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Deep sea *Yoldiella* (Pelecypoda: Protobranchia: Yoldiidae) from Campos Basin, Rio de Janeiro, Brazil

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Despite the increasing number of reports on the deep-sea molluscs from the south-western Atlantic, we know very little about the protobranchs. The lack of information on the protobranch Pelecypoda off southern Brazil is reflected in the genus Yoldiella. *This contribution is part of an effort to increase the knowledge about this group off the Brazilian coast. Eight species of* Yoldiella *are recognized here. For* Yoldiella biguttata*, previously reported from Brazil, the known distribution is extended southwards to the Campos Basin. For* Yoldiella similis *this is the first record in the western Atlantic Ocean. For* Yoldiella extensa *and* Yoldiella *aff.* jeffreysi *this is the first record for Brazil. Four previously unknown species are described,* Yoldiella lapernoi *sp. nov.,* Yoldiella paranapuaensis *sp. nov.,* Yoldiella arariboia *sp. nov. and* Yoldiella curupira *sp. nov. Considering only conchological features for the Atlantic species we could propose some clusters of species of* Yoldiella.

Keywords: deep-sea, biodiversity, Bivalvia, Protobranchia, Yoldiidae, *Yoldiella*, new species

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INTRODUCTION

The largest habitat, covering two-thirds of the surface of the Earth, lies in the deep sea (Etter *et al.*, 2005). At least 94% of the seabed lies below the permanent thermocline (Allen & Sanders, 1996b). In these deep waters (400–5000 m), the Protobranchia comprises the most abundant group of Pelecypoda.

The last 30 years have seen important contributions to knowledge about the western Atlantic protobranch fauna (Sanders & Allen, 1973, 1977, 1985; Allen & Hannah, 1989; Rhind & Allen, 1992; Allen *et al.*, 1995; Allen & Sanders, 1996a, b; Allen, 2008). Even though these efforts elucidated much of the protobranch Brazilian deep-water fauna, the samples from this area were not only undersampled (Allen & Sanders, 1996b; Allen, 2008), but were limited to the northern waters of Brazil.

Recently, additional deep-water samples became available as a secondary result of deep-sea oil-prospecting, in response to the requirements of IBAMA, the Brazilian Environmental Agency. Our results are an outcome of the programme 'Environmental Characterization of Campos Basin, Rio de Janeiro, Brazil' developed by Petrobras (Brazilian Oil Co.).

Even considering the increasing number of reports on the deep-sea molluscs from the south-western Atlantic (e.g. Absalão *et al.*, 2001, 2003; Absalão & Pimenta, 2003, 2005; Absalão & Santos, 2004; Caetano *et al.*, 2006; Zelaya *et al.*, 2006; Pimenta *et al.*, 2008; Oliveira & Absalão, 2008, 2009; Absalão, 2009), the protobranchs remain very poorly known.

The lack of information on the protobranch Pelecypoda off southern Brazil is reflected in the genus *Yoldiella* Verrill & Bush, 1897, which comprises one of the most common and diverse genera of the Protobranchia in deep waters, along with *Ledella* and some groups of the family Nuculidae (Allen & Hannah, 1989; Rhind & Allen, 1992; Allen, 2008). There are about 50 species of *Yoldiella* worldwide, and more than 33 species recorded for the Atlantic Ocean. However, the last Brazilian catalogue of molluscs (Rios, 2009) made no mention of the genus *Yoldiella*. Even though this does not reflect the actual knowledge of the genus for Brazil, only three species of *Yoldiella* are known for Brazilian waters: *Yoldiella biguttata* Allen, Sanders & Hannah, 1995; *Y. curta* Verrill & Bush, 1898; and *Y. ella* Allen, Sanders & Hannah, 1995, all of them recorded between the latitudes of 0 to 8°S.

This paper is part of a general effort to fill the gaps in knowledge of protobranch biodiversity in the waters off south-eastern Brazil. We provide a taxonomic discussion on the genus *Yoldiella*.

MATERIALS AND METHODS

The samples used in the present study were collected with a box corer in the Campos Basin off Brazil (22°S41°W) by the research vessel 'Astro-Garoupa' belonging to Petrobras S.A. (Brazilian Oil Co.) as part of the programme 'Environmental Characterization of Campos Basin, RJ, Brazil' in the years 2002 and 2003. Species of *Yoldiella* were present at 96 stations between the isobaths of 700 and

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Table 1. Table of the given localities

Station	Depth	Latitude	Longitude	Date
32	900	22°38′01 14″S	40°17′26 55″W	18/5/2002
33	900	22°35′47 22″S	40°15′00 33″W	18/5/2002
34	900	22°33′31 21″S	40°12′05 38″W	18/5/2002
35	1000	22°35′17 02″S	40°10′49 99″W	19/5/2002
36	1000	22°37′54 17″S	40°13′36 46″W	19/5/2002
37	1000	22°39′44 28″S	40°1′544 41″W	19/5/2002
38	1100	22°41′18 79″S	40°14′05 93″W	15/5/2002
39	1100	22°39′40 14″S	40°11′35 16″W	19/5/2002
40	1100	22°36′47 26″S	40°09′11 51″W	16/5/2002
41	1200	22°39′34 36″S	40°08′22 27″W	15/5/2002
42	1200	22°41′39 45″S	40°10′24 84″W	15/5/2002
43	1200	22°43′17 37″S	40°12′12 34″W	15/5/2002
44	750	22°10′43 28″S	39°54′46 04″W	10/12/2002
45	1050	22°10′54 32″S	39°52′19 43″W	10/12/2002
46	1350	22°10′55 5″S	39°49′00 6″W	10/12/2002
47	1650	22°11′04 4″S	39°470′4 6″W	25/11/2002
48	1950	22°11′16 63″S	39°43′44 7″W	25/11/2002
49	750	22°04′34 72″S	39°54′05 90″W	22/11/2002
50	1050	22°04′34″S	39°52′05″W	24/11/2002
51	1350	22°04′43 44″S	39°490′8 29″W	24/11/2002
52	1650	22°04′44 26″S	39°46′31 55″W	24/11/2002
53	1950	22°04′46 20″S	39°43′02 02″W	24/11/2002
54	750	21°57′17 5″S	39°56′01 1″W	12/12/2002
50A	1050	22°02′50 81″S	39°52′24 10″W	14/12/2002
56	1350	21°57′15 5″S	39°49′37 43″W	14/12/2002
57	1650	21°57′15 55″S	39°47′43 8″W	14/12/2002
58	1950	21°57′26 87″S	39°403′3 8″W	11/12/2002
59	750	21°52′59 6″S	39°55′30 6″W	12/12/2002
60	1050	21°52′50 45″S	39°51′42 60″W	12/12/2002
61	1350	21°525′1 90″S	39°48′11 68″W	12/12/2002
62	1650	21°52′41 91″S	39°46′17 52″W	11/12/2002
63	1950	21°52′44 1″S	39°404′5 6″W	11/12/2002
64	750	22°36′03″S	40°21′45 36″W	22/11/2002
65	1050	22°40′57 81″S	40°163′0 35″W	22/11/2002
66	1350	22°44′48 61″S	40°10′07 68″W	22/11/2002
67	1650	22°46′59 05″S	40°07′49 44″W	22/11/2002
68	1950	22°48′05 28″S	40°06′38 64″W	15/11/2002
69	750	22°31′12 47″S	40°15′11 08″W	22/11/2002
70	1050	22°35′04 54″S	40°08′53 14″W	21/11/2002
71	1350	22°38′53 60″S	40°04′14 20″W	23/11/2002
72	1650	22°41′03 82″S	40°022′9 58″W	23/11/2002
73	1950	22°41′35 24″S	40°00′45 24″W	22/11/2002
74	750	22°273′1 62″S	40°09′23 19″W	21/11/2002
75	1050	22°31′28 28″S	40°03′50 40″W	19/11/2002
76	1350	22°34′05 75″S	40°00′10 34″W	19/11/2002
77	1650	22°36′03 37″S	39°57′54 68″W	16/11/2002
78	1950	22°37′02 47″S	39°56′20 52″W	23/11/2002
79	750	22°195′0 13″S	40°00″ 35 11″W	26/11/2002
80	1050	22°24′31 58″S	39°57′28 05″W	20/11/2002
81	1350	22°27′18 98″S	39°54′50 48″W	17/11/2002
82	1650	22°28′49 50″S	39°53′24 33″W	17/11/2002
83	1950	22°30′35 35″S	39°51′45 42″W	23/11/2002
84	1050	22°26′27 75″S	39°58′51 65″W	20/11/2002
85	1350	22°29′33 89″S	39°56′17 64″W	19/11/2002
86	1650	22°313′6″S	39°55′15″W	16/11/2002
45	1050	22°10′53 4″S	39°52′18 3″W	1/7/2003
46	1336	22°10′54 6″S	39°485′9 5″W	25/6/2003
47	1654	22°11′04 4″S	39°47′04 8″W	22/6/2003
48	1968	22°11′16 5″S	39°43′44 6″W	22/6/2003
49	722	22°04′32 8″S	39°54′11 4″W	30/6/2003
50	1030	22°04′33 9″S	39°52′05 1″W	30/6/2003
51	1299	22°04′43 3″S	39°49′09 3″W	25/6/2003
52	1643	22°04′45 2″S	39°46′31 7″W	27/6/2003
53	1910	22°04′45 4″S	39°41′58 5″W	27/6/2003

Continued

Table 1. Continued

Station	Depth	Latitude	Longitude	Date
54	698	21°57′11 8″S	39°560′4 2″W	29/6/2003
50A	1050	22°02′51 6″S	39°52′22.4″W	29/6/2003
59	750	21°52′59 2″S	39°55′32 2″W	29/6/2003
60	1050	21°524′9 5″S	39°51′40 4″W	28/6/2003
61	1350	21°52′51 8″S	39°48′12 5″W	26/6/2003
62	1650	21°52′41 5″S	39°46′17 0″W	26/6/2003
63	1941	21°52′43 1″S	39°40′41 6″W	26/6/2003
64	750	22°36′01 3″S	40°21′43 7″W	11/6/2003
65	1050	22°40′57 7″S	40°16′31 1″W	11/6/2003
66	1323	22°44′49 5″S	40°10′06 6″W	11/6/2003
67	1596	22°46′58 3″S	40°0′749 3″W	12/6/2003
68	1972	22°48′05 9″S	40°06′38 6″W	12/6/2003
69	743	22°31′11 8″S	40°15′12 1″W	18/6/2003
70	1050	22°35′04 54″S	40°08′53 14″W	15/6/2003
71	1350	22°38′52 9″S	40°041′6 3″W	14/6/2003
74	750	22°27′31 1″S	40°09′23 5″W	18/6/2003
75	1050	22°31′28 3″S	40°03′49 3″W	18/6/2003
76	1350	22°34′05″S	40°00′12 6″W	15/6/2003
77	1650	22°36′12 2″S	39°58′22 9″W	13/6/2003
78	1945	22°37′02 9″S	39°562′0 1″W	13/6/2003
79	755	22°20′22 4″S	40°01′24 7″W	21/6/2003
80	1050	22°24′30 4″S	39°57′28 6″W	20/6/2003
81	1350	22°26′28 5″S	39°54′08 3″W	21/6/2003
82	1650	22°28′46 5″S	39°53′27 9″W	17/6/2003
83	1970	22°30′34 9″S	39°51′44 9″W	16/6/2003
84	1050	22°26′28 8″S	39°58′53 3″W	20/6/2003
85	1350	22°30′21 7″S	39°56′53 7″W	21/6/2003
86	1630	22°31′37 2″S	39°55′14 5″W	16/6/2003

1950 m. The list of localities is given in Table 1. Most of the shells were in a good state of preservation, although no live specimens were found. Each specimen was examined under magnification, and selected specimens were photographed with a SEM (Zeiss EVO 40), at the Gerência de Bioestratigrafia e Paleoecologia Aplicada (BPA), of the Petrobrás Research Center (Centro de Pesquisas da Petrobrás—CENPES), and at the Museu Nacional—Universidade Federal do Rio de Janeiro (JEOL–6390LV). Taxonomic identifications were made through comparison with the figures of *Yoldiella* types held at the Natural History Museum, London—BM(NH) and the National Museum of Natural History (Smithsonian Institution), Washington, DC—(USNM); and also with types illustrated in the literature (Verrill & Bush, 1897; Warén, 1989; Allen *et al.*, 1995; Bonfitto & Sabelli, 1995; La Perna, 2008; Killeen & Turner, 2009; Oliver *et al.*, 2009).

The material is deposited in the Mollusca collection of the following institutions: Departamento de Zoologia, Instituto de Biologia, Universidade Federal do Rio de Janeiro (IBUFRJ), Museu Nacional do Rio de Janeiro (MNRJ), Museu de Zoologia da Universidade de São Paulo (MZUSP), Museu Oceanográfico da Fundação Universitária de Rio Grande (MOFURG) and Muséum National d'Histoire Naturelle, Paris (MNHN).

Because we noted the importance of the features of the hinge plate for the discrimination of *Yoldiella* species, and considering some subjective concepts in taxonomy (e.g. 'thin' or 'thick), we described the species using some quantitative information such as the ratios of the hinge plate measurements (wat, wap and wpt, wpp—Figure 1C), which are described as follows: 'thin' for width of teeth/total height

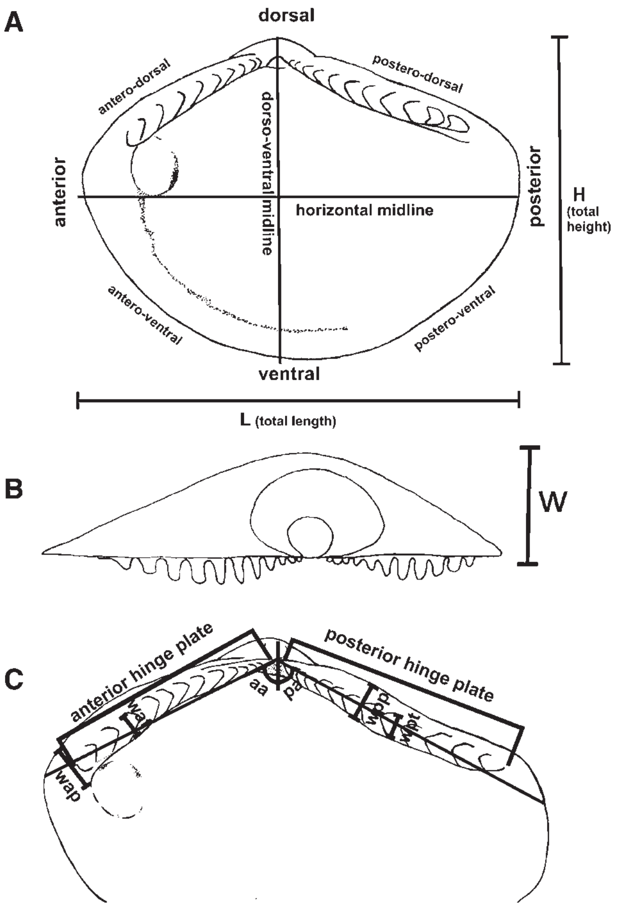

Fig. 1. Scheme of the measurements and abbreviations used in the descriptions of the species. (A) Margins; total length (L) and total height (H); (B) width of a valve (W); (C) anterior and posterior sides of the hinge plate, anterior (aa) and posterior (pa) angles between the two sides of the hinge plate, based on lines going from the dorso-ventral midline to the anterior and posterior margins edge, midline is the dorso-ventral line represented in sketch A; width of the anterior plate (wap), width of the anterior teeth (wat), width of the posterior plate (wpp), width of the posterior teeth (wpt).

ratio < 0.07 and width of the hinge plate/total height ratio $<$ 0.1; 'thick' for width of teeth/total height ratio ≥ 0.07 and width of the hinge plate/total height ratio ≥ 0.1. The width of the hinge teeth was measured just above (dorsal) and below (ventral) the teeth limit. We also used the precise angles between the anterior and posterior area of the hinge plate, defined by lines beginning at the top of the resilifer, passing through the first teeth of the hinge plate and going until the distal part of the margins (anterior and posterior, respectively). Height is the longest dorso-ventral dimension passing through the dorsalmost tip of resilifer and orthogonal to length, which is anterior to the longest antero-posterior dimension of a line tangential to the ventralmost part of adductor muscle scar.

RESULTS

Subclass PROTOBRANCHIA Pelseneer, 1889
Order NUCULANOIDA Dall, 1889
Family YOLDIIDAE Habe, 1977
Subfamily YOLDIELLINAE Allen, 1978
Genus *Yoldiella* Verill & Bush, 1897

TYPE SPECIES

Yoldiella lucida Lovén, 1846 (subsequent designation, Warén, 1989).

TYPE LOCALITY

Hammerfest, nothern Norway (established by Warén, 1989).

The genus *Yoldiella* Verrill & Bush, 1897 contains a large number of small, mostly deep-sea species, nearly always having a slightly postero-ventral sinuosity, with a poorly defined rostrum without any carination or posterior gape. The prodissoconch, when discernible, is smooth. The hinge plate is composed of chevron-shaped teeth interrupted by a resilifer. The pallial sinus is usually indistinct, reflecting the small siphons (Verrill & Bush, 1897; Warén, 1978, 1989; Allen *et al.*, 1995; La Perna, 2004).

The systematic arrangement and position of the genus *Yoldiella* remain unclear (Warén, 1978, 1989; Schileyko, 1985; Allen & Hannah, 1986; Maxwell, 1988; Kilburn, 1994; Allen *et al.*, 1995; Ocklemann & Warén, 1998; La Perna, 2004, 2008; Killeen & Turner, 2009). Some authors (Knudsen, 1970; Ocklemann & Warén, 1998; La Perna, 2004) discussed the validity of the genus *Yoldiella* and the family Yoldiidae, and many different taxonomic configurations have been used.

KEY TO *YOLDIELLA* SPECIES FROM CAMPOS BASIN

1. Resilifer deep. 2
— Resilifer shallow. 3
2. Posterior end above the horizontal midline; teeth occupying about 70% of hinge plate width. . . . . *Y. lapernoi*
— Posterior end at the horizontal midline; teeth occupying about 86% (anterior) and 82% (posterior) of hinge plate width. . . . . *Y. paranapuaensis*
3. Posterior area short or with the same length of the anterior area, without any callosity at the postero-dorsal margin. 4
— Posterior area elongated, with a callosity at the postero-dorsal margin. . . . . *Y.* aff. *jeffreysi*
4. Anterior area as acute as the posterior one. 5
— Anterior area rounded, unlike the posterior one. 6
5. Shell and hinge plate thick. . . . . *Y. arariboia*
— Shell and hinge plate thin. *Y. extensa*
6. Shell translucent; postero-ventral margin sinuous, giving an oblique configuration to the shell in lateral view; teeth occupying all the hinge plate width, which is very thin (width of the teeth/total height ratio between 0.03 and 0.05). . . . . *Y. biguttata*
— Shell opaque, postero-ventral margin convex; teeth not occupying all hinge plate width; hinge plate thick (width of the teeth/total height between 0.08 and 0.15). 7
7. Posterior area expanded. . . . . *Y. similis*
— Posterior area narrowly rounded. . . . . *Y. curupira*

SYSTEMATICS

Yoldiella lapernoi sp. nov.
(Figure 2A–G & J)

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Yoldiella striolata (Brugnone, 1876) La Perna (2008): 17, figure 2E, F.

HOLOTYPE
MNRJ 15200, Figure 2A, B, G, J (Station 41), 15 May 2002, 22°39′34 36″S40°08′ 22 27″W.

PARATYPES
IBUFRJ 18762 (Figure 2C, E), Station 41, 1 valve; 18756 (Station 51, 2002), 1 valve; 18757 (Station 71, 2002), 1 valve; 18758 (Station 71, 2003), 1 valve; 18759 (Station 81, 2003), 1 valve; 18760 (Station 81, 2003), 1 valve; MZUSP 93356, Figure 2D (Station 41), 1 valve; MOFURG 50902, (4 Station 1), 1 valve; USNM, Station 82 (2002), 4 valves and MNHN, Station 64 (2003), 1 valve.

MATERIAL EXAMINED
IBUFRJ—15866 (Station 66, 2002), 3 valves; 17526 (Station 64, 2003), 1 valve; 18724 (Station 32), 2 valves; 18725 (Station 34), 9 valves; 18726 (Station 38), 2 valves; 18727 (Station 41), 3 valves; 18728 (Station 42), 2 valves; 18729 (Station 80, 2002), 1 valve; 18730 (Station 81, 2002), 5 valves; 18731 (Station 82, 2002), 2 valves; 18732 (Station 86, 2002), 3 valves; 18733 (Station 45, 2003), 1 valve; 18734 (Station 50A, 2003), 1 valve; 18735 (Station 62, 2003), 1 valve; 18736 (Station 69, 2003), 1 valve; 18737 (Station 66, 2003), 1 valve; 18738 (Station 85, 2003), 3 valves.

ETYMOLOGY
In honour of Dr Rafael La Perna from the Università di Bari, who illustrated this species for the first time, and holds the specimens from the Mediterranean Sea.

DISTRIBUTION
Mediterranean (Calabria) (La Perna, 2008). Campos Basin in depths between 750 and 1650 m (present study).

DIAGNOSIS
Shell, inequilateral, H/L about 0.69, posterior area longer and more acute than anterior one, posterior hinge plate smaller than anterior one; resilifer deep, drop-shaped; teeth occupying about 70% of the hinge plate width.

DESCRIPTION
Shell oblong–elliptical, inflated, thick for its size, equivalve, inequilateral, H/L about 0.69; umbones inflated, prominent, opisthogyrous and inwardly directed, anterior to midline. Antero-dorsal margin convex; anterior margin rounded, merging smoothly to the ventral margin. Ventral margin

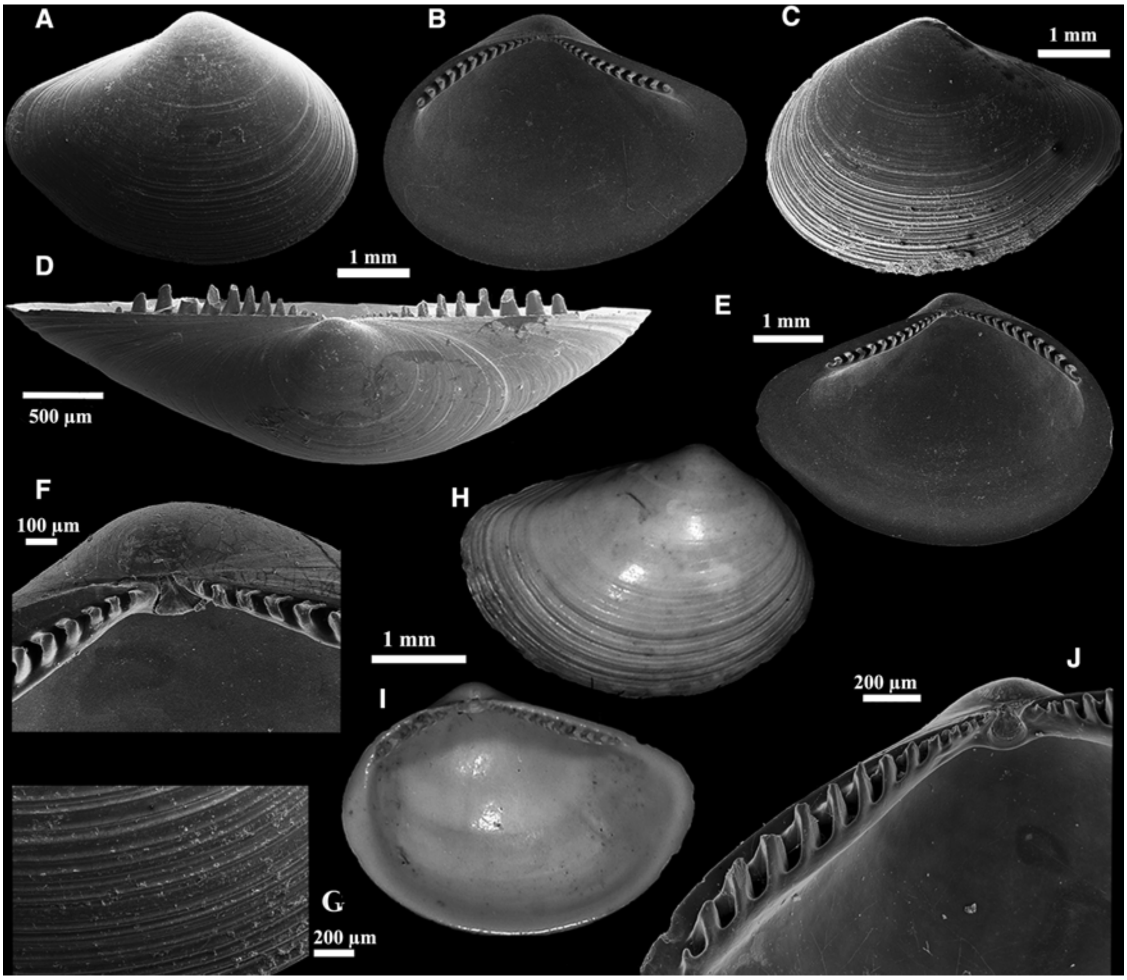

Fig. 2. *Yoldiella lapernoi* sp. nov. (A, B, G, J) holotype MNRJ 15200; (C, E, F) paratype IBUFRJ 18762; (D) paratype MZUSP 93356. External view, right valve (A), left valve (C); internal view, right valve (B), left valve (E); dorsal view (D); detail of umbo (F); detail of the co-marginal striae (G); detail of the drop shaped resilifer (J); (H, I) *Yoldiella semistriata* (Jeffreys, 1879), USNM 199748.

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forming a sinuosity leading to a rostrate posterior end which points upward; postero-dorsal margin almost straight, sloping downward. Surface with subtle co-marginal striae but smooth on the dorsal area and umbones. Hinge plate with 14 teeth on both anterior and posterior plates, interrupted by an excavated, deep, drop-shaped resilifer. There is a total angle of 127 to 140° between the anterior (60–70°) and posterior (65–70°) plates. Posterior hinge plate usually smaller than anterior one in adult specimens, and almost equal in juveniles. Hinge plate of moderate size, with the anterior plate being thinner (wat/H ratio about 0.07 and wap/H ratio about 0.08) and the posterior thicker (0.07 and 0.1, respectively). Width of both the anterior and posterior rows of teeth occupying about 70% of the total width of the hinge plate. Shell length ranging from 1.72 to 5.23 mm; prodissoconch from 100 to 270 μm.

REMARKS

La Perna (2008) illustrated specimens of *Yoldiella lapernoi* sp. nov. from the Southern Calabria Pleistocene (La Perna, 2008, p. 17; Figure 2E, F), and the syntype of *Y. producta* Monterosato, 1880 (as a synonym of *striolata*) (La Perna, 2008, p. 17; Figure 2A, B), both as *Yoldiella striolata* Brugnone, 1876. However, we do not agree that they are conspecific. The syntype of *Y. producta* shows umbones more projected and orthogyrous, the antero-dorsal margin slightly concave (giving the impression that the anterior margin is more acute), ventral margin less convex and the rostral area pointing medially; also, the two rows of teeth are separated by an angle of 125°. On the other hand, *Y. lapernoi* sp. nov. show umbones less projected, opisthogyrous, antero-dorsal and ventral margins convex, and rostral area pointing upward; the angle between the two rows of teeth is usually over 130°.

Apparently La Perna (2008) considered these differences as intra-specific variation. We have samples of varying sizes, from different depths (700–2000 m) over a large area in the Campos Basin. In these samples we could not perceive a similar variation in form among specimens of this species. The specimens illustrated in his paper (La Perna, 2008; p. 17; Figure 2A, B, E & F) are about the same size (4.68 and 4.06 mm, respectively), which clearly shows that this is not a question of allometry.

Although *Y. lapernoi* sp. nov. has a similar general shape and robustness to *Y. philippiana* (Nyst, 1845) (Warén, 1989; p. 239; Figure 9B, C) and *Y. semistriata* (Jeffreys, 1879) (Figure 2H, I), it can be distinguished from them by having umbones more inwardly directed, a larger rostral area, and a more concave postero-dorsal margin. Also, *Y. semistriata* is more ovate, has a less-extended anterior length, and more convex antero-dorsal margin, and the hinge teeth are thinner in relation to the size of the shell.

Both *Yoldiella striolata* and *Y. philippiana* have confused taxonomic histories, which have been recounted by Warén (1989) and La Perna (2008).

Yoldiella paranapuaensis sp. nov.
(Figure 3A, B, E–H)

HOLOTYPE

MNRJ 15201 (Figure 3A), Station 41, 15 May 2002, 22°39′34 36″S40°08′22 27″W.

PARATYPES

IBUFRJ 18748, Station 77 (2002), 3 valves; 18761, Station 61 (2003) (Figure 3E); MNRJ 15205 Station 61 (2003), 1 valve; MOFURG 50903 (Figure 3B), Station 85 (2002), 2 valves; MZUSP 93357, Station 66 (2003), 1 valves; USNM, Station 69 (2002), 2 valves; MCZ, Station 32, 2 valves; and MNHN, Station 46, 5 valves.

MATERIAL EXAMINED

IBUFRJ—15739 (Station 32), 2 valves; 18740, Station 34, 2 valves; 18741, Station 36, 1 valve; 18742, Station 40, 1 valve; 18743, Station 41, 1 valve; 18744, Station 43, 5 valves; 18745, Station 46 (2002), 3 valves; 18746, Station 69 (2002), 1 valves; 18747, Station 73 (2002), 1 valves; 18748, Station 77 (2002), 3 valves; 18749, Station 85 (2002), 2 valves; 18750, Station 45 (2003), 2 valves; 18751, Station 50A (2003, 3 valves; 18752, 6 Station 0 (2003), 2 valves; 18753, Station 61 (2003), 20 valves; 18754, Station 71 (2003), 3 valves.

ETYMOLOGY

Paranapuã is the ancient name of the island where Araribóia lived, a Brazilian Native American and chief of the Temiminó tribe, who fought against the French invasion of Rio de Janeiro. This island, today named Ilha do Governador, is the seat of the Universidade Federal do Rio de Janeiro.

DIAGNOSIS

Shell inequilateral in adult specimens and equilateral in young ones, H/L about 0.71. Rostral area rounded and pointing medially, postero-dorsal margin almost straight, posterior hinge plate usually longer than anterior one, resilifer deep, drop-shaped in adults and rectangular in juveniles. Teeth occupying about 86% (anterior) to 82% (posterior) of the hinge plate width.

DESCRIPTION

Shell oblong, thick for its size, equilateral in juveniles and inequilateral in adult specimens, H/L about 0.71; umbones inflated, almost at the midline, projected and orthogyrate. Antero-dorsal margin convex; anterior margin rounded, merging smoothly to ventral margin. Ventral margin slightly convex, leading to an acutely rounded posterior end with no rostrum or carena. Postero-dorsal margin convex. Surface smooth. Hinge plate composed by 10 anterior and 11 posterior teeth, interrupted by a deep drop-shaped resilifer; resilifer of juveniles rectangular in outline. Two rows of teeth forming angles between 120 and 140°, about 60–70° in both anterior and posterior row of teeth. Anterior and posterior hinge plates are usually the same length. Hinge plate thin, with both anterior and posterior wt/H ratios 0.07 and wp/H ratio 0.09. Anterior row of teeth occupying about 86% of the total width of the hinge plate and 83% in the posterior series. Shell ranges from 1.17 to 3.47 mm. Prodissoconch from 130–270 μm.

REMARKS

At first, these shells were misidentified with juveniles of *Yoldiella lapernoi* sp. nov., however, closer observation made it possible to recognize two different groups. *Yoldiella paranapuaensis* sp. nov. are less inequilateral and the umbones are orthogyrous. The hinge plate occupies almost the entire

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dorsal margin length; the posterior plate is never as oblique as in *Yoldiella lapernoi* sp. nov.

Yoldiella paranapuaensis resembles, in general shape, *Y. propinqua* (Leche, 1878), *Y. lenticula* (Möller, 1842), and *Y. tamara* (Gorbunov, 1846). It can be distinguished from *Y. propinqua* by the angle between the two sides of the hinge plate, which in the latter species is 68° on the anterior plate and 80° on the posterior one, whereas in *Y. paranapuaensis* it is 70° on each side of the hinge plate. Also, the ventral posterior area is slightly blunted in *Y. propinqua* and convex in *Y. paranapuaensis. Yoldiella subaequilatera* (Jeffreys, 1979) (Figure 3C, D) has been considered a synonym of *Y. propinqua* (see Warén, 1989, p. 235); however, it does not have a blunted postero-ventral margin, showing a thinner hinge plate and a more obtuse angle between the two plates of the hinge (75° for both the anterior and posterior plates).

Yoldiella lenticula (Möller, 1842) occurs in the continental shelf (10–300 m), but is conchologically similar to *Y. paranapuaensis* sp. nov. However, *Y. paranapuaensis* sp. nov has a rather flat shell, which is more compressed dorso-ventrally, posterior area more rounded and pointing medially, postero-dorsal margin more convex and hinge plate thinner.

Although *Y. tamara* (Gorbunov, 1846) and *Y. paranapuaensis* share an oval shape, equilateral form, and prominent umbones, the former has a distinct prodissoconch form (Warén, 1989, p. 228; Figure 2G) with frizzed sculpture, an angle between the two sides of the hinge plate of 65° (anterior) and 75° (posterior), the teeth occupy 50% (anterior) and 67% (posterior) of the total width of the hinge plate (which is thick), and the resilifer is trapezoidal, limited to the hinge area. In *Y. paranapuaensis*, the width of the anterior row of teeth occupies about 86% of the total width of the hinge plate and 83% in the posterior series, and the resilifer is drop-shaped, extending downward and a little forward of the hinge plate.

The juveniles of *Y. paranapuaensis* resemble *Yoldiella veletta* Allen, Sanders & Hannah, 1995, *Yoldiella fabula* Allen, Sanders & Hannah, 1995, and *Y. dissimilis* in the oval outline, with both ends almost equally rounded. Considering shells of the same size, *Y. paranapuaensis* is more inequilateral, with umbones not inwardly directed, as can be seen in *Y. fabula*, and a less acute angle on the posterior end compared to *Y. veletta*. Also, *Y. dissimilis* is more equilateral, has a smaller H/L ratio, and umbones directed forward.

Yoldiella aff. *jeffreysi* (Hidalgo, 1877) (Figure 4)

Leda lata Jeffreys 1876, Jeffreys 1876, p. 431 (in part).

Leda jeffreysi Hidalgo 1877, p. 396. Jeffreys 1879, p. 579, pl. 46, figure 2; Dall 1881, p. 124; Dautzenberg 1889, p. 75; Dautzenberg & Fischer 1897, p. 204.

Portlandia jeffreysi Abbott, 1974, p. 419.
Yoldiella jeffreysi (Hidalgo, 1877) Verrill & Bush 1898, p. 866, pl 81, figure 5, pl. 83, figure 3; Salas, 1996, p.44, figures 43–45, Allen *et al*., 1995, p. 63.

type material

Lectotype USNM 199696 (designated by Allen *et al*., 1995), syntypes (designated by Warén, 1980) USNM 199695, 199694, 199696, 199700, 199701 (Figure 4A, B), 199698 and

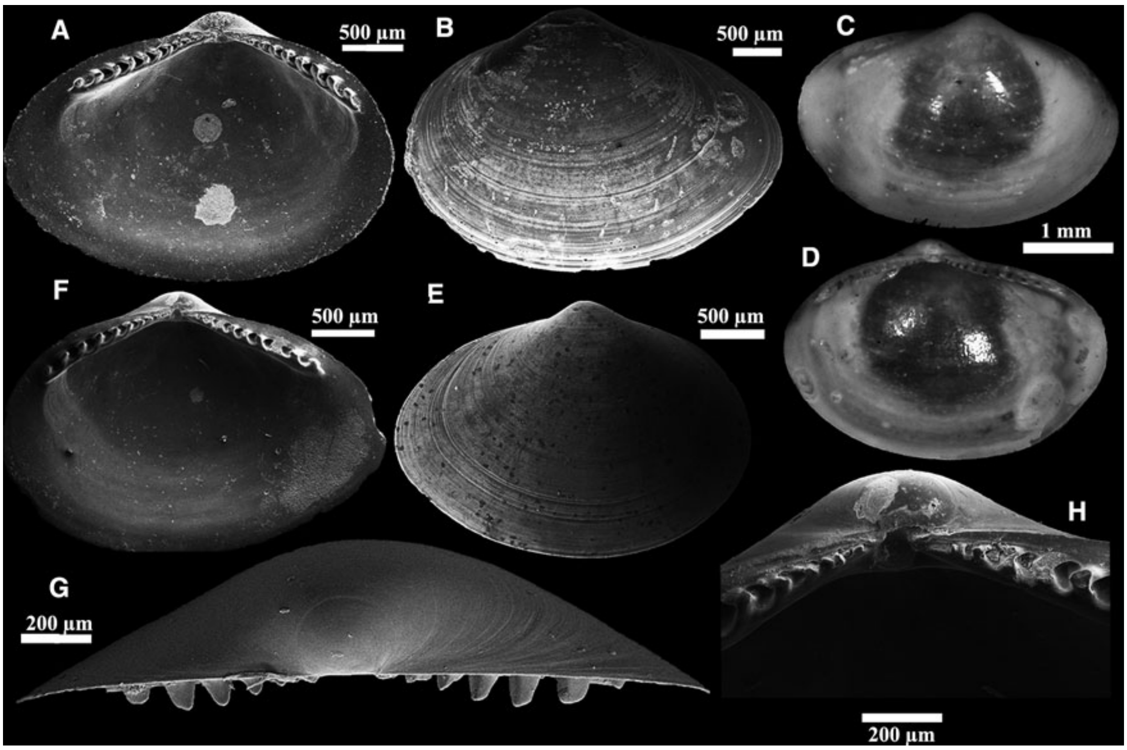

Fig. 3. *Yoldiella paranapuaensis* sp. nov., (A, B, E, H). (A) holotype, MNRJ 15201; (B) paratype MOFURG 50903; (E) paratype, IBUFRJ 18761; (F) paratype, IBUFRJ 18743; (G) paratype IBUFRJ 18748. Internal view, left valve (A); right valve (F), detail of the resilifer, same valve (H); external view, right valve (B), left valve (E); dorsal view (G). *Y. subaequilatera*, holotype, USNM 199573 (C, D).

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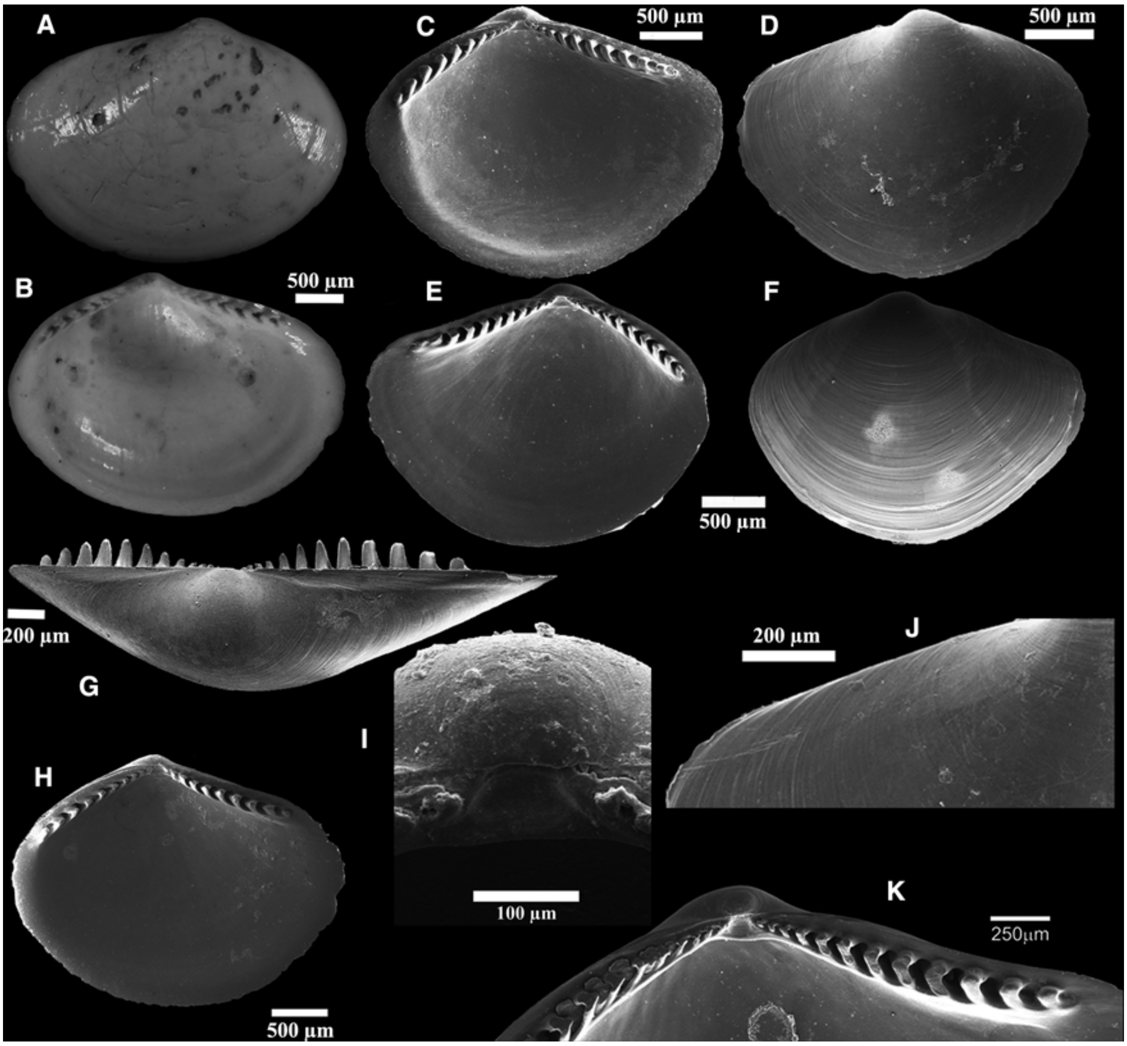

Fig. 4. *Yoldiella jeffreysi* (Hidalgo, 1877), (A, B) holotype USNM 199701. *Yoldiella* aff. *jeffreysi* (C–K). Internal view, right valve IBFRJ 18646 (C) and IBUFRJ 18763 (H), left valve IBUFRJ 17607 (E); external view, right valve IBUFRJ 18623 (D), left valve IBUFRJ 17607 (F); dorsal view IBUFRJ 18646 (G); detail of the resilifer of a right valve IBFRJ 18646 (I); detail of the postero-dorsal mound IBUFRJ 15287 (K); detail of the transverse ridge (J), same valve.

BM(NH) 77.11.18.25, 85.11.5.592, 85.11.5.593, 85.11.5.366, 85.11.5.367, 85.11.5.591.

MATERIAL EXAMINED

IB UFRJ 14999, Station 54 (2002), 1 valve; 15480, Station 54 (2002), 3 valves; 15287, Station 74 (2002), 43 valves and 9 individuals; 15990, Station 69 (2003), 25 valves; 16075, Station 64 (2002), 9 valves; 16826, Station 75 (2003), 105 valves and 6 individuals; 17031, Station 59 (2002), 43 valves and 2 individuals; 17143, Station 44 (2002), 105 valves and 22 individuals; 17607, Station 44 (2003), 43 valves; 18623, Station 32, 5 valves; 18624, Station 33, 5 valves; 18625, Station 34, 30 valves; 18626, Station 36, 1 valve; 18627, Station 37, 7 valves; 18628, Station 38, 2 valves; 18629, Station 40, 1 valve; 18630, Station 45 (2002), 2 valves; 18631, Station 75 (2002), 5 valves; 18632, Station 80 (2002), 1 valve; 18633, Station 81 (2002), 3 valves; 18634, Station 45 (2003), 1 valve; 18635, Station 49 (2003), 1 valve; 18636, Station 52 (2003), 2 valves; 18637, Station 59 (2003), 1 valve; 18638, Station 61 (2003), 4 valves and 1 individual; 18639, Station 64 (2003), 7 valves; 18640, Station 71 (2003), 6 valves; 18641, Station 74 (2003), 12 valves; 18642, Station 75 (2003), 10 valves; 18643, Station 76 (2003), 4 valves; 18644, Station 77 (2003), 3 valves; 18645, Station 80 (2003), 5 valves; 18646, Station 41, 30 valves.

TYPE LOCALITY

Valorous Station 16, Iceland Basin, 3264 m, 55°10′N 25°58′W.

GEOGRAPHICAL DISTRIBUTION

Portugal, between Azores and Bermuda, 1261–3264 m (Jeffreys, 1879); North America, Washington, DC coast, 1330–2602 m (Verrill & Bush, 1898); west of Europe, 1494–4823 m; Canaries, 6704 m; Cape Verde, 2952–3119 m; Angola, 4592–4597 m; Cape Basin, 4585 m; North America, 2864–4862 m; Guyana, 3392–4980 m; Argentine, 3305–3317 m (all adopted from Allen *et al.*, 1995); Portugal and Spain, 2035 m (Salas, 1996); Campos Basin, 750–1950 m (present study). The latter represents the shallowest (750 m) record of this species.

DIAGNOSIS

Shell longer than high, anterior margin acutely rounded, ventral area convex, posterior area extended, rostral area

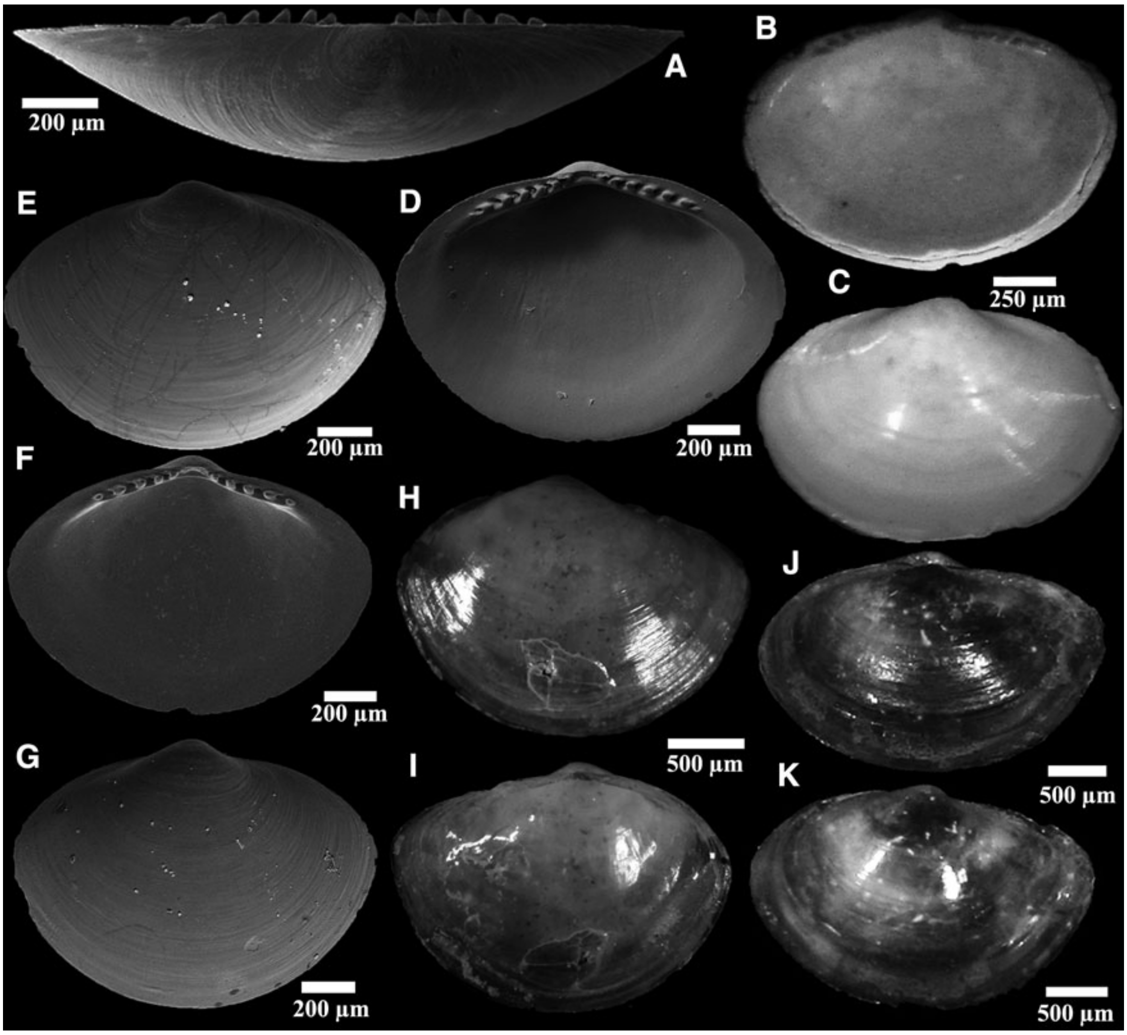

Fig. 5. *Yoldiella extensa* Allen, Sanders & Hannah, 1995 (A–G); dorsal view IBUFRJ 18621 (A); holotype BM(NH) 1992036 (B, C); internal view, left valve (D), right valve (G); external view, right valve (E), left valve (G), all from lot IBUFRJ 18617; *Yoldiella curta* Verrill & Bush, 1897 USNM 38457 (H, I); *Yoldiella inconspicua* Verrill & Bush, 1898 USNM 48867 (J, K).

depressed, forming a sinuosity and a transverse ridge. Hinge teeth occupying 68% (anterior) and 70% (posterior) of the hinge plate.

DESCRIPTION

Shell oval, slender, inflated, inequilateral, H/L about 0.73; umbones small and curved inward and backward, anterior to midline. Antero-dorsal margin slightly convex; anterior margin acutely rounded, sloping to the ventral margin. Ventral margin rounded with the edge posterior to midline; posterior end obtusely rounded with no defined rostrum; postero-dorsal margin convex in the beginning (marked by a mound), concave in the middle, rising at the end. Surface smooth with subtle co-marginal striae; periostracum with a transverse ridge from the edge of the postero-dorsal margin to the umbones, where it weakens. Hinge plate with 10 anterior and 12–13 posterior teeth, interrupted by a trapezoidal resilial pit. Angle of 130 to 140° between the anterior (60–70°) and posterior (70–75°) plates. Anterior and posterior hinge plates usually the same length. Hinge plate of medium size, with wt/H ratio 0.07 and wp/H ratio 0.1. Width of the rows of teeth occupying about 68% (anterior) and 70% (posterior) of the total width of the hinge plate. Shell length ranges from 1.63 to 3.4 mm. Prodissoconch length: 100–200 µm.

REMARKS

Yoldiella jeffreysi has been considered the replacement name for *Leda lata* Jeffreys, 1876. However, according to Allen *et al.* (1995), the material that Jeffreys used to describe *L. lata* included two different species, in the same lot, that are very similar in form, so Allen considered both as valid species and designated lectotypes for them. However, the name *Leda lata* was preceded by *Leda lata* (Hinds, 1845). Killeen & Turner (2009), realized the mistake in using the epithet *lata*, and re-described the species replacing *Y. lata sensu* Allen, Sanders & Hannah, 1995 by *Y. valorouseae* Killeen & Turner, 2009.

As pointed out by Allen *et al.* (1995), *Y. jeffreysi* has a high degree of variation in form due to a slight morphological change during growth, which can be clearly seen in a growth series (p. 67, figure, 104). The degree of variation in form found in our specimens matches Allen's morphometric data. However, our samples show some differences from the syntype of lot 199701 (Figure 4A, B) in being more inflated, with the edge of the ventral margin pointing medially, a more acute angle between the two rows of teeth, and especially the presence of a mound on the postero-dorsal margin (Figure 4A). Also, according to Allen *et al.* (1995), the prodissoconch length of *Y. jeffreysi* is 187–198 μm.

Another notable point is the wide Atlantic distribution of this species. Allen *et al.* (1995), in their morphometric analysis of material from the North American, Argentinean and western European basins (p. 67, figure 105), demonstrated some clear divergence in the values of height, width, and postero-umbonal length to length ratios, among western and eastern Atlantic samples. This rather wide divergence may conceal more profound variations among the populations, and further consideration must be given, to elucidate this *jeffreysi/lata* problem and to seek for different species hidden within this material. Because we did not have access to the entire lot of syntypes of *Y. jeffreysi*, housed in the National Museum of Natural History (Smithsonian Institution), and additional material from different localities in the Atlantic Ocean, for the present we consider the specimens in our possession as *Y.* aff. *jeffreysi*.

The younger specimens resemble *Y. sinuosa* Allen, Sanders & Hannah, 1995, but have higher H/L and hp/L ratios.

Although *Y. jeffreysi* resembles *Y. enata* Allen, Sanders & Hannah, 1995 and *Y. ella* Allen, Sanders & Hannah, 1995 in the ventral flexure, which is posterior to the midline, and in the rounded posterior end, it differs from *Y. enata* in the smaller L/H ratio (higher than long) and in having a thicker hinge plate (0.07 and 0.1), which in *Y. enata* is 0.05 and 0.06. According to Allen *et al.* (1995), *Y. ella* is a truly abyssal species, living mostly at depths from 3200 to 4823 m, in the eastern Atlantic and North American basins.

Yoldiella extensa Allen, Sanders & Hannah, 1995
(Figure 5A–G)

Yoldiella extensa Allen *et al.*, 1995, p. 40.

HOLOTYPE

BM(NH) 1992036 (Figure 5B, C).

MATERIAL EXAMINED

IBUFRJ 18601, Station 32, 8 valves and 1 individual; 18602, Station 33, 11 valves; 18603, Station 34, 19 valves; 18604, Station 35, 1 valve; 18605, Station 37, 2 valves; 18606, Station 41, 11 valves; 18607, Station 38, 3 valves; 18608, Station 46 (2002), 1 valve; 18609, Station 60 (2002), 28 valves and 4 individuals; 18610, Station 61 (2002), 112 valves and 10 individuals; 18611, Station 75 (2002), 81 valves and 6 individuals; 18612, Station 81 (2002), 3 valves; 18613, Station 82 (2002), 9 valves; 18614, Station 84 (2002), 6 valves; 18615, Station 50A (2003), 40 valves and 6 individuals; 18616, Station 60 (2003), 4 valves; 18617, Station 61 (2003), 74 valves and 4 individuals; 18618, Station 70 (2003), 2 valves; 18619, Station 71 (2003), 2 valves; 18620, Station 75, 63 valves and 5 individuals; 18621, Station 84 (2003), 2 valves; 18622, Station 85 (2003), 2 valves.

TYPE LOCALITY

Argentine Basin, 36°55′S 53°01′W.

GEOGRAPHICAL DISTRIBUTION

Argentine Basin, 2707 m (Allen *et al.*, 1995); Campos Basin, 750–1950 m (present study). Previously known only from the type locality.

DIAGNOSIS

Shell oblong–ovate, usually equilateral, inflated, iridescent; umbones posteriorly directed. Hinge plate thin and short.

DESCRIPTION

Shell oblong–ovate, inflated, thin, usually equilateral, but inequilateral in larger specimens, H/L ratio of 0.71; umbones short, posteriorly directed at midline. Antero-dorsal margin convex; anterior margin pointed. Ventral margin convex. Surface smooth with periostracum iridescent. Hinge plate with 5–7 teeth on both anterior and posterior plates, interrupted by a shallow, rectangular resilifer. There is an angle of 130° to 145° between the anterior (65°–70°) and posterior (65°–75°) plates. Hinge plate is short, with the same length on both anterior and posterior sides; thin, with wt/H ratio about 0.06 and wp/H ratio 0.09. Width of both the anterior and posterior rows of teeth occupying about 60% of the total width of the hinge plate. The shell length ranges from 1.08 to 2.06 mm. Prodissoconch from 110–190 μm.

REMARKS

Warén (1989) retained *Y. fraterna* Verrill & Bush, 1898 and *Y. inconspicua* Verrill & Bush, 1898 (Figure 5J, K) (both from the north-eastern USA) as synonyms of *Y. nana* (Sars, 1865), and, as indicated by the specimens that he illustrated (Warén, 1989, p. 231; Figure 5C–H and p. 232; Figure 6E–G), he also considered a wide intraspecific variation in form for *Y. nana*. This latter species and *Y. extensa* are similar in the H/L ratio which is about 0.7, in the hinge plate with the same length on both anterior and posterior sides, and in the thin hinge plate. Our specimens differ from the lectotype of *Y. nana* and from the holotype of *Y. fraterna* Verrill & Bush, 1898 (=*Y. nana*) (both illustrated by Warén, 1989) in showing the antero-dorsal and postero-ventral margins convex, merging gradually in the anterior and posterior margins respectively; whereas *Y. nana* and *Y. fraterna* show blunted margins. In addition, *Y. extensa* has a less-obtuse angle between the two sides of the hinge plate, which in *Y. nana* is about 78° in both the anterior and posterior plates. The Iceland specimens of *Y. nana* (Warén, 1989, p. 230; Figure 5E, F) are slightly different from the types illustrated, and more closely resemble *Y. extensa*. These *Y. nana* specimens from Iceland seem to be less inflated than our *Y. extensa*.

Yoldiella extensa differs from both *Y. curta* (Figure 5H, I) and *Yoldiella frigida* (Torrel, 1859) (Warén, 1989, p. 241;) in being more equilateral, with a smaller H/L ratio, and a thicker extension of the resilifer below the umbo, making the hinge plate appear to be continuous in this area.

Yoldiella extensa resembles *Y. americana* Allen, Sanders & Hannah, 1995 in exterior view, but the former differs in being less rounded and, internally, in having a short hinge plate.

Yoldiella arariboia sp. nov.
(Figure 6)

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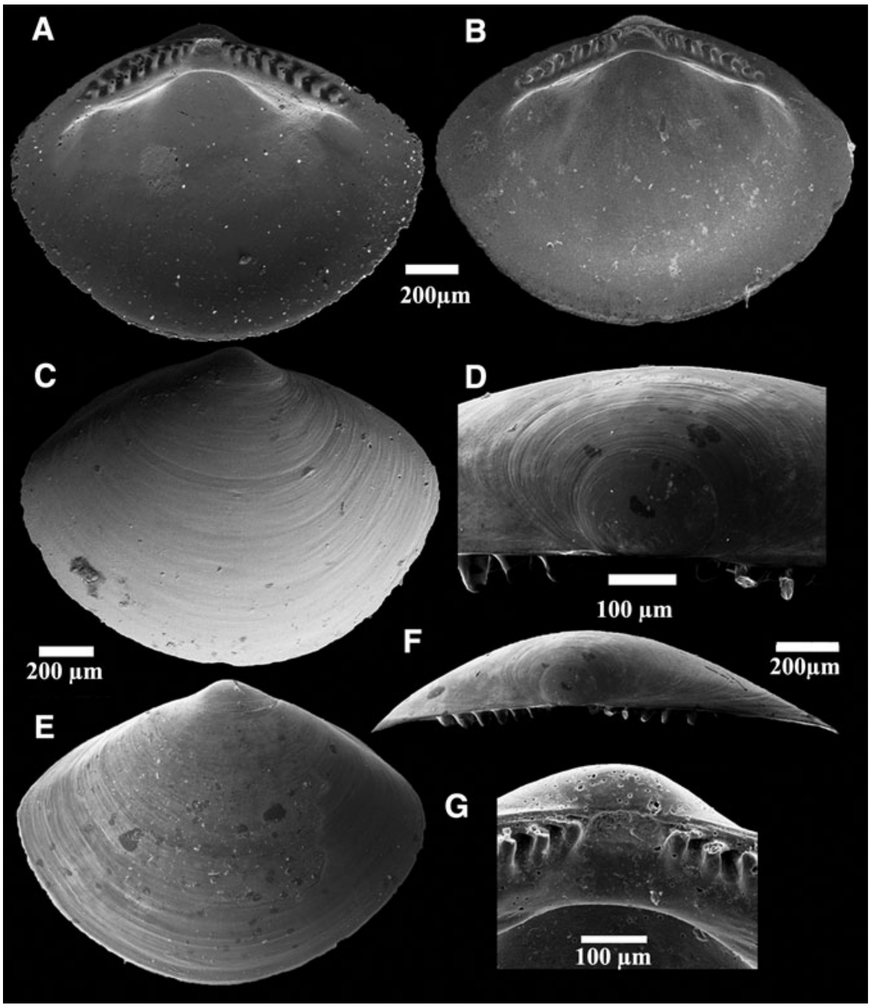

Fig. 6. (A–G) *Yoldiella arariboia* sp. nov., (A, G) holotype, MNRJ 15202; (B, E) paratype, MOFURG 50904; (D, F) paratype MNRJ15206. Internal view, left valve (A); right valve (B); detail of resilifer (G); external view, left valve (C), right valve (E); dorsal view (D, F).

HOLOTYPE

MNRJ 15202 (Figure 6A), Station 60 (2002), 12 December 2002, 21°52′50 45″S 39°51′41 6″W, 1050 m.

PARATYPES

IBUFRJ 18691, Station 32, 17 valves; 18693, Station 34, 15 valves; MNRJ 15206, Station 60 (2002), 20 valves (Figure 6D, F); MORG 50904, Station 84 (2002), 11 valves; MZUSP 93358, Station 84 (2003), 5 valves; IBUFRJ 17563, Station 79 (2003), 1 valve; USNM, Station 75 (2002), 25 valves; MCZ, Station 74 (2003), 17 valves; MNHN, Station 75 (2003), 15 valves.

MATERIAL EXAMINED

IBUFRJ 15296, Station 74 (2002), 2 valves; 17498, Station 66 (2003), 1 valve; 17563, Station 79 (2003), 1 valve; 18692, Station 33, 6 valves; 18694, Station 35, 2 valves; 18695, Station 36, 1 valve; 18696, Station 37, 1 valve; 18697, Station 38, 1 valve; 18698, Station 41, 3 valves; 18699, Station 42, 1 valves; 18700, Station 43, 1 valve; 18701, Station 49 (2002), 1 valve; 18702, Station 60 (2002), 25 valves; 18703, Station 61 (2002), 7 valves; 18704, Station 70 (2002), 1 valve; 18705, Station 74 (2002), 22 valves; 18706, Station 75 (2002), 28 valves; 18707, Station 76 (2002), 1 valve; 18708, Station 81 (2002), 1 valve; 18709, Station 82 (2002), 10 valves; 18710, Station 84 (2002), 13 valves; 18711, Station 44 (2003), 9 valves; 18712, Station 45 (2003), 1 valve; 18713, Station 49 (2003), 6 valves; 18714, Station 50A (2003), 1 valve; 18715, 6 Station 0 (2003), 19 valves; 18716, Station 61 (2003), 2 valves; 18717, Station 64 (2003), 1 valve; 18718, Station 70 (2003), 3 valves; 18719, Station 71 (2003), 1 valve; 18720, Station 74 (2003), 9 valves and 1 individual; 18721, Station 75 (2003), 10 valves; 18722, Station 84 (2003), 15 valves; 18723, Station 85 (2003), 15 valves.

ETYMOLOGY

In honour of Araribóia, a Brazilian Native American who fought against the French invasion in Rio de Janeiro. Proposed as a noun in apposition.

DIAGNOSIS

Shell small, thick, balloon-shaped, equilateral, and equally acute at anterior and posterior margins. Hinge plate thick for its size, with teeth medially positioned and a subtle callosity projecting downward from the hinge plate.

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DESCRIPTION

Shell small, balloon-shaped, inflated, thick, and equilateral, H/L ratio of 0.71; umbones small, backwards-directed. Muscle scars and pallial sinus well impressed; posterior adductor muscle rounded and larger than anterior one, which is lanceolate. Antero-dorsal margin convex; anterior margin acute. Ventral margin rounded, with a pronounced convexity in the midline. Posterior margin as acute as anterior; postero-dorsal margin convex. Surface smooth, and with iridescent periostracum. Hinge plate thick (wp/H ratio 0.12), with 5–6 teeth medially positioned, leaving two extensions of the hinge plate, usually forming a callosity on the inferior surface. Angle of 130 to 140° between the anterior (65–70°) and posterior (65–75°) plates. Posterior and anterior hinge plates usually with the same length. Width of both the anterior and posterior rows of teeth occupying about 60% of the total width of the hinge plate. Hinge plate interrupted by a shallow, trapezoidal–rectangular, ligament pit. Shell length ranges from 1.28–2.43 mm. Prodissoconch from 110–170 μm.

REMARKS

Yoldiella arariboia sp. nov. resemble *Y. extensa* and *Y. americana* in the general shell shape, with equally pointed anterior and posterior ends, but are thicker, more inflated and rounded, with the anterior and posterior ends being slightly more acute. Also in *Y. extensa* and *Y. americana* Allen, Sanders & Hannah, 1995 the hinge plate is considerably thinner, with teeth occupying almost the entire width of the hinge plate.

Yoldiella similis Allen, Sanders & Hannah, 1995
(Figure 7A–G)

Yoldiella similis Allen *et al.*, 1995 p. 26.

HOLOTYPE

1992023 BM(NH), Figure 7C, D.

MATERIAL EXAMINED

IBUFRJ 18647, Station 32, 8 valves; 18648, Station 33, 2 valves; 18649, Station 34, 14 valves; 18650, Station 36, 2 valves; 18651, Station 37, 6 valves; 18652, Station 41, 14 valves; 18653, Station 42, 1 valve; 18654, Station 54 (2002), 1 valve; 18655, Station 61 (2002), 1 valve; 18656, Station 64 (2002), 6 valves; 18657, Station 75 (2002), 9 valves; 18658, Station 79 (2002), 3 valves and 1 individual; 18659, Station 80 (2002), 2 valves; 18660, Station 81 (2002), 1 valve; 18661, Station 82 (2002), 1 valve; 18662, Station 49 (2003), 1 valve; 18663, Station 59 (2003), 1 valve; 18664, Station 71 (2003), 4 valves; 18665, Station 74 (2003), 13 valves; 18666, Station 75 (2003), 2 valves.

TYPE LOCALITY

Angola Basin 10°24′S 909′E–10°29′S 90′4E.

GEOGRAPHICAL DISTRIBUTION

Angola, 4559–4630 m (Allen *et al.*, 1995); Brazil, Campos Basin, 750–1350 m. This species was only recorded from the type locality, so this is the first record for the West Atlantic

DIAGNOSIS

Shell oval, dorsal area straight, posterior area broad and blunted. Hinge plate thick for its size.

DESCRIPTION

Shell small, ovate, thin, equilateral, compressed, H/L ratio of 0.75; umbones weakly pronounced, inwardly directed. Antero-dorsal margin slightly convex; anterior margin acutely rounded; ventral margin sloping anteriorly to a marked convexity positioned medially or posterior to midline; broad postero-ventral margin; posterior margin broad, more compressed than the rest of the shell and blunted on the margin; postero-dorsal margin straight. Surface smooth. Hinge plate with 7–9 hinge teeth in both anterior and posterior plates, interrupted by a rectangular resilifer. Angle of about 125 to 145° between the anterior (60–70°) and posterior (75–75°) plates. Posterior hinge plate usually smaller than anterior one. Hinge plate thick for its size, with width of teeth/total height ratio of 0.08 and width of the hinge plate/ total height ratio of 0.12. Width of the row of teeth occupying anteriorly and posteriorly about 67% of the total width of the hinge plate. The shell length ranges from 1.14 to 2.06 mm. Prodissoconch length 110–130 μm.

REMARKS

Yoldiella similis resembles *Yoldiella insculpta* (Jeffreys, 1879) (type illustrated by Warén, 1989; Figure 9D, E), and *Yoldiella perplexa* Allen, Sanders & Hannah, 1995 (Figure 7H, I) in the oval outline and in the broad posterior area. However, compared to *Y. insculpta*, *Y. similis* has a wider expansion of the postero-ventral area, more prominent umbones, a more acute angle between the two sides of the hinge plate, and a thicker hinge plate. Also, *Y. perplexa* has a larger H/L ratio, the umbones are more projected, the posterior end points medially rather than upward as in *Y. similis*, and the posterior part of the hinge plate is longer than the anterior one.

The drawings used by Allen *et al.* (1995, p. 27, figure 30) to illustrate the species do not match the contour of the type specimens, which can be seen in Figure 7C, D. The original description of Allen *et al.* (1995) also makes reference to a 'posterior margin sharply curved' (p. 27), which is definitely not present in the type specimens.

Yoldiella curupira sp. nov.
(Figure 8A–H)

HOLOTYPE

MNRJ 15203 (Figure 8A), Station 38, 22°41′19″S 40°14′06″W, 1100 m.

PARATYPES

IBUFRJ 18668, Station 41, 2 valves (Figure 8B); MNRJ 15205, Station 82, 1 valve; MOFURG 50905, Station 41, 1 valve (Figure 8D, E); MZUSP 93359, Station 41, 2 valves; MNHN, Station 41, 2 valves.

MATERIAL EXAMINED

IBUFRJ 18669, Station 36, 3 valves; 18670, Station 37, 1 valve; 18671, Station 38, 5 valves; 18672, Station 41, 14 valves; 18673, Station 42, 1 valve; 18674, Station 61 (2002), 9 valves; 18675, Station 76 (2002), 2 valves; 18676, Station 77 (2002), 1 valve; 18677, Station 80 (2002), 1 valve; 18678, Station 81 (2002), 8 valves; 18679, Station 75 (2002), 1 valve; 18680, Station 82 (2002), 5 valves; 18681, Station 85

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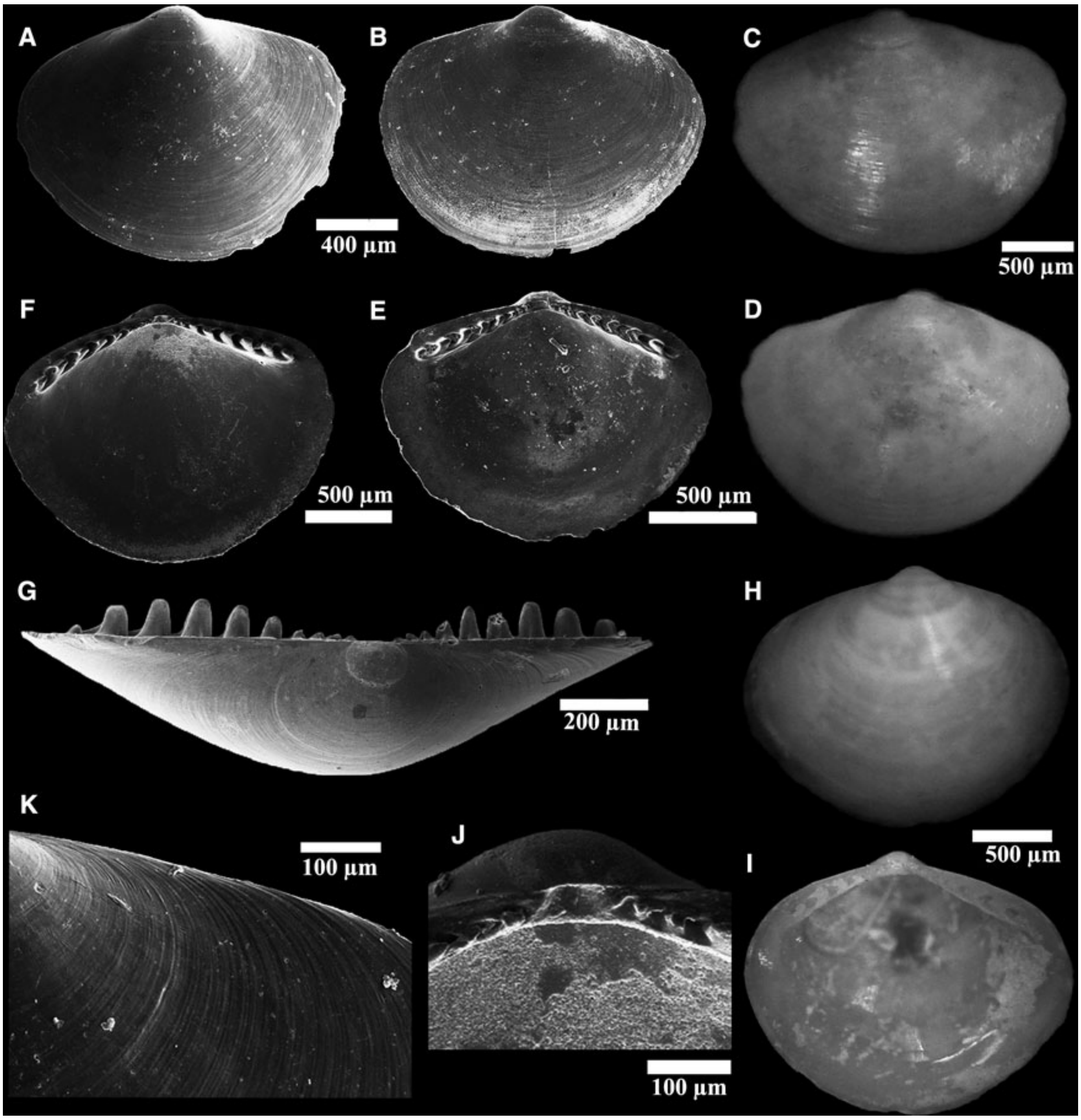

Fig. 7. *Yoldiella similis* Allen, Sanders & Hannah, 1995, holotype (C, D); external view, left valve IBUFRJ 18657 (A), right valve IBUFRJ 18649 (B); internal view, left valve (E), right valve (F) both from lot IBUFRJ 1869; dorsal view IBUFRJ 18665 G); detail of the resilifer IBUFRJ 18649 (J); detail of the surface IBUFRJ 18657 (K); *Yoldiella perplexa* Allen, Sanders & Hanna, 1995 BM(NH) 1992031, holotype (H, I).

(2002), 9 valves; 18682, Station 86 (2002), 2 valves; 18683, Station 45 (2003), 6 valves; 18684, Station 50A (2003), 1 valve; 18685, Station 49 (2003), 1 valve; 18686, Station 54 (2003), 2 valves; 18687, Station 71 (2003), 1 valve; 18688, Station 74 (2003), 1 valve; 18689, Station 75 (2003), 4 valves; 18690, Station 81 (2003), 2 valves.

etymology

Curupira is the name of a mythological being of Brazilian folklore responsible for protecting the forests against hunters, which he does with tricks. Proposed as a noun in apposition.

diagnosis

Shell ovate, equilateral. Umbones short. Hinge plate thick, with 4–7 anterior and 5–7 posterior rounded teeth. Resilifer triangular.

description

Shell ovate, compressed, thin, equilateral, H/L ratio about 0.72; umbones small, orthogyrous, positioned at midline. Antero-dorsal margin straight, oblique, anterior margin acutely rounded. Ventral margin convex, but not expanded, regularly continued with a rounded posterior end; postero-dorsal margin straight. Surface smooth. Hinge plate with 4–7 anterior and 5–7 posterior teeth, interrupted by a triangular resilifer. Angle of about 135° between the anterior (65°) and posterior (70°) plates, in most of the cases, with a variation in juveniles, which tends to be more equilateral and decreases the posterior angle. Posterior hinge plate usually smaller than anterior one in adult specimens, and almost equal in juveniles. Hinge plate thick (wt/H ratio 0.09 and wp/H ratio 0.12). Teeth short and rounded. Width of both the anterior and posterior rows of teeth occupying about 70% of the total width of the hinge plate. The shell length ranges from 1.14–2.06 mm. Prodissoconch from 90–150 µm.

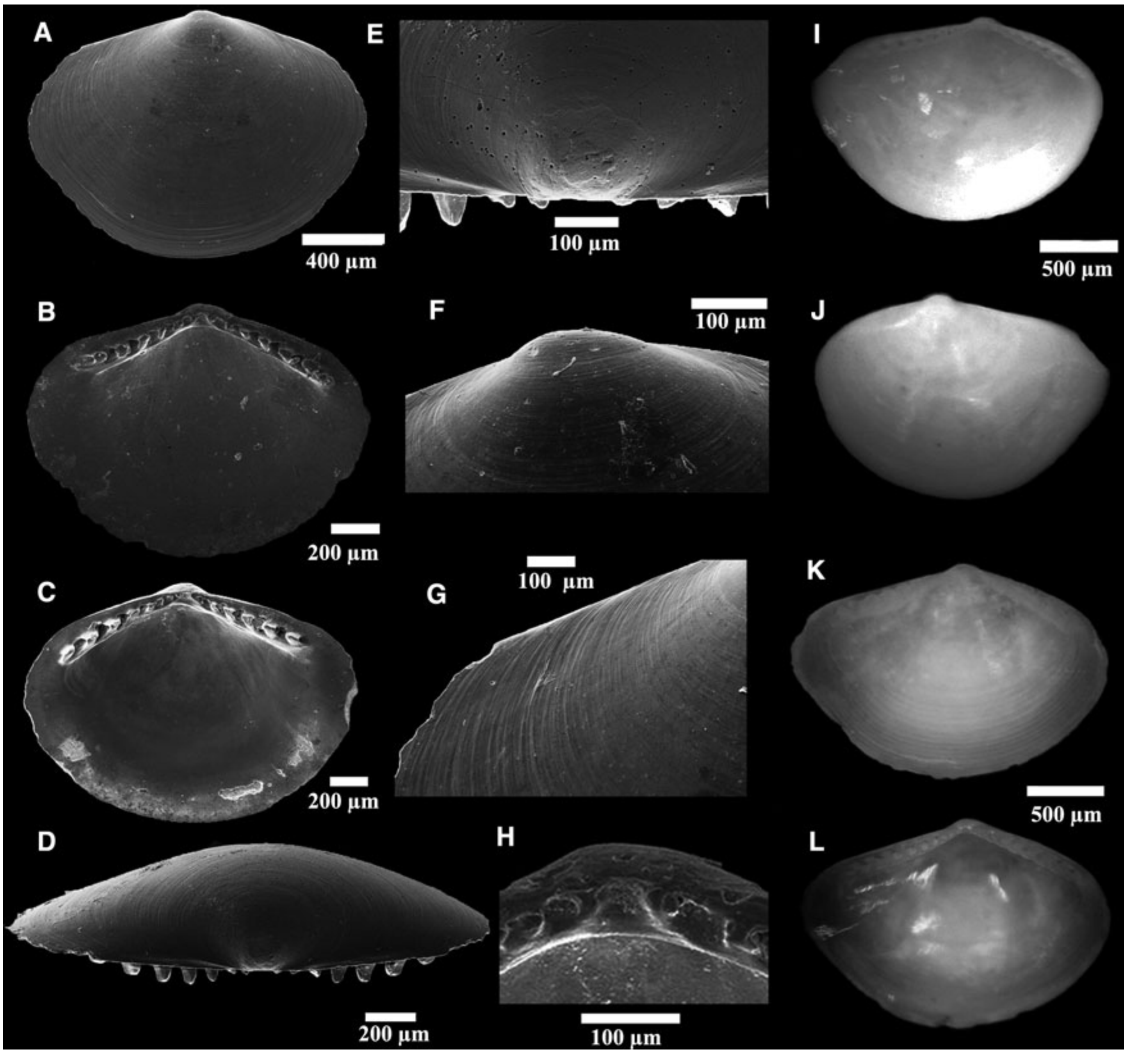

Fig. 8. *Yoldiella curupira* sp. nov.; (A, F, G) holotype MNRJ 15203; (B, H) paratype IBUFRJ 18668; (D, E) paratype MOFURG 50905. External view (A), detail of the umbo (F) and detail of the surface (G); internal view, right valve (C) IBUFRJ 18764, left valve (B) and detail of the resilifer (H); dorsal view (D) and detail of the prodissoconch (E). *Yoldiella artipica* Allen, Sanders & Hannah, 1995; holotype BM(NH) 1992021 (I, J); *Yoldiella sinuosa* Allen, Sanders & Hannah, 1995; holotype BM(NH) 1992025 (K, L).

REMARKS

Yoldiella curupira resembles *Y. sinuosa* Allen, Sanders & Hannah, 1995 (Figure 8K, L) in the shape and width of the teeth, but does not have a posterior sinuosity and has this area more rounded than acute, as we can see in *Y. sinuosa*. It also resembles *Y. similis* in the general shell shape, and can be confused with the juveniles of this species. *Yoldiella curupira* has smaller and rounded teeth, and a triangular resilifer, which in *Y. similis* is rectangular. In adults of *Y. similis*, the postero-ventral and posterior areas are broad and rounded, whereas they are slightly acute in *Yoldiella curupira*.

The general shell shape, and the angle formed by the row of teeth and resilifer resemble those of *Neilonella corpulenta* (Dall, 1881). These species can be distinguished by differences in the outline of the shell, such as the ventral margin which in *Neilonella* is less convex, giving a rectangular aspect to the shell.

Yoldiella curupira resembles *Y. hanna* Allen, Sanders & Hannah, 1995 and *Y. artipica* Allen, Sanders & Hannah, 1995 (Figure 8I, J) in the elongated shape, with the posterior area slightly extended and short umbones. *Yoldiella curupira* has a more rounded posterior end, the hinge teeth in *Y. hanna* occupy 60% of the total width of the hinge plate, and the shells are more inflated in this latter species. In *Y. artipica* the teeth occupy about 50% of the total width of the hinge plate, which is thin (wt/H = 0.05, wp/H = 0.1).

Yoldiella biguttata Allen, Sanders & Hannah, 1995
(Figure 9)

Yoldiella biguttata Allen *et al.*, 1995, p. 57.

TYPE SPECIMEN

BM(NH) 1992029.

TYPE LOCALITY

Knorr Cruise 25, Station 299, Guyana Basin, 7°55.1′N 55°42′W.

GEOGRAPHICAL DISTRIBUTION

Guyana, 1000–2500 m; Argentine, 2707 m; Brazil, 943–1007m (all adapted from Allen *et al.*, 1995); Brazil—Campos Basin, 750-1950 m.

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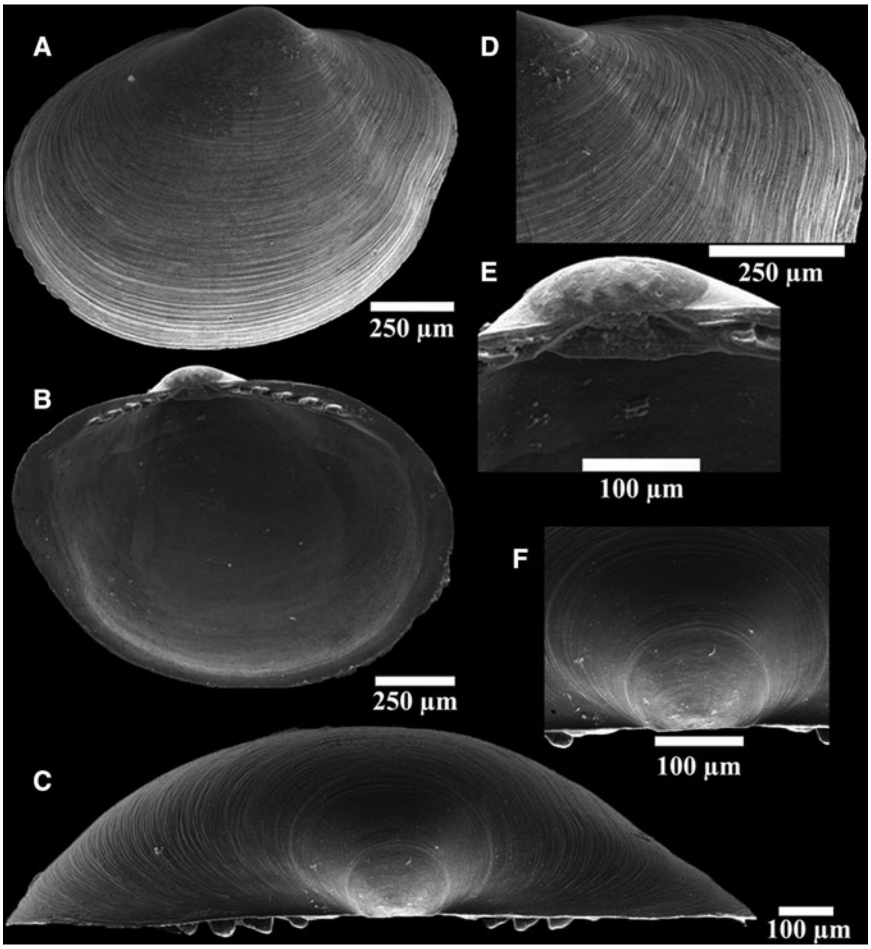

Fig. 9. *Yoldiella biguttata* Allen, Sanders & Hannah, 1995. External view, right valve (A), posterior sinuosity in detail (D), both form the lot IBUFRJ 18575; internal view, right valve (B), both form the lot IBUFRJ 15888; dorsal view, left valve (C), prodissoconch detail (F), both form the lot IBUFRJ 18560.

MATERIAL EXAMINED

IBUFRJ 18539, Station 32, 105 valves and 5 individuals; 18540, Station 33, 19 valves; 18541, Station 34, 53 valves and 3 individuals; 18542, Station 35, 51 valves and 4 individuals; 18543, Station 36, 70 valves and 3 individuals; 18544, Station 37, 60 valves and 2 individuals; 18545, Station 38, 66 valves and 1 individual; 18546, Station 40, 102 valves; 18547, Station 41, 74 valves; 18548, Station 42, 50 valves; 18549, Station 43, 71 valves and 4 individuals; 18550, Station 45 (2002), 6 valves and 1 individual; 18551, Station 46 (2002), 42 valves and 6 individuals; 18552, Station 47 (2002), 19 valves and 3 individuals; 18553, Station 48 (2002), 13 valves and 3 individuals; 18554, Station 51 (2002), 70 valves and 4 individuals; 18555, Station 52 (2002), 34 valves and 6 individuals; 18556, Station 53 (2002), 6 valves and 1 individual; 18557, Station 57 (2002), 36 valves and 9 individuals; 18558, Station 58 (2002), 9 valves and 1 individual; 18559, Station 61 (2002), 12 valves and 2 individuals; 18560, Station 62 (2002), 143 valves and 23 individuals; 18561, Station 63 (2002), 2–4 valves and 2 individuals; 18562, Station 67 (2002), 38 valves and 13 individuals; 18563, Station 70 (2002), 54 valves and 6 individuals; 18564, Station 71 (2002), 19 valves and 1 individual; 18565, Station 73 (2002), 47 valves and 4 individuals; 18566, Station 75 (2002), 10 valves; 18567, Station 76 (2002), 31 valves and 2 individuals; 18568, Station 77 (2002), 44 valves and 5 individuals; 18569, Station 78 (2002), 18 valves and 2 individuals; 18570, Station 81 (2002), 132 valves and 6 individuals; 18571, Station 82 (2002), 41 valves and 8 individuals; 18572, Station 85 (2002), 68 valves and 5 individuals; 18573, Station 86 (2002), 55 valves and 3 individuals; 18574, Station 46 (2003), 64 valves and 4 individuals; 18575, Station 50A (2003), 212 valves and 52 individuals; 18576, Station 51 (2003), 45 valves and 5 individuals; 18577, Station 52 (2003), 22 valves and 1 individual; 18578, Station 56 (2003), 19 valves and 4 individuals; 18579, Station 57 (2003), 43 valves and 9 individuals; 18580, Station 58 (2003), 4 valves and 1 individual; 18581, Station 60 (2003), 13 valves and 5 individuals; 18582, Station 61 (2003), 51 valves and 13 individuals; 18583, Station 62 (2003), 25 valves and 1 individual; 18584, Station 63 (2003), 7 valves and 1 individual; 18585, Station 68 (2003), 7 valves and 2 individuals; 18586, 7 Station 0 (2003), 48 valves and 12 individuals; 18587, Station 71 (2003), 18 valves and 1 individual; 18588, Station 72 (2003), 54 valves and 12 individuals; 18589, Station 73 (2003), 12 valves and 2 individuals; 18590, Station 75 (2003), 3 valves; 18591, Station 76 (2003), 40 valves and 7 individuals; 18592, Station 77 (2003), 38 valves and 3 individuals; 18593, Station 78 (2003), 13 valves; 18594, Station 81 (2003), 15 valves and 2 individuals; 18595, Station 82 (2003), 5 valves and 4 individuals; 18597, Station 84 (2003), 6 valves and 2 individuals; 18598, Station 85 (2003), 38 valves and 3 individuals; 18599, Station 86

(2003), 19 valves and 3 individuals; 18600, Station 87 (2003), 26 valves and 3 individuals.

DIAGNOSIS

Shell bean-shaped, inflated, subequilateral, surface smooth, posterior margin sinuous and depressed in relation to the rest of the shell, hinge plate short.

DESCRIPTION

Shell very small, bean-shaped, inflated, delicate, translucent, equilateral, H/L ratio 0.71; umbones prominent, large, posterior to midline, leaning posteriorly, inwardly directed. Antero-dorsal margin straight, oblique; anterior margin broadly rounded, merging smoothly to the ventral margin. Ventral margin slightly convex, postero-ventral margin sinuous giving a characteristic oblique configuration to the shell in lateral view; postero-dorsal margin slightly convex. Surface smooth. Hinge plate with 5–6 anterior and 4 posterior teeth, interrupted by a large, rectangular and shallow resilifer. Angle of 140 to 160° between the anterior (70°–80°) and posterior (70°–75°) hinge plates. Posterior hinge plate usually smaller than anterior one in adult specimens, and almost equal in juveniles. Width of both the anterior and posterior rows of teeth occuying the entire width of the hinge plate, which is thin with wp/H ratio 0.04, both anterior and posterior. The shell length ranges from 1.22–1.23 mm. Prodissoconch from 90–130 µm.

REMARKS

This is the most abundant species of Nuculanoidea from the Campos Basin.

Yoldiella biguttata resembles *Y. annenkovae* (Gorbunov, 1946) from northern Norway in the posterior sinuosity of the rostral area, and the width and length of the hinge plate. Besides the geographical distance, *Y. bigutatta* can be distinguished by being more inflated and having a rounded anterior margin. Although *Y. extensa* and *Y. americana* share the bean-shaped shell with *Y. biguttata*, the latter is rather inflated, with a peculiar sinuosity and depression in the rostral area.

DISCUSSION

Members of the genus *Yoldiella* are probably present in all the world oceans, and are especially abundant in deep waters. This genus includes groups of species that are similar to each other, with subtle conchological variations. Although the anatomical features are often essential to distinguish among protobranch genera and species, especially the hindgut configuration (Allen, 1992), much information can be obtained from conchological features. Moreover, anatomical observations are not always feasible. In any event, shell characters are important for taxonomy, and among the protobranchs the distinguishing features are usually shell outline and the configuration of the ligament and hinge teeth (Warén, 1989; Oliveira & Morales, 2010).

According to La Perna (2004), 'within this confused "genus" some clusters of morphologically similar species can be recognized, with the morphological distance among these clusters suggesting distinct systematic ranks. The systematic of these protobranchs might be more clearly settled when, or if, it will be possible to limit these clusters and highlight distinct lineages'. We do agree that there are different species clusters within *Yoldiella*, but whether they represent different systematic ranks will only be clarified through the combination of conchological, anatomical, morphometric and perhaps molecular data.

Since only empty shells were available for this study, for now we can tentatively propose some clusters, considering only conchological features for some of the Atlantic species.

Yoldiella curupira, *Y. sinuosa*, *Y. artipica* and *Y. similiris* Allen, Sanders & Hannah, 1995 are members of a cluster that is most similar to the type species *Y. lucida*, with a flat shell with parallel or almost parallel dorsal and ventral margins, an obliquely truncated posterior end, evenly rounded anterior end, and a hinge plate that is thick for its size. *Yoldiella similis* and *Y. jeffreysi* are variations of this cluster.

Yoldiella lapernoi sp. nov. and *Y. paranapuaensis* sp. nov. are members of a group of species that differ from the type species of *Yoldiella* in having thicker, more convex shells, a low rostrum and a longer and thicker hinge plate. This group is represented by *Y. philippiana*, *Y. striolata*, *Y. propinqua*, *Y. tamara* and *Y. pygmaea* (Di Geronimo & La Perna, 1997).

The third cluster of species is composed of *Yoldiella extensa*, *Y. arariboia* sp. nov., *Y. nana*, *Y. inconspicua*, *Y. biguttata*, *Y. americana*, *Y. profundorum* and *Y. curta*. This group differs from the type species of *Yoldiella* in having equilateral valves, with a short narrow hinge plate.

CONCLUSIONS

The near absence of records of species of the genus *Yoldiella* on the Brazilian coast in previous literature references could not be more surprising, since this is the most diverse and abundant genus of protobranchs in deep waters. This apparent poverty is an artefact, reflecting the logistical difficulties in obtaining material from these depths. Once this material became available, the real diversity was brought to light.

Of the eight *Yoldiella* species found in the Campos Basin, four are described here as new and two (*Y. extensa* and *Y. similis*) were not previously recorded in Brazil. *Yoldiella biguttata*, the previously known species, is the most abundant and frequent species in the Campos Basin, comprising 62, 5% of the specimens found. We presume that most of the pelecypods inhabiting Brazilian deep waters are still awaiting discovery.

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