



Redescription of *Solatisationax cabrali* (Gastropoda, Architectonicidae), with two new records from southeastern Brazil

Daniel C. Cavallari^{1,*}, Rodrigo B. Salvador^{2,3}, Luiz R.L. Simone¹

¹Universidade de São Paulo, Museu de Zoologia. São Paulo, SP, Brazil.

²Staatliches Museum für Naturkunde Stuttgart. Stuttgart, Germany.

³Mathematisch-Naturwissenschaftliche Fakultät, Eberhard KarlsUniversität Tübingen. Tübingen, Germany.

*corresponding author: dccavallari@gmail.com

Cavallari D.C, Salvador R.B. & Simone L.R.L. (2013) Redescription of *Solatisationax cabrali* (Gastropoda, Architectonicidae), with two new records from southeastern Brazil. *Strombus* 20(1-2): 12–18.

ABSTRACT

The original description of *Solatisationax cabrali* Tenório, Barros, Francisco & Silva, 2011 (Architectonicidae) was based on four eroded juvenile shells found on the northeastern Brazilian coast. The present study redescribes this snail species based on the type material and additional well-preserved shells collected in southeastern Brazil, an adult and a juvenile, respectively from off Ubatuba (São Paulo state) and Campos Basin (Rio de Janeiro state). The type material is also partially illustrated herein. Some problems with the original description of the species are here addressed. The new records extend the known geographic range of the species ca. 1,700 km southwards, from Pernambuco to São Paulo.

Keywords: Deep-water, Heterobranchia, Rio de Janeiro, São Paulo.

INTRODUCTION

The Architectonicidae are a diverse group of heterobranch marine snails, with a dozen extant genera and ca. 120 species living from shallow to deep waters worldwide (BIELER & GOFAS 2013). The study of deep-water species has received increased attention in Brazil as of late (*e.g.*, SIMONE & CUNHA 2012). An accurate knowledge of the deep-water fauna became vital for environmental analyses since the Brazilian government started the extraction of the “Pré-Sal” (pre-salt) level of petroleum, which is causing major disturbances in depths up to 2000 m off the SE Brazilian coast (ROMERO *et al.* 2011).

Solatisonax cabrali Tenório, Barros, Francisco & Silva, 2011 is a recently described and up to now relatively uncommon deep-water Brazilian species from Alagoas (type locality) and Pernambuco states, found at depths of 520 to 720 m (TENÓRIO *et al.* 2011). A recent review of the Architectonicidae collection of the Museu de Zoologia da Universidade de São Paulo (MZSP; São Paulo, Brazil) revealed two well-preserved specimens of *S. cabrali*: a juvenile from Campos Basin, off Rio de Janeiro state, and an adult from off Ubatuba, São Paulo state, that bring additional information on this species.

The original description of *S. cabrali* was based on four empty and eroded juvenile shells found on the northeastern Brazilian coast. The absence of a well-preserved adult specimen has clearly left a descriptive hiatus in conchological and ontogenetic features. Therefore, this study fills this gap, providing a redescription of the species based on new fairly intact specimens, as well as on the type material. Moreover, some problems detected in the original description are also addressed herein.

MATERIALS AND METHODS

The specimens studied here are all empty shells housed in the malacological collections of the Museu Nacional do Rio de Janeiro (MNRJ; Rio de Janeiro, Brazil) and the MZSP. A list of the examined material is given after the species description. Photographs and measurements were obtained using a Zeiss AxioCam MRc5 and Zeiss AxioVision SE64 Rel 4.8 imaging software, and crosschecked with a digital caliper. The following abbreviations are used throughout the text for shell measurements, following Bieler (1993): SD, shell diameter; H, shell height; P, protoconch width; BF, basal field width; w, aperture width; h, aperture height, UD, umbilical diameter. Other abbreviations: REVIZEE - Live Resources of the Exclusive Economic Zone (research project).

SYSTEMATICS

Family Architectonicidae

Genus *Solatisonax* Iredale, 1931

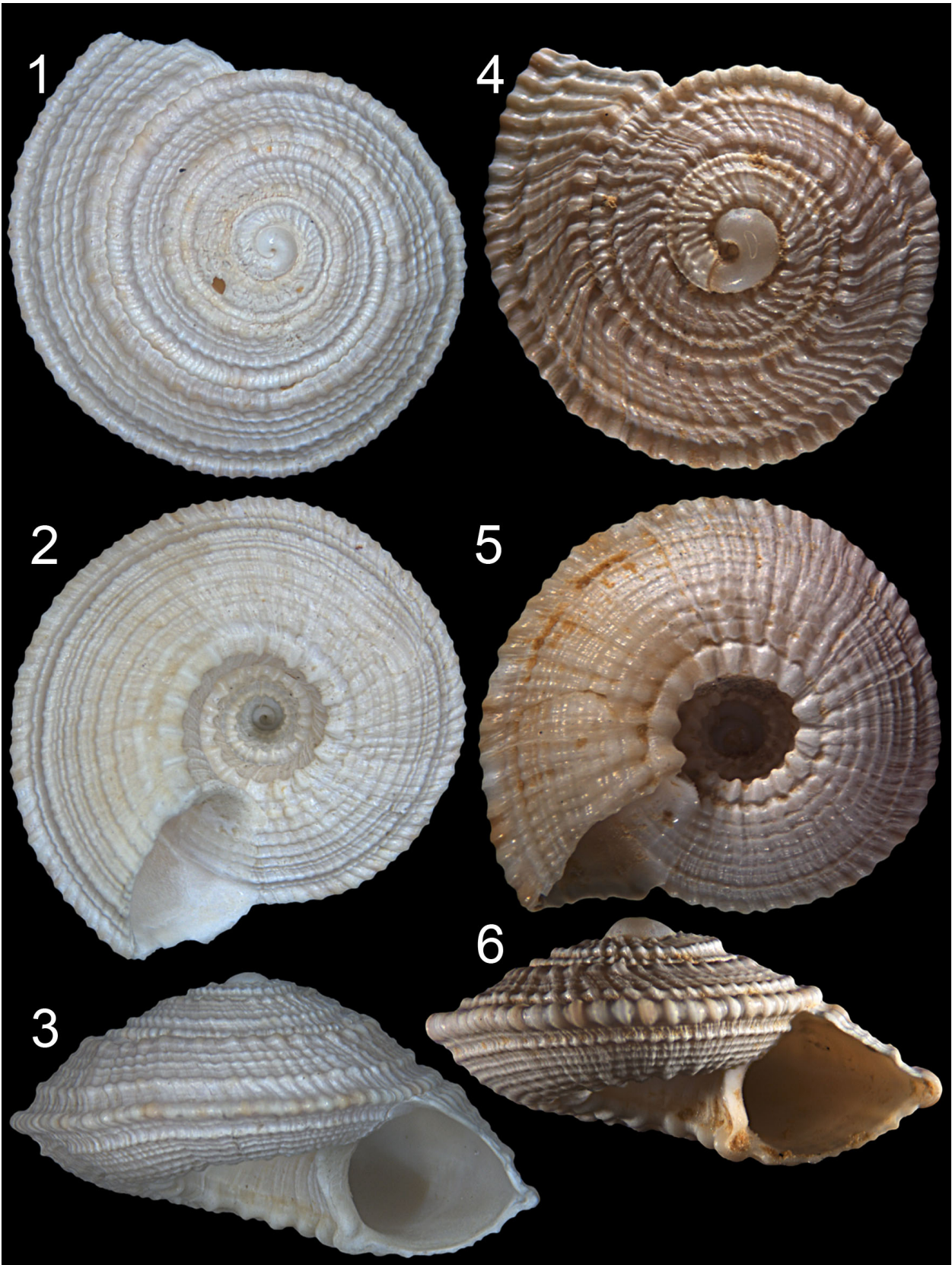
Type species: *Solatisonax injussa* Iredale, 1931; recent, Indo-Pacific.

Solatisonax cabrali Tenório, Barros, Francisco & Silva, 2011

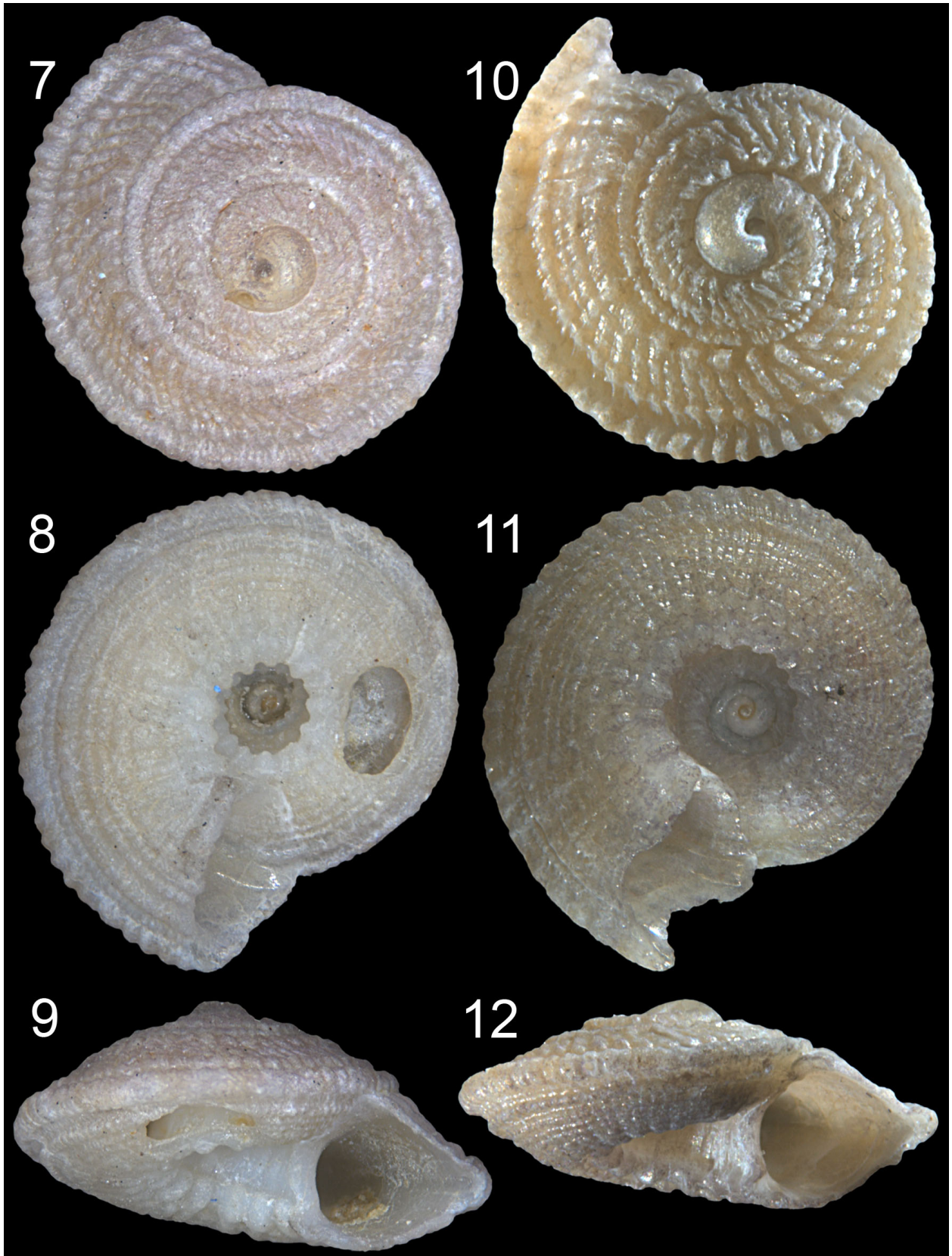
(Figures 1–12)

Solatisonax cabrali Tenório, Barros, Francisco & Silva, 2011: 178, figs. 2B–C, 2E–F (figs. A and G in error, see below).

Material examined: Holotype: MNRJ 13027 (juvenile shell), Brazil, off Alagoas state, 10°06'S 35°46'W, 720 m, muddy bottom, 1 shell (REVIZEE, dredging no. 31, 16/xii/2001). **Paratype 1:** MNRJ 13028 (1 juvenile shell), Brazil, off Pernambuco state, 08°46.5'S 34°44.5'W, 690 m, muddy



Figures 1-6: *Solatisonax cabrali* from southeastern Brazil; **1.** MZSP 50653, apical view (SD = 7.67 mm); **2.** same, umbilical view; **3.** same, apertural view (H = 4.2 mm); **4.** MZSP 93408, apical view (SD = 4.42); **5.** same, umbilical view; **6.** same, apertural view (H = 2.15 mm).



Figures 7-12: *Solatisonax cabrali* types; **7.** holotype MNRJ 13027, apical view (SD = 4.18 mm); **8.** same, umbilical view; **9.** same, apertural view (H = 2.2 mm); **10.** paratype 1 MNRJ 13028, apical view (SD = 3.62 mm); **11.** same, umbilical view; **12.** same, apertural view (H = 1.6 mm).

bottom, 1 shell (REVIZEE, dredging no. 11, 18/xi/2000). **Paratype 2:** MNRJ 13029 (1 juvenile shell), Brazil, off Pernambuco state, 09°04.7'S 34°51.2'W, 520 m, muddy bottom, 1 shell (REVIZEE, dredging no. 10, 17/xi/2000). **Paratype 3:** MNRJ 13030 (1 juvenile shell), Brazil, off Pernambuco state, 08°46.5'S 34°44.5'W, 690 m, muddy bottom, 1 shell (REVIZEE, dredging no. 11, 18/xi/2000). **Additional material:** MZSP 93408 (1 juvenile shell), Brazil, off Rio de Janeiro state, Campos Basin, 21°58'S 40°02'W, 230 m depth, (H. Caetano col., 18/v/2005); MZSP 50653 (1 adult shell), Brazil, São Paulo state, off Ubatuba, 23°49'S 44°39'W, 70 m depth, sandy bottom, (Projeto Integrado sta. 4853, R/V "W. Besnard", 16/xii/1985).

Diagnosis: Shell small, conical with depressed spire; concave regions on both sides of periphery, becoming increasingly wider on later whorls; bearing a thin nodose spiral thread medially on later whorls. Protoconch small (0.7–0.9 mm), distinctly inflated, weakly heterostrophic. Teleoconch sculptured by nodose spiral cords and threads as well as axial ribs, forming nodules at intersections; axial sculpture becoming weaker on later whorls. Umbilicus wide; umbilical crenae bearing angulose nodules; region between umbilical crenae and second innermost proxumbilical rib with deep notch, becoming wider on later whorls.

Redescription: Shell small (maximum diameter 7.7 mm), conical with depressed spire; upper side more inflated than base; relatively thick-walled; shell height $\sim 1/2$ width. Juveniles lenticular, with depressed spire and base more inflated than upper side. Color pale beige to white with scattered beige spots. Protoconch of $\sim 1\frac{1}{2}$ whorls ($\frac{1}{2}$ whorl after immersion), small (0.75–0.88 mm), dome-shaped, distinctly inflated, weakly heterostrophic, without anal keel; smooth and glossy; transition to teleoconch very clear, marked by a strong terminal varix (Fig. 4). Teleoconch of up to $3\frac{1}{2}$ convex whorls, sculptured by nodose spiral cords (predominant) and axial ribs. Upper side (above keel) sculpture consisting of well-developed, distinctly separated spiral cords and prosocline axial ribs, with well-marked nodules at intersections; axial ribs stronger on early whorls, gradually decreasing in strength. Upper peripheral rib width $\sim 20\%$ of whorl width from periphery, slightly weaker than subsutural rib ($\sim \frac{1}{2}$ as wide); midrib area with three spiral threads. Prominent peripheral keel formed by very strong, nodose lower peripheral rib (width $\sim 20\%$ of whorl width from periphery), with distinctly developed concave zones on both sides, becoming increasingly deeper and wider on later whorls; concave zones on both sides bearing thin nodose spiral thread medially, only distinguishable on later whorls (Figs 1-2). Basal sculpture similar to upper side sculpture, except for more numerous and thinner axial threads (also forming nodules at intersections); infraperipheral rib distinct, slightly weaker than upper peripheral rib; basal field with 5 to 8 spiral ribs or threads slightly increasing in width towards umbilicus, innermost (UC) rib with strong, angular nodules. Clear notch between two innermost proxumbilical ribs, becoming increasingly wider in older specimens. Umbilical side of columellar wall without distinct spiral sculpture, but bearing strong axial growth lines. Upper point of whorl attachment at lower peripheral rib, forming narrow, almost indistinct suture. Aperture rounded triangular (more markedly triangular in juveniles), acuminate towards peripheral keel and umbilical crenae. Umbilicus wide ($\sim 22\text{--}32\%$ of shell width).

Measurements (in mm): holotype MNRJ 13027, 3 whorls, SD = 4.18, H = 2.2, P = 0.88, UD = 0.9, BF = 1.6, w = 1.57, h = 1.14; paratype 1 MNRJ 13028, $2\frac{1}{2}$ whorls, SD = 3.62, H = 1.6, P = 0.83, UD = 0.95, BF = 1.33, w = 1.1, h = 1.0; paratype 2 MNRJ 13029, $2\frac{3}{4}$ whorls, SD = 4.27, H = 1.99, P = 0.88, UD = 1.22, BF = 1.52, w = 1.36, h = 0.94; paratype 3 MNRJ 13030, $2\frac{1}{2}$ whorls, SD =

3.51, H = 1.83, P = 0.93, UD = 0.93, BF = 1.3, w = 1.14, h = 0.93; MZSP 50653, 4 whorls, SD = 7.67, H = 4.2, P = 0.75, UD = 2.48, BF = 2.6, w = 2.77, h = 2.18; MZSP 93408, 3 whorls, SD = 4.42, H = 2.15, P = 0.86, UD = 0.93, BF = 1.48, w = 1.65, h = 1.14.

Distribution: Type locality: Off Alagoas state, Brazil, 10°06'S, 35°46'W, 720 m. **Previously known distribution:** Brazil, from Pernambuco and Alagoas states at depths of 520 to 720 m. (TENÓRIO *et al.*, 2011). **New records:** Brazil: off Rio de Janeiro state, Campos Basin (21°58'S 40°02'W, 230 m depth); São Paulo state, off Ubatuba (23°49'S 44°39'W, 70 m depth).

DISCUSSION

While examining the type specimens of *S. cabrali* some inconsistencies with the original description by Tenório *et al.* (2011) were detected. In the first place, the measurements are very discrepant; despite the fact that those authors have not stated how the specimens were measured, the disparity between our measurements and theirs is too great to be a mere difference in procedure. Therefore, the logical conclusion seems to be that the measurements of all type specimens are incorrect in the original description, thus invalidating their statistical analysis (TENÓRIO *et al.* 2011: table 2).

Secondly, there is some confusion with the figures presented by Tenório *et al.* (2011: 180) and their captions: several views of the holotype were supposed to be shown in their figures 2A–C. Actually, their figures 2B and 2C are undoubtedly of the holotype, however, a comparison with our photographs (Figure 7) reveals that the specimen in figure 2A cannot possibly be the holotype. The coloration, aperture profile and sculpture are remarkably different, especially the lower peripheral rib nodules. One could already easily suspect that by comparing the lower peripheral rib in their figures 2A and 2B, as well as the aperture's profile. In fact, the outline and sculpture of the specimen from figure 2A does not match any of the paratypes as well and thus likely is a representative of another architectonicid species.

Continuing with the figures of Tenório *et al.* (2011: 180), a few SEM images are shown in figures 2E–G, allegedly of paratype 1 (MNRJ 13028); nevertheless, this attribution seems to be mistaken. Though it is possible to obtain good SEM images without covering the specimens with a metallic coating, the images' contrast and depth suggest otherwise. The paratype 3 (MNRJ 13030) bears a metallic coating and compares fittingly with both views shown in figures 2E and 2F, so it is most probably the specimen figured. Figure 2G, however, is still controversial, for none of the type specimens bear a small hole near the protoconch. As such, in order to avoid further confusion, the holotype (Figs. 7–9) and best preserved paratype (paratype 1, MNRJ 13028, Figs. 10–12) are properly figured here.

Finally, the lack of an adult specimen in the original description may also have lead Tenório *et al.* (2011) to a few mistakes when comparing *S. cabrali* with its congeners. The comparison with *S. rudigerbieleri* Tenório, Barros Francisco & Silva, 2011 (TENÓRIO *et al.* 2011: 179), is mostly correct except for a few details: the depression on both sides of the peripheral keel (harder to distinguish in younger specimens) is much deeper and bears a thin nodose rib medially in *S. cabrali*. Besides, the shell coloration of *S. cabrali* is more homogeneous; the width of the spiral ribs on both shell sides is more variable; the umbilical crenae is more strongly nodose, with more angular nodules. The notch between the two innermost proxumbilical ribs is exclusive to *S. cabrali*. The lack of concave zones bordering the peripheral keel is pointed by Tenório *et al.* (2011) as a distinction from *S. acutecarinata* (Thiele, 1925), but both species actually share this feature; the same holds true for

the shell size, also very similar in both species. The umbilical diameter (UD) measurements are also used by Tenório *et al.* (2011) for comparison, but as their measurements are likely at fault, as explained above (correct UD stands between 22–32% of shell width), these comparisons should be disregarded. In fact, the correct UD is very similar to *S. acuteccarinata*: ca. 28% of SD, according to Bieler (1993). *Solatisonax cabrali* differs from *S. acuteccarinata* by having more inflated whorls, with a more conspicuous spiral sculpture on both sides and a homogeneous coloration; upper point of whorl attachment at (and not below) the lower peripheral rib; a distinct notch between the two innermost proxumbilical ribs, and more angular nodules at the umbilical crenae.

Although *S. cabrali* was originally described from NE Brazil, the new records reported here are close to or inside petroleum extraction areas, and endorse the necessity of a deeper understanding of the species. The data presented in this paper complete and complement the original description of *S. cabrali*, correcting some of the initially established distortions and objectively increasing our knowledge of this deep-water sea snail.

ACKNOWLEDGEMENTS

We are very grateful to Alexandre D. Pimenta (MNRJ) for providing the type specimens, and to Jonata A. Francisco for elucidating a few questions regarding the original description.

REFERENCES

- Bieler R.** (1993) Architectonicidae of the Indo-Pacific (Mollusca, Gastropoda). *Abhandlungen des Naturwissenschaftlichen Vereins in Hamburg* 30: 1–376.
- Bieler R. & Gofas S.** (2013) Architectonicidae J.E. Gray in M.E. Gray, 1850. *World Register of Marine Species*. Available from: <http://www.marinespecies.org/aphia.php?p=taxdetails&id=22989> (Date of access: 03/vii/2013).
- Iredale T.** (1931) Australian molluscan notes, No.1. *Records of the Australian Museum* 18(4): 201–235.
- Romero A.F., Riedel O.S., Milanelli J.C.C. & Lammardo A.C.R.** (2011) Mapa da vulnerabilidade ambiental ao óleo – um estudo de caso na Baía de Santos, Brasil. *Revista Brasileira de Cartografia* 63: 315–332.
- Simone L.R.L & Cunha C.M.** (2012) Taxonomic study on the molluscs collected in Marion-Dufresne expedition (MD55) to SE Brazil: Xenophoridae, Cypraeoidea, mitriforms and terebridae (Caenogastropoda). *Zoosystema* 34: 745–781.
- Tenório D.O., Barros J.C.N., Francisco J.A. & Silva G.F.** (2011) New species of Architectonicidae (Gastropoda Heterobranchia) from northeastern Brazil. *Tropical Zoology* 24: 173–191.
- Thiele J.** (1925) Gastropoden der Deutschen Tiefsee-Expedition. *Wissenschaftliche Ergebnisse der Deutschen Tiefsee-Expedition II. Teil* 17(2): 35–382.

Received: August 12, 2013. Accepted: October 18, 2013.