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Three new species of Cancellariidae (Gastropoda: Neogastropoda) from north-east Brazil with first record of *Gergovia* for the Atlantic ocean

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Abstract

Brocchinia verheckeni n. sp. and *Brocchinia harasewychi* n. sp. are described from several stations from 340 to 720m on the Continental Slope off Northeast Brazil. *Brocchinia verheckeni* occurred from the states of Ceará to Sergipe, and *B. harasewychi* was collected from the states of Pernambuco to Alagoas. Both species are considered endemic to these regions. This is the second record of the genus *Brocchinia* Jousseaume, 1887 in deep waters off Brazil. *Brocchinia harasewychi* has a protoconch with 1 ¼ whorls, which is more inflated in comparison to *B. verheckeni*, the body whorl has 3 spiral cords, the uppermost bordering the suture and the other 2 near mid-whorl. The body whorl of *Brocchinia verheckeni* has 3 strongly nodulose spiral cords and an outer lip with 5 to 6 internal denticles, while that of *B. harasewychi* has a smooth outer lip. The genus *Gergovia* Cossmann, 1899 is recorded for the first time in the Atlantic Ocean with the description of *Gergovia petiti* n. sp., known only from the oceanic region from Northeast Brazil, occurring from the state of Ceará to the state of Bahia, as well as in the Fernando de Noronha archipelago, probably living in the muddy substrate at depths of between 206 and 720 meters.

Key words: Cancellariidae, *Brocchinia*, *Gergovia*, deep sea, Northeast Brazil

Introduction

Cancellariidae are represented by small to medium-sized marine neogastropods (Ponder 1973), which are highly specialized, but taxonomically enigmatic, and little is known about their biology (Harasewych & Petit 1982; 1984). They have morphologically similar shells, making the group easy to recognize at the family and species levels. However generic classifications lead to confusion, especially because of the presence of various overlapping characteristics (Verhecken 1997). Nonetheless, there is consensus that the members of this family possess solid, biconic shells, cancellate sculpture, with both axial and spiral ribs that intercept one another, forming reticulate sculpture, an elliptical aperture with a short siphonal canal and strong columellar folds in most genera (Abbott 1974; Rios 1994).

The genus *Brocchinia* consists of species with a small, turreted shell; smooth, paucispiral protoconch; convex, anteriorly rounded, axially and spirally sculptured whorls, well-marked suture, oval to semi-circular aperture, imperforate or with an umbilical chink, outer lip smooth or with internal folds, short siphonal canal, slightly curved columella with one or two slight, rounded columellar folds.

The genus *Gergovia* Cossmann, 1899 [type species, by original designation, *Cancellaria platypleura* Tate, 1898] encompasses a small number of species so far known only from temperate Australian waters. These gastropods possess a small shell with a prominent protoconch, and teleoconch with strong axial ribs, whorls shouldered and coronate, suture channeled, small ovate aperture, and a straight columella with two medium to strong folds. This is the first record of the genus outside of the Australian area.

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During the development of the REVIZEE (Live Resources of the Economical Exclusive Zone) Program for coastal Brazil, carried out between 1999 and 2003, a large quantity of small species of Cancellariidae Forbes & Hanley, 1851, were obtained through dredges of the Continental Slope off Brazil. Bathyal Cancellariidae are rarely collected and poorly represented in malacological collections. Only a small number of species are known to occur in the Atlantic Ocean and are mostly described based on shell morphology, and often from a small number of specimens. The rarity of the material may be linked to the bathyal habitat, where the animals live in the sandy mud substrate. However, a large diversity of Cancellariidae have been described from the eastern Pacific and the Indo-Pacific (Petit & Harasewych 2005). A few studies describing new species have been carried out along the Brazilian coast, among these are Verhecken (1991; 2002) and Harasewych *et al*. (1992), who treated *Axelella* Petit, 1988, *Brocchinia* Jousseaume, 1887, *Cancellaria* Lamarck, 1799 and *Tritonoharpa* Dall, 1908.

Materials and methods

All specimens examined were obtained during oceanographic prospecting work on the Continental Slope off Northeast Brazil by the fishing vessel "Natureza", under the auspices of the Research and Management Center of Fishing Resources of the Northeastern Coast — CEPENE/IBAMA. The cruising area comprised a region stretching from the state of Ceará (03°01'32'' S and 38°47'1''W) to Bahia (12°02'03''S and 37°36'29'') and also the Fernando de Noronha archipelago (03°55'00'' S, 32°38'03''W) in muddy sediment at depths ranging from 340 to 720 meters. All samples were placed into plastic bags and frozen. In the laboratory, the sediment was rinsed in running water and sorted under a stereomicroscope. No specimen was obtained with soft parts, but many shells were "fresh dead".

Shells were mounted on metal stubs for scanning electron microscopy (SEM). Dimensions were determined with a stereomicroscope equipped with an ocular micrometer. Shell length is the maximum dimension parallel to the coiling axis. Shell width is the maximum measurement perpendicular to the coiling axis.
The generic identification of *Brocchinia* was established through comparisons with original illustrations and descriptions, mainly following the work of Petit (1986) and Verhecken (1991; 2002). The generic identification of *Gergovia* was based on Garrard (1975).

The following are the abbreviations used in the present article: LMUFRPE — Laboratory de Malacology, Universidade Federal Rural de Pernambuco, Recife, Brazil; MHNC — Haus der Natur, Cismar, Germany; MNRJ — National Museum, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil; MORG — Oceanographic Museum of Rio Grande, state of Rio Grande do Sul, Brazil; MZUSP — Museum of Zoology — Universidade de São Paulo, state of São Paulo, Brazil; D — Dredging; Lt — Length of shell; La — Length of aperture; Lp — Length of protoconch; Wa — width of aperture; Wp — width of protoconch; Wt — width of shell.

Taxonomy

Cancellariidae Forbes & Hanley, 1851

Brocchinia Jousseaume, 1887

Brocchinia verheckeni n. sp.

(Figures 1–5)

Type material: Holotype, MZUSP 77665 [Lt 4.3 mm, Wt 2.1 mm]; Paratype 1, MZUSP 77070, along the

state of Rio Grande do Norte, Brazil, D-24, 04°51'40'' S, 35°08'01'' W, 384 m, muddy substrate, 24.xi.2001; Paratype 2, MHNC 64505, along the state of Pernambuco, Brazil, D-04, 08°42,1'00''S, 34°44,1'00''W, 465 m, muddy bottom, 25.iii.2000; Paratype 3, LMUFRPE 008, along the state of Pernambuco, Brazil, D-11, 08°46,5'00''S, 34°44,5'00''W, 690 m, muddy bottom, 18.xi.2000; Paratype 4, MZUSP 77071, along the state of Ceará, Brazil, D-20, 03°30'51''S, 37°59'28''W, 384 m, muddy bottom, 07.xi.2001; Paratype 5, MNRJ 10575, along the state of Ceará, Brazil, D-20, 03°30'51''S, 37°59'28''W, 384 m, muddy bottom, 07.xi.2001; Paratype 6, MNRJ 10576, along the state of Alagoas, Brazil, D-32, 09°20'30''S, 34°59'11''W, 452 m, muddy bottom, 18.xii.2001; Paratype 7, MORG 50.657, along the state of Sergipe, Brazil, D-06, 10°41,4'00''S, 36°18'07''W, 365 m, muddy bottom, 28.x.2000; Paratype 8, MNRJ 10577, along the state of Sergipe, Brazil, D-06, 10°41,4'00''S, 36°18'07''W, 365 m, muddy bottom, 28.x.2000; Paratype 9, MORG 50.658, along the state of Sergipe, Brazil, D-06, 10°41,4'00''S, 36°18'07''W, 365 m, muddy bottom, 28.x.2000; Paratype 10, LMUFRPE 009, along the state of Pernambuco, Brazil, D-11, 08°46,5'00''S, 34°44,5'00''W, 690 m, muddy bottom, 18.xi.2000.

Type Locality: Along the state of Rio Grande do Norte, Brazil ("Natureza", D-27, 06°14'24"S, 34°52'06"W,), at a depth of 500 meters, muddy bottom, 26.xii.2001.

Diagnosis: Globular protoconch with 1 whorl, teleoconch with 3¼ whorls, first whorl with 2 smooth or slightly nodulose spiral cords, penultimate whorl with 3 strongly nodulose spiral cords, body whorl with 4 spiral cords, the uppermost forming a crown at the shoulder; base with 2 smooth spiral cords; aperture with internal lirae, columella biplicate.

Description: Solid, white, nodulose conical shell (Lt 4.0–4.4 mm) (Figs. 1–2). Globular, paucispiral, smooth protoconch of 1 whorl (Fig. 4), with transition to teleoconch marked by straight axial edge (Fig. 5). Teleoconch with 3¼ whorls (Fig. 2). First post-nuclear whorl initially ornamented by 2 smooth or slightly nodulose spiral cords, with third cord appearing at end of this whorl. Spiral sculpture formed by 3 strongly nodulose spiral cords on last 2 whorls, with 3 more smooth basal cords appearing on body whorl; uppermost appearing at the suture at posterior end of aperture. Axial sculpture formed by strong nodulose ribs emerging from under suture, crossed by equally spaced spiral cords, with uppermost forming small crown on the shoulder. Suture deeply incised, forming broad suprasutural furrow. Strongly conical base, ornamented by 2 smooth spiral cords that emerge from the interior of the aperture, with a large abapical smooth area. Shell entirely marked by strong axial growth lines. Elliptical aperture, thin prosocline outer lip, with 5 to 6 internal lirae, normally 6, that do not reach the edge. Inner lip strongly reflected, weakly developed parietal region, with no callus (Fig. 3). Columella a bit inclined to right, with 2 evident folds, posterior slightly larger. Slight dorsal deflection at end of columella, which unites with the outer lip to form a weak siphonal notch.

Etymology: in homage to Mr. André Verhecken of the Royal Belgian Institute of Natural Science, Malacology Section, who studied Brazilian *Brocchinia* species.

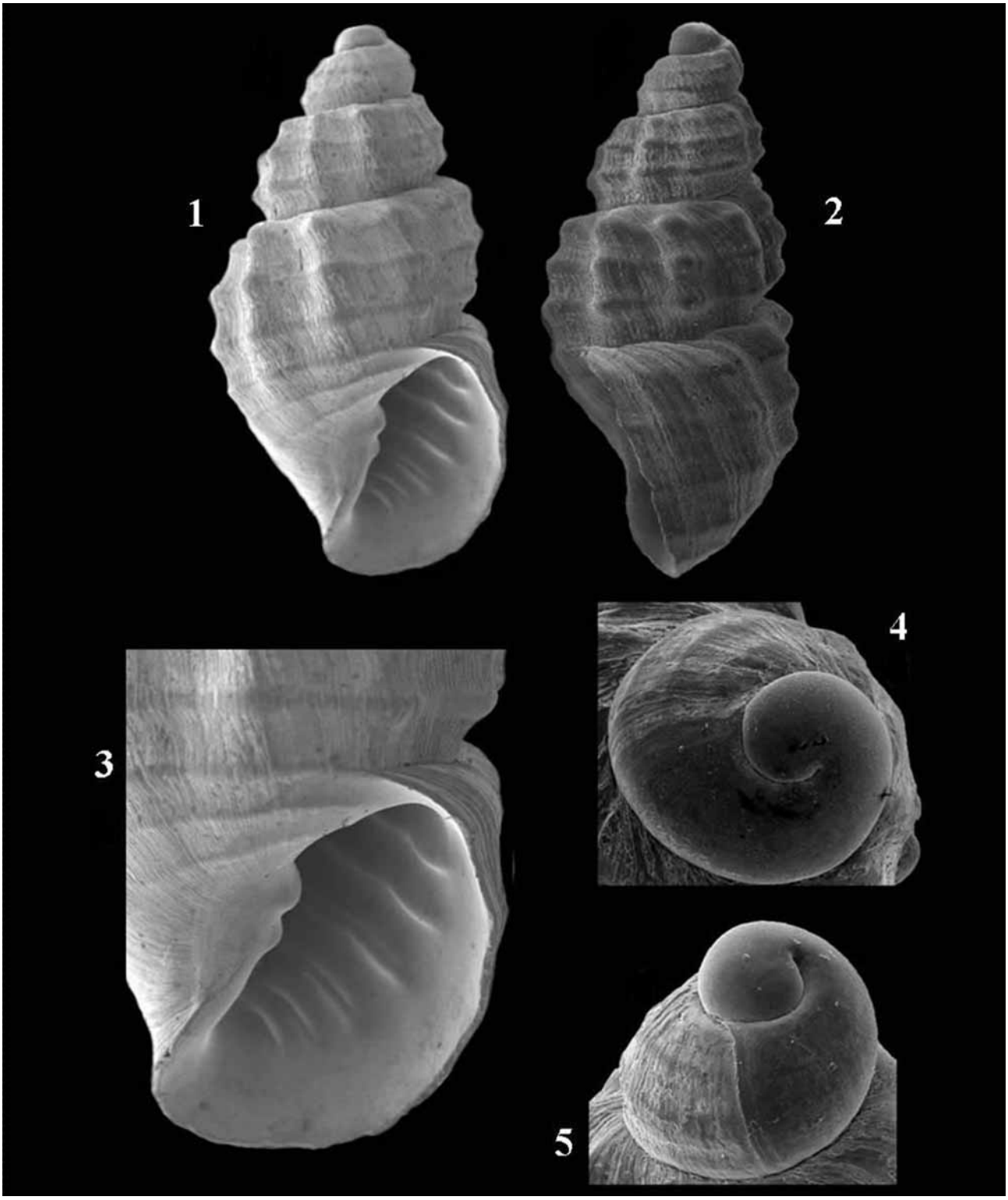
Geographic Distribution: From the State of Ceará to state of Sergipe, Northeast Brazil.

***Brocchinia harasewychi* n. sp.**
(Figures 6–11)

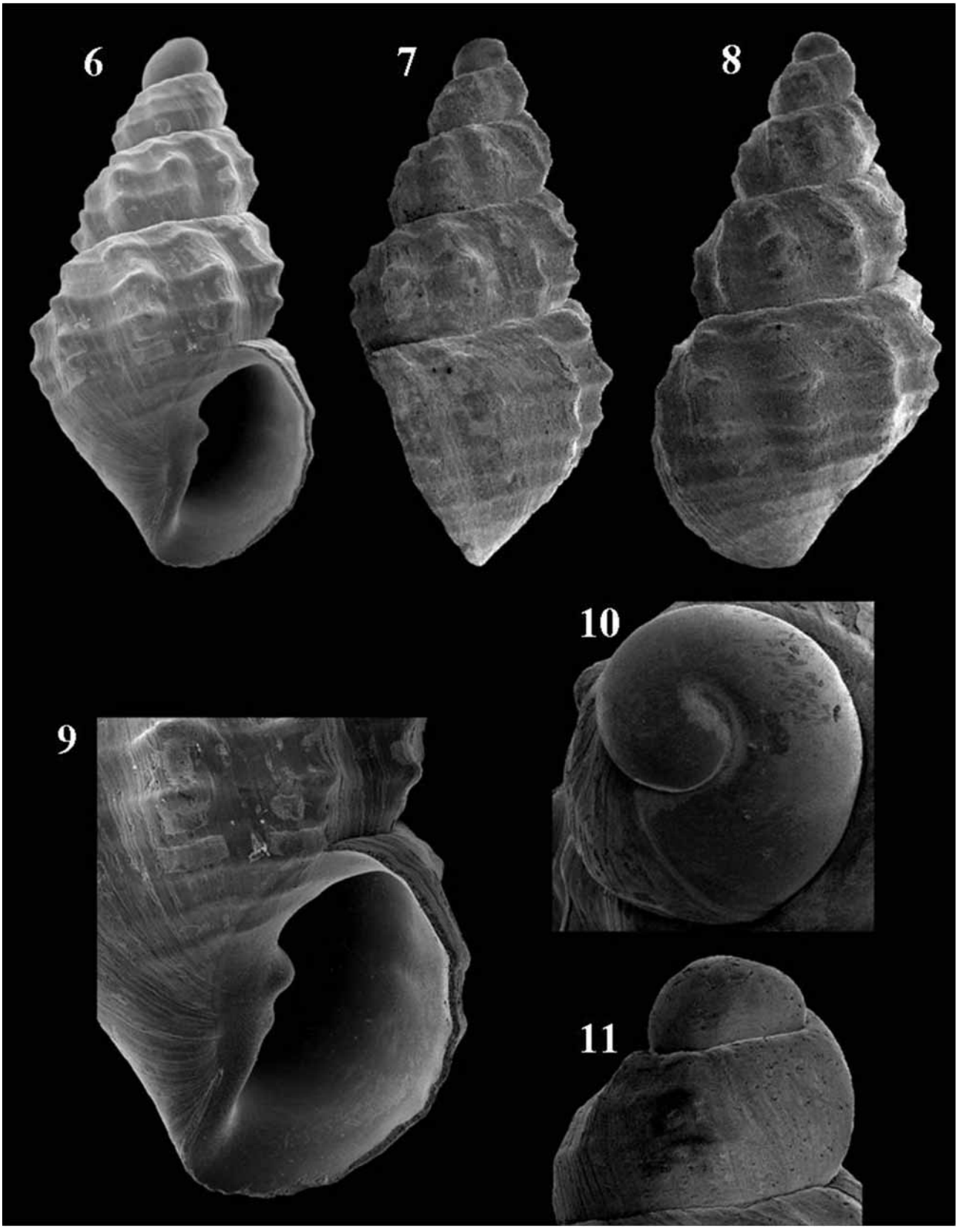
Type material: Holotype, MZUSP 77069, [Lt 6.3 mm, Wt 3.4 mm],; Paratype 1, LMUFRPE 010, along the state of Alagoas, Brazil, D-32, 09°20'30''S, 34°59'11''W, 452 m, muddy bottom, 18.xii.2001; Paratype 2, MNRJ 10574, along the state of Pernambuco, Brasil, D-11, 08°46,5'00''S, 34°44,5'00''W, 690 m, muddy bottom, 18.xi.2000; Paratype 3, MORG 50.659, along the state of Pernambuco, Brasil, D-11, 08°46,5'00''S, 34°44,5'00''W, 690 m, muddy bottom, 18.xi.2000.

Type locality: along the state of Pernambuco, Brazil, D-11, 08°46,5'00''S, 34°44,5'00''W, 690 m, muddy bottom, 18.xi.2000.

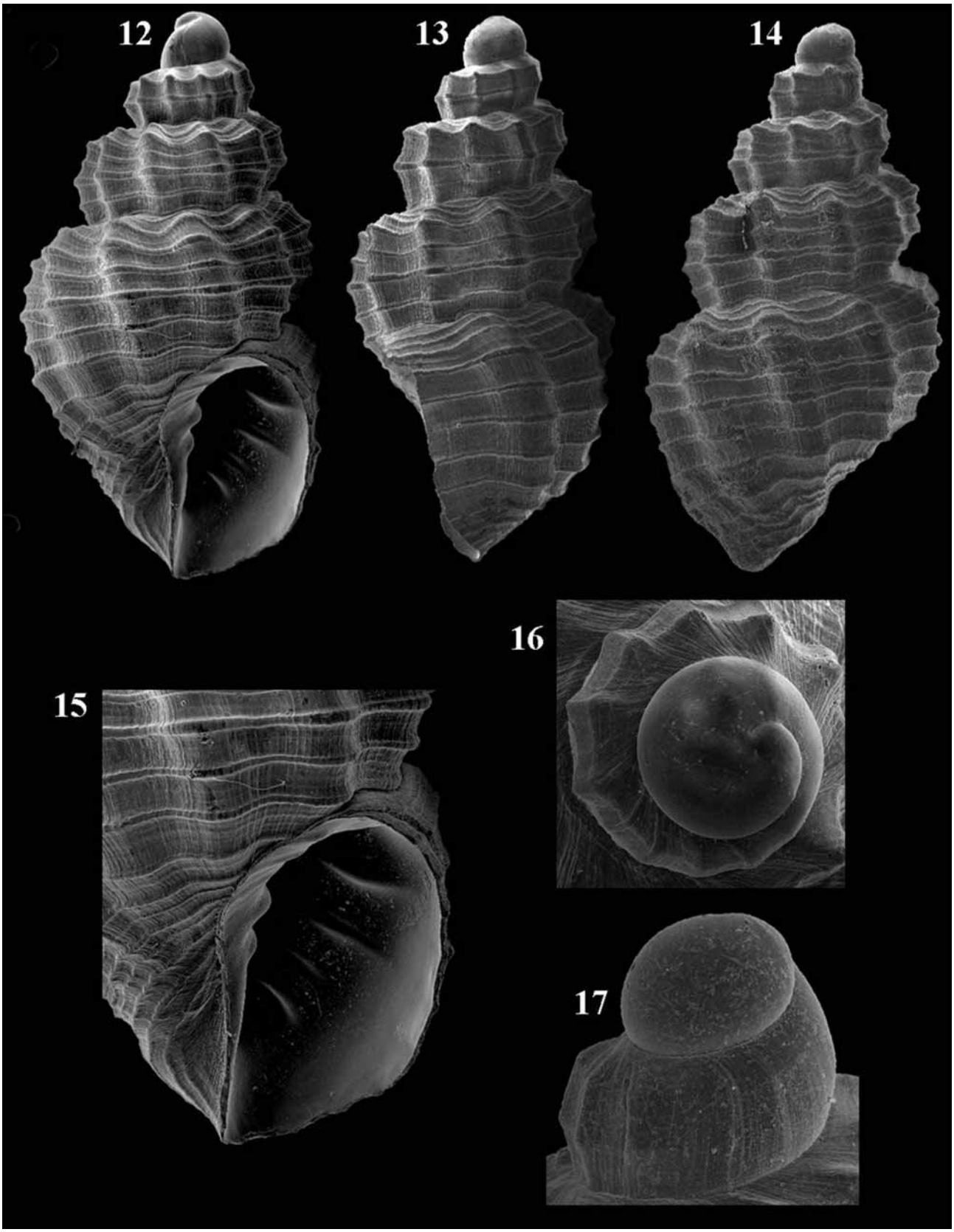
Diagnosis: Large protoconch, with 1¼ whorls; teleoconch with 3½ whorls, first whorl with 3 strong spiral cords, penultimate whorl with 4 cords, one smooth and subsutural and 3 nodulose cords below. Body whorl with 5 cords, 3 strongly nodulose and 2 lower smooth cords. Outer lip with no internal sculpture, columella with 2 folds.



FIGURES 1–5. *Brocchinia verheckeni* n. sp. (SEM): 1. Holotype, MZUSP 77665 (Lt: 4.3 mm; width: 2.1 mm), ventral view; **2**. Paratype 1, MZUSP 77070 (Lt 4.4 mm; Wt 2.2 mm), lateral view; **3.** Holotype, view aperture (La: 1 mm; Wa: 0.7 mm); **4.** Paratype 3, LMUFRPE 008, detail of protoconch (Lp 0.5 mm; Wp 0.6 mm); **5.** Paratype 10, LMUFRPE 009, detail of protoconch (Lp 0.5 mm; Wp 0.6 mm).



FIGURES 6–11. ***Brocchinia harasewychi*** **n. sp. (SEM): 6.** Holotype, MZUSP 77069 (Lt 6.3 mm), ventral view; **7**. Holotype, lateral view; **8**. Holotype, dorsal view; **9**. Holotype, view aperture (La 2.8 mm; Wa 1.3); **10**. Paratype 3, MORG 50.659, detail of protoconch (Lp 0.7 mm; Wa 0.8 mm); **11**. Holotype, detail of protoconch (Lp 0.8 mm; Wa 0.8 mm).



FIGURES 12–17. ***Gergovia petiti*** **n. sp. (SEM): 12.** Holotype, MZUSP 77067 (Lt 3.7 mm, Wt 2.0 mm), ventral view; **13**. Paratype 1, MZUSP 77068 (Lt 3.9 mm, Wt 2.0 mm), lateral view; **14**. Paratype 2, MNRJ 10572 (Lt 4.1 mm, Wt 2.2 mm), dorsal view; **15**. Holotype, view aperture (La 1.7 mm, Wa 0.8 mm); **16**. Paratype 1, MZUSP, detail of protoconch (La 0.4 mm, Wa 0.5 mm); **17**. Paratype 2, MNRJ, detail of protoconch (Lp 0.5 mm, Wp 0.5 mm).

Description: Broad, white, conical shell, very ample body whorl, with 3½ post-nuclear whorls (Figs. 6–8) (Lt 4.6–6.3 mm). Smooth, large, globular, paucispiral protoconch, 1¼ whorls, with transition to the teleoconch marked by a thin axial edge (fig. 10–11). First teleoconch whorl with 3 equally strong spiral cords, uppermost bordering the suture and 2 more median ones with no evident nodulations. Subsequent whorls with strong blunt axial ribs, over which the cords become more prominent, forming broad interstices ornamented only by axial growth lines. Penultimate whorl with a weak, smooth subsutural spiral cord and 3 nodulose spiral cords passing over broad ribs. Body whorl ornamented by 3 strong spiral cords, uppermost near suture and separated from it by a narrow subsutural area. The 2 median spiral cords have a similar appearance. There are another 3 weaker, smooth spiral cords, the middle of which emerges from the suture. Suture well marked. Conic base ornamented spirally by a smooth spiral cord emerging from the interior of the aperture at the height of the parietal region. Elliptical aperture, narrower on the posterior side (fig. 9). Small prosocline outer lip, with no internal lirae. Inner lip slightly reflected. Very thin parietal callus. Reinforced columella, with 2 oblique folds, the posterior of which is bigger, with the smaller one just anterior to the primary fold. Small, short, rounded siphonal canal.

Etymology: In homage to Dr. M. G. Harasewych, of the Department of Invertebrate Zoology of the National Museum of Natural History — Smithsonian Institution, Washington, DC.

Geographic Distribution: From the state of Pernambuco to the state of Alagoas, Northeast Brazil.

Gergovia Cossmann, 1899

Gergovia petiti n. sp.

(Figures 12–17)

Type material: Holotype, MZUSP 77067 [Lt 3.7 mm, Wt 2 mm]; Paratype 1, MZUSP 77068, along the state of Alagoas, Brazil, D-31, 10°06’35’’S, 35°46’41’’W, 720 m, muddy bottom, 16.xii.2001; Paratype 2, MNRJ 10572, along the state of Alagoas, Brazil, D-31, 10°06’35’’S, 35°46’41’’W, 720 m, muddy bottom, 16.xii.2001; Paratype 3, MNRJ 10573, along the state of Alagoas, Brazil, D-31, 10°06’35’’S, 35°46’41’’W, 720 m, muddy bottom, 16.xii.2001; Paratype 4, LMUFRPE 001, along the Fernando de Noronha Archipelago, state of Pernambuco, Brazil, D-14, 03°54,9’00’’S, 32°37,8’00’’W, 380 m, muddy bottom, 12.x.2001; Paratype 5, MORG 50.655, along the state of Rio Grande do Norte, Brazil, D-26, 06°14’04’’S, 34°52’33’’W, 510 m, muddy bottom, 26.xi.2001; Paratype 6, MORG 50.656, along the Fernando de Noronha Archipelago, state of Pernambuco, Brazil, D-14, 03°54,9’00’’S, 32°37,8’00’’W, 380 m, muddy bottom, 12.x.2001; Paratype 7, LMUFRPE 002, along the state of Pernambuco, Brazil, D-1, 06°25,6’00’’S, 34°43,9,’00’’W, 425 m, muddy bottom, 29.viii.1999.

Additional material: 3 specimens, MHNC 64506, along the state of Rio Grande do Norte, Brazil, D-27, 06°14’24’’S, 34°52’06’’W, 500 m, muddy bottom, 16.xi.2001; 3 specimens, LMUFRPE 003, along the state of Rio Grande do Norte, Brazil, D-29, 06°13’22’’S, 34°52’20’’W, 223 m, muddy bottom, 16.xii.2001; 2 specimens, LMUFRPE 004, along the state of Ceará, Brazil, D-18, 02°05’19’’S, 41°05’01’’W, 390 m, muddy bottom, 30.x.2001; 1 specimen, LMUFRPE 005, along the state of Alagoas, Brazil, D-31, 10°06’35’’S, 35°46’41’’W, 720 m, muddy bottom, 16.xii.2001; 2 specimens, LMUFRPE 006, along the state of Rio Grande do Norte, Brazil, D-22, 04°15’02’’S, 37°12’37’’W, 206 m, muddy bottom, 10.xi.2001; 1 specimen, LMUFRPE 007, along the state of Rio Grande do Norte, Brazil, D-26, 06°14’04’’S, 34°52’33’’W, 510 m, muddy bottom, 16.xi.2001.

Type locality: along the state of Rio Grande do Norte, Brazil, D-29, 06°13’22’’S, 34°52’20’’W, 223 m, muddy bottom, 26.xi.2001

Diagnosis: Protoconch with 1.5 whorls, teleoconch with 3.5 whorls; first whorl with two strong spiral

cords, crossed by equally strong ribs; penultimate whorl with 6 spiral cords, the third of which forms the shoulder and the last of which is slightly nodulose. Body whorl with 7 spiral cords, upper third cord forming the shoulder. Base with seven smooth spiral cords, last 3 of which form the fasciole. Notched base, outer lip with 4 lirae, columella with 2 folds.

Description: White, spindle-like, conical shell (Lt 3.2–4.1 mm), with strongly axially and spirally ornamented convex whorls (Figs. 12–14). Smooth, globular, paucispiral protoconch, with nucleus slightly raised in relation to subsequent whorls, composed of 1.5 well-defined whorls and well-marked transition to teleoconch by the emergence of nodulose spiral cords (Figs. 16–17). Teleoconch with 3.5 whorls. First postnuclear whorl marked by 2 strong spiral cords crossed by well developed axial ribs, distributed from suture to suture. Spiral cords positioned medially, leaving a sub and supra-sutural gap with no spiral ornamentation. Penultimate whorl with 2 thin subsutural cords before nodulose shoulder, crossed by 10 strong axial ribs. Below shoulder are 3 spiral cords, the last of which is slightly nodulose and supra-sutural, upper two resembling one another and slightly thinner than shoulder. Strong axial ribs delimiting broad, spirally developed interspaces. Ample body whorl, ornamented by 2 slight subsutural spiral cords, a thin, nodulose shoulder cord and 4 equally nodulose spiral cords, the last thinner. All spiral ornamentation crossed by 8 strong axial ribs. Nodules on cords of body whorl developed spirally over ribs. Well-marked suture. Ribs of body whorl extending downward, stronger on last spiral cord. Conic, sharp base, ornamented by 7 spiral cords with smoother appearance than the upper cords, first base cord emerging from interior of aperture and three last ones forming short siphonal fasciole. Elliptic aperture, widened on posterior side. Small outer lip with 4 elongated internal lirae, not reaching edge. Narrow umbilicus in form of fissure. Strongly reflected parietal region, but without formation of a callus. Straight columella, with 2 folds, uppermost slightly stronger. Short, siphonal canal, sharp on anterior side (fig. 15).

Etymology: In homage to Mr. Richard E. Petit for the generic identification of the species described in the present article.

Geographic distribution: From the state of Ceará to the state of Bahia, along the Fernando de Noronha archipelago**,** Northeast Brazil, 206–720 m.

Taxonomic discussion

Adding to the species thus far known for the Western South Atlantic, Verhecken (2002) broadened the geographic distribution of *Brocchinia clenchi* Petit, 1986, which is similar and may be closely related to *B. verheckeni* n. sp., to include a single specimen dredged off Pernambuco. At the same time Verhecken (2002: 511) suggested that "the extreme depth-range (15–1520 m) might indicate the existence of two forms or species which cannot be clearly separated on conchological basis now." The Brazilian specimen identified by Verhecken as *B. clenchi* resembles *B. verheckeni* in its conical shape, the presence of columellar folds with the posterior fold being slightly larger, outer lip with internal lirae that do not reach the edge. *Brocchinia verheckeni* can be easily separated from *B. clenchi* by its protoconch of 1 whorl, 3 strong spiral cords on the penultimate whorl, body whorl with 4 spiral cords with the basal being the weakest, axial sculpture formed by strong ribs, with strong nodules present on all of them crossed by spiral cords, with the uppermost cord forming a small subsutural crown. The suture is much more constricted in *B. verheckeni*, forming a broad suprasutural furrow. The shape of this single Brazilian specimen, referred to as *B. clenchi* by Verhecken (2002: 510) dredged by the "Challenger" Expedition (station 122) and mentioned by Watson (1886: 698) more strongly resembles *B. verheckeni* than *B. clenchi*, especially with regard to the depth of the suture, its 2 columellar folds, and the strongly nodulose ornamentation. However, they differ considerably by having just 2 and 3 spiral cords on the penultimate whorl and final whorl, respectively, and the latter a protoconch with more than one whorl.

Brocchinia harasewychi n. sp. displays a greater similarity to *B. verheckeni* in having a solid shell with a widened, conical, sharp profile, ornamented by strongly nodulose spiral cords. However, in *B. verheckeni* the protoconch has just one whorl. The first teleoconch whorl has 2 smooth or slightly nodulose spiral cords, the penultimate whorl has 3 slightly nodulose spiral cords. In *B. harasewychi*, the protoconch is larger and more inflated, with 1¼ whorls, and the teleoconch has 3 strong spiral cords, the uppermost bordering the suture and the other 2 approximately median, with no nodules. The penultimate whorl has 4 cords, the last of which is thinner and just suprasutural. The body whorl is ample, ornamented with 3 strong spiral cords, the uppermost near the suture and separated from it by a narrow subsutural area and by 2 additional lower spiral cords with a smooth appearance. In both *B. verheckeni* and *B. harasewychi*, the nodules are rounded, and the suture is well marked, but in *B. verheckeni* there is a strong sutural furrow. *B. verheckeni* has internal lirae on the outer lip lacking in *B. harasewychi*.

The genus *Gergovia*, now recorded also from Brazil, is previously known only from deep waters off Australia. This species was placed in this group in accordance with the conchological characteristics indicated by Richard Petit (pers. comm., March 2006), Garrard (1975) and Iredale (1925). Despite the long geographical distance separated by large oceanic barriers, *Gergovia petiti* is morphologically similar to *G. haswelli* Garrard, 1975 from Australia, being similar in its spindle-like appearance, the convex contour of the whorls forming soft shoulders, the strongly ribbed ornamentation, the aperture shape and suture deeply impressed. The umbilicus is grooved, with the same number of folds in the columella and protoconch and teleoconch whorls. *G. petiti* has a higher number of spiral cords on the penultimate whorl and has 10 axial ribs on the penultimate whorl with 8 on the body whorl, whereas *G. haswelli* has 9 ribs on both whorls. Four strong lirae are present in the outer lip of all the adult specimens of *G. petiti*, whereas there can be 4 to 5, or even none, in *G. haswelli*.

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