

Fusculima and *Halielloides* (Gastropoda: Eulimidae) in the southwestern Atlantic, with descriptions of two new species of *Fusculima*

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ABSTRACT. *Fusculima* Laseron, 1955 and *Halielloides* Bouchet & Warén, 1986 are reported from the southwestern Atlantic for the first time. *Halielloides ingolfiana* Bouchet & Warén, 1986 is considered a valid name, and the taxon is distinct from its previous senior synonym *Eulima verrilliana* Bush, 1909 in shell shape and absence of an umbilicus. *Fusculima saturata* sp. nov. is characterized by a conical shell, domed at the apex, a short ovoid aperture, and a distinct dark-brown spiral band near the suture. *Fusculima toffee* sp. nov. also has a conical shell and a dome-shaped apex, but has a taller high aperture and the entire shell is dark brown. *Halielloides* cf. *ingolfiana*, *Fusculima* cf. *boscheineni*, and *Fusculima* cf. *minuta*, are here recorded from the continental shelf off southeastern Brazil. The nominal species of these taxa were originally described from the northeastern Atlantic. Their status remains dubious because of lack of information on their biology, anatomy and molecular data. Regarding shell morphology, we cannot distinguish the Brazilian specimens from species in the northeastern Atlantic with the material available. A series of short grooves close to the suture of the protoconch in all species of *Fusculima*, including the type species *Fusculima jacksonensis* Laseron, 1955, is a possible diagnostic character for this genus.

KEY WORDS. Eulimids; Eulimoidea; *Halielloides ingolfiana*; taxonomy; West Atlantic.

Eulimidae Philippi, 1853 consists of a large and diverse group of marine microgastropods, with approximately 1000 valid species (BOUCHET 2014), most of which are parasites of echinoderms (WARÉN 1984). The Eulimidae is one of the five most species-rich families of marine gastropods in the Indo-Pacific (BOUCHET *et al.* 2002, ALBANO *et al.* 2011). This diversity is not related exclusively to the number of extant species, but also to the wide range of parasitic strategies (TAKANO & KANO 2014). Despite these large numbers and differences in life habits, the morphology of the shell differs mainly in the general shape: some genera are very distinct in the latter and are easily recognizable, whereas others have very similar morphology and their limits are difficult to identify. The scarcity of morphological characters on the shell (e.g., axial ribs and spiral cords) poses a challenge for taxonomists (DGEBUADZE *et al.* 2012).

In the western Atlantic, eulimids are represented by 147 species and 37 genera (ROSENBERG 2009). Of these, only 28 species, distributed in ten genera, are known from Brazil: *Annulobalcis* Habe, 1965 (two species), *Batheulima* F. Nordsieck, 1968 (two), *Costaclis* Bartsch, 1847 (one), *Eulima* Risso 1826 (four), *Eulimostraca* Bartsch, 1917 (two), *Melanella* Bowdich, 1822 (nine), *Niso* Risso, 1826 (two), *Oceanida* Folin, 1870 (two), *Pisolamia* Bouchet & Lutzen, 1976 (one), *Scalenostoma* (two) and *Thaleia* Warén, 1979 (one) (FOLIN 1867, WATSON 1883, LEAL 1991, BARROS *et al.* 2001, SIMONE 2002, LIMA *et al.* 2005, SIMONE & BIRMAN 2006, RIOS 2009, QUEIROZ *et al.* 2013), in addition to record

of *Halielloides* (ABSALÃO 2010). The most recent eulimids reported from the western Atlantic were described by ESPINOSA *et al.* (2007), and since this contribution this family has received little attention in this region.

Recent oceanographic campaigns off southeastern Brazil and collection-based studies have revealed large numbers of unknown eulimids. A taxonomic review of the Eulimidae (in progress) using the material from the Campos Basin, southeastern Brazil, has led to the discovery of several species, including species of *Fusculima* Laseron, 1955 and *Halielloides* Bouchet & Warén, 1986, which are the topic of this paper.

Members of *Fusculima* occur in all oceans (THIELE 1925, LASERON 1955, BOUCHET & WARÉN 1986), but in the Atlantic, records of this genus are limited to the north – northeastern region. *Fusculima* currently comprises 18 species (BOUCHET & GOFAS 2014). The distribution of *Halielloides* is limited to the North Atlantic (BOUCHET & WARÉN 1986), with only two valid species. *Halielloides nitida* (Verrill, 1884) is the only member of the genus known from the western Atlantic, on the USA coast, based on a synonymy (WARÉN 1991). No records from *Fusculima* and *Halielloides* have been reported from the southwestern Atlantic.

In this study, we report for the first time the presence of species of *Fusculima* and *Halielloides* in the southwestern Atlantic, based on empty shells collected in the Campos Basin, southeastern Brazil (20.5–24°S, 40–41°W).

MATERIAL AND METHODS

The taxonomic identifications were based on conchological comparisons with type material and/or original descriptions and illustrations. Almost all species treated here were illustrated using scanning electron microscope (SEM) images.

The terminology used for conchological features follows BOUCHET & WARÉN (1986). The method used to count the number of whorls of the protoconch is in accordance with LEAL (1991).

Most of the material examined is from two projects: (HAB) Projeto Habitats – “Heterogeneidade Ambiental da Bacia de Campos” (Habitats Project – Campos Basin Environmental Heterogeneity), carried out by CENPES/PETROBRAS; Collector: Research Vessel “Miss Emma McCall”; (REVIZEE) “Programa de Avaliação do Potencial Sustentável de Recursos Vivos da Zona Econômica Exclusiva” (Program of Evaluation of the Sustainable Potential of Living Resources in the Economic Exclusive Zone), of the Ministério do Meio Ambiente, Brazilian Government; collectors: REVIZEE Central campaign 1: Oceanographic Ship “Antares”. The remaining material was collected by other short campaigns in Campos Basin (Southeast Brazil) that are not related to a major project.

In the material examined, the number inside the brackets indicates number of shells in each lot. In addition to the material examined listed, the holotype of *Eulima verrilliana* Bush, 1909 (USNM 38182) and syntypes of *Fusculima jacksonensis* Laceron, 1955 (AMS C.103028 [7 shells]) were also studied by us.

Abbreviations used throughout the text are as follows: AMS: Australian Museum, Sidney, Australia; IBUFRJ: Instituto de Biologia, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil; MNHN: Muséum national d’histoire naturelle, Paris, France; MNRJ: Museu Nacional/Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil; MORG: Museu Oceanográfico Eliézer de Carvalho Rios, Rio Grande, Brazil; MZSP: Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil; NHMUK: Natural History Museum, London, United Kingdom; SMNH: Naturhistoriska riksmuseet, Stockholm, Sweden; USNM: Smithsonian National Museum of Natural History, Washington D.C., United States of America; ZMUC: Zoologisch Museum University of Copenhagen, Copenhagen, Denmark.

TAXONOMY

Halielloides Bouchet & Warén, 1986

Halielloides Bouchet & Warén, 1986: 342. Type species by original designation: *Halielloides ingolfiana* Bouchet & Warén, 1986: 342, Off Iceland, Ingolf sta. 90, 64°45’N, 29°06’W, 1070 m depth (Fig. 1).

Diagnosis. Short, cylindrical shell, convex whorls, a strongly arched but weakly opisthocline outer lip. An ovate aperture and reflected inner lip with a distinct umbilical fissure (based on BOUCHET & WARÉN 1986).

Halielloides cf. *ingolfiana* Bouchet & Warén, 1986

Figs 2-10

Characterization. Vitreous shell, cylindrical with a broad, obtuse apex, reaching 2.8 mm in length. Larval shell about 1.7 whorls, diameter about 400 µm; smooth. Teleoconch with up to six whorls and a rounded outline, strongly convex; suture deep and distinct, sinuous; subsutural zone distinct, narrow, occupying about 0.2 height of each whorl; surface sculptured by indistinct growth lines; incremental scars strong, well demarcated, appearing irregularly in number (4-6) and intervals (0.4-1.2 whorls). Last whorl comprising 0.4 total shell length; base elongated with rounded outline. Aperture high, elongated, ovoid, slightly pointed posteriorly with a rounded anterior margin; outer lip thin, with a sinuous profile, deeply sinuate below suture, evenly curved downwards, projecting most in the lower half; inner lip slightly projected into parietal region; columella straight. Small umbilical fissure.

Dimensions. Largest specimen with approximately 6 whorls; length 2.8 mm; width 1.0 mm; aperture height 0.9 mm; aperture width 0.6 mm.

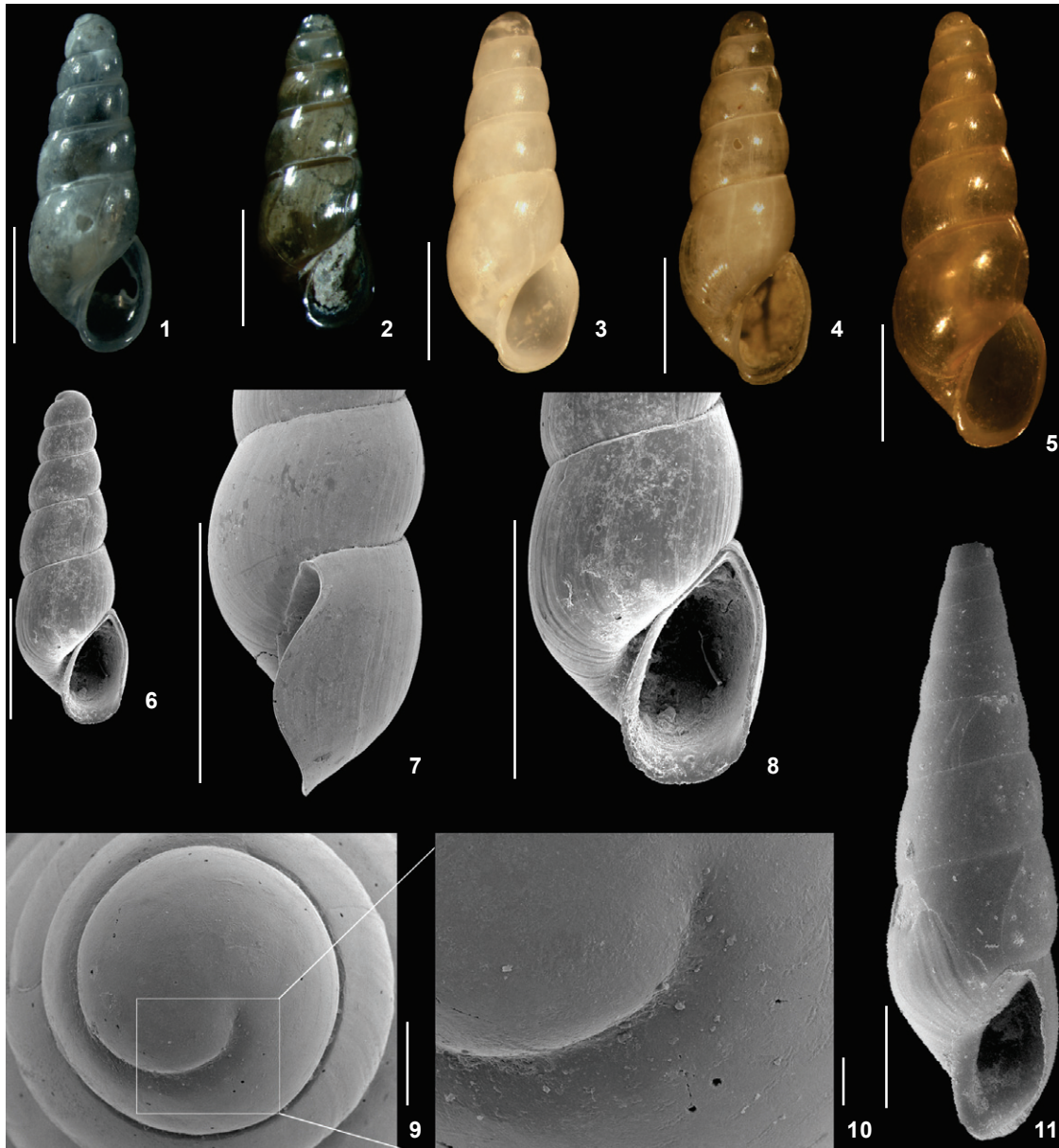
Type Material of *Halielloides ingolfiana*. Holotype ZMUC-GAS 1105; paratypes ZMUC-GAS 1106 [5 shells], type locality.

Type locality of *Halielloides ingolfiana*. Off Iceland, INGOLF sta 90 (64°45’N, 29°06’W, 1070 m).

Material examined: Holotype and paratypes of *Halielloides ingolfiana*. Shells of *Halielloides* cf. *ingolfiana* from southeast Brazil: Espírito Santo state, Campos Basin: REVIZEE Central sta VV 16 (21°10’58.79”S, 40°27’03.60”W, 26 m), 26/ii/1996: MORG 40160 [5 shells]; Rio de Janeiro state, Campos Basin: HAB 13 sta H4 (21°42’49.55”S, 40°10’22.39”W, 98 m), 09/iii/2009: MNRJ 16332 [1 shell]; HAB 16 sta H3 (21°43’05.82”S, 40°11’36.97”W, 73 m), 08/vii/2009: MNRJ 17711 [4 shells], IBUFRJ 19685 [1 shell]; HAB 16 sta G4 (22°03’33.98”S, 40°07’05.61”W, 90 m), 07/vii/2009: MNRJ 17716 [1 shell]; HAB 16 sta D5 (22°31’02.68”S, 40°31’39.03”W, 137 m), 03/vii/2009: MNRJ 17717 [1 shell]; (22°42’48.69”S, 40°51’19.62”W, 110-120 m), 19/ix/2003: MNRJ 31885 [1 shell], MNRJ 31253 [1 shell]; (22°42’48.69”S, 40°51’19.62”W, 110-120 m), iii/2007: MNRJ 31838 [1 shell]; REVIZEE Central sta D3 (22°52’58”S, 41°09’14”W, 80 m), 23/ii/1996: IBUFRJ 11454 [1 shell]; (23°04’14.30”S, 40°59’30.69”W, 100 m), xii/2004: MNRJ 31907 [1 shell], MORG 50137 [1 shell]; (23°05’22.73”S, 40°58’55.52”W, 100 m), ix/2004: MNRJ 31906 [1 shell]; HAB 11 sta B5 (23°11’24.52”S, 41°00’55.55”W, 106 m), 21/ii/2009: MNRJ 17669 [1 shell].

Geographic distribution: *Halielloides ingolfiana*: Norway; Iceland; Greenland; Portugal. Depth range 150-2000 m (BOUCHET & WARÉN 1986, WARÉN 1991). *Halielloides* cf. *ingolfiana*: Brazil: states of Espírito Santo and Rio de Janeiro, Campos Basin, from 26 to 137 m depth (this study).

Remarks. The holotype of *Halielloides ingolfiana* was illustrated by BOUCHET & WARÉN (1986) in a drawing, and is here illustrated by a photograph for the first time (Fig. 1). BOUCHET & WARÉN (1986) considered *Halielloides nitida* (= *Eulimella nitida*



Figures 1-11. (1) *Halielloides ingolfiana*, holotype, whole shell, ZMUC-GAS 1105. (2-10) *Halielloides* cf. *ingolfiana*: (2) MNRJ 17711; (3) MNRJ 17717; (4) IBUFRJ 19681; (5) MORG 50137; (6, 8) MNRJ 31838; (7, 9-10) MORG 40160. (2-6) whole shells; (7-8) last whorl; (9) protoconch in apical view; (10) detail of suture at outset of protoconch; (11) *Eulima verrilliana*, holotype, whole shell, USNM 38182. Scale bars: 1-8, 11 = 1.0 mm, 9 = 100 μ m, 10 = 20 μ m.

Verrill, 1884 = *Eulima verrilliana* Bush, 1909) as a very similar species that differs in size (larger) and in having a more oblique aperture and weaker incremental scars. BOUCHET & WARÉN (1986) also mentioned the possibility of these two species becoming synonyms, and later, WARÉN (1991), based on additional material from other localities in the northeastern Atlantic, concluded that there is more variation in specimens of *H. ingolfiana* than

in the material observed by BOUCHET & WARÉN (1986), which led him to confirm *H. ingolfiana* as a synonym of *H. nitida*.

However, examination of the holotype of *Eulima verrilliana* (Fig. 11) revealed a different shell, with a more-conical shape and less-convex whorl profile. In addition, *E. verrilliana* lacks the umbilical fissure, as stated by VERRILL (1884) in the original description. The umbilical fissure is a diagnos-

tic character of *Halielloides* (BOUCHET & WARÉN 1986), as are the cylindrical shell and convex whorls. The protoconch of *E. verrilliana* is broken and does not permit a comparison. Thus, we consider *H. ingolfiana* as a valid name, and also consider that the generic assignment of *Eulima verrilliana* requires further investigation.

Shells from southeastern Brazil (Figs 2-10) are very similar in shape and sculpturing (growth lines) to the holotype of *H. ingolfiana*, with strongly convex whorls and an easily recognizable umbilical fissure (Fig. 8). However, the mean diameter of the protoconch is smaller (narrower) in shells from Brazil, approximately 400 µm, and the protoconch reaches about 1.7 whorls. Shells of *H. ingolfiana* have a protoconch with approximately 1.2 whorls and a diameter of 530 µm. Concerning the color, the Brazilian specimens are also vitreous or whitish, but some have a slightly yellow tint (Fig. 5).

Considering *H. ingolfiana* as a valid name, there are no records of *Halielloides* from the western Atlantic. *Halielloides* cf. *ingolfiana* is quite distinct from any other named western Atlantic eulimid; the extremely close similarity in the shell morphology of Brazilian specimens with the shells of *H. ingolfiana* from the northeastern Atlantic prevents us from discriminating them. However, since we have no data to support the amphi-Atlantic distributions of this species, and given the limited bathymetric distribution (restricted to the continental shelf) of the material from southeastern Brazil, we hesitate to identify the material examined here as *H. ingolfiana*. A more

reliable identification will depend on examination of soft parts and material from the continental slope off Brazil.

Fusceulima Laseron, 1955

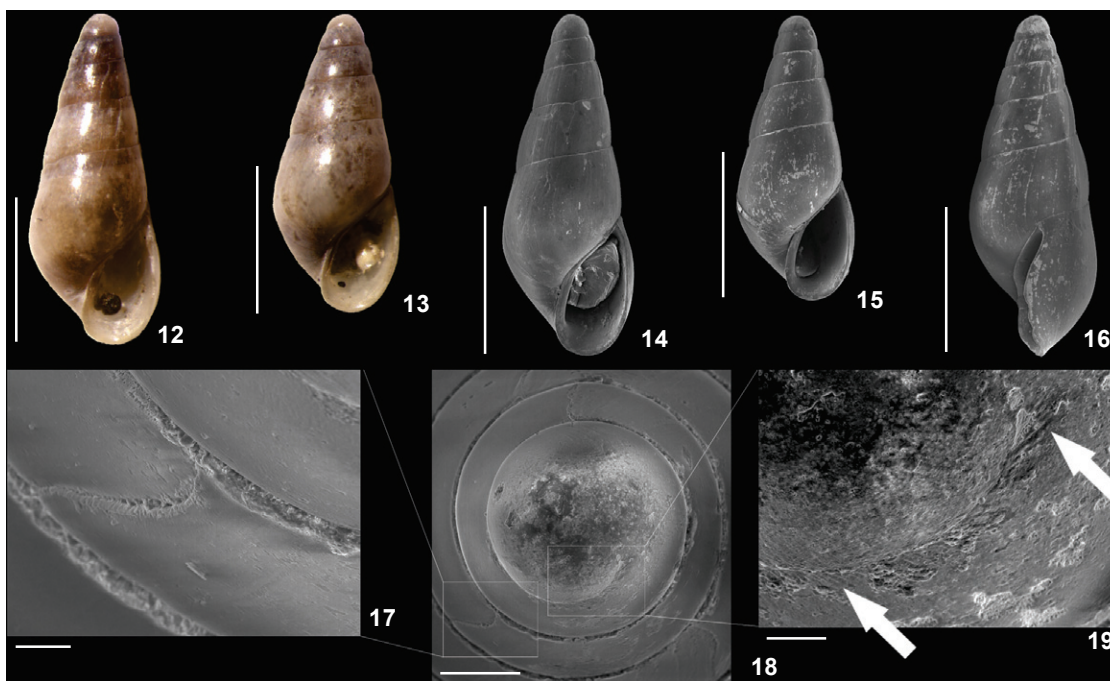
Fusceulima Laseron, 1955: 95. Type species by original designation. *Fusceulima jacksonensis* Laseron, 1955, North Harbour, Port Jackson, New South Wales, between tidemarks (Figs 12-19).

Diagnosis. Small shell (1.5-4.0 mm high), broad and domed apex; few whorled (4-6 whorls), whorls almost flat, last whorl about half total length; aperture short, outer lip curved; brownish to yellowish or colorless. Based on LASERON (1955) and BOUCHET & WARÉN (1986).

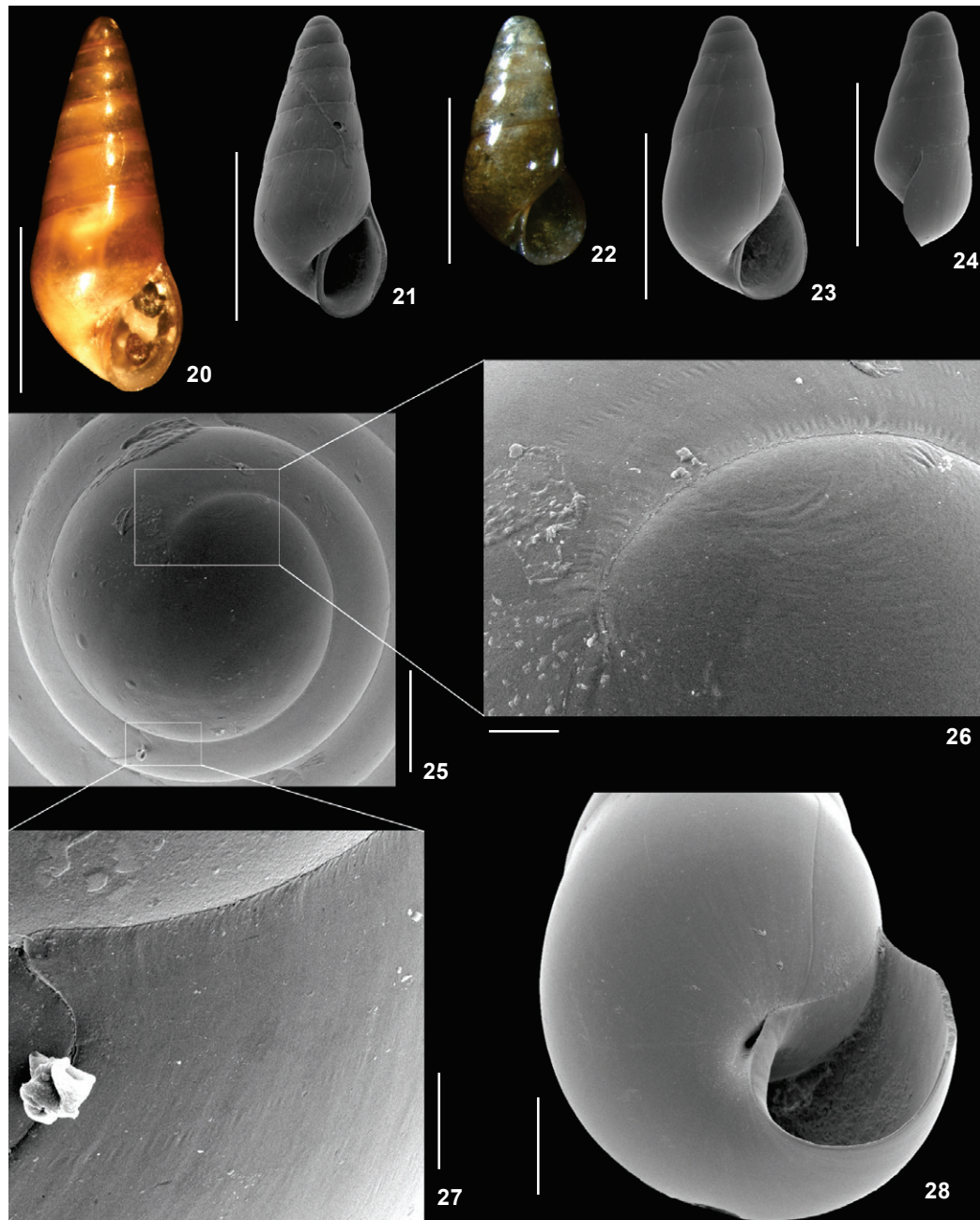
Fusceulima cf. *boscheineni* Engl, 1998

Figs 22-28

Characterization. Shell conical with a wide spire angle, and a broad, obtuse apex, reaching 1.5 mm in length. Larval shell approximately 1.5 whorls, diameter about 240 µm; smooth, with short, fine striations below suture, from the nucleus to the strongly recurved terminal scar at the transition to teleoconch. Teleoconch with up to three whorls of slightly sinuous outline, with a very slight convexity on the lower region; suture shallow, rectilinear; subsutural zone distinct, occupying about 0.2 height of each whorl; surface glossy and smooth; incremental scars weak, approximately 4, with



Figures 12-19. *Fusceulima jacksonensis*, syntypes AMS C.103028: (12-16) whole shells; (17) detail of the terminal scar; (18) protoconch in apical view; (19) detail of suture at outset of protoconch. Scale bars: 12-16 = 1.0 mm, 17, 19 = 20 µm, 18 = 100 µm.



Figures 20-28. (20-21) *Fusculima boscheineni*, topotypes, W. Engl personal collection: whole shells. (22-28) *Fusculima* cf. *boscheineni*; (22, 24) MNRJ 17403; (23) MNRJ 31903; (25-27) MNRJ 31903; (28) MNRJ 31903. (22-24) whole shells; (25) protoconch in apical view; (26) detail of suture at outset of protoconch; (27) detail of grooves near the terminal scar; (28) detail of the umbilical fissure. Scale bars: 20-24 = 1.0 mm, 25 = 100 μ m, 26-27 = 20 μ m, 28 = 200 μ m.

intervals near 0.7-1.0 whorls. Last whorl about 0.6 total shell length; base elongated with rounded outline. Aperture ovoid, pointed posteriorly, laterally expanded, with a rounded anterior margin; outer lip thin, with sinuous profile, deeply sinu-

ate below suture, evenly curved downward, with the most projecting part in the lower half; inner lip slightly projected into parietal region; columella straight. Small, chink-like umbilicus. Fresh shells with brownish/gold spots.

Dimensions. Largest specimen about 5 whorls; length 1.5 mm; width 0.7 mm; height of aperture 0.6 mm; width of aperture 0.3 mm.

Type material of *Fusculima boscheineni*. Holotype SMNH 4898; several Paratypes listed by ENGL (1998).

Type locality of *Fusculima boscheineni*. Puerto del Carmen, Lanzarote, Canary Islands, 45-50 m.

Material examined. Topotypes of *Fusculima boscheineni*: Winfried Engl personal collection [3 shells].

Shells of *Fusculima* cf. *boscheineni* from southeast Brazil: Rio de Janeiro state, Campos Basin: (22°42'48.69"S, 40°51'19.62"W, 110-120 m), 19/x/2003: MNRJ 31884 [3 shells], MNRJ 32887 [2 shells]; HAB 16 sta C4 (22°51'57.63"S, 40°57'35.17"W, 92 m) 03/vii/2009: MNRJ 17403 [3 shells]; (23°05'22.73"S, 40°58'55.52"W, 100 m), ix/2004: MNRJ 31903 [1 shell], IBUFRJ 19684 [1 shell]; Campos Basin, P.M.S. Costa leg. 2003: MORG 48594 [1 shell].

Geographic distribution. *Fusculima boscheineni*: Canary Islands, Northeast Atlantic (ENGL 1998). *Fusculima* cf. *boscheineni*: Brazil: Campos Basin, Rio da Janeiro state, from 52 to 92 m depth (this study).

Remarks. Although the holotype of *F. boscheineni* is a larger shell, reaching six whorls, with a somewhat elongate shape, while all shells from Brazil are shorter with the maximum of five whorls, some paratypes of *F. boscheineni* have shorter shells, similar to the shells from Brazil. *Fusculima projectilabrum* Bouchet & Warén, 1986 from the northeastern Atlantic, including also records from Greenland (WARÉN 1989), has a similar laterally expanded aperture and an umbilical chink, but differs in the almost cylindrical shape and the colorless shell.

Since we have no data to evaluate the possibility of a wide range of distribution in the Atlantic Ocean for species of Eulimidae, we refrain from describing a new species. *Fusculima boscheineni* is limited to the continental shelf of the Canary Islands while *Fusculima* cf. *boscheineni* is restricted to the continental shelf of the Campos Basin.

Fusculima cf. *minuta* (Jeffreys, 1884)

Figs 31-36

Characterization. Shell conical to subcylindrical, with obtuse apex, reaching 1.8 mm in length. Larval shell with 1.8 whorls, diameter about 330 µm; smooth, with short, fine striations below suture, from the nucleus to the strongly recurved terminal scar at the transition to teleoconch. Teleoconch with up to three whorls with sinuous outline, and a convexity on the lower region; suture deep, rectilinear; subsutural zone distinct, occupying about 0.35 height of each whorl; surface glossy and smooth; incremental scars strongly demarcated, about five in irregular intervals of 0.3-1.1 whorls. Last whorl about 0.5 total shell length; base elongated with slightly rounded outline. Aperture ovoid, pointed posteriorly with a rounded anterior margin; outer lip thin, of sinuous profile, deeply sinuate below suture, evenly curved downward, with the most projecting part at the middle; inner lip slightly projected into pari-

etal region; columella straight. Imperforate. Shell vitreous, occasionally with brownish spots.

Dimensions. Largest specimen about 5 whorls; length 1.8 mm; width 0.6 mm; height of aperture 0.6 mm; width of aperture 0.3 mm.

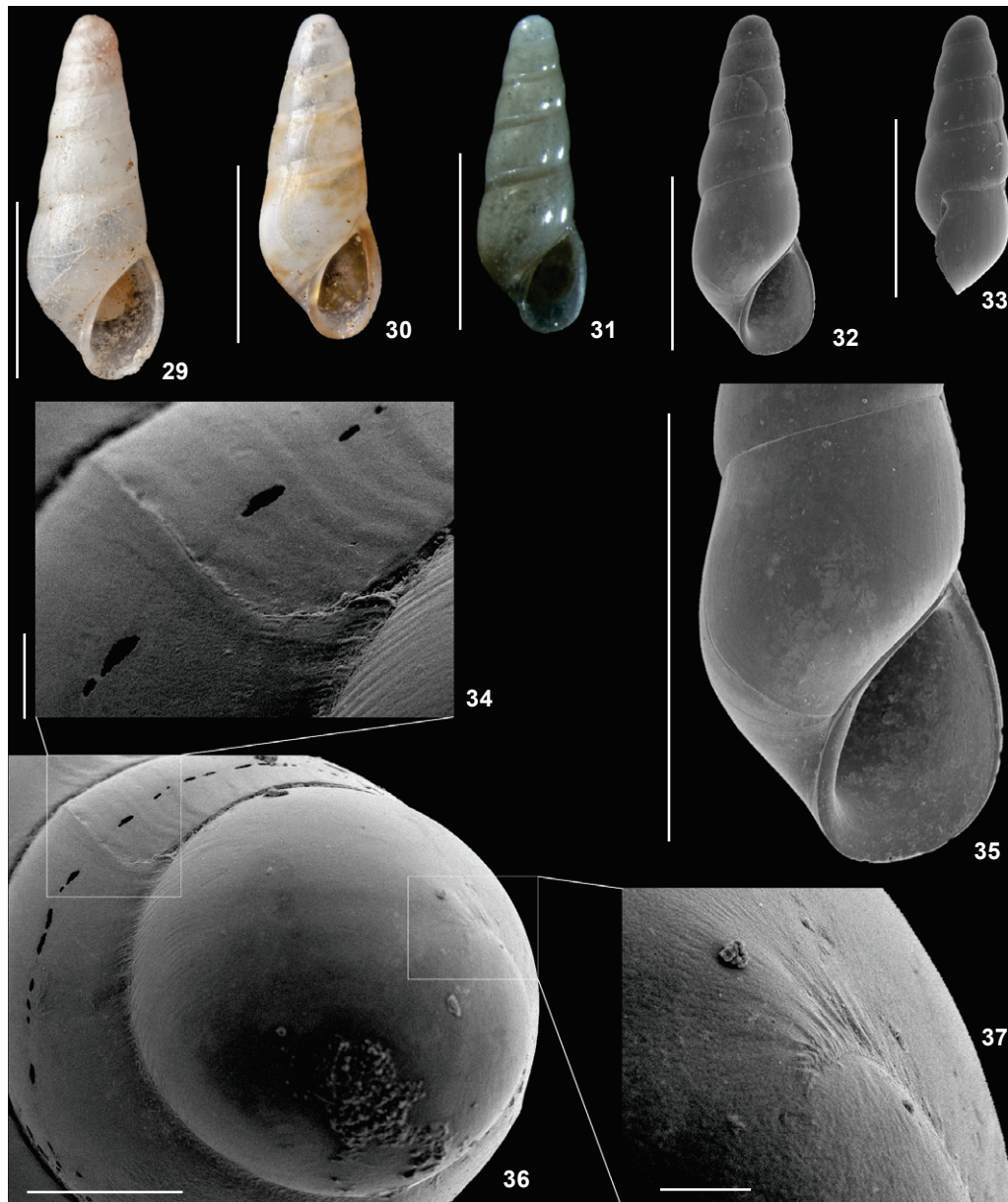
Type material of *Fusculima minuta*. Lectotype NHMUK 1885.11.5.2064; Paralectotypes NHMUK 1885.11.5.2064, NHMUK 19790227, USNM 133157. All from type locality. Not examined.

Type locality of *Fusculima minuta*. Off Morocco, Porcupine 1870, sta 26-29, between 36°44'N 9°08'W and 36°20'N 06°47'W, 413-662 m.

Material examined. Shells of *Fusculima* cf. *minuta* from southeast BRAZIL, Rio de Janeiro: Campos Basin: HAB 16 sta H3 (21°43'05.82"S, 40°11'36.97"W, 73 m), 08/vii/2009: MNRJ 17438 [1 shell]; HAB 17 sta D2 (22°12'48.69"S, 40°51'19.62"W, 52 m), 17/vii/2009: MNRJ 17402 [1 shell]; HAB 16 sta D3 (22°19'27.44"S, 40°37'25.36"W, 73 m), 04/vii/2009: MNRJ 17437 [4 shells]; HAB 16 sta C3 (22°46'49.81"S, 41°03'39.16"W, 78 m), 02/vii/2009: MNRJ 17719 [1 shell], IBUFRJ 19683 [1 shell]; HAB 16 sta C4 (22°51'57.49"S 40°57'34.82"W, 90 m), 03/vii/2009: MNRJ 17651 [2 shells].

Geographic distribution. *Fusculima minuta*: Iberian Peninsula and the Mediterranean (BOUCHET & WARÉN 1986, PENAS *et al.* 2006); MOROCCO (JEFFREYS 1884). Depth range: empty shells from 15-662 m depth. *Fusculima* cf. *minuta*: Brazil: Campos Basin, Rio da Janeiro state, from 52 to 92 m depth (this study).

Remarks. The lectotype of *F. minuta* (Fig. 29) is slightly more conical, but the paralectotypes (Fig. 30) have a more cylindrical shell shape, similar to the shells from Brazil. In addition, the irregular light-brown spots of the paralectotypes are also found on shells from Brazil. The material available to us was composed exclusively of empty shells, and for this reason we cannot distinguish the specimens from Brazil from the eastern Atlantic shells of *F. minuta*. *Fusculima* cf. *minuta* is limited to the continental shelf of the Campos Basin, and we have no records of it in greater depths such as in the northeastern Atlantic, where *F. minuta* reaches 662 m. However, the uncertainty about the possibility of amphi-Atlantism and the limited bathymetric distribution of the material examined here lead us to refrain from identifying *Fusculima minuta* in Brazil. BOUCHET & WARÉN (1986) discriminated *Fusculima minuta* (Figs 29-30) from two other species of *Fusculima* from the northeastern Atlantic (*F. thalassae* Bouchet & Warén, 1986 and *F. lineata* (Monterosato, 1869); *F. minuta* is also different from *F. projectilabrum* in the expanded outer lip and the presence of an umbilical chink in the latter species. *Fusculima ingolfiana* Bouchet & Warén, 1986 differs in the strong convexity of the whorls. *Fusculima sordida* (Watson, 1897) is quite similar to the paralectotypes of *F. minuta* in its cylindrical shape, but the whorls are almost perfectly flat and according to the description of WATSON (1897), *F. sordida* possesses a minute chink behind the inner lip that is not present in *F. minuta*.



Figures. 29-37. (29-30) *Fusceulima minuta*, lectotype and paralectotype NHMUK 1885.11.5.2065, respectively; (31-37) *Fusceulima* cf. *minuta*: (31) MNRJ 17651; (32) MNRJ 17438; (33) MNRJ 17437; (34-36) IBUFRJ 19683; (37) MNRJ 17438. (29-33) whole shells; (34) detail of the terminal scar; (35) protoconch in apical view; (36) detail of suture at outset of protoconch; (37) last whorl. Scale bars: 29-33, 37 = 1.0 mm, 34, 36 = 20 μ m, 35 = 50 μ m. Images (29-30) courtesy of Harry Taylor, NHMUK photographic unit.

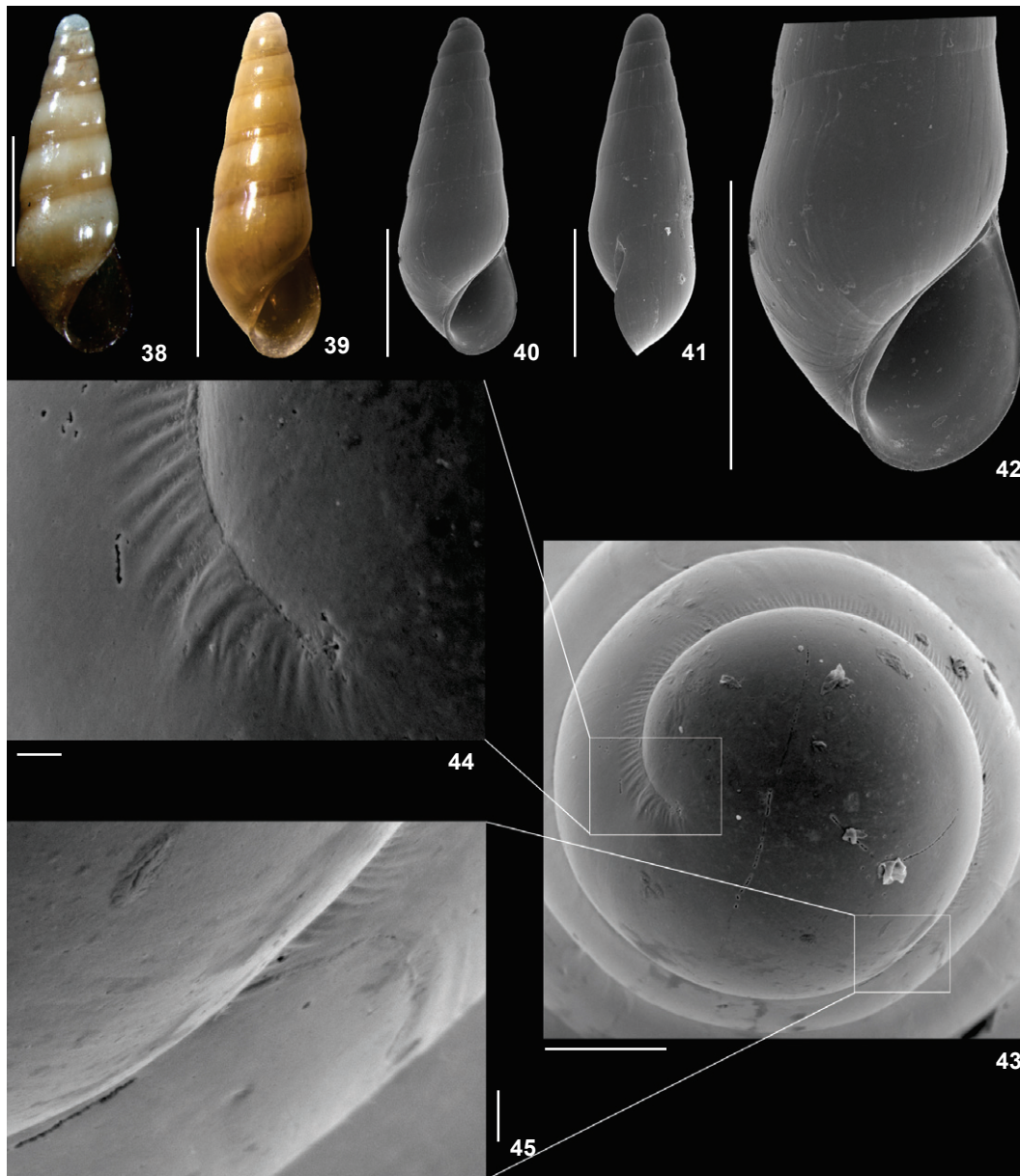
Fusceulima saturata sp. nov.

Figs 38-45

Melanella sp. 1: Absalão & Pimenta, 2005: 36, fig. 98.

Diagnosis. Broad shell with dark brown spiral band at sub-sutural zone; strong grooves at subsutural region of protoconch.

Description. Shell conical with a broad, obtuse apex, reaching 2.7 mm in length. Larval shell with 1.75 whorls, diameter about 220 μ m; smooth, with short, fine striations below suture, from the nucleus to the strongly recurved terminal scar at the transition to teleoconch. Teleoconch with up to four whorls of slightly sinuous outline, with a slight convex-



Figures 38-45. *Fusceulima saturata* sp. nov.: (38) holotype MNRJ 17718; (39) paratype USNM 1265881; (40, 42) paratype MNRJ 17435; (41) MNRJ 17436; (43-45) paratype MNRJ 16117; (38-41) whole shells; (42) last whorl; (43) protoconch in apical view; (44) detail of suture at the outset of protoconch; (45) detail of the terminal scar. Scale bars: 38-42 = 1.0 mm, 43 = 100 μ m, 44-45 = 10 μ m.

ity on the lower region; suture shallow, rectilinear; subsutural zone distinct, occupying about 0.25 height of each whorl; surface glossy and smooth, except for very fine, almost indistinguishable growth lines; incremental scars very weak, about six with more regular intervals of 0.4-0.6 whorls. Last whorl about 0.5 total shell length; base elongated with slightly rounded outline. Aperture ovoid, pointed posteriorly with a rounded anterior margin; outer lip thin, with sinuous profile,

deeply sinuate below suture, evenly curved downward, with the most projecting part in the lower half; inner lip slightly projected into parietal region; columella straight. Imperforate. Color of fresh shells brownish, with whitish or transparent apex; dark-brown spiral band at subsutural zone; beach-worn shells usually white.

Dimensions. Holotype with six whorls; length 2.6 mm; width 0.9 mm; height of aperture 0.8; width of aperture 0.5 mm.

Type material. Holotype MNRJ 17718: HAB 16 sta G2, 06/vii/2009; paratypes: Campos Basin, Rio de Janeiro state: type locality: MNRJ 17435 [2 shells], MNRJ 17401 [1 shell], USNM 1265881 [1 shell]; HAB 16 sta F3 (22°7'39.14"S, 40°18'53.18"W, 72 m), 05/vii/2009; MNHN IM-2012-2789 [1 shell], MNRJ 17436 [2 shells]; HAB 11 sta G2 (21°58'59.34"S, 40°25'16.31"W, 137 m), 25/ii/2009; MNRJ 16117 [3 shells]; HAB 11 sta E2 (22°6'51.25"S, 40°39'4.44"W, 53 m), 26/ii/2009; MNRJ 16118 [1 shell]; HAB 16 sta D5 (22°31'2.68"S, 40°31'39.03"W, 137 m), 03/vii/2009; MNRJ 17650 [2 shells]; REVIZEE Central sta D3 (22°52'00"S, 41°09'00"W, 80 m), 23/ii/1996; MORG 39716 [1 shell]; Cabo Frio VII sta 6165 (23°02.8'S, 42°46'W, 56 m); MORG 38898 [1 shell]; Cabo Frio VII sta 6192 (23°25.5'S, 44°00'W, 67 m); IBUFRJ 15232 [1 shell]; Arquipélago de Santana, Macaé, 12-38 m, Astro Garoupa coll. 3-5/v/1993; MNRJ 33524 [5 shells], IBUFRJ 19682 [8 shells], MZSP 118421 [8 shells]; off São Paulo state: MBT sta 81, 39I (24°46'S, 45°58'W, 72 m), 16/vi/1970; MZSP 37081 [1 shell].

Additional material. Brazil: *Rio de Janeiro*: Campos Basin, (Arquipélago de Santana, Macaé, 12-38 m), supply boat Astro Garoupa coll., 3-5/v/1993, IBUFRJ 9614 [100 shells].

Type locality. Continental shelf of Campos Basin, Rio de Janeiro, southeast Brazil; (21°58'59.9"S, 40°25'16.67"W, 52 m).

Geographic distribution. Brazil: Rio de Janeiro state, Campos Basin, and São Paulo state from 12-137 m depth.

Etymology. *satur* (Latin), an adjective meaning full, rich, with reference both to its relative abundance in Campos Basin.

Remarks. *Fusculima saturata* sp. nov. (Figs 38-43) resembles *Fusculima minuta* (Figs 29-30) in the general shape of the shell, but *F. saturata* is taller, more conical, while *F. minuta* has a conical to subcylindrical shell. Furthermore, *F. saturata* has a shallowly demarcated suture. *Fusculima saturata* differs from *F. projectilabrum* and *F. boscheineni* (Figs 20-21) principally in the absence of an umbilicus. *Fusculima saturata* differs markedly from *Fusculima ingolfiana* in the strong convexity of the whorls in the latter species. In addition, the color pattern of *Fusculima saturata* differs from all the other Atlantic species. The general shape and color pattern of this species is more similar to *Fusculima goodingi* Warén, 1981, described from New Zealand waters (WARÉN 1981), but the shells studied by us are even taller and *F. goodingi* possesses whorls that are almost cylindrical in contrast to the slightly sinuous outline of the whorls in *F. saturata*.

Fusculima toffee sp. nov.

Figs 46-53

Diagnosis. Elongated shell (about 2.9 mm high/0.8 mm width), with high ovoid aperture; color brownish, with whitish or transparent apex.

Description. Shell conical with a broad, obtuse apex, reaching 2.9 mm in length. Larval shell about 1.8 whorls, diameter about 350 µm; smooth, with short, fine striations below suture, from the nucleus to the strongly recurved terminal scar at the transition to teleoconch. Teleoconch with up to 3.2 whorls of sinuous outline, with a convexity on the lower region; suture

more impressed, rectilinear; subsutural zone distinct, occupying about 0.15 height of each whorl; surface glossy and smooth, weak incremental scars, about six with irregular intervals of 0.3-0.9 whorls. Last whorl with about 0.6 total shell length; base elongated with slightly rounded outline. Aperture high, ovoid, acute posteriorly with a rounded anterior margin; outer lip thin, of sinuous profile, sinuate below suture, evenly curved downward, with the most projecting part at the upper half; inner lip slightly projected into parietal region; columella straight. Imperforate. Color of fresh shells brownish, with whitish or transparent apex; false suture distinguished by a dark brown color; beach-worn shells usually cream or yellowish.

Dimensions. Holotype with 5 whorls; length 2.8 mm; width 0.8 mm; aperture height 1.1 mm; aperture width 0.5 mm.

Type material. Holotype MNRJ 17400: HAB 13 sta H2, 09/iii/2009; paratypes: BRAZIL, *Espírito Santo*: Campos Basin, HAB 13 sta 11 (21°10'56.54"S, 40°28'33.22"W, 26 m), 05/iii/2009, MNRJ 16119, [3 shells]; *Rio de Janeiro*: Campos Basin (21°36'36"S, 40°36'59"W), x/2002, MNRJ 33528 [1 shell], USNM 1265882 [1 shell]; HAB 17 sta F1 (21°57'14.26"S, 40°38'04.40"W, 26 m), 18/vii/2009, MNRJ 17702, [1 shell].

Type locality. Continental shelf of Campos Basin, Rio de Janeiro, southeast Brazil; (21°44'15.09"S, 40°17'21.80"W, 50 m).

Geographic distribution. Brazil: *Espírito Santo* and Rio de Janeiro, Campos Basin, from 26-50 m depth.

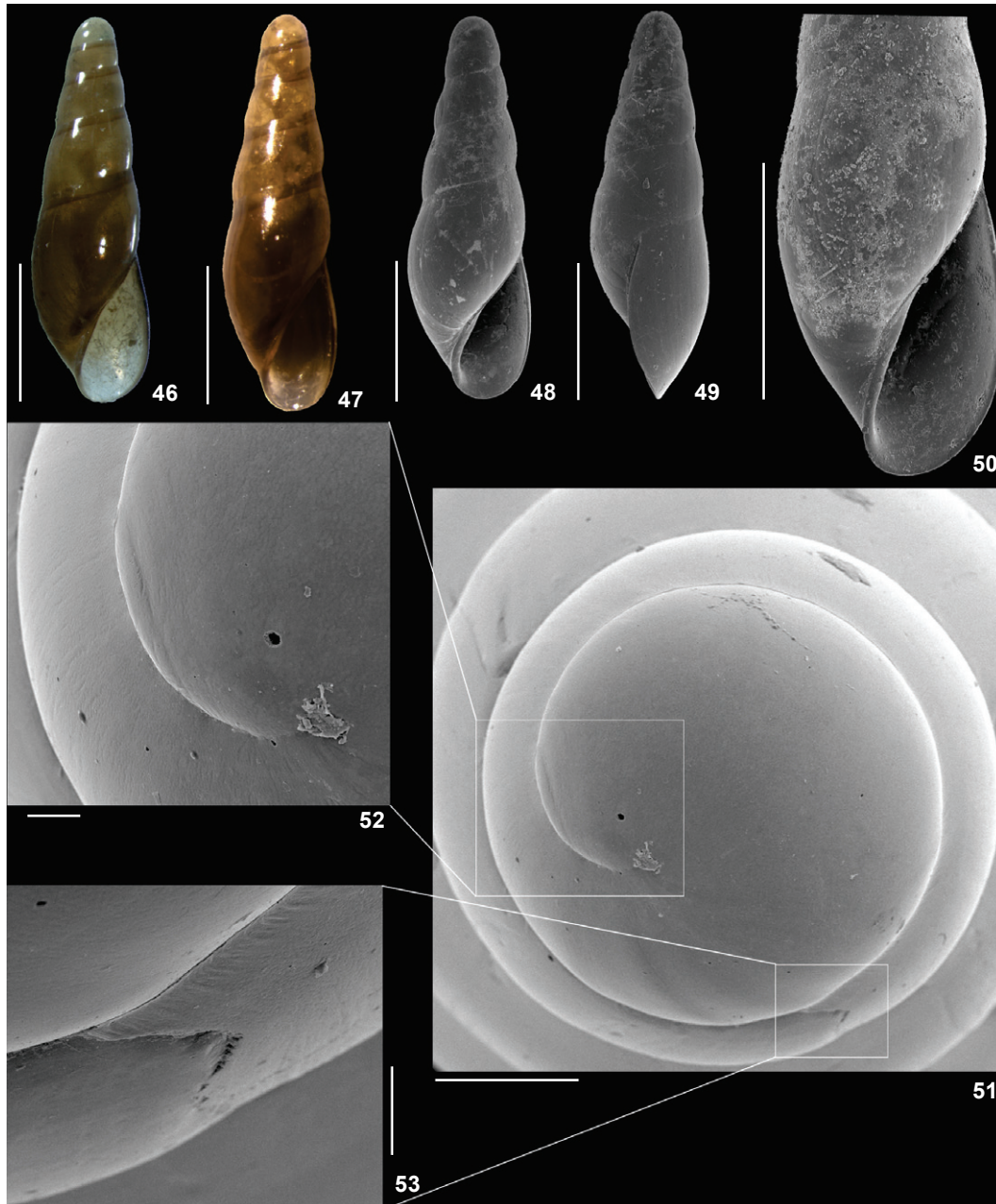
Etymology. This species is named after its caramel color of the shell, resembling a toffee candy. Epithet as a noun in apposition.

Remarks. *Fusculima toffee* sp. nov. (Figs 46-51) has a slightly sinuous whorl outline, similar to *F. saturata* sp. nov. (Figs 38-41) and *F. minuta* (Figs 29-30), but the elongate aperture (Fig. 50) clearly discriminates this species from the others that have a shorter aperture. In addition, the evenly curved outer lip has a different tortuosity from the common shape, not curving backward immediately below the suture, differing from all other species of *Fusculima*. The color of *F. toffee* is more similar with the color of *Fusculima fulva* (Watson, 1897), but *F. fulva* does not show the above-mentioned features of *F. toffee*.

DISCUSSION

Fusculima and *Halielloides* are somewhat similar in shell morphology, especially in the dome-shaped apex and the ovoid aperture. Species of *Halielloides* have more-convex whorls, but *Fusculima ingolfiana* Bouchet & Warén, 1986 is an exception, with very convex whorls, resembling *Halielloides* Bouchet & Warén, 1986.

According to BOUCHET & WARÉN (1986) the cylindrical outline of the shell and the presence of an umbilicus are some of the diagnostic characters of *Halielloides*. However, some species of *Fusculima* also have these features; for example, *F. projectilabrum* has an almost cylindrical shape, and *F. boscheineni* (and also *F. cf. boscheineni*, as discussed above) possesses a developed umbilicus. A small fissure is also present in *Fusculima*



Figures 46-53. *Fusceulima toffee* sp. nov.: (46) holotype MNRJ 17400; (47) paratype USNM 1265882; (48-50) paratypes MNRJ 16119; (51-53) paratype MNRJ 33528; (46-49) whole shells; (50) last whorl; (51) protoconch in apical view; (52) detail of suture at the outset of protoconch; (53) terminal scar. Scale bars: 46-50 = 1.0 mm, 51 = 100 μ m, 52-53 = 20 μ m.

sordida (Watson, 1897), an eastern Atlantic species, as stated by WATSON (1897) in the original description, and in *F. projectilabrum* (BOUCHET & WARÉN 1986). However, in all of the above cases, such a fissure characterizes an umbilicus similar to that present in *F. boscheineni*.

The four species of *Fusceulima* treated here have small and short grooves, mainly on the subsutural region of the protoconch whorls (Figs 25-27, 34-36, 43-45, 51-53), especially visible close to the base of the protoconch and to the terminal scar, where this ornamentation stops, and is absent from the

teleoconch whorls. This feature was not examined in the past in other eulimids and perhaps renders the classification of these species in the same genus more robust, even with different shapes and with the presence of an umbilical fissure in *F. boscheineni*. Among the species studied by us, this characteristic is especially visible in *F. saturata* (Figs 43-45), while in *F. jacksonensis*, the type species of the genus, some very tiny grooves can be seen (indicated by white arrows in Fig. 19), in spite of the eroded state of the shells.

Few species in other eulimid genera possess this feature (pers. obs.), and possibly this is not an exclusive feature of the genus. The possibility that the grooves are merely signs of growth of the shell in the protoconch region or are associated with the type of larval development, in this case lecithotrophy for all the species of *Fusculima* studied by us, requires further investigation, but *Halielloides* cf. *ingolfiana* does not have grooves (Figs 9-10), nor do many other eulimids.

Thus, we consider that the umbilicus is a variable characteristic in *Fusculima* and the short axial grooves on the protoconch are a potential diagnostic character. Their occurrence in other *Fusculima* species requires further examination.

ABSALÃO (2010) reported "*Halielloides* (?) sp." from Campos Basin, expressing uncertainty as to the generic assignment. This record was based on broken specimens dredged from 800 m depth (IBUFRJ 15086, IBUFRJ 17209) and cannot be evaluated here, as the shells are damaged and does not allow a reliable determination. Nevertheless, the presence of *Halielloides* cf. *ingolfiana* in the material examined in this study confirms that *Halielloides* occurs in the South Atlantic. *Fusculima*, on the other hand, has wider geographic range, with most species recorded from the Indo-Pacific, Mediterranean and North Atlantic (THIELE 1925, LASERON 1955, BOUCHET & WARÉN 1986).

Our choice to report *Halielloides* cf. *ingolfiana*, *Fusculima* cf. *boscheineni* and *Fusculima* cf. *minuta* without a definitive determination (expressed by the use of "cf.") is based on the absence of evidence to support that a population from the western Atlantic continental shelf is somehow connected to those on the northeastern Atlantic continental shelf. Additionally, the lack of a clear morphological feature that could distinguish the shells from Brazil from the shells from the northeastern Atlantic belonging to the above-mentioned species led us to refrain from describing this material as new species.

PIMENTA *et al.* (2009, 2011) advocated that in the absence of supporting data to justify the existence of amphiatlantism in species of Pyramidellidae, this possibility should be viewed with caution, avoiding the introduction of new names or proposal of wide distributional ranges without proper foundation. Pyramidellidae also includes cases of shells with identical morphology occurring in shallow localities (continental shelf) of the eastern and western Atlantic.

In the case of Eulimidae, a similar approach should be employed. There is little available knowledge about the duration of the larval phase in this family. However, the type of

protoconch present in the species studied by us indicates that it is short. The species of *Halielloides* and *Fusculima* treated here do not have more than two protoconch whorls, and the whorls are more than 200 µm in diameter, suggesting lecithotrophic development (WARÉN 1984). *Rectilabrum lanceolatum* Bouchet & Warén, 1986 is one of the few species with inferred planktotrophy and anatomical studies that confirm an amphiatlantism distribution, with records from the northeastern Atlantic and Virginia, USA (BOUCHET & WARÉN 1986, 1994, ROSENBERG 2009); planktotrophy is not a predominant characteristic in deep-sea eulimids from the North Atlantic (BOUCHET & WARÉN 1994). In addition, there is no evidence of rafting that would guarantee continuity of such distant populations. Although other intrinsic factors can affect dispersal ability (PAULAY & MEYER 2006), paucispiral protoconchs are not related to wide distributions, and thus the taxa treated here as "cf." possibly have a short planktonic period or lack of this period, which reduces their dispersal capacity.

Thus, the question of taxonomic treatment remains: such taxa are either considered conspecific under the application of the strict morphological species concept, in this case, based on the available shell morphology data, or they are deemed cryptic but distinct species when it comes to shell-morphology. An accurate taxonomic study including the morphology, biology and genetics of species provisionally identified here is necessary to elucidate the taxonomy of these specific cases, or even a possible complex of sibling species.

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