b), MNHN; Paratype 2: 30.0 x 16.2 mm (Plate 1, Fig. 3a – 3b), USNM; Paratype 3: 28.6 x 15.6 mm (Plate 1, Fig. 5), coll. MJT; Paratype 4: 29.3 x 15.4 mm (Plate 1, Fig. 5), coll. JR; Paratype 5: 36.3 x 18.6 mm (Plate 1, Fig. 4a – 4b), coll. AJM. One paratype (unnumbered) will be deposited at the MNHNA, Luanda, Angola. Additional paratypes (unnumbered) in the reference collections of the authors, and of Sandro Gori (Livorno, Italy) and Armando Verdasca (Lisbon, Portugal).

Other material examined: Between 30 and 40 live taken specimens have been studied.

Type locality: Cabo Santa Marta in the Namibe Province, Angola, Southern Angola, West Africa (coordinates 13º 52.500' S, 12º 25.700' E)

Distribution and habitat: The new species is found at Capins and Cabo Santa Marta, where it is more abundant (Fig. 1). It also occurs, in lesser densities, at Baía do Calongo, São Nicolau and Piscinas; it is also found along the Namibe Province in southern Angola. *V. inesae* sp. nov. is found from 3 to 12 meters deep usually on top of rock slabs or half buried in rock fissures, in rough waters. It has been observed in sympatry with several other endemic *Varioconus* species but mainly *V.* cf. *bulbus* (Reeve, 1843), *V. chytreus* (Tryon, 1884), *V. variegatus* (Kiener, 1845) and *V. zebroides* (Kiener, 1845).

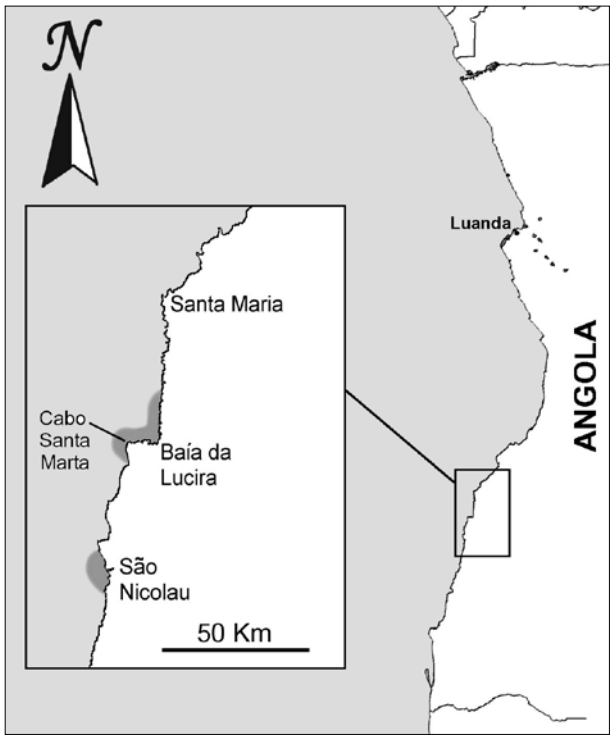

Fig 1.- Type locality and known geographical distribution of *Varioconus inesae* sp. nov. along the coast of Angola.

Etymology: The new species is named after Inês Faleiro Pirinhas, daughter of the fifth author.

Taxon	L (mm)	RD	RSH	PMD
inesae sp. nov.	25 – 36	0.59 – 0.63	0.10 – 0.16	0.81 – 0.85
franciscoi	30 – 38	0.65 – 0.70	0.10 – 0.16	0.75 – 0.81
babaensis	17 – 32	0.67 – 0.71	0.09 – 0.14	0.70 – 0.80
flavusalbus	18 – 24	0.66 – 0.72	0.04 – 0.15	0.73 – 0.80
filmeri	23 – 33	0.68 – 0.72	0.09 – 0.14	0.74 – 0.80
anabelae	18 – 29	0.66 – 0.73	0.07 – 0.14	0.76 – 0.80
medvedevi sp. nov.	23 – 29	0.61 – 0.64	0.13 – 0.16	0.80 – 0.85
nobrei	12 – 20	0.69 – 0.73	0.10 – 0.16	0.71 – 0.77
bocagei	20 – 32	0.67 – 0.78	0.12 – 0.20	0.69 – 0.77
africanus	17 – 25	0.65 – 0.72	0.11 – 0.18	0.70 – 0.75
tenuilineatus	18 – 29	0.54 – 0.61	0.09 – 0.14	0.76 – 0.82
petuchi sp. nov.	28 – 33	0.67 – 0.76	0.09 – 0.17	0.73 – 0.82
bulbus	16 – 25	0.63 – 0.71	0.07 – 0.19	0.66 – 0.71
zebroides	28 – 51	0.64 – 0.70	0.07 – 0.17	0.74 – 0.80
lineopunctatus	23 – 38	0.65 – 0.76	0.11 – 0.18	0.72 – 0.78
trovaoi	25 – 44	0.67 – 0.71	0.09 – 0.16	0.73 – 0.81
variegatus	18 – 26	0.60 – 0.72	0.08 – 0.17	0.70 – 0.76
micropunctatus	25 – 35	0.63 – 0.68	0.08 – 0.17	0.75 – 0.79
chytreus	19 – 32	0.62 – 0.71	0.08 – 0.16	0.69 – 0.72

Table 1.- Morphometric parameters of the shells of the *Varioconus* species discussed in the present work.

TAXON	D	d in S	LC/DR	DR/PA	100F/PA	Reference
inesae sp.nov.	26	34 – 38	50	1.90 – 1.95	75 – 80	This work
franciscoi	40 – 61	30 – 43	43 – 57	1.7 – 1.8		Rolán & Röckel, 2000
babaensis	48 – 78	27 – 38	40 – 55	1.71 – 2.09	51 – 74	Rolán & Röckel, 2001
flavusalbus	40	15 – 18	45 – 64	2.1 – 2.3	71 – 80	Rolán & Röckel, 2000
filmeri	55 – 108	22	56 – 69	2.1 – 2.3	71 – 82	Rolán & Röckel, 2000
anabelae	70 – 100	13 – 20	52 – 60	2.01 – 2.25	70 – 76	Rolán & Röckel, 2001
medvedevi sp. nov.	40	34 – 36	51	2.2 – 2.3	85	This work
nobrei		18	34 – 38	2.14	73	Rolán & Röckel, 2000
bocagei	50 – 60	22 – 30	48 – 63	2.0 – 2.1	80	Rolán & Röckel, 2000
africanus	72 – 96	13 – 20	46 – 58	2.1 – 2.4	82	Rolán & Röckel, 2000
tenuilineatus	48 – 58	19 – 21	38 – 43	1.93 – 1.98	80	Rolán & Röckel, 2001
petuchi sp. nov.	85	10 – 11	103 – 104	2.4 – 2.5	-	This work
lineopunctatus (=neoguttatus)	80 – 90	-	90 – 155	2.7 – 3.0	-	Rolán & Röckel, 2000
trovaoi	103 – 123	0 – 16	113 – 141	2.4 – 3.1	-	Rolán & Röckel, 2000
bulbus	58 – 63	15 – 29	40 – 59	1.9 – 2.2	80	Rolán & Röckel, 2000
zebroides	55 – 118	10 – 27	51 – 97	2.0 – 3.6	-	Rolán & Röckel, 2000
variegatus	53 – 80	21 – 30	47 – 62	2.0 – 2.2	70 – 80	Rolán & Röckel, 2000
micropunctatus	52 – 73	15 – 28	32 – 68	2.0 – 2.3	65 – 75	Rolán & Röckel, 2000
chytreus	52 – 71	17 – 26	39 – 60	1.8 – 2.0	55 – 68	Rolán & Röckel, 2000

Table 2.- Morphometric parameters of the radular teeth of the *Varioconus* species discussed in the present work.

Description of the shell: Morphometric parameters: L = 25 – 36 mm; average L = 30.3 mm; RD = 0.59 – 0.63; RSH = 0.10 – 0.16; PMD = 0.81– 0.85.

Shell moderately small, solid. Last whorl ventricosely conical, elongated. Profile more or less straight, rounded shoulder. Spire low to moderately high, slightly convex, teleoconch whorls smooth; protoconch and first whorls typically eroded. Last whorl smooth, often with visible marks of previous lips. Periostracum yellow. The shell is usually light brown to brown but dirty white and dark brown shells are known; usually the brown color is not uniform, forming spiral bands or lines of different hues; in some cases these spiral bands can be almost white. The spiral ramps are of the same color as the last whorl of the teleoconch, sometimes somewhat lighter, except near the suture. The interior of the aperture is violet, fading towards the anterior end; the interior of the lip is white. The operculum is small, elongated.

Living animal and radula: The living animal is dark red. Radular tooth examined for the holotype (Fig. 2A). 26 teeth in radular sac. Radular tooth slender, medium-sized (LC/DR = 50) with the anterior section longer than the half of the total tooth length (DR/PA = 1.90 – 1.95). Waist evident. Blade almost indistinctive, covering most of the anterior part (100F/PA = 75 – 80 %). 34 to 38 sharp denticles present in serration, arranged in one row in the apical portion, becoming 2 to 3 rows below, ending in a rounded terminating cusp. Basal spur present.

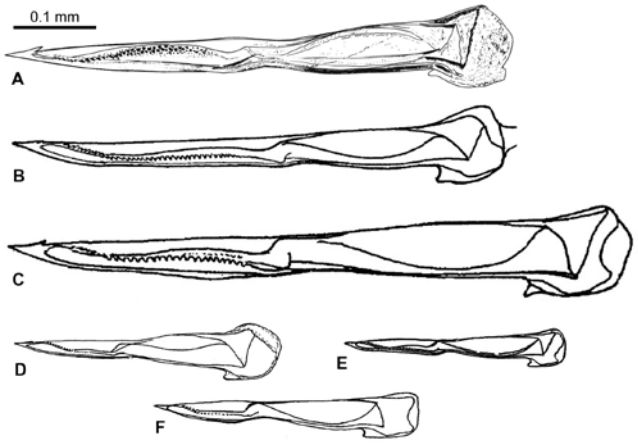

Fig. 2.- Radular teeth of A) *V. inesae* sp. nov. (holotype, shell length 31.0 x 16.7 mm, from the type locality); B) *V. franciscoi* (shell length 34.4 mm, from Chapéu Armado – ER coll.); C) *V. babaensis* (shell length 35.4 mm, from Baía do Baba – ER coll.); D) *V. flavusalbus* (shell length 21.9 mm, from Baía das Pipas – ER coll.); E) *V. filmeri* (shell length 28.1 mm, from Saco Mar – ER coll.); F) *V. anabelae* (shell length 20.2 mm, from Ponta Noronha – ER coll.). All teeth are represented at the same scale (0.1 mm).

Remarks: *V. inesae* sp. nov. is quite variable in color, but the constant shell shape leads us to consider all studied variations as conspecific. Darker brown specimens of the new species may resemble *V. franciscoi* (Rolán & Röckel, 2000) (Plate 1, fig. 7) in some ways. However, the body whorl of the latter usually shows a broad central band consisting of white blotches instead of spiral bands or lines of different hues as seen in *V. inesae* sp. nov. The shells of *V. franciscoi* and *V. inesae* sp. nov. also differ in shell shape (RD and PMD; see morphometric parameters for these and other taxa in Table 1).

The elongated radular teeth of both *V. inesae* sp. nov. (Fig. 2A) and *V. franciscoi* (Fig. 2B; Plate 1, fig. 7) are similar. Both of them exhibit an anterior section that is longer than the half of the tooth length, but they differ in the number of teeth present in the radular sac (see radular morphometric parameters for these and other taxa in Table 2) as well as in the extent of the anterior section which is covered by blade (100F/PA = 60 in *V. franciscoi*). Furthermore, the denticles in the serration of *V. inesae* sp. nov. are arranged in multiple rows, but in a single row in *V. franciscoi*. The radular tooth of *V. inesae* sp. nov. also resembles that of *V. babaensis* (Rolán & Röckel, 2001) (Fig. 2C; Plate 1, fig. 8), but again teeth are more numerous in the radular sac of this species (48 to 78 teeth), and the denticles in the serration are arranged in a single row. The shell of *V. babaensis* is more ovate than that of *V. inesae* sp. nov., and its characteristic pattern of wide brown spiral bands on a white background allows immediate separation between the two species. The more ovate shell shape, coloration and the absence of fine spiral lines on the body whorl distinguish *V. inesae* sp. nov. from *V. flavusalbus* (Rolán & Röckel, 2000) (Plate 1, fig. 9). The latter has also a different radular tooth morphology (Fig. 2F), which essentially differs from *V. inesae* sp. nov. in having an anterior part shorter than the posterior part (DR/PA = 2.1 – 2.3), and less denticles on the serration (d in S = 15 – 18). *V. filmeri* (Plate 1, fig. 10) may appear somewhat similar in external morphology, especially when compared with the lighter dirty white morphotypes of *V. inesae* sp. nov., but the latter is much more slender in shape (smaller RD and more elevated PMD), has a tighter aperture, occasionally tinged with purple on the upper portion, and a more convex spire. The radular teeth of *V. filmeri* (Rolán & Röckel, 2000) (Fig. 2D) are more numerous in the radular sac (55 – 108 teeth) and have a smaller relative size smaller than those of *V. inesae* sp. nov. (LC/DR = 59 – 69), with less denticles in the serration (d in S = 22). *V. anabelae* (Rolán & Röckel, 2001) (Plate 1, fig. 11) is distinguished from *V. inesae* sp. nov. by the wider shape of its shell (larger RD and lower PMD), as well as by the shell coloration (uniform brown in *V. anabelae*) and the morphology of the radular teeth: smaller (LC/DR = 52 – 60) and more numerous (85 teeth in radular sac) than in *V. inesae* sp. nov, with less denticles in the serration (d in S = 17) and with a shorter anterior section (DR/PA = 2.09 – 2.25).

Varioconus medvedevi sp. nov. (Plate 2, Figs. 1 – 6)

Type material: Holotype: 26.0 x 14.4 mm (Plate 2, Figs. 2a – 2b), MNCN; Paratype 1 : 23.2 x 12.4 mm (Plate 2, Figs. 1a – 1b), MNHN; Paratype 2: 16.8 x 9.9 mm (Plate 2, Fig. 3a – 3b), USNM; Paratype 3: 29.0 x 15.7 mm (Plate 2, Fig. 4a – 4b), coll. JR; Paratype 4: 25.1 x 13.8 mm (Plate 2, Fig. 6a – 6b), coll. JR; Paratype 5: 27.0 x 14.3 mm (Plate 2, Fig. 5), coll. AJM. One paratype (unnumbered) will be deposited at the MNHNA, Luanda, Angola. Additional paratypes (unnumbered) in the reference collections of the authors, and of Alexander Medvedev (Moscow, Russia), Sandro Gori (Livorno, Italy) and Armando Verdasca (Lisbon, Portugal).

Other material examined: 25 live taken specimens have been studied, as well as several shell specimens from the collections of the authors.

Plate 1.- **1-6** *Varioconus inesae* sp. nov. All specimens from type locality: Cabo Santa Marta, Namibe Province, Angola. **1a-b**. Paratype 1, dorsal and ventral views, MNHN, 27.8 x 15.1 mm; **2a-b**. Holotype, dorsal and ventral views, MNCN, 31.0 x 16.7 mm. **3a-b**. Paratype 2, dorsal and ventral views, USNM, 30.0 x 16.2 mm. **4a-b**. Paratype 5, dorsal and ventral views, coll. AJM, 36.3 x 18.6 mm. **5**. Paratype 3, MJT coll., 28.6 x 15.6 mm. **6a-b**. Paratype 4, dorsal and ventral views, coll. JR, 29.3 x 15.4 mm. **7**. *V. franciscoi*, holotype, MNCN, 28.4 mm, Chapéu Armado. **8**. *V. babaensis*, holotype, MNCN, 25.8 mm, Baía do Baba. **9**. *V. flavusalbus*, holotype, MNCN, 23.7 mm, Baía das Pipas. **10**. *V. filmeri*, paratype, MNCN, 27 mm, Saco Mar. **11**. *A. anabelae*, holotype, MNCN, 23.3 mm, Praia Amelia.

Type locality: Baía do Bom Fim (Lucira area) in the Namibe Province, Southern Angola, West Africa. (coordinates: 13º 49.100' S, 12º 31.600 E)

Distribution and habitat: Specimens of the new species have been regularly sampled in the Lucira area, mainly in the localities of Baía do Bom Fim, Baía da Canhoca, Zeca Pequeno, Periquitos and Doca. It occurs between 0.5 and 7 meters depth. Smaller juvenile specimens are normally observed in slightly deeper water (5 to 7 meters depth), completely buried in sand beneath rocks, while larger adult ones are commonly seen in shallower water (0.5 to 2 meters depth), partially buried in sand under rocks or in rock holes and fissures, normally close to the wave action zone. Throughout its geographical distribution it occurs in sympatry with the endemic *Pseudonoduloconus carnalis* (G. B. Sowerby III, 1879), *V. chytreus*, *V. micropunctatus* (Rolán & Röckel, 2000), *V. naranjus* (Trovão, 1975), *V. nobrei* (Trovão, 1975), *V.* cf. *tevesi* (Trovão, 1978), *V. trovaoi* (Rolán & Röckel, 2000), *V. variegatus*, *V. zebroides* and the non-endemic *Kalloconus pulcher* ([Lightfoot], 1786), *Chelyconus ermineus* (Born, 1778) and *Genuanoconus genuanus* (Linnaeus, 1758). Egg capsules have been observed in October 2011 together with the ones of *V. chytreus*, *V. zebroides* and *V. variegatus*.

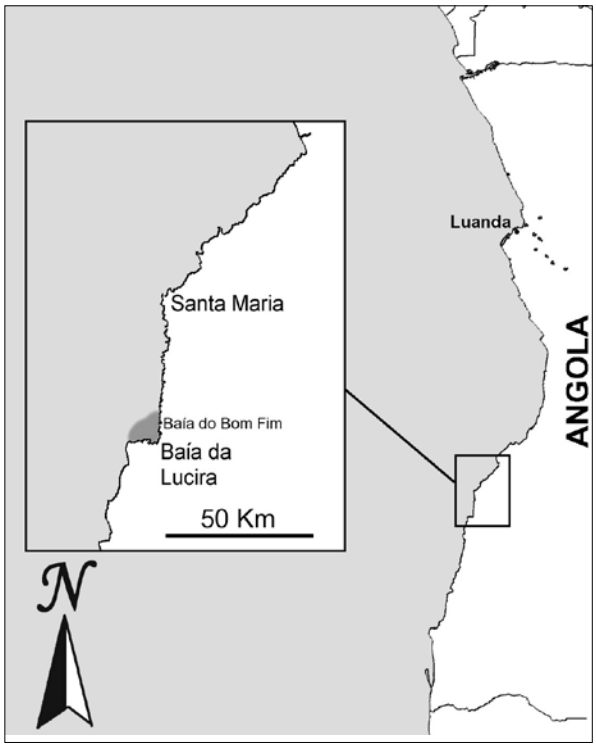

Fig 3.- Type locality and known geographical distribution of *Varioconus medvedevi* sp. nov. along the coast of Angola.

Etymology: The species is named after Alexander Medvedev a well-known Russian Cone collector and a personal friend of the authors.

Description of the shell: Morphometric parameters: L = 23 – 29 mm; average L = 26 mm; RD = 0.61 – 0.64; RSH = 0.13 – 0.16; PMD = 0.80 – 0.85.

Shell small to moderately small, moderately solid. Last whorl ventricosely conical, slightly elongated. Profile more or less straight and with a rounded shoulder. Spire moderately high, convex, teleoconch whorls smooth. Last whorl smooth, except for about four spiral raised lines near the anterior tip. The ground color of the shell is dark brown, occasionally olive-brown, with many light bluish specks (prone to fading over time) that normally form a wide central spiral band, but can also be present almost over the entire last whorl of the teleoconch, usually more numerous between the central band and the shoulder. In some specimens the bluish specks can give way to reticulated arrow shaped patterns. The spiral ramps present light bluish axial streaks. The aperture is bluish gray inside, with a dark violet zone parallel to the lip, interrupted about half the length of the lip and again near the shoulder; the interior of the lip is white, with the outer color showing by transparency. Aperture banded at the central portion and just below the shoulder. The periostracum is yellowish to olive-green, transparent. Operculum small and elongated, typical of a *Varioconus*. Shells often have scars and cracks and the first whorls are typically eroded; apex perforations are also common in many specimens.

Living animal and radula: The living animal is dark grey to black, tinged with pinkish shades. Radular tooth examined for the holotype (Fig. 4A). 40 teeth in radular sac. Radular tooth slender, medium-sized (LC/DR = 51) with the anterior section shorter than the half of the total tooth length (DR/PA = 2.2 – 2.3). Waist evident. Blade almost indistinctive, covering most of the anterior part (100F/PA = 85 %). 34 to 36 denticles present in serration (d in S), arranged in one row in the apical portion, becoming 2 rows below, ending in a rather large, prominent cusp which is characteristic. Basal spur present.

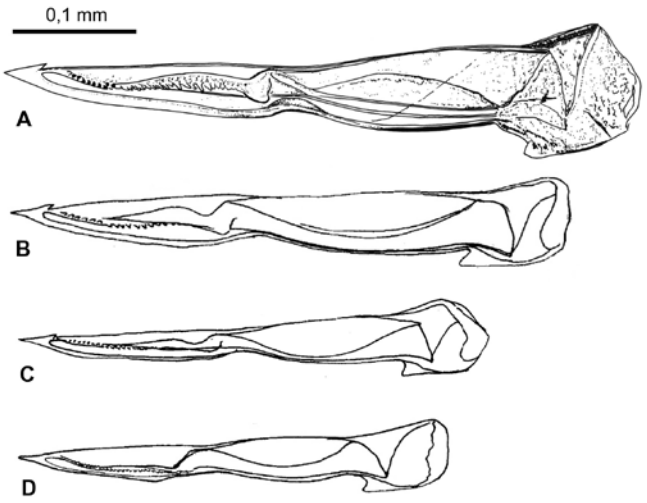

Fig. 4.- Radular teeth of A) *V. medvedevi* sp. nov. (holotype, shell length 26.0 x 14.4 mm, from the type locality); B) *V. nobrei* (shell length 18.6 mm, from Lucira – ER coll.); C) *V. bocagei* (shell length 22.4 mm, from Lobito – ER coll.); D) *V. africanus* (shell length 19.5 mm, from Bentiaba – ER coll.). All teeth are represented at the same scale (0.1 mm).

Remarks: Sympatric *V. nobrei* (Plate 2, fig. 7) can be easily distinguished from *V. medvedevi* sp. nov. by its smaller size, more ovate shape (larger RD and lower PMD) and more rounded spire, as well as by its constant brownish to olive-green ground color patterned with numerous small bluish-white or white dotted lines that cover the entire last whorl and spiral ramps. The radular teeth of *V. nobrei* (Fig. 4B) is similar to that of *V. medvedevi* sp. nov. However it bears less denticles in the serration and has a larger relative size LC/DR. The shell of *V. bocagei* (Trovão, 1978) (Plate 2, fig. 8), which

Plate 2.- **1-6** *Varioconus medvedevi* sp. nov. All specimens from type locality: Baía do Bom Fim, Lucira, Namibe Province, Angola. **1a-b**. Paratype 1, dorsal and ventral views, MNHN, 23.2 x 12.4 mm; **2a-b**. Holotype, dorsal and ventral views, MNCN, 26.0 x 14.4 mm. **3a-b**. Paratype 2, dorsal and ventral views, USNM, 16.8 x 9.9 mm. **4a-b**. Paratype 3, dorsal and ventral views, coll. JR, 29.0 x 15.7 mm. **5**. Paratype 5, coll. AJM, 27.0 x 14.3 mm. **6a-b**. Paratype 4, dorsal and ventral views, coll. JR, 25.1 x 13.8 mm. **7**. *V. nobrei*, AJM collection, 16.7 mm, Lucira. **8**. *V. bocagei*, MJT coll., 25.7 mm, Lobito. **9**. *V. africanus*, MJT coll., 25.0 mm, Porto Alexandre, North of Tombua. **10**. *V. tenuilineatus*, holotype, MNCN, 26.7 mm, Baía Binga.

has a characteristic angulate to subangulate shoulder instead of rounded, has a larger RD and a lower PMD, a different pattern arrangement, and the color of the animal color (uniform cream) is different to that of *V. medvedevi* sp. nov. The radular teeth of *V. bocagei* (Fig. 4C) and *V. medvedevi* sp. nov. are similar, although the terminating cusp in *V. bocagei* is not as well developed as in *V. medvedevi* sp. nov. *V. africanus* (Kiener, 1845) (Plate 2, fig. 9) differs in that the shell is not as elongated as in *V. medvedevi* sp. nov.; spire and last whorl have dark brown blotches and streaks turning into lines or dashes. Compared to *V. medvedevi* sp. nov., the radular teeth of *V. africanus* (Fig. 4D) in the radular sac are very numerous. They bear less denticles in the serration, arranged in one single row, and lack the prominent terminating cusp which is characteristic in *V. medvedevi* sp. nov. The close-set hairlines from the spire to the base on a white or light brown ground color seen in the shells of *V. tenuilineatus* (Rolán & Röckel, 2001) (Plate 2, fig. 10) also easily separate it from *V. medvedevi* sp. nov.

Varioconus petuchi sp. nov. (Plate 3, Figs. 1 – 7)

Type material: Holotype: 28.6 x 17.2 mm (Plate 3, Figs. 2a – 2b), MNCN; Paratype 1: 29.9 x 20.0 mm (Plate 3, Figs. 1a – 1b), MNHN; Paratype 2: 31.8 x 19.0 mm (Plate 3, Figs. 3a – 3b), USNM; Paratype 3: 29.9 x 18.0 mm (Plate 3, Figs. 4a – 4b), coll. JR; Paratype 4: 30.8 x 19.1 mm (Plate 3, Fig. 5), coll. AJM; Paratype 5: 28.8 x 18.5 mm (Plate 3, Fig. 6), coll. AJM; Paratype 6: 28.9 x 17.3 mm (Plate 3, Fig. 7), coll. JR. One paratype (unnumbered) will be deposited at the MNHNA, Luanda, Angola. Additional paratypes (unnumbered) in the reference collections of the authors, and of Armando Verdasca (Lisbon, Portugal) and Sandro Gori (Livorno, Italy).

Other material examined: Between 20 and 25 live taken specimens have been studied.

Type locality: Northern Baía do Baba, Namibe Province, Southern Angola, West Africa. (coordinates: 14º 48.600' S, 12º 15.400' E).

Distribution and habitat: Specimens are only known from the type locality. The new species is found in fissures with coarse sand on rock slabs and platforms in relatively calm waters at the outer side of the bay, from 4 to 12 meters deep. *V. petuchi* sp. nov. can be seen living sympatrically with *V. babaensis* and *V.* cf. *fuscolineatus* (G. B. Sowerby III, 1905).

Etymology: The species is named after Edward J. Petuch, PhD, a well-known researcher, author of more than 100 papers and 14 books. Ed Petuch has worked extensively on both fossil and living Cones and is a personal friend of the authors.

Description of the shell: Morphometric parameters: L = 28 – 33 mm; average L = 30.5 mm; RD = 0.67 – 0.76; RSH = 0.09 – 0.17; PMD = 0.73 – 0.82.

Shell solid, moderately small, broadly and ventricosely conical, with rounded shoulder. Spire low to moderate, spiral ramps slightly convex, depressed sutures; protoconch and first whorls typically eroded. Last whorl smooth, previous lips often noticeable. The periostracum is yellowish brown and translucent. Ground color ivory white, covered with axial

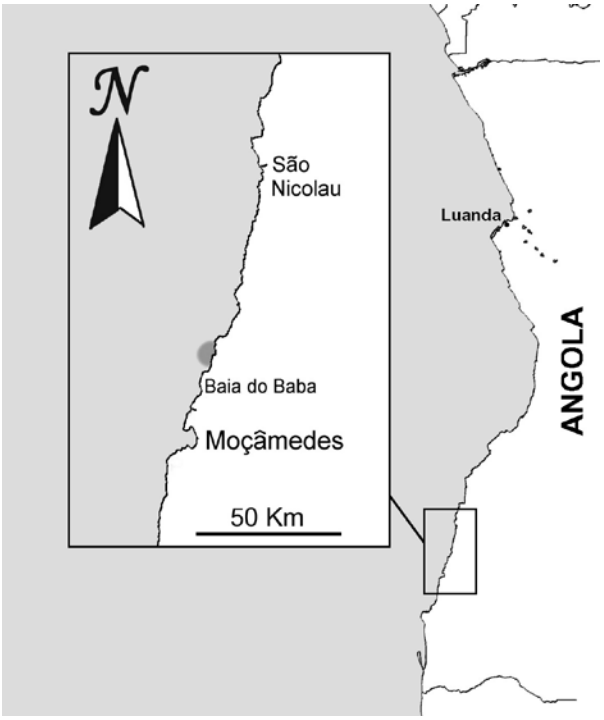

Fig 5.- Type locality and known geographical distribution of *Varioconus petuchi* sp. nov. along the coast of Angola.

lightning-shaped dark brown markings that may coalesce forming wide spiral bands, namely on the anterior tip of the shell and on the first third below the shoulder; almost entirely dark brown shells are known. The spiral ramps are of the same color as the body whorl. The aperture is white. The operculum is small and elongated.

Living animal and radula: The living animal is dark red. Radular tooth examined for the holotype (Fig. 6A). Around 85 teeth in radular sac. Radular tooth very small (LC/DR = 103 – 104) with the anterior section much shorter than the posterior section of the tooth (DR/PA = 2.4 – 2.5). Waist evident. Blade not observable. 10 – 11 small denticles present in serration, arranged in one row in the apical portion, which may become 2 rows below, ending in a rounded, almost indistinct terminating cusp. Base large, with a basal spur pointing upwards.

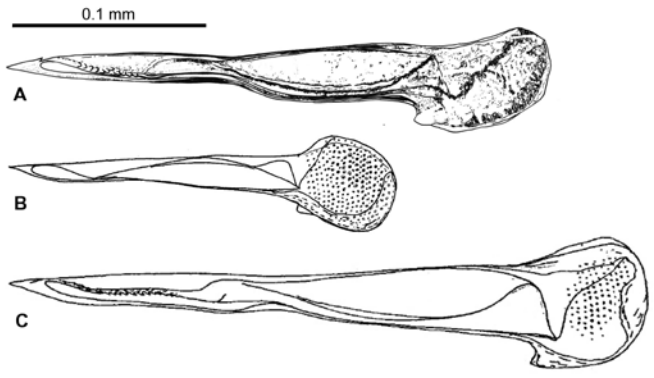

Fig. 6.- Radular teeth of A) *V. petuchi* sp. nov. (holotype, shell length 28.6 x 17.2 mm, from the type locality); B) *V. lineopunctatus* (shell length 29.1 mm, from Santa Maria – ER coll.); C) *A. trovaoi* (shell length 38.4 mm, from Baía do Cesar – ER coll.). All teeth are represented at the same scale (0.1 mm).

Plate 3.- **1-7** *Varioconus petuchi* sp. nov. All specimens from type locality: Northern Baía do Baba, Namibe Province, Angola. **1a-b**. Paratype 1, dorsal and ventral views, MNHN, 29.9 x 20.0 mm; **2a-b**. Holotype, dorsal and ventral views, MNCN, 28.6 x 17.2 mm. **3a-b**. Paratype 2, dorsal and ventral views, USNM, 31.8 x 19.0 mm. **4a-b**. Paratype 3, dorsal and ventral views, coll. JR, 29.9 x 18.0 mm. **5**. Paratype 4, coll. AJM, 30.8 x 19.1 mm. **6**. Paratype 5, coll. AJM, 28.8 x 18.5 mm. **7**. Paratype 6, coll. JR, 28.9 x 17.3 mm. **8**. *V. bulbus*, coll. AJM, 26.1 mm, Caota. **9**. *V. zebroides*, coll. AJM, 44.0 mm, Lucira. **10**. *V. lineopunctatus*, lectotype, USNM, 38.1 mm, Baía dos Elefantes. **11.** *V. trovaoi*, holotype, MNCN, 38.5 mm, Limagens.

Remarks: Morphologically, *V. petuchi* sp. nov. can be easily separated from the other endemic Cones found along the Angolan coast by its characteristic robust shell profile and typical pattern arrangement. In spite of the highly variable pattern, radular morphology suggests that all examined specimens are in fact conspecific. *V. bulbus* (Plate 3, fig. 8) may resemble *V. petuchi* sp. nov., but can be distinguished by its large axial streaks, more slender appearance, and less angulated shoulder; the radular teeth of *V. bulbus* (not shown, see Rolán & Röckel, 2000) has a much larger relative size, more denticles in the serration, and a blade covering most of the anterior part of the tooth. In this species, the anterior and posterior sections of the tooth are subequal in length. *V. zebroides* (Plate 3, fig. 9) has a larger shell length (average 35 to 45 mm) and a different pattern arrangement. The radular tooth of *V. zebroides* (not shown, see Rolán & Röckel, 2000) differs in general terms from that of *V. petuchi* sp. nov. in its much larger relative size and the presence of more denticles in the serration. However, a large variability of radular morphometric parameters has been observed among different populations of *V. zebroides*, a fact that might question the conspecificity of the compared populations (Rolán & Röckel, 2000). Comparing with *V. africanus* (Plate 2, fig. 9), the pattern on the shells of the latter consists of spiral lines and dashes which are not present in the decoration of the shells of *V. petuchi* sp. nov. The radular tooth of *V. africanus* (Fig. 4D) differs in its much larger relative size and increased number of denticles in the serration, as well as in the presence of a blade covering most of the anterior part of the tooth. The species with morphometric parameters of the radular teeth most similar to *V. petuchi* sp. nov. are *V. lineopunctatus* (Kaicher, 1977) (= *V. neoguttatus* (da Motta, 1991b)) (Plate 3, fig. 10) and *V. trovaoi* (Plate 3, fig. 11). These two species have radular teeth which are very numerous and with very small relative size. None of the two exhibit a blade, and both have anterior sections of the tooth much shorter than the posterior section, as it occurs in the tooth of *V. petuchi* sp. nov. The tooth of *V. lineopunctatus* is neotenic (Fig. 6B), and has no denticles in the serration, whereas in the case of *V. trovaoi* (Fig. 6C) denticles can be absent or present. Despite similarities in radular tooth morphology, the shells of *V. lineopunctatus* and *V. trovaoi* are quite different from that of *V. petuchi* sp. nov. and allow for immediate separation. Thus, *V. lineopunctatus* has a white shell patterned with irregular brown flecks or bars, often with incomplete dotted spiral lines, whereas the shell of *V. trovaoi* is essentially patternless, with a greenish-grey ground color and a dark violet aperture.

Varioconus variegatus (Kiener, 1845) (Plate 4, Figs. 1 – 8)

Rolán & Röckel (2000) considered *Conus obtusus* Kiener, 1845 as a synonym of *Conus variegatus* Kiener, 1845, based on Article 24(a) of ICZN. Since no type specimens were known, Röckel & Fernandes (1981) designated as lectotype of *Conus variegatus* the representation by Kiener (1845): pl. 106, fig. 1a (Fig. 7A), the whereabouts of the illustrated specimen being currently unknown. Later, Rolán & Röckel (2000) designated Kiener (1845), pl. 109, fig. 3 as a representation of the lectotype of *C. obtusus* Kiener (Fig. 7B).

Despite having considered the synonymy of the two *taxa*, it would appear that Rolán & Röckel (2000), did not have at hand

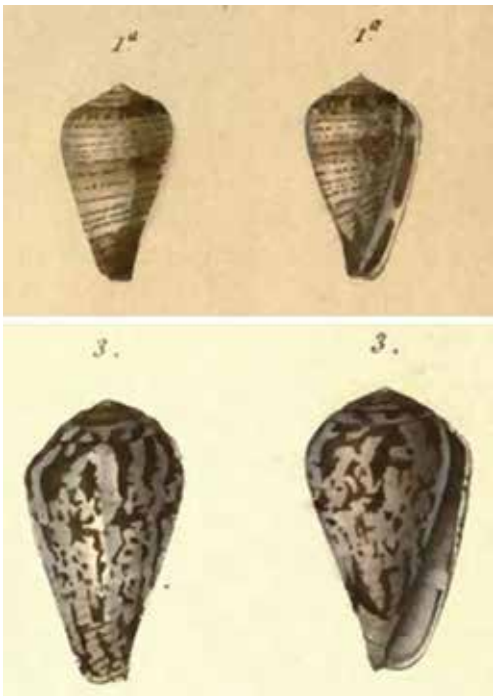

Fig. 7.- Representations of lectotypes in Kiener (1845): A) *Conus variegatus* Kiener (1845), pl. 106, fig. 1a; B) *Conus obtusus* Kiener (1845), pl. 109, fig. 3

any specimens perfectly matching the lectotype of *Conus variegatus* Kiener, 1845, since the four specimens shown (figs. 23-26) all correspond to *V. variegatus* form *obtusus* (Kiener, 1845). Recently, however, a sample of 40 to 50 live specimens collected at Baía do Calongo, Cape Santa Marta, Namibe Province, has been found to correspond precisely to what Kiener illustrated as *Conus variegatus*. For this reason, we hereby present a redescription of this *taxon*, currently placed in the genus *Varioconus*:

Type material: Type series was in collection Largilliert, present whereabouts unknown. Röckel & Fernandes (1981) designated as lectotype representative the figure in Kiener (1845), plate 106, fig. 1a (Fig. 7A).

Material examined: More than 40 live-collected specimens.

Type locality: Not mentioned in the original description. Rolán & Röckel (2000) designated "Santa Maria Bay, Angola" as the type locality.

Distribution and habitat: The highest density of specimens corresponds to Doca Funda and Baía do Capato (Lucira area) in the Namibe Province, Southern Angola, West Africa. However, specimens have also been regularly found at Inamangano, Baía do Calongo, Baía do Zeca Pequeno, Periquitos and occasionally to the north of Lucira at Bomfim.
V. variegatus has been observed from 2 to 5 meters (occasionally living as deep as 12 meters) found partially or completely buried in sand patches near large rocks normally in calm water and in sheltered areas. Specimens can often be found in rock crevices, on rock platforms beneath rock slabs or in-between piles of rocks (Fig. 9).

V. variegatus has been mainly seen living in direct sympatry with endemic *V. chytreus*, *V. micropunctatus*, *V. naranjus*, *V.*

nobrei, *V. zebroides*, *V. inesae* sp. nov., as well as non-endemic *C. ermineus* and *G. genuanus*.

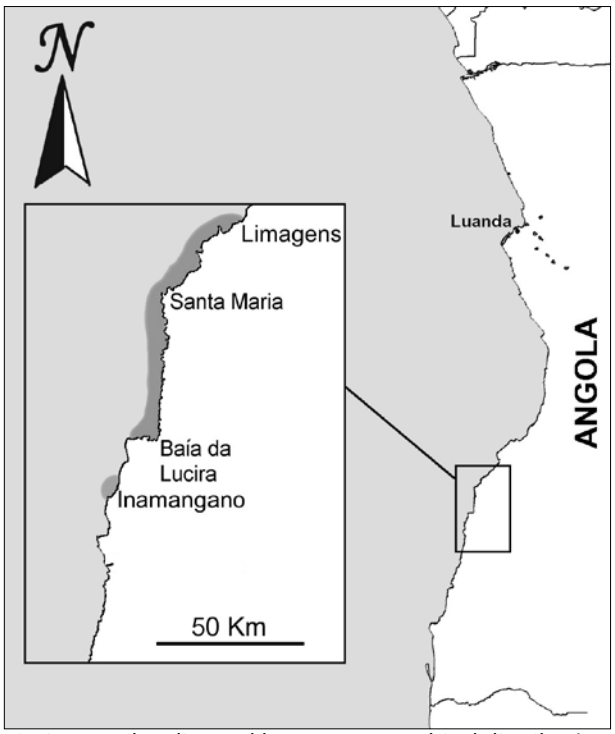

Fig 8.- Type locality and known geographical distribution of *Varioconus variegatus* (Kiener, 1845) along the coast of Angola.

Fig. 9.- *Varioconus variegatus* (Kiener, 1845*)* live in natural habitat in Baía do Capato (coordinates 13º 52.500' S, 12º 27.900 E), Namibe Province, Southern Angola, West Africa (photo by José Rosado).

Description of the shell: Morphometric parameters: L = 18 – 26 mm; average L = 22 mm; RD = 0.60 – 0.72; RSH = 0.08 – 0.17; PMD = 0.70 – 0.76.

Shell moderately solid, last whorl ventricosely conical, slightly elongated. Profile more or less straight, rounded shoulder. Spire moderately high, slightly convex, teleoconch whorls with extremely fine spiral sulci; protoconch and first whorls typically eroded. Last whorl smooth, except for about four spiral grooves near the anterior tip. Ground color very light bluish grey. Last whorl with about 20 spiral rows of tiny light brown dots separated by almost white spaces. Light brownish shades, sometimes forming bands are visible, especially on the upper and lower portions of the last whorl, which often presents 3 light brown bands: one close to the shoulder, the second one at about upper mid body whorl, and the third on the anterior tip of the shell. The spiral ramps present light brown axial streaks. The aperture is violet inside to dark violet in a zone parallel to the lip, with two narrow whitish spiral bands, one close to the shoulder and the other roughly at the centre of the aperture. The interior of the lip is white. The same pattern of the shell can appear in a different lighter color way, in which the light bluish gray tone is absent and replaced with a general yellowish tone (Plate 4, figs. 6a-b); the dots along the spiral rows then become dark yellow to light orange. The violet hue inside the aperture is also replaced with a yellowish hue. There are almost patternless variants, in which the pattern of spiral rows with tiny light brown dots can be only appreciated with magnification (Plate 4, figs. 2a-b), and specimens in which the multiple spiral rows of brown dots are reduced to just 5 or 6, widely spaced and separated by bands of bluish grey ground color (Plate 4, figs. 4a-b). Forma *obtusus* is characterised by extended brown patches at the shoulder/spire area and the base (Plate 4, figs. 7, 8). The periostracum is translucent pale yellow to olive-green. The operculum is small, elongated, and typical of a *Varioconus*. Most shells are incrusted with calcareous algae and often have *Crepidula* specimens attached. Scars and cracks made predator attacks are common in many specimens, and so are worm perforations, especially around the spire area.

Living animal and radula: The living animal is cream with salmon or pink shades and tinged with dark grey to black mainly along the foot margins and especially around the siphon. 53 to 80 teeth in radular sac. Radular tooth (Fig. 10A) of medium size (LC/DR = 47 – 62) with the anterior section equal or slightly shorter than the posterior section of the tooth (DR/PA = 2.0 – 2.2). Waist evident. Blade covering most of the anterior section. 21 – 30 denticles in serration, arranged in one row in the apical portion, becoming 2 rows below, ending in a rounded terminating cusp. Base large, with a basal spur. The radular tooth of *V. variegatus* form *obtusus* (Fig. 10B) is essentially identical to that of typical *V. variegatus*.

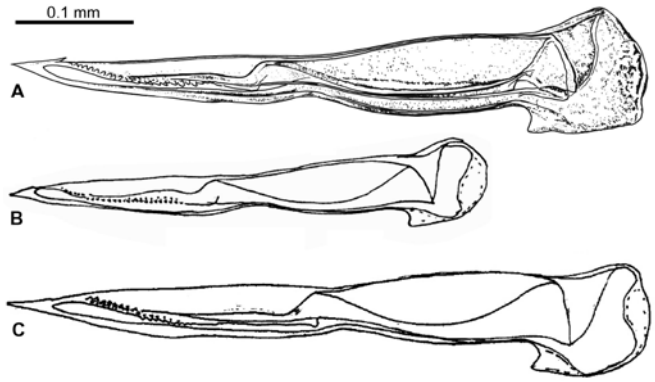

Fig. 10.- Radular teeth of A) *V. variegatus* (shell length 24.8 mm, from Doca Funda, Lucira); B) *V. variegatus* form *obtusus* (shell length 25.5 mm, from Capato, Lucira – ER coll.); C) *V. chytreus* (shell length 23.7 mm, from Lucira – ER coll.). All teeth are represented at the same scale (0.1 mm).

Remarks: Although similar in shell shape, sympatric *Varioconus micropunctatus* can (Plate 4, fig. 9) be easily separated from *V. variegatus* by its white or cream background color and its pattern of numerous brownish needle-shaped dots arranged

Plate 4.- **1-8** *Varioconus variegatus* (Kiener, 1845). **1a-b**. Typical form, dorsal and ventral views, coll. JR, 26.9 mm, Baía do Calongo. **2a-b**. Almost patternless form, dorsal and ventral views, MJT coll., 24.6 mm, Doca Funda, Baía da Lucira. **3a-b**. Transition to form *obtusus*, dorsal and ventral views, MJT coll., 27.9 mm, Inamangano. **4a-b**. Form with widely spaced spiral rows of brown dots resembling *V. chytreus*, dorsal and ventral views, MJT coll., 27.0 mm, Lucira. **5**. Typical form, coll. AJM, 26.2 mm, Baía do Calongo. **6a-b**. Yellow form, dorsal and ventral views, coll. JR, 27.8 mm, Doca Funda, Baía da Lucira. **7**. Form *obtusus*, MJT coll., 22.6 mm, Baía da Lucira. **8**. Form *obtusus*, MJT coll., 20.1 mm, Baía da Lucira. **9**. *V. micropunctatus*, holotype, MNCN, 32.5 mm, Lucira. **10**. *V. chytreus*, MJT coll., 27.1 mm, São Nicolau.

in spiral lines that cover the entire last whorl or at least most of it. *V. micropunctatus* also differs from *V. variegatus* by the absence of light brownish band shades, the presence of brown axial hairlines on the spiral ramps and its white aperture (very occasionally tinged with light purple on the upper portion when fresh). The radular teeth of *V. variegatus* and *V. micropunctatus* (Fig. 10C) are similar. Specimens of *V. variegatus* with reduced number of widely spaced spiral rows of light brown dots may superficially resemble *V. chytreus* (Plate 4, fig. 10). However, the ground color is different (bluish grey in *variegatus* and white or very light yellow in *chytreus*), as well as the color of the aperture (white in *chytreus* and violet to dark violet in *variegatus*). The two species also differ in their radular teeth (see Fig. 10C). For additional discussion regarding the differences in radular morphology between these two species, see Rolán & Röckel (2000).

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BIBLIOGRAPHY

DA MOTTA, A. J. 1991a. A Systematic Classification of the Gastropod Family Conidae at the Generic Level. *La Conchiglia*, Rome. 48 pp.

DA MOTTA, A. J. 1991b. Three new replacement names (Gastropoda: Conidae). *La Conchiglia*, 22 (258): 73.

KAICHER, S. D. 1976-1977. Card catalogue of worldwide shells. Conidae (part I-IV, cards # 1010-1434).

KIENER, L. C. 1845-1850. Spécies géneral et iconographie des coquillages vivantes, 2. Rousseau, Paris. 379 pp, 111 pls.

MONTEIRO, A., TENORIO, M. J. & POPPE, G. T. 2004. The West African and Mediterranean species of *Conus*. In: *A Conchological Iconography*. Conch Books, Hackenheim. 104 pp., 164 pls.

PAES DA FRANCA, M. L. 1957. Contribuição para o conhecimento da fauna malacológica de Angola. Gastrópodes Testáceos. *Trabalhos da Missão Biológica Marítima*, 13: 49-85.

REEVE, L. 1843-1849. *Monograph of the genus Conus. Conchologia Iconica*, I. Reeve Bros, London, *Conus*: 46 pp., 9 plates,

RÖCKEL, D. & FERNANDES, F. 1981. Conidae from Angola. Part I. *La Conchiglia*, 13 (152-153): 3-5.

RÖCKEL, D. & FERNANDES, F. 1982a. Conidae from Angola. Part II. *La Conchiglia*, 14 (154-155): 16-17.

RÖCKEL, D. & FERNANDES, F. 1982b. Conidae from Angola. Part III. *La Conchiglia*, 14 (156-157): 4-5.

RÖCKEL, D. & FERNANDES, F. 1982c. Conidae from Angola. Part IV. *La Conchiglia*, 14 (164-165): 17-18.

RÖCKEL, D., KORN, W. & KOHN, A.J. 1995. Manual of the Living Conidae, Volume

1: Indo-Pacific Region. Verlag Christa Hemmen. Hackenheim, Germany. 517 pp. 84 pls.

ROLÁN, E. 1993. A hypothesis on the evolution of the radular tooth in the family Conidae. *La Conchiglia*, 25 (269): 42-46.

ROLÁN, E. 2000. History of the study of the radular tooth in *Conus* and a new method of comparison employed for the Angolan species. *Argonauta*, 13 (2): 45-56.

ROLÁN, E. & RAYBAUDI-MASSILIA, G. 1994a. New investigation on the radular tooth of *Conus*. Part I. *Argonauta*, 8 (1-6): 6-59

ROLÁN, E. & RAYBAUDI-MASSILIA, G. 1994b. New investigation on the radular tooth of *Conus*. Part II. *Argonauta*, 8 (7-12): 9-68

ROLÁN, E. & RAYBAUDI-MASSILIA, G. 2002. Evaluation of character state polarity of *Conus* radular tooth characters. *Bollettino Malacologico, Suppl*, 4: 175-194.

ROLÁN, E. & RÖCKEL, D. 2000. The endemic *Conus* of Angola. *Argonauta*, 13 (2): 5-44.

ROLÁN, E. & RÖCKEL, D. 2001. The endemic *Conus* from Angola. 2. Description of three new species. Los *Conus* endemicos de Angola. 2. Descripcion de tres nuevas especies. *Iberus*, 19 (2): 57-66.

SOWERBY, G. B. II. 1858. Monograph of the genus *Conus*. Van Voorst, London, 56 pp.

SOWERBY, G. B. III. 1905. Descriptions of seven new species of marine Mollusca from the collection of the late Admiral Keppel. *Proceedings of the Malacological Society of London*, 6: 279-282.

TROVÃO, H. 1975a. Contribuição para o estudo dos moluscos gasterópodes da família Conidae de Angola. Novas espécies de *Conus* Linné, 1758 de Angola (Mollusca: Gastropoda). *Bolletim do CPAS* (unnumbered): 3-8.

TROVÃO, H. 1975b. Contribuição para o estudo dos moluscos gasterópodes da família Conidae de Angola. Novas espécies de *Conus* Linné, 1758 de Angola (Mollusca: Gastropoda). *Bolletim do CPAS*, IV série (2) : 9-15

TROVÃO, H. 1978. Contribuição para o estudo dos moluscos gasterópodes da família Conidae de Angola. Novas espécies de *Conus* Linné, 1758 de Angola (Mollusca: Gastropoda). *Bolletim do CPAS*, 4 (4): 11-20.

TUCKER, J.K. & TENORIO, M.J. 2009. Systematic Classification of Recent and Fossil Conoidean Gastropods, with Keys to the Genera of Cone Shells. ConchBooks, Hackenheim, Germany, 295 pp.