

Research article

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A review of Atlantic deep-water species in the genus *Talassia* (Caenogastropoda, Vanikoridae)

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Abstract. A review was done on all species of the genus *Talassia* (family Vanikoridae Gray, 1840), which are known from an upper bathyal depth range in the Atlantic Ocean. Four new species are proposed: *Talassia mexicana* sp. nov. from the Gulf of Mexico, *T. laevapex* sp. nov. and *T. flexisculpta* sp. nov. from off Mauritania and *T. rugosa* sp. nov. from off Angola. Empty shells of the new species were found in sediment samples collected in habitats associated with deep-water corals. The new species were compared with the type species *Talassia coriacea* (Manzoni, 1868) and the deep-water species *T. tenuisculpta* (R.B. Watson, 1873), *T. dagueneti* (de Folin, 1873) and *T. sandersoni* (A.E. Verrill, 1884). Particularly the shape and sculpture of the protoconch show regional differences. Other specific characteristics are macro- and micro-sculpture of the teleoconch.

Keywords. Mollusca, Gastropoda, Atlantic Ocean, W Africa, Gulf of Mexico, upper bathyal.

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Introduction

This article is a contribution to the biodiversity of Gastropoda Cuvier, 1798 (Mollusca) in the upper bathyal depth range of the Atlantic Ocean. The study reviews Atlantic upper bathyal species in the genus *Talassia* Warén & Bouchet, 1988. The genus *Talassia* was erected by Warén & Bouchet (1988) in the family Vanikoridae Gray, 1840. To date, only six species are known in *Talassia* (MolluscaBase 2022): the type species *Talassia coriacea* (Manzoni, 1868), *T. tenuisculpta* (R.B. Watson, 1873), *T. dagueneti* (de Folin, 1873), *T. sandersoni* (A.E. Verrill, 1884), *T. macrostoma* (Thiele, 1925) and *T. philippeswinneni* Rolán & Swinnen, 2011. *Talassia coriacea* lives on the shelf from the Canary Islands to the southern Bay of Biscay (Warén & Bouchet 1988; Segers *et al.* 2009; Naturalis 2022). *Talassia dagueneti* and *T. tenuisculpta* live on the upper bathyal slope and shelf in the northeastern Atlantic and into the western Mediterranean Sea (Warén & Bouchet 1988; Bouchet & Warén 1993; Segers *et al.* 2009; Naturalis 2022), and *T. sandersoni* lives on the upper bathyal slope in the northwestern Atlantic (Rosenberg 2009). *Talassia macrostoma* was described from shallow water of the Agulhas Bank, South Africa and

T. philippeswinneni was described from the sublittoral in Senegal (Rolán & Swinnen 2011). In our study, we only concentrate on deep-water species and the latter *T. macrostoma* and *T. philippeswinneni* have not been reviewed. Four new species of the genus *Talassia* are proposed herein: *Talassia mexicana* sp. nov. from the Gulf of Mexico, *T. laevapex* sp. nov. and *T. flexisculpta* sp. nov. from off Mauritania, and *T. rugosa* sp. nov. from off Angola.

Material and methods

The samples studied herein were gathered during cruises by German and Dutch research vessels over the period 1978–2018. The Atlantic species in *Talassia* were sampled during cruises with the *RV Victor Hensen* (VH97), *RV Meteor* (M61/1, M61/3, M122, M151), *RV Poseidon* (POS316, POS346), *RV Sonne* (SO175), *RV MS Merian* (MSM16/3, MSM20/4), *RV Tydeman* (CANCAP/3) and *RV Pelagia* (64PE182, 64PE229, 64PE320). The objectives of most of these cruises included studying biological, oceanographic and geological aspects related to deep-water coral (DWC) habitats. New species of the genus *Talassia* were encountered in three areas: the Gulf of Mexico (Matos *et al.* 2017), off Mauritania (Ramos *et al.* 2017; Wienberg *et al.* 2018) and off Angola (Hebbeln *et al.* 2020). In 2007, the *RV Poseidon* cruise POS346 concentrated on the southern coral mound chain off Mauritania (Westphal 2007); sampling of two new species was conducted by box core. In 2010, the *RV MS Merian* cruise MSM16/3 sampled in and near DWC habitats on the coral mound chain as well as in canyons of the Mauritanian upper margin (Westphal *et al.* 2014; Wienberg *et al.* 2018); sampling was done by bottom grabs and box cores. In 2012, the *RV MS Merian* cruise MSM20/4 sampled DWC habitats off the Bahamas, around Florida and off Yucatan (Hebbeln *et al.* 2012, 2015; Matos *et al.* 2017); samples with a new species were taken by box core and bottom grab. In 2016, the *RV Meteor* cruise M122 visited DWC mound chains off Namibia and Angola (Hebbeln *et al.* 2016, 2020). During M122, shells of a new species were only found in sediment taken by a bottom grab off Angola.

The seabed sediment samples were sieved retaining fractions larger than 0.5 mm. Subsequently, the fractions were washed with fresh water and dried on board. The molluscs were separated from the sieved fractions at Senckenberg am Meer (SaM) under low magnification binocular microscopes. Selected specimens were prepared for imaging using a scanning electron microscope (SEM: VEGA3-Tescan); a gold coating was used to improve image quality. An incident electron energy of 10 KeV was used and micrographs were taken using both, secondary electrons as well as back-scatter electrons.

The shells from the Gulf of Mexico and West Africa were compared with species known from the northern Atlantic and the western Mediterranean. Important references included Warén & Bouchet (1988), Bouchet & Warén (1993), Segers *et al.* (2009) and Rolán & Swinnen (2011). Shells from known species were taken from the reference collection at Senckenberg am Meer (SaM), Wilhelmshaven.

The holotype and most paratypes of the new species are stored in the Senckenberg Museum Frankfurt (SMF). Two paratype shells are kept in the Naturalis Biodiversity Center, Leiden, The Netherlands. The remaining material (including a few paratypes) is retained in the reference collection at SaM.

Coordinates have been converted to decimal degrees to facilitate incorporation into Geographic Information Systems and databases. The four decimals used suggest a spatial accuracy of about 10 m; the actual areal accuracy of sea bottom sampling is estimated to be 5–50 m.

Abbreviations for morphological terms

- H = height of shell
- Ha = height of shell aperture
- Hp = height of exposed protoconch
- W = width of shell

Wp = maximum width of exposed protoconch

Institutional abbreviations

- BMNH = Natural History Museum (NHMUK), London, UK (former British Museum of Natural History)
GeoB = geographic sample indicator from the University of Bremen, Germany
NMNH = United States National Museum of Natural History, Washington, DC, USA (USMN)
MNHN = Muséum national d'histoire naturelle, Paris, France
SaM = Senckenberg am Meer, Wilhelmshaven, Germany
SMF = Senckenberg Museum Frankfurt, Frankfurt am Main, Germany

Results

Taxonomy

Class Gastropoda Cuvier, 1798
Subclass Caenogastropoda Cox, 1960
Superfamily Vanikoroidea Gray, 1840
Family Vanikoridae Gray, 1840

Genus *Talassia* Warén & Bouchet, 1988

Type species

Talassia coriacea (Manzoni, 1868) by original designation; described from Madeira.

Talassia coriacea (Manzoni, 1868)
Figs 1–3

Rissoa coriacea – Manzoni, 1868: 166–167.

Talassia coriacea – Warén & Bouchet 1988: 93, fig. 47. — Segers *et al.* 2009: 153, pl. 26 fig. 4–4a.

Material examined

MADEIRA • 1 shell (Figs 1–3); off Funchal; depth 70 m; SaM74968.

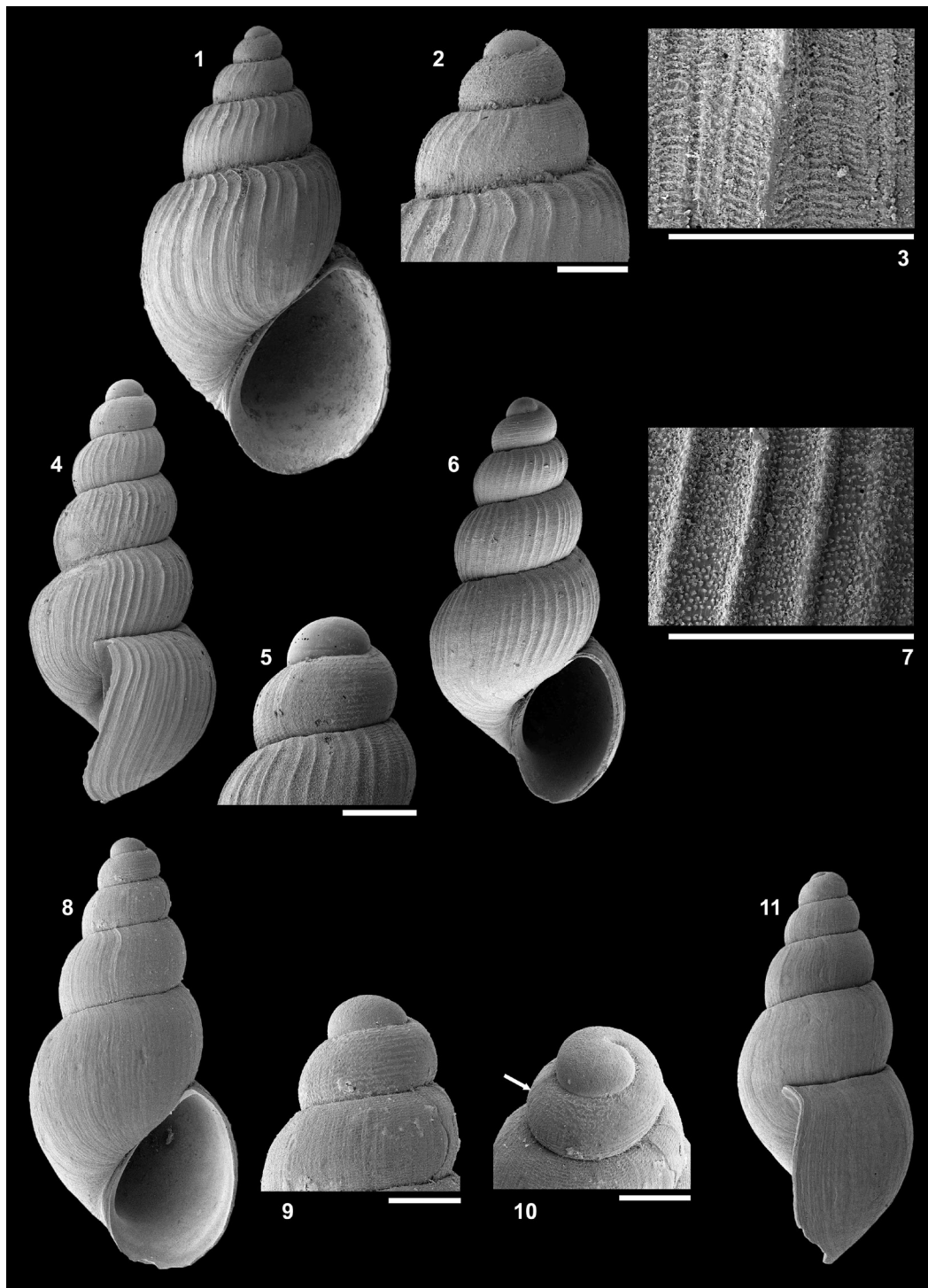
Remarks

The aperture of the shell is relatively large (about 45% of shell height, Fig. 1) when compared to other NE Atlantic species (typically less than 40%). The spiral sculpture has fine, rugose and continuous ridges covering the teleoconch (Fig. 3). The species is found on the shelf of the Canary Islands, the Salvage Islands, Madeira and the western and northern Iberian Peninsula down to 200 m (Segers *et al.* 2009; Naturalis 2022). *Talassia coriacea* has been found sympatrically with *T. dagueneti* and *T. tenuisculpta* on the shelf of Madeira (Segers *et al.* 2009).

Talassia dagueneti (de Folin, 1873)
Figs 4–7

Salassia dagueneti – de Folin, 1868: 112, pl. 3 fig. 2.

Talassia dagueneti – Warén & Bouchet 1988: 93, fig. 45. — Bouchet & Warén 1993: 714, 717, figs 1681–1700, 1702–1703.



Figs 1–11. *Talassia* Warén & Bouchet, 1988 from the NE Atlantic. **1–3.** *Talassia coriacea* (Manzoni, 1868), off Funchal, Madeira, depth 70 m (SaM74968). **1.** Ventral view, H = 2.7, W = 1.5 mm, Ha = 1.2 mm. **2.** Protoconch, Wp = 0.37 mm. **3.** Sculpture body whorl. **4–7.** *Talassia dagueneti* (de Folin, 1873), Porcupine Seabight, Galway Mound, POS316-524 (SaM). **4–5.** Side view, H = 2.5 mm. **5.** Protoconch, Wp = 0.32 mm. **6–7.** Ventral view, H = 2.3 mm, W = 1.0 mm. **7.** Sculpture body whorl. **8–11.** *Talassia tenuisculpta* (R.B. Watson, 1873), Azores, Mar da Prata, M151-GeoB23111 (SaM). **8–10.** Ventral view, H = 2.6 mm, W = 1.3 mm. **9–10.** Protoconch, Wp 0.40 mm, arrow indicates lip. **11.** Side view, H = 2.3 mm. Scale bars = 0.2 mm.

Material examined

PORCUPINE BASIN – **NW Porcupine Bank** • 5 shells; 53.1950° N, 14.7923° W; depth 651 m; 30 Jun. 2001; box core in coral debris with sand; M2001-6 (64PE182); SaM. – **Belgica Mound Province, Castor Mound** • 7 shells; 51.4375° N, 11.7867° W; depth 994 m; 23 Apr. 2004; M61/1-215; van Veen grab; SaM. – **Belgica Mound Province, Pollux Mound** • 6 shells; 51.4300° N, 11.7941° W; depth 1029 m; 23 Apr. 2004; box core; M61/1-223; SaM. – **Belgica Mound Province, Galway Mound** • 5 shells; 51.4210° N, 11.7600° W; depth 981 m; 23 Apr. 2004; box core; M61/1-224; SaM • 121 shells; 51.4972° N, 11.7017° W; depth 845 m; 24 Apr. 2004; pelagic net; M61/1-234; SaM • 1 shell; 51.4490° N, 11.7527° W; depth 837 m; 5 Jun. 2004; box core in silt with coral rubble; M61/3-551 (GeoB9204); SaM • 9 shells; 51.4507° N, 11.7520° W; depth 810 m; 5 Jun. 2004; box core in live corals; M61/3-552 (GeoB9205); SaM • 56 shells; 51.4552° N, 11.7520° W; depth 857 m; 5 Jun. 2004; box core in live corals; M61/3-553 (GeoB9206); SaM • 45 shells (Figs 4–7); 51.4542° N, 11.7329° W; depth 860 m; 11 Aug. 2004; box core in live corals; POS316-524; SaM.

GULF OF CADIZ – **Hesperides Mud Volcano** • 3 shells; 36.1815° N, 7.3058° W; depth 676 m; 2 Dec. 2003; TV-grab; SO175-GeoB9022; SaM. – **Gemini Mud Volcano** • 83 shells; 35.2942° N, 6.7878° W; depth 529 m; 17 Aug. 2004; box core; Moundforce2004-4; SaM.

ALBORAN SEA – **Off Alboran Island** • 1 shell; depth 250 m; 2005; J. Martin leg; SaM.

Remarks

Talassia dagueneti was described from off Cape Breton, Bay of Biscay; a syntype is shown by Warén & Bouchet (1988: fig. 45; MNHN-IM-2000-5648). The species is distributed from the Porcupine Basin off Ireland to the Gulf of Cadiz, Madeira and Canary Islands and in the western Mediterranean Sea in 170–1809 m (Bouchet & Warén 1993; Segers *et al.* 2009; this study). The outline of the shell is more slender (Fig. 6) than that of *T. coriacea* (Fig. 1) and the spiral sculpture of the teleoconch has finely dotted lines; the flexuous axial riblets are equidistant (Fig. 7).

Talassia tenuisculpta (R.B. Watson, 1873)

Figs 8–11

Rissoa tenuisculpta – R.B. Watson, 1873: 389–390, pl. 36 fig. 28.

Talassia tenuisculpta – Warén & Bouchet 1988: 93, fig. 44.

Material examined

MADEIRA – **south off Porto Santo** • 1 shell; 33.0167° N, 16.3500° W; depth 310 m; 16 Oct. 1978; Harmon grab; in sand; CANCAP/III-3.032; SaM.

DACIA SEAMOUNT • 1 shell; 31.1777° N, 13.6093° W; depth 108 m; 17 Apr. 1997; van Veen grab; in bioclastic sand; VH97-132; SaM • 2 shells; 31.1217° N, 13.6550° W; depth 125 m; 25 Apr. 1997; van Veen grab; in bioclastic sand; VH97-285; SaM.

GREAT METEOR SEAMOUNT • 1 shell; 29.7501° N, 28.4661° W; depth 292 m; 21 Mar. 2010; Shipex grab; in bioclastic sand; POS397-111-2; SaM • 1 shell; 29.5652° N, 28.3388° W; depth 945 m; 25 Oct. 2018; ROV sample 4 with large sponge; M151-GeoB23425; SaM • 1 shell; 29.5649° N, 28.3389° W; depth 948 m; 25 Oct. 2018; ROV sample 9 with coral; M151-GeoB23425; SaM.

LITTLE METEOR SEAMOUNT • 1 shell; 29.6451° N, 28.9750° W; depth 284 m; 27 Oct. 2018; grab in bioclastic sand; M151-GeoB23440; SaM • 7 shells; 29.6333° N, 28.9834° W; depth 274 m; 27 Oct. 2018; grab in bioclastic sand; M151-GeoB23442; SaM.

ATLANTIS SEAMOUNT • 8 shells; 33.9707° N, 30.2064° W; depth 677 m; 21 Oct. 2018; grab in bioclastic sand with coral rubble; M151-GeoB23404; SaM • 40 shells; 33.9965° N, 30.1767° W; 617 m; 21 Oct. 2018; grab in bioclastic sand with coral rubble; M151-GeoB23408; SaM.

AZORES, MAR DA PRATA • 5 shells; 37.6685° N, 25.9260° W; depth 834 m; 8 Oct. 2018; grab in bioclastic sand; M151-GeoB23109; SaM • 37 shells (Figs 8–11); 37.6732° N, 25.9246° W; depth 595 m; 8 Oct. 2018; grab in bioclastic sand with coral rubble; M151-GeoB23111; SaM • 15 shells; 37.6607° N, 25.9180° W; depth 599 m; 8 Oct. 2018; grab in bioclastic sand with coral rubble; M151-GeoB23112; SaM • 3 shells; 37.6589° N, 25.7878° W; depth 600 m; 18 Oct. 2018; grab in coral rubble; M151-GeoB23173; SaM • 2 shells; 37.6587° N, 25.7886° W; depth 599 m; 19 Oct. 2018; box core in coral rubble; M151-GeoB23181; SaM.

AZORES, JOSÉ GASPAR SEAMOUNT • 1 shell; 37.6754° N, 25.7167° W; depth 309 m; 12 Oct. 2018; box core in coral rubble; M151-GeoB23130; SaM.

AZORES, AÇOR BANK • 1 shell; 38.3587° N, 29.0505° W; depth 648 m; 13 Oct. 2018; box core in bioclastic sand; M151-GeoB23135; SaM.

Remarks

Talassia tenuisculpta was described from off Madeira; a syntype is shown by Warén & Bouchet (1988: fig. 44; National Museum of Wales). Four additional syntypes are in BMNH (reg. 1875.5.27.29, not seen). The species is distributed from the Bay of Biscay to Madeira, the Azorean Seamounts and Islands and in the western Mediterranean Sea in 21–948 m (Segers *et al.* 2009; this study). The outline of the shell is more slender (Fig. 8) than that of *T. coriacea* (Fig. 1) and the teleoconch is smooth with numerous growth lines and very fine dotted spiral lines (Figs 8, 11).

Talassia sandersoni (A.E. Verrill, 1884) Figs 12–21

Cingula sandersoni – A.E. Verrill, 1884: 241.

Talassia sandersoni – Warén & Bouchet 1988: 93, fig. 44.

Material examined

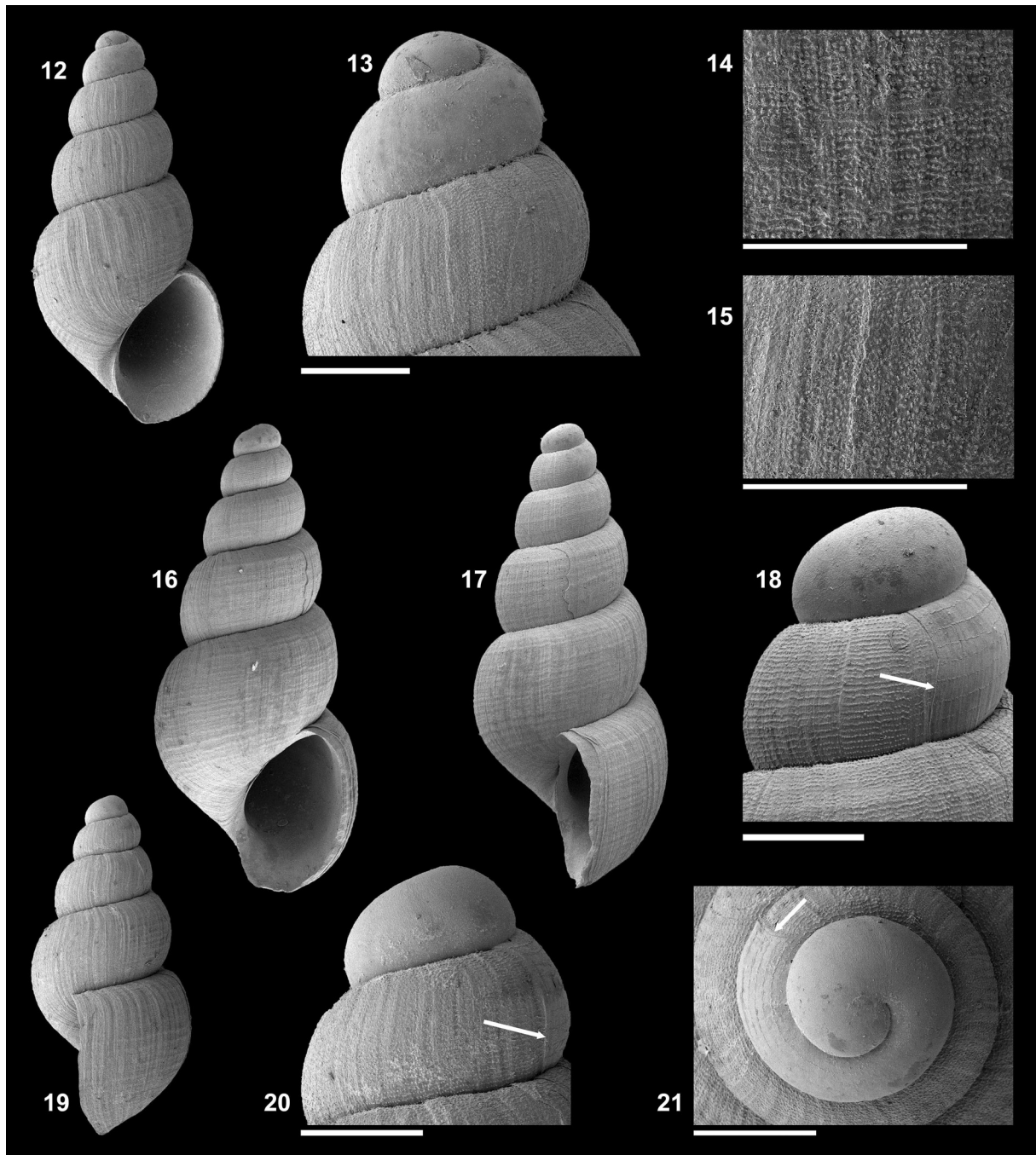
OFF CAPE LOOKOUT, USA • 42 shells (Figs 12–21); 34.2080° N, 75.8603° W; depth 430 m; 3 Jun. 2010; box core in bioclastic sand with coral rubble; TRACOS2010-32; SaM.

WESTERN SLOPE, FLORIDA, USA • 1 shell; 26.3370° N, 84.7598° W; depth 507 m; 27 Mar. 2012; grab in coral fragments; MSM20/4-GeoB16337-2; SaM • 1 shell; 26.4204° N, 84.7704° W; depth 500 m; 27 Mar. 2012; gravity core in sand; MSM20/4-GeoB16339; SaM.

Remarks

Talassia sandersoni was described from off Cape Hatteras (Verrill 1884) and is found off the Atlantic coast of the USA and into the eastern Gulf of Mexico; in NMNH the syntypes (USNM 34447) are stored as well as two more lots from off Cape Hatteras and six lots from off Florida (Rosenberg 2009; this study). The syntype (USNM 34447) was depicted by Warén & Bouchet (1988: fig. 48). The teleoconchs

are covered by spirally dotted cordlets of irregular strength and weakly flexuous growth lines (Figs 12–21).



Figs 12–21. *Talassia sandersoni* (A.E. Verril, 1884), USA, off Cape Lookout, TRACOS2010-32. **12–15.** Subadult shell, H = 2.4 mm, W = 1.1 mm, Ha = 0.9 mm, apical angle = 32°. **12.** Ventral view. **13.** Protoconch, Wp = 0.38 mm. **14.** Sculpture first whorl. **15.** Sculpture body whorl. **16–18.** Adult shell, H = 3.0 mm, W = 1.3 mm, Ha = 1.0 mm, apical angle = 28°. **16.** Ventral view. **17.** Side view. **18.** Protoconch, Wp = 0.38 mm, arrow at lip. **19–22.** Subadult shell, H = 2.2 mm, Ha = 0.9 mm. **19.** Side view. **20–21.** Protoconch, Wp = 0.38 mm. Scale bars = 0.2 mm.

Talassia mexicana sp. nov.

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Figs 22–30

Etymology

The specific epithet refers to the distribution area, the Gulf of Mexico.

Material examined

Holotype

MEXICO – off Yucatan, Campeche Slope • 1 shell (Figs 25–28); 23.4907° N, 87.1703° W; depth 566 m; 22 Mar. 2012; box core in coral rubble with calcareous mud; MSM20/4-GeoB16310; SMF358964.

Paratypes

MEXICO – off Yucatan, Campeche Slope • 2 shells (Figs 22–24, 29–30); same collection data as for holotype; SMF3658965 • 7 shells; same collection data as for holotype; SMF358966.

Other material examined

MEXICO – off Yucatan, Campeche Slope • 22 shells; 23.8335° N, 87.1338° W; depth 640 m; 24 Mar. 2012; box core in coral rubble with calcareous mud; MSM20/4-GeoB16321; SaM83497.

USA – off SW Florida • 2 shells; 26.3370° N, 84.7598° W; depth 507 m; 27 Mar. 2012; box core in coral rubble with mud; MSM20/4-GeoB16337; SaM83194.

Description

Elevated shell with rounded whorls, flexuous axial ribs and fine spiral cordlets, flexuous lip and smooth, glossy protoconch, cream white. Holotype dimensions: height 4.1 mm, width 1.5 mm, apical angle 29°.

PROTOCONCH. Elevated paucispiral shell with globular nucleus and 1 ½ whorls (Figs 23–24, 26); smooth; lip flexuous, ophistocline on exposed area (Fig. 26); width 0.44 mm.

TELEOCONCH. Elevated spire with 5 rounded whorls with impressed suture (Fig. 25). Axial sculpture sharp flexuous ribs, approximately 18 per whorl on first 3 whorls; more irregular on body whorl. Micro-sculpture composed of aligned raised beads on first whorl (Fig. 27); coarser and more irregular on subsequent whorls (Fig. 28). Narrow, deep, elongated umbilicus at base body whorl partly covered by parietal lip (Figs 22, 25, 29–30).

APERTURE. Oval outline, flattened on parietal side; smooth inside (Figs 22, 25, 30). Parietal lip very thin, occasionally strongly reclined; columellar lip sharp; external lip not thickened, blunt, flexuous with notches below suture and at base (Fig. 29). Aperture height 1.4 mm in holotype.

VARIABILITY. Number and strength of axial riblets and micro-sculpture is variable. Spiral cordlets sometimes faint or irregular, more frequently distinct and regular. Apical angle 29°–30°. Known range of adult height 3.6–4.1 mm.

Distribution

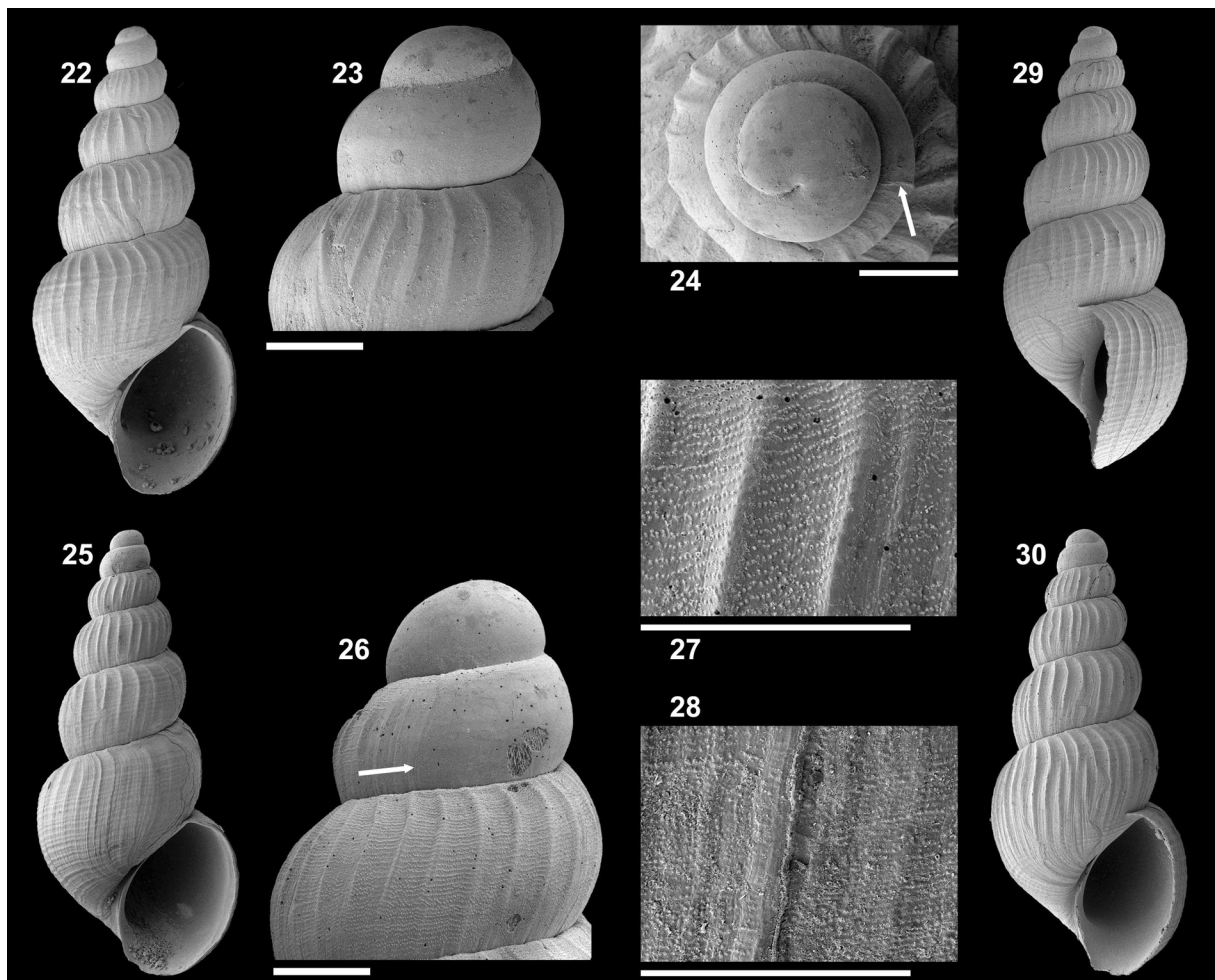
Gulf of Mexico, off Yucatan and off western Florida, known depth range 507–640 m.

Remarks

The radula and the soft parts of the new species are unknown. Only empty shells were found in or near coral debris with silty or muddy sand.

Differential diagnosis

This species is the largest in *Talassia*; adult size is more than 3.5 mm whereas all other species measure less than 3 mm. The protoconch is also largest with a diameter exceeding 0.4 mm; all other known congeneric species have a smaller protoconch diameter. *Talassia sandersoni* from off the SE USA is smaller, has 9–10 spiral lines on the last ¼ whorl of the protoconch and the sculpture of the teleoconch lacks the axial ribs (Warén & Bouchet 1988: fig. 48; Figs 12, 16–17, 19). The protoconch of the new species is smooth (Figs 23–24, 26) and the teleoconch has sharp axial ribs (Figs 22, 25, 29–30). All hitherto known NE Atlantic species (*Talassia coriacea*, *T. tenuisculpta*, *T. dagueneti*) have a protoconch with spiral cordlets composed of raised dots and dashes; the new species has a smooth protoconch. *Talassia dagueneti* shows more flexuous riblets on the teleoconch (Warén & Bouchet 1988; Figs 4, 6). *Talassia coriacea* has a large pyriform aperture (Warén & Bouchet 1988; Fig. 1).



Figs 22–30. *Talassia mexicana* sp. nov., Yucatan, Campeche Slope, MSM20/4-GeoB16310 (SaM). 22–24. Paratype (SMF3658965). 22. Ventral view, H = 3.8 mm, W = 1.7 mm, Ha = 1.3 mm, apical angle = 30°. 23–24. Protoconch, Wp = 0.44 mm. 25–28. Holotype (SMF358964). 25. Ventral view, H = 4.1 mm, W = 1.8 mm, Ha = 1.4 mm, apical angle = 29°. 26. Protoconch, Wp = 0.44 mm, arrow at lip. 27. Sculpture first whorl. 28. Sculpture body whorl. 29–30. Paratype (SMF3658965), H = 3.6 mm, W = 1.5 mm, Ha = 1.3 mm, apical angle = 29°, protoconch, Wp = 0.45 mm. Scale bars = 0.2 mm.

Talassia laevapex sp. nov.

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Figs 31–43

Etymology

The specific epithet refers to the smooth protoconch.

Type material

Holotype

MAURITANIA – **Tamxat Mounds** • 1 shell (Figs 36–39); 17.5410° N, 16.6666° W; depth 486 m; 15 Nov. 2010; box core in coral rubble with silty mud; MSM16/3-GeoB14905; SMF358967.

Paratypes

MAURITANIA – **Tamxat Mounds** • 2 shells (Figs 34–35, 40–43); same collection data as for holotype; SMF358968 • 13 shells; same collection data as for holotype; SMF358969 • 4 shells; 17.5427° N, 16.6634° W; depth 510 m; 15 Nov. 2010; box core in coral rubble with silty mud; MSM16/3-GeoB14904; SaM79757.

Other material examined

MAURITANIA • 1 shell; Arguin South 3 Canyon; 19.7378° N, 17.1459° W; depth 493 m; 7 Nov. 2010; bottom grab in silty mud; MSM16/3-GeoB14860; SaM79747 • 3 shells (Figs 31–33); Banda Mounds; 17.6794° N, 16.6684° W; depth 450 m; 8 Jan. 2007; box core in coral rubble with mud; POS346-GeoB11579; SaM79753.

Description

Elevated shell with rounded whorls, fine irregular axial sculpture, flexuous lip and smooth, glossy translucent protoconch, cream white. Holotype dimensions: height 2.2 mm, width 1.1 mm, apical angle 34°.

PROTOCONCH. Elevated paucispiral shell with globular nucleus and 1¼ whorls (Figs 33, 35, 37); smooth, numerous shallow micro pits visible under high magnification; faint spiral lines below upper suture in last part whorl; lip straight yet oblique at 17° with spire axis (Fig. 35); width 0.35 mm.

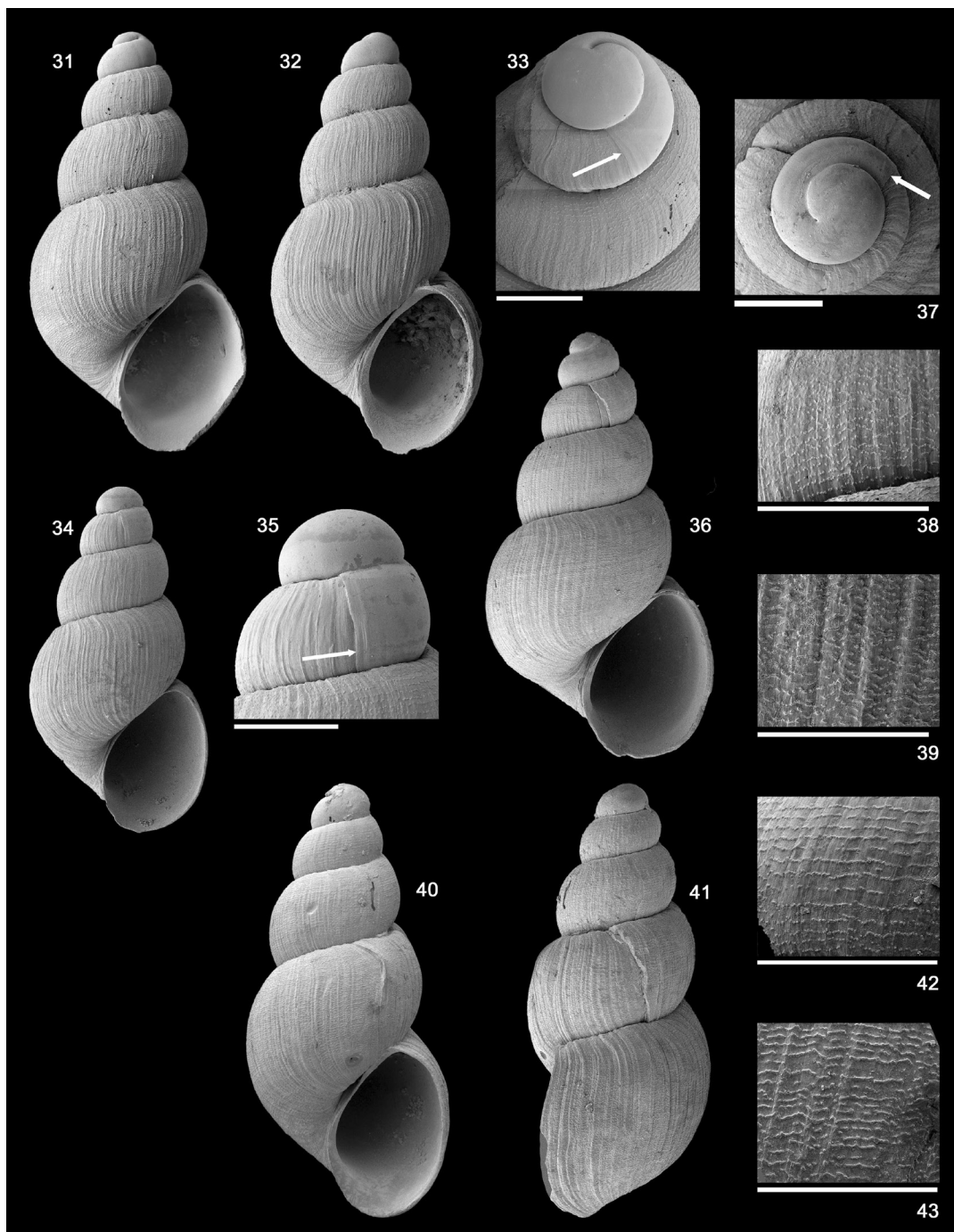
TELEOCONCH. Elevated spire with 3 rounded whorls and deep suture (Figs 31–32, 34, 36, 40–41). Axial sculpture coarse with numerous irregularly spaced flexuous growth lines; opisthocline below upper suture. Many spiral lines composed of aligned raised dots and dashes (Figs 38–39, 42–43); fine on the first whorl, coarser and more irregular on subsequent whorls. Narrow, deep, elongated umbilicus at base body whorl partly covered by parietal lip (Figs 31–32, 36, 40–41).

APERTURE. Oval outline, flattened on parietal side; smooth inside (Figs 31–32, 36, 40). Parietal and columellar lip sharp; external lip not thickened, blunt, flexuous with notches above the periphery and at base (Fig. 41). Aperture height 0.9 mm.

VARIABILITY. The growth lines on teleoconch vary in roughness. Occasionally, umbilical slit is nearly closed. The observed range for apical angle is 34°–36°. No variability observed in adult height (2.2 mm).

Distribution

NE Atlantic Ocean, Mauritania, latitude 17.5°–19.8° N, known depth range 450–510 m.



Figs 31–43. *Talassia laevapex* sp. nov., Mauritania. **31–33.** Banda Mounds, POS346-GeoB11579 (SaM79753). **31.** Ventral view, H = 2.2 mm, W = 1.1 mm. **32–33.** Ventral view, H = 2.2 mm, W = 1.1 mm. **33.** Protoconch, Wp = 0.35 mm. **34–35.** Tamxat Mounds, MSM16/3-GeoB14905. **34–35.** Paratype (SMF358968). **34.** Subadult ventral view, H = 1.8 mm, W = 0.9, Ha = 0.7 mm, apical angle = 34°. **35.** Protoconch, Wp = 0.31 mm, arrow indicates lip. **36–39.** Holotype (SMF358967). **36.** Ventral view, H = 2.2 mm, W = 0.9 mm, Ha = 0.9 mm, apical angle = 31°. **37.** Protoconch, Wp = 0.34 mm, arrow indicates lip. **38.** Sculpture first whorl, teleoconch. **39.** Sculpture body whorl, teleoconch. **40–43.** Paratype (SMF358968). **40–41.** Ventral and side view, H = 2.2 mm, W = 1.1 mm, Ha = 0.8 mm, apical angle = 36°, Wp = 0.31 mm. **42.** Sculpture first whorl, teleoconch. **43.** Sculpture body whorl, teleoconch. Scale bars = 0.2 mm.

Remarks

The radula and the soft parts of the new species are unknown. Only empty shells were found in or near coral debris with silty or muddy sand.

Differential diagnosis

All hitherto known NE Atlantic species have a protoconch sculpture with spiral lines composed of raised dots and dashes. *Talassia dagueneti* shows an axial sculpture of regular raised flexuous riblets on the teleoconch and finely aligned spirals of raised beads on the protoconch (Warén & Bouchet, 1988; Fig. 5) whereas *T. laevapex* sp. nov. has finer irregular growth lines (Figs 38–39, 42–43) and a smooth protoconch (Figs 33, 35, 37). *Talassia tenuisculpta* has similar fine growth lines and spiral lines as the new species but its protoconch has a clear spiral sculpture of raised dotted lines (de Folin 1873; Warén & Bouchet 1988; Figs 9–10). *Talassia coriacea* is larger and has a large pyriform aperture (Warén & Bouchet 1988; Fig. 1). *Talassia philippeswinneni* has a protoconch with shallow micro-pits and its teleoconch has spiral cords (Rolán & Swinnen 2016: 120–124, figs 1–4). *Talassia coriacea* and *T. philippeswinneni* live on the shelf whereas the new species is found on the upper bathyal slope.

Talassia flexisculpta sp. nov.

[urn:lsid:zoobank.org:act:E296DB40-9DC8-4EF4-A17B-B49046CAA209](https://doi.org/10.21203/rs.3.rs-1111111/v1)

Figs 44–50

Etymology

The specific epithet refers to the flexuous axial sculpture.

Type material

Holotype

MAURITANIA – **Arguin South 3 Canyon** • 1 shell (Fig. 49); 19.7381° N, 17.1465° W; depth 483 m; 7 Nov. 2010; van Veen grab; in silty mud; MSM16/3-GeoB14858; SMF358970.

Paratypes

MAURITANIA – **Arguin South 3 Canyon** • 2 shells (Figs 46–48, 50); same collection data as for holotype; SMF358971 • 1 shell same collection data as for holotype; SMF358972.

Other material examined

MAURITANIA • 1 shell; Tanôudêrt Canyon; 20.2429° N, 17.6681° W; depth 490 m; 3 Nov. 2010; box core in coral rubble with silty mud; MSM16/3-GeoB14799; SaM79754 • 1 shell (Figs 44–45); Timiris deep coral mound chain; 18.9634° N, 16.8688° W; depth 498 m; 11 Nov. 2010; box core in coral rubble with silty mud; MSM16/3-GeoB14877; SaM79756 • 1 shell; Banda Mounds; 17.6794° N, 16.6684° W; depth 450 m; 8 Jan. 2007; box core in coral rubble with mud; POS346-GeoB11579; SaM79753 • 3 shells; Banda Mounds; 17.6699° N, 16.6736° W; depth 505 m; 14 Nov. 2010; bottom grab in silty mud; MSM16/3-GeoB14898; SaM81473.

Description

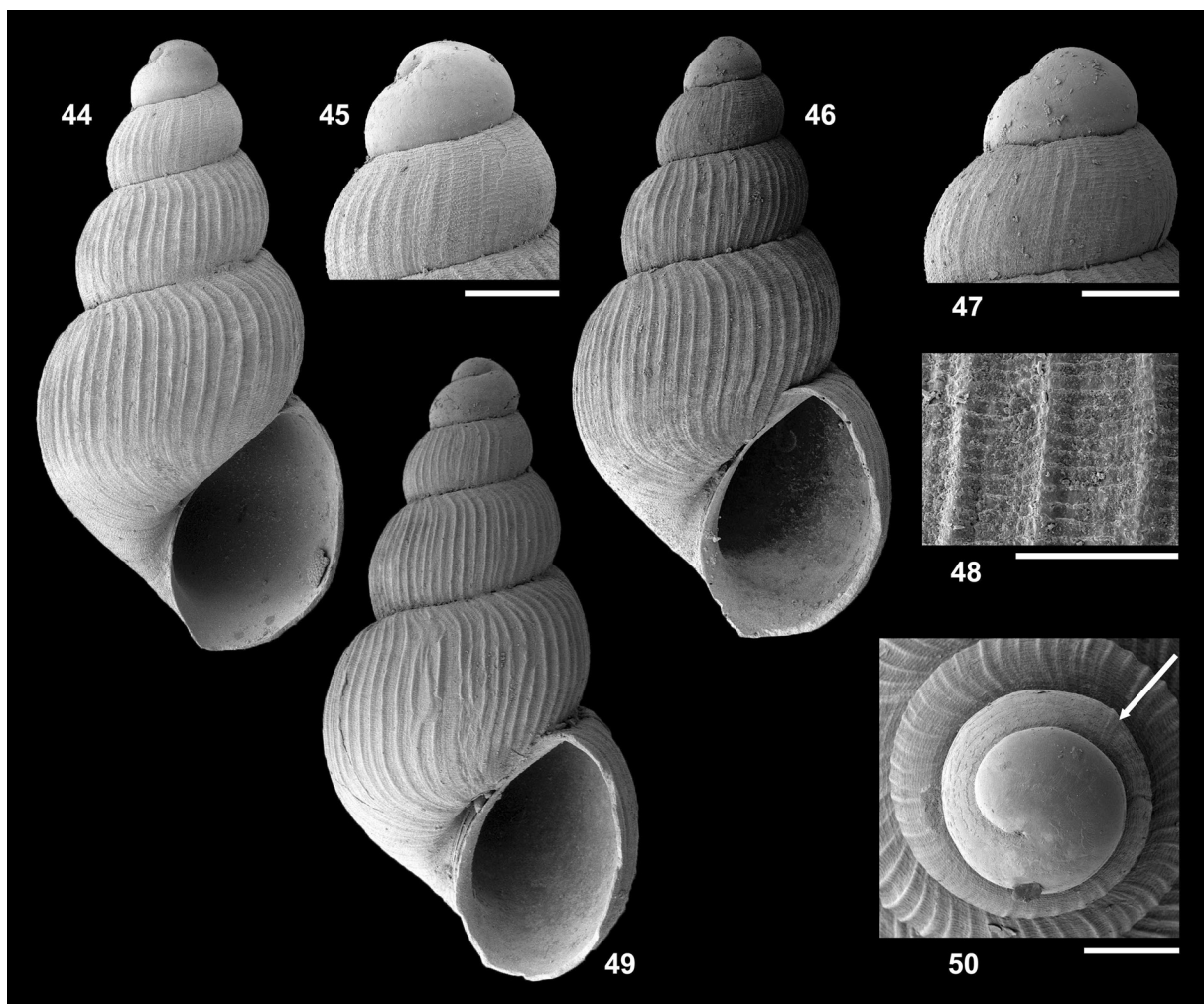
Elevated shell with rounded whorls, regular axial sculpture of raised flexuous ribs, flexuous lip and smooth protoconch, cream white. Holotype dimensions: height 2.5 mm, width 1.2 mm, apical angle 38°.

PROTOCONCH. Elevated paucispiral shell with globular nucleus and 1¼ whorls (Figs 45, 47, 50); first whorl smooth, last ¼ whorl with weak broad spiral bands; lip straight, slightly thickened (Fig. 50); width 0.44 mm.

TELEOCONCH. Elevated spire with 3 rounded whorls and deep suture (Figs 44, 46, 49). Axial sculpture with regularly spaced flexuous ribs and numerous growth lines. Many regularly-spaced spiral lines composed of closely-aligned raised dots (Fig. 48 of paratype). Narrow, deep, elongated umbilicus at base body whorl partly covered by parietal lip (Figs 46, 49).

APERTURE. Oval outline, flattened on parietal side; smooth inside (Figs 44, 46, 49). Parietal and columellar lip sharp; external lip not thickened, blunt, flexuous with notches above periphery and at base. Aperture height 1.0 mm in holotype.

VARIABILITY. Sculpture of the teleoconch shows variability in strength of axial ribs. In a subadult shell (Fig. 44), the umbilical slit is nearly closed. Observed range of adult height 2.4–2.5 mm.



Figs 44–50. *Talassia flexisculpta* sp. nov., Mauritania. **44–45.** Timiris Mounds, MSM16/3-GeoB14877 (SaM79756). **44.** Ventral view, H = 2.2 mm, W 1.1 mm, Ha = 0.85 mm. **45.** Protoconch, Wp = 0.40 mm. **46–50.** Arguin South 3 Canyon, MSM16/3-GeoB14858. **46–48.** Paratype (SMF358971). **46.** Ventral view, H = 2.4 mm, W = 1.2 mm, Ha = 1.0 mm. **47.** Protoconch, Wp = 0.40 mm. **48.** Sculpture body whorl. **49.** Holotype (SMF358970), ventral view, H = 2.5 mm, W = 1.2 mm, Ha = 1.0 mm, protoconch, Wp = 0.4 mm. **50.** Paratype (SMF358971), apical view protoconch, Wp = 0.44 mm, arrow indicates lip. Scale bars: 44–47, 49–50 = 0.2 mm; 48 = 0.1 mm.

Distribution

NE Atlantic Ocean, Mauritania, latitude 17.6–20.3° N, known depth range 450–505 m.

Remarks

The radula and the soft parts of the new species are unknown; only empty shells were found in or near coral debris with silty or muddy sand. *Talassia flexisculpta* sp. nov. was found sympatrically with *T. laevapex* sp. nov.

Differential diagnosis

Talassia dagueneti has a similar teleoconch sculpture but its whorls are more inflated, its spire is more elevated with a smaller apical angle and its protoconch has a strong spiral sculpture (Warén & Bouchet 1988; Figs 4–6) whereas *T. flexisculpta* sp. nov. has a more conical outline (Fig. 48) and a largely smooth protoconch (Figs 45, 47, 50). *Talassia mexicana* sp. nov. also has a similar teleoconch sculpture and a smooth protoconch; however, this species is taller and it has fine spiral cordlets on the teleoconch (Figs 22, 25, 29–30) which are absent in *T. flexisculpta* sp. nov. A comparison with other known species is given under *T. laevapex* sp. nov.

Talassia rugosa sp. nov.

[urn:lsid:zoobank.org:act:F640609C-2447-4C82-9467-30AEC281163A](https://zoobank.org/urn:lsid:zoobank.org:act:F640609C-2447-4C82-9467-30AEC281163A)

Figs 51–56

Etymology

The specific epithet refers to the rugose axial and spiral sculpture.

Type material

Holotype

ANGOLA – **Castle Mounds** • 1 shell (Figs 51–54); 9.6650° S, 12.7156° E; depth 453 m; 1 Jan. 2016; van Veen grab; in fine sand with clay; M122-GeoB20958; SMF358973.

Paratypes

ANGOLA – **Castle Mounds** • 1 shell (Figs 55–56); same collection data as for holotype; SMF358974 • 2 shells; same collection data as for holotype; SMF358975 • 2 shells; same collection data as for holotype; Naturalis, Leiden, the Netherlands.

Description

Elevated shell with rounded whorls and flattened apex, irregular axial sculpture of raised ribs and spiral cordlets, flexuous lip and smooth protoconch, cream white. Holotype dimensions: height 3.2 mm, width 1.6 mm, apical angle 36°.

PROTOCONCH. Flattened paucispiral shell with 1¼ whorls (Figs 52–53, 56); smooth; lip straight (Fig. 56); width 0.34 mm.

TELEOCONCH. Elevated spire with 4 rounded whorls and deep suture (Figs 51, 55). Axial sculpture with irregularly spaced slightly flexuous ribs and numerous growth lines. Irregularly-spaced spiral cordlets composed of sets of closely-aligned lines of various strength; lines composed of raised dots (Fig. 54). Umbilicus nearly completely covered by columellar lip (Fig. 51, 55).

APERTURE. Oval outline, slightly concave on parietal side; smooth inside (Figs 51, 55). Columellar lip sharp; external lip not thickened, blunt, flexuous with notches above periphery and at base. Aperture height 1.1 mm in holotype.

VARIABILITY. Little variability observed. Observed adult height 3.0–3.2 mm.

Distribution

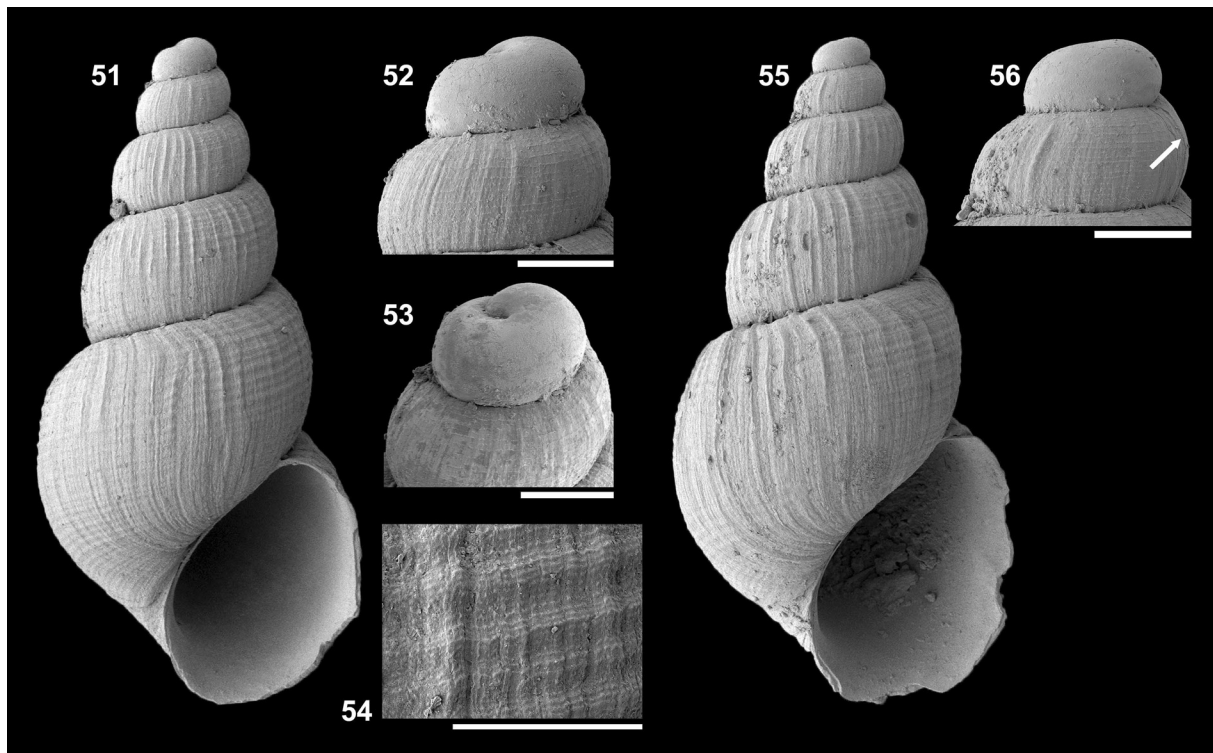
The species is only known from the type locality.

Remarks

The radula and the soft parts of the new species are unknown.

Differential diagnosis

Talassia dagueneti has a similar teleoconch sculpture but its axial sculpture is more regular and lacks the spiral cordlets and its protoconch has a stronger spiral sculpture and a more elevated outline (Warén & Bouchet 1988; Figs 4–7) whereas *T. rugosa* sp. nov. has a more conical outline, an irregular sculpture with spiral cordlets and a smooth protoconch with a flattened outline. *Talassia mexicana* sp. nov. from the Gulf of Mexico is larger and it has a more regular and stronger axial sculpture.



Figs 51–56. *Talassia rugosa* sp. nov., Angola, Castle Mounds, M122-GeoB20958. **51–54.** Holotype (SMF358973). **51.** Ventral view, H = 3.2 mm, W = 1.6 mm, Ha = 1.1 mm. **52–53.** Protoconch, Wp = 0.34 mm. **54.** Sculpture body whorl. **55–56.** Paratype (SMF358974). **55.** Ventral view, H = 3.2 mm, W = 1.6 mm, Ha = 1.2 mm. **56.** Protoconch, Wp = 0.34 mm, arrow indicates lip. Scale bars = 0.2 mm.

Discussion

One new species of the genus *Talassia* is described from the Gulf of Mexico and three are described from western Africa. All American and western African species show a predominantly smooth protoconch. Conversely, the three hitherto known species from the NE Atlantic and western Mediterranean Sea all show protoconchs with spiral sculptures. The two American species have spiral cordlets on the teleoconchs; the NE Atlantic species lack distinct spiral features.

Talassia tenuisculpta, *T. dagueneti*, *T. sandersoni*, *T. mexicana* sp. nov., *T. laevapex* sp. nov. and *T. flexisculpta* sp. nov. have been found in association with DWC habitats. The food source of these species must be present in these habitats. A link between *Talassia rugosa* sp. nov. and coral habitats needs to be confirmed.

Talassia laevapex sp. nov., *T. flexisculpta* sp. nov. and *T. rugosa* sp. nov. have been found in upper bathyal oxygen minimum zones (OMZ) off western Africa (Westphal 2007; Westphal *et al.* 2014; Hebbeln *et al.* 2016, 2020; Ramos *et al.* 2017; Wienberg *et al.* 2018). Off Cape Blanc (NW Africa), the southward flowing Canary Current collides with the northward flowing Mauritanian current thereby forming the SW flowing Northern Equatorial Current (NEC). The bathyal water mass south of the NEC has a dissolved oxygen concentration of less than 1.5 ml/l (Wienberg *et al.* 2018). Higher oxygen levels are found in the water mass to the north of the NEC (Wienberg *et al.* 2018). Hence, it is likely that this hydro-oceanographic separation causes a distinct development of NE Atlantic and West African bathyal species.

The reference collection at SaM contains shells of *Talassia dagueneti* from the Porcupine Basin. This submarine structure is the northern extent of its distribution range. *Talassia dagueneti* shows significant variability in outline and sculpture over its distribution area (Warén & Bouchet 1988; Bouchet & Warén 1993).

Similarly, many shells of *Talassia tenuisculpta* have been found on seamounts south of the Azores. This area currently is the western extent of its distribution area. The species has relatively little variability; it appears to have a more southern range when compared to *T. dagueneti*, including the Lusitanian Seamounts and island slopes off Madeira and the Canary Islands. The syntype figured by Warén & Bouchet (1988: fig. 44) is a slender subadult specimen. We consider the species distinct from *T. dagueneti* based on the sculpture of the teleoconch.

Few descriptions of soft parts and radula have been reported upon (for example by Warén & Bouchet 1988). Therefore, differentiation of species within *Talassia* is predominantly based on shell morphology. Actually, most species are solely known from empty shells. A study on DNA sequences could verify the current specific split when adequate soft parts become available. Soft parts could also be used to determine the food source of *Talassia*, for example by analysis of stomach contents or by stable isotope studies.

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