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ORIGINAL ARTICLE

Glass sponges (Porifera, Hexactinellida) of the northern Mid-Atlantic Ridge

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Abstract

Glass sponges (Hexactinellida) collected under the framework of the MAR-ECO project on the *G.O. Sars* cruise to the northern Mid-Atlantic Ridge, between the Azores and the Reykjanes Ridge, and on the 49th cruise of *Akademik Mstislav Keldysh* to the Charlie-Gibbs Fracture Zone are described. Fourteen species were identified in the material. This relatively rich fauna includes several novel findings, indicating that the hexactinellid fauna of the northern Mid-Atlantic Ridge is poorly investigated. One genus, *Dictyaulus*, has never before been reported from the Atlantic Ocean. Two species belonging to the genera *Heterotella* and *Amphidiscella* are new to science. Two other species, *Rossella nodastrella* Topsent, 1915 and *Doconestes sessilis* Topsent, 1928, have been collected just one other time. Finally, a probable new genus of Euplectellidae, which unfortunately cannot be adequately described because of how small the specimens are, is represented among these collections. A large portion of dead, rigid skeletons of Euretidae and spicule mats of Rossellidae are also reported but not described in detail. Representation of some genera in the Charlie-Gibbs Fracture Zone, coupled with recent observations from elsewhere along the Mid-Atlantic mountain chain, suggests that this fauna is as similar to those of the Indian Ocean and Indo-West Pacific as it is to West or East Atlantic faunas.

Key words: *Hexactinellida, North Atlantic, Porifera*

Introduction

Mid-ocean ridges are topologically and hydrographically complex structures. Especially complex are transform faults, such as the Charlie-Gibbs Fracture Zone on the northern Mid-Atlantic ridge, where changes in depth are radical over small distances and two large adjacent transform faults serve as channels through which water is exchanged between the eastern and western Atlantic (Searle 1981; Calvert & Whitmarsh 1986; Saunders 1994; Belkin & Levitus 1996; Dobrolyubov et al. 2003). Given such a complicated nature of the region, it should be home to a diverse and interesting deep-sea fauna. This expectation has prompted recent biological investigations on the northern Mid-Atlantic Ridge, including the Charlie-Gibbs Fracture Zone area, within the framework of the international project MAR-ECO ('Patterns and Processes of the Ecosystems of the Northern Mid-Atlantic') (Bergstad 2002;

Bartle 2003). Benthic animals were sampled on the RV *Akademik Mstislav Keldysh* 49th cruise (2003) and the RV *G.O. Sars* MAR-ECO cruise (2004) (Bergstad & Gebruk 2008). Here we report on the hexactinellid sponges collected during these cruises.

The hexactinellid fauna of the north Mid-Atlantic Ridge is thus far poorly investigated. Indeed, occurrence data for hexactinellids is generally scant, limiting one's ability to make strong conclusions about biogeographic patterns. Nevertheless, our report contains several novel findings that are worth noting. Surprisingly, this fauna appears to have some connections with that of the Indo-West Pacific, sharing the presence of *Saccocalyx pedunculata*, though this species is broadly distributed. In addition, two genera – represented on the north Mid-Atlantic Ridge by *Dictyaulus* sp. n. and *Heterotella* sp. n. [the latter genus was previously known in the Atlantic Ocean from a single record of *H. pomponae* (Reiswig 2000)] – are shared between this region and

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the Indo-West Pacific. On the other hand, a strong connection with the East Atlantic fauna (mainly described off the Azores) is obvious from records of such species as *Farrea* aff. *laminaris*, *Rossella* aff. *nodastrella* and *Doconestes* aff. *sessilis*. Typical elements of the North Atlantic fauna were also present: *Euplectella suberea*, *Hertwigia falcifera* and *Caulophacus* (*Caulophacus*) *arcticus*.

Finding complete specimens of *Hertwigia falcifera*, previously known only by fragments, clarifies its external shape and how it is constructed. We also document a very rare genus and species, *Doconestes sessilis*, previously known only from a single specimen.

Material and methods

On the *G.O. Sars* MAR-ECO cruise sponges were collected using a modified semi-commercial Otter trawl (the Campelen 1800 shrimp trawl) lined with a 5 mm mesh at the cod end. The trawl had an opening of 17 m × 12 m × 4.5 m.

In the MAR-ECO material sponges occurred at 11 stations (Table I). Specimens were preserved on board in 80° alcohol or dried. The collection of MAR-ECO sponges was examined during a 2-week visit to the Museum of Zoology, University of Bergen.

In addition to the *G.O. Sars* material, sponges collected in the Charlie-Gibbs Fracture Zone on the 49th cruise of the RV *Akademik Mstislav Keldysh* in 2003 using submersibles *Mir-1* and *Mir-2* were included in the present paper. Also included is one specimen from the Mid-Atlantic Ridge (the Azores area), stored in the Muséum national d'Histoire naturelle, Paris.

Abbreviations

HM, Humboldt Museum (Berlin); IORAS, P.P. Shirshov Institute of Oceanology, Russian Academy

of Sciences (Moscow); MNHN, Muséum national d'Histoire naturelle (Paris); ZMBN, Museum of Zoology, University of Bergen.

Species account

Hexactinosida Schrammen, 1903

Euretidae Zittel, 1877

Chonelasma Schulze, 1886

Chonelasma choanoides Schulze & Kirkpatrick, 1910

(Table II)

Material examined

IORAS, *Akademik Mstislav Keldysh*, 49th cruise, St. 4535 (52°58'N, 35°1'W, depth 2156 m), cat. no. 5/2/3170, 5/2/3171, 5/2/3172. ZMBN, MAR-ECO St. 40/367, cat. no. 14948; St. 50/379, cat. no. 15433, 15444, 15458; St. 62/380, cat. no. 15889.1, 15889.2, 15889.3; St. 70/385, cat. no. 14794, 14850, 15248.

Description

Body: usually represented by fragments 1–7 mm in thickness. Three specimens (MAR-ECO cat. no. 14794, 14850 and 15444) tubular, everted cones 80–300 mm long, 35–180 mm in diameter in the upper part with walls 207 mm in diameter. Three other specimens (MAR-ECO cat. no. 15889) attached inside a dead part of large specimen of *Hertwigia falcifera*, tubular, stout and curved, 60–120 mm long, 12–18 mm in diameter with walls 2–2.5 mm in thickness.

Spicules: rigid framework typical for the species. Loose spicules dermal and atrial pentactins, uncinate, scopules of two types (small and mediate, statistically distinguishable from each other), spiny hexactins and various microscleres: oxyhexactins predominate over the other rare types: hemioxyhexasters, oxyhexasters, onychohexactins,

Table I. MAR-ECO trawl stations on which sponges were sampled.

| Areas sampled | Super station | Trawl station | Date | Sampling location | | | Trawling depth (m) | |
|---|---------------|---------------|--------------|-------------------|-----------|------|--------------------|------|
| | | | | Latitude | Longitude | Mean | Max. | Min. |
| North of the Azores | 40 | 367 | 7 July 2004 | 42°55'N | 30°20'W | 2961 | 2968 | 2954 |
| | 46 | 372 | 11 July 2004 | 42°46'N | 29°16'W | 3031 | 3050 | 3005 |
| | 50 | 373 | 12 July 2004 | 43°01'N | 28°33'W | 2600 | 2607 | 2593 |
| South-east of Charlie-Gibbs Fracture Zone | 56 | 378 | 17 July 2004 | 51°45'N | 29°33'W | 1916 | 1950 | 1872 |
| | 60 | 379 | 19 July 2004 | 51°33'N | 30°18'W | 1263 | 1296 | 1237 |
| | 62 | 380 | 20 July 2004 | 51°55'N | 30°25'W | 1910 | 1959 | 1872 |
| | 65 | 382 | 23 July 2004 | 52°16'N | 31°00'W | 753 | 979 | 607 |
| | 66 | 383 | 24 July 2004 | 53°01'N | 33°36'W | 3030 | 3071 | 2995 |
| North-west of Charlie-Gibbs Fracture Zone | 68 | 384 | 25 July 2004 | 53°08'N | 34°46'W | 2350 | 2374 | 2306 |
| | 70 | 385 | 26 July 2004 | 52°58'N | 34°52'W | 1650 | 1670 | 1630 |
| | 72 | 386 | 27 July 2004 | 53°16'N | 35°31'W | 2548 | 2567 | 2522 |

Table II. Spicule dimensions of *Chonelasma choanoides* Schulze & Kirkpatrick, 1910 (in mm).

| | IORAS 5/2/3173 | | | | | ZMBN MAR-ECO 15889.3 | | | | |
|---|----------------|-------|-------|-------|-------|----------------------|-------|-------|-------|-------|
| | n | Mean | Min. | Max. | SD | n | Mean | Min. | Max. | SD |
| L. dermal pentactin tangential ray | 19 | 0.283 | 0.175 | 0.350 | 0.044 | 41 | 0.331 | 0.175 | 0.456 | 0.075 |
| L. dermal pentactin distal ray | 9 | 0.350 | 0.243 | 0.464 | 0.081 | 16 | 0.362 | 0.251 | 0.547 | 0.096 |
| L. atrial pentactin tangential ray | 8 | 0.308 | 0.243 | 0.342 | 0.031 | 13 | 0.258 | 0.182 | 0.350 | 0.041 |
| L. atrial pentactin tangential ray | 1 | 0.403 | 0.403 | 0.403 | | 2 | 0.175 | 0.160 | 0.190 | 0.021 |
| L. mediate scopule | 8 | 0.235 | 0.153 | 0.288 | 0.050 | 9 | 0.277 | 0.202 | 0.351 | 0.043 |
| L. line of mediate scopule | 8 | 0.046 | 0.027 | 0.058 | 0.010 | 9 | 0.047 | 0.038 | 0.054 | 0.005 |
| L. small scopule | 3 | 0.166 | 0.151 | 0.194 | 0.025 | 50 | 0.140 | 0.099 | 0.166 | 0.015 |
| L. line of small scopule | 3 | 0.034 | 0.027 | 0.040 | 0.006 | 50 | 0.023 | 0.014 | 0.034 | 0.004 |
| D disco-, hemidisco-, onycho- and hemionychohexasters | | | | | | 1 | 0.059 | 0.059 | 0.059 | |
| d disco-, hemidisco-, onycho- and hemionychohexasters | | | | | | 1 | 0.011 | 0.011 | 0.011 | |
| D discohexactin and onychohexactin | 17 | 0.051 | 0.040 | 0.058 | 0.005 | 10 | 0.048 | 0.036 | 0.061 | 0.008 |
| D oxyhexaster | 4 | 0.069 | 0.058 | 0.083 | 0.011 | 2 | 0.047 | 0.040 | 0.054 | 0.010 |
| d oxyhexaster | 4 | 0.012 | 0.011 | 0.014 | 0.002 | 2 | 0.010 | 0.009 | 0.011 | 0.001 |
| D oxyhexactin | 16 | 0.077 | 0.058 | 0.094 | 0.011 | 50 | 0.060 | 0.043 | 0.077 | 0.009 |

L, length; D, diameter; d, diameter of primary rosette.

hemionychohexactins, discohexactins and hemidiscohexasters. Most significant measurements given in Table II.

Remarks

Unlike other specimens of *C. choanoides* the new ones have some peculiarities which are entirely within the dimensions of various specimens from the North Atlantic reported by Reiswig & Mehl (1994); the scopules are not distinguishable into two types. Further, unlike the specimen from the Weddell Sea (Janussen et al. 2004), the specimens from the North Atlantic have no large discoscopules.

Farreidae Gray, 1872

Farrea Bowerbank, 1862

Farrea aff. *laminaris* Topsent, 1904

(Figure 1; Table III)

Material examined

ZMBN, MAR-ECO St. 70/385, cat. no. 14836.

Description

Body: sponge represented by several small and poor quality fragments of wall composed of one or two dictyonal farreoid layers.

Loose spicules: dermalia and atrialia pentactins with spiny rays, uncinates of common size and shape, clavules of one type with pileate heads and rough shafts.

Microscleres: discoidal and oxyoidal microscleres in the forms of hexasters, hemihexasters (with two, sometimes three secondary rays) and hexactins. Among discoidal microscleres, hemidiscohexasters and discohexactins more numerous than discohexasters. Among oxyoidal microscleres, oxyhexasters and hemioxyhexasters prevail; oxyhexactins very rare.

Remarks

The newly found sponge is similar to *F. laminaris* Topsent, 1904 (redescribed by Topsent in 1928) off the Azores but there are some differences. In the new specimen, there is an absence of two types of discohexasters, large and small (with four or five secondary rays). Thus, this sponge may represent a new subspecies. However, the poor condition of the specimen prevents it from being assigned holotype status. Furthermore, the insufficient original description and our inability to examine bona fide specimens of *F. laminaris* prevent a proper comparison (for instance Topsent called discohexactins discohexasters, probably because he considered the former to be derivatives of the latter).

***Farrea* sp.**

(Figure 2)

Material examined

ZMBN, MAR-ECO St. 70/385, cat. no. 15542.

Description

Body: small ovoid specimen about 2 mm in diameter, dried after capturing.

Framework: irregular skeleton with meshes 0.07–0.17 mm, usually triangular or rectangular, composed of rough beams 0.008–0.015 mm in diameter. Some hexactins with smooth rays about 0.045/0.002 mm fused with this framework.

Loose spicules: uncinates 0.6–0.7/0.011–0.015 mm. Clavules represented by several fragments with slightly clavate heads and no discs, head

diameter exceeds 0.2 mm, whereas ray diameter about 0.002 mm.

Dermalia rough pentactins with conically pointed outer ends, tangential rays 0.144–0.303 mm ($n=25$, mean = 0.222 mm, standard deviation (SD) = 0.043 mm), proximal ray 0.085–0.185 mm ($n=5$, mean = 0.144 mm, SD = 0.036 mm); diameter of rays 0.011–0.014 mm.

Microscleres: hemidiscohexasters prevail; 0.029–0.052 mm in diameter ($n=25$, mean = 0.043 mm, SD = 0.007 mm) with primary ray 0.004–0.011 mm long; one or two rays not branching and two, rarely three, secondary rays). Discohexasters 0.036–0.061 mm in diameter ($n=8$, mean = 0.048 mm, SD = 0.008 mm) with primary rosette 0.017–0.023 mm in diameter ($n=8$, mean = 0.017 mm, SD = 0.004 mm).

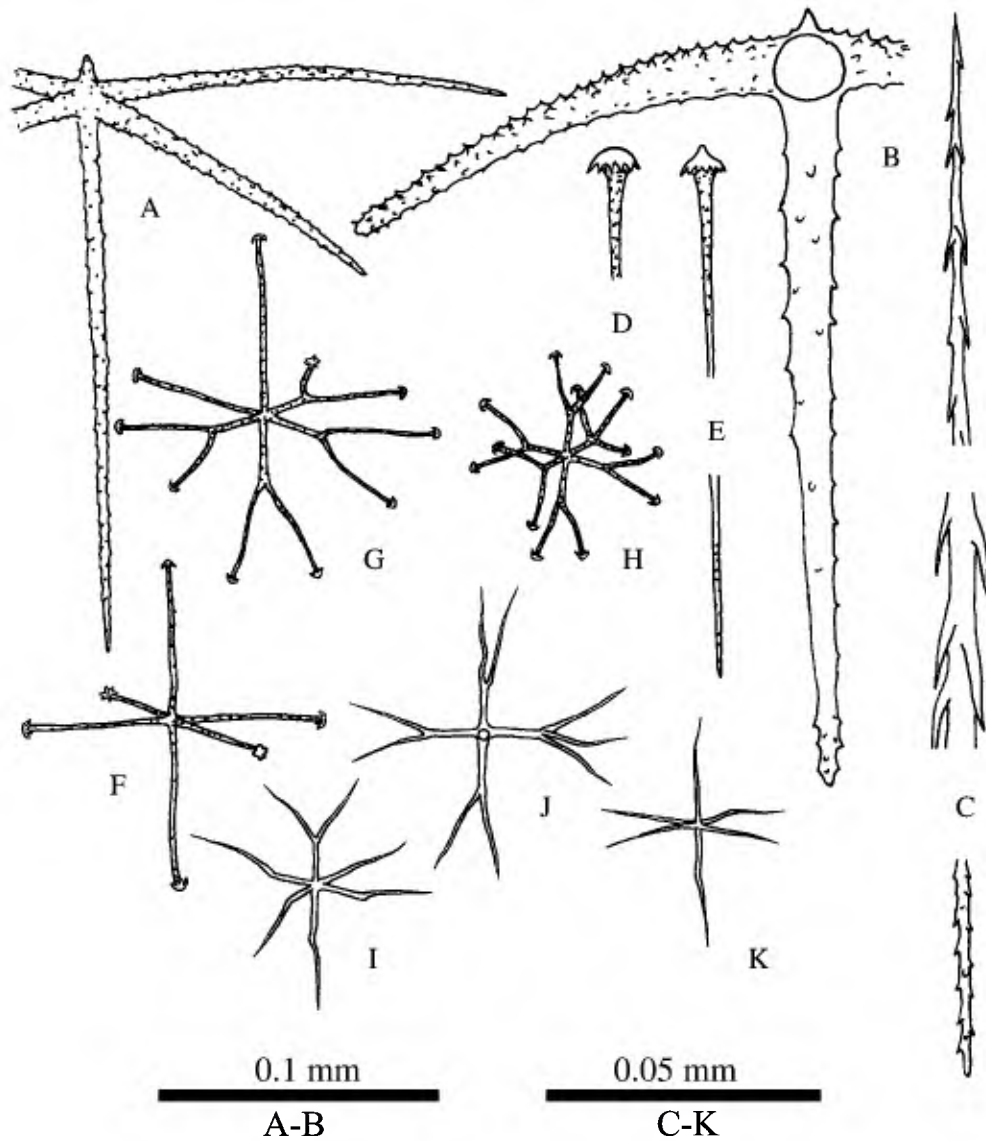


Figure 1. Spicules of *Farrea* aff. *laminaris* Topsent, 1904 (cat. no. 14836). (A, B) Dermal/atrial pentactins; (C) uncinata; (D, E) clavules; (F) discohexactin; (G) hemidiscohexaster; (H) discohexaster; (I) oxyhemihexaster; (J) oxyhexaster; (K) oxyhexactin.

Table III. Spicule dimensions of *Farrea laminaris* Topsent, 1904 (in mm).

| | From Topsent (1928) | | | | ZMBN MAR-ECO 14836 | | | |
|--|---------------------|-------|-------|----|--------------------|-------|-------|-------|
| | Mean | Min. | Max. | n | Mean | Min. | Max. | SD |
| L dermal/atrial pentactin tangential ray | | 0.140 | 0.210 | 25 | 0.165 | 0.123 | 0.224 | 0.023 |
| L dermal/atrial pentactin unpaired ray | | | | 25 | 0.209 | 0.132 | 0.274 | 0.031 |
| L discoclavule | | 0.200 | 0.280 | 23 | 0.260 | 0.112 | 0.331 | 0.039 |
| D width of disc of discoclavule | | | | 25 | 0.006 | 0.003 | 0.008 | 0.002 |
| L of disc of discoclavule | | | | 25 | 0.012 | 0.006 | 0.020 | 0.003 |
| D large discohexaster | | 0.130 | 0.140 | | | | | |
| D discohexaster | 0.060 | | | 12 | 0.086 | 0.062 | 0.106 | 0.013 |
| d discohexaster | | | | 12 | 0.034 | 0.022 | 0.045 | 0.007 |
| D hemidiscohexaster | | | | 25 | 0.095 | 0.073 | 0.134 | 0.016 |
| D discohexactin | | | | 25 | 0.106 | 0.078 | 0.126 | 0.014 |
| D oxyhexaster | | 0.070 | 0.090 | 24 | 0.085 | 0.073 | 0.106 | 0.010 |
| d oxyhexaster | | | | 24 | 0.031 | 0.025 | 0.039 | 0.004 |
| D hemioxyhexaster | | | | 16 | 0.092 | 0.073 | 0.118 | 0.012 |
| D oxyhexactin | | | | 3 | 0.082 | 0.067 | 0.101 | 0.017 |

L, length; D, diameter; d, diameter of primary rosette.

Remarks

The specific identification of this specimen is impossible due to its small size and absence of a proximally collected adult. The presence of undeveloped clavules similar to that described for newly settled *Farrea sollasii* off Japan (Okada 1928) leave little doubt that it is a representative of *Farrea*.

Lyssacinosida Zittel, 1877

Euplectellidae Gray, 1867

Euplectellinae Schulze, 1876

Euplectella Owen, 1841

Euplectella suberea Thomson, 1877

(Table IV)

Material examined

ZMBN, MAR-ECO St. 46/372, cat. no. 14878; St. 50/373, cat. no. 15150 (three specimens), 14976.

Description

Body: sponges of tubular shape typical for the species, 90–210 mm high, 20–23 mm in diameter.

Spicules: most important spicule measurements given in Table IV. Principal choanosomal spicules pentactins; most numerous choanosomal spicules tauactins; stauractins, paratractins and pentactins (the latter not common).

Remarks

The microsclere content is very simple in the investigated specimens: no discohexasters (Schulze

1887; Topsent 1892) or onychohexasters (onychasters in Topsent 1904). Floricomes and oxyhexasters as microscleres were also reported by Boury-Esnault et al. (1994). The atrial pentactins are very rare as mentioned by Schulze (1887) and they should perhaps be referred to choanosomal spicules. If so, specific atrial spicules are absent in this species.

Euplectella gibbsa sp. nov.

(Figures 3, 4; Table V)

Holotype: ZMBN, MAR-ECO St. 68/384, cat. no. 14401.

Material examined

Type of *E. nobilis* Schulze, 1904 (one of two specimens marked as type, another is HM 5449 and contains many fragments): HM 4392, *Valdivia*, St. 33.

Description

Body: sponge represented by the lower part of a considerably larger individual; diameter at the lower part at least 70 mm; entire length of the fragment 300 mm, of which basalia are about one-third. Walls thin, 1.5–2 mm in thickness, and composed of circular (inner) and longitudinal (outer) beams with no synapticular fusions. Lateral oscula irregularly situated between the square meshes of the beams; appear as numerous openings 1–1.5 mm in diameter.

Spicules: principalia mostly stauractins (rarely, may be pentactins); rays 0.03–0.11 mm in diameter and 3–16 mm long when straight, longitudinally

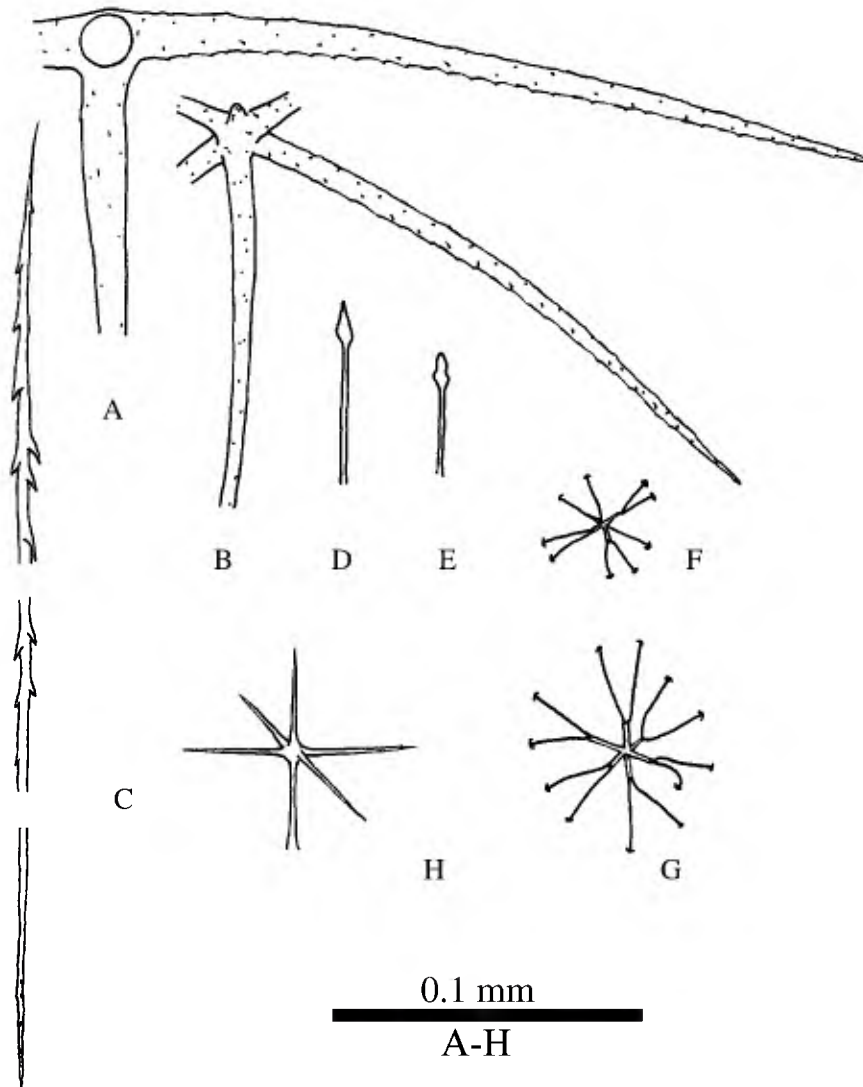


Figure 2. Spicules of *Farrea* sp. (cat. no. 15542). (A, B) Dermal pentactins; (C) uncinat; (D, E) young clavules; (F) hemidiscohexaster; (G) discohexaster; (H) oxyhexactin attached to a framework.

directed; curved rays, circularly directed 8–36 mm long with smooth, conically pointed outer ends. Most numerous choanosomal spicules tauactins, some paratetractins, stauractins and rare diactins. Unpaired ray of the tauactins shortest, about 0.5 mm long, long rays about 3 mm long with a diameter of 0.01–0.02 mm, their outer ends rounded or conically pointed, rough. Basalia long spicules with spiny shafts 0.014–0.023 mm in diameter and four-teeth anchorate heads, spicular centre situated some distance from head about 0.06 mm long and 0.05 mm in diameter. Dermal hexactins with conically pointed, rough outer ends and distal ray carrying some spines. Distal ray of dermal hexactins 0.090–0.227 mm long, tangential rays 0.148–0.291 mm, proximal ray 0.336–0.924 mm; diameter of rays 0.006–0.007 mm. Atrial pentactins with rays similar to dermal hexactins. Tangential rays of atrial pentactins 0.154–

0.447 mm long, distal ray 0.174–0.646 mm long, diameter of rays 0.007–0.009 mm.

Microscleres: microscleres floricoles, oxyhexasters and graphiocomes. Floricoles with secondary rays having three or four teeth, 0.123–0.151 mm in diameter; primary rosette 0.014–0.028 mm in diameter. Graphiocomes reconstructed to be 0.403–0.504 mm in diameter with primary rosette 0.012–0.024 mm in diameter. Oxyhexasters with slightly curved secondary rays two or three (rarely four or five) in number, 0.095–0.174 mm in diameter, primary rosette 0.011–0.025 mm in diameter.

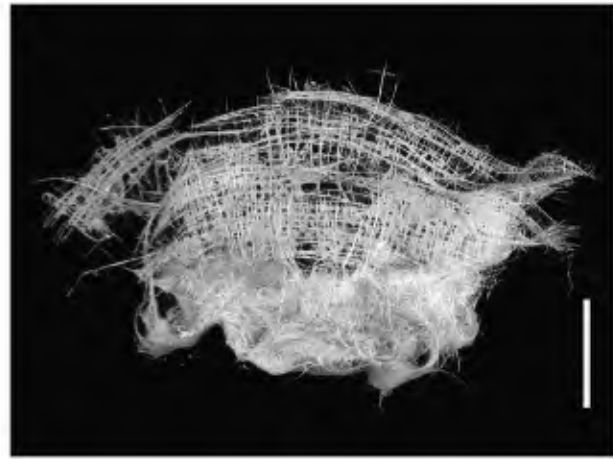
Etymology

The name of the species is given in connection with the location of this sponge in the Charlie-Gibbs Fracture Zone.

Table IV. Spicule dimensions of *Euplectella suberea* Thomson, 1877 (in mm).

| | ZMBN MAR-ECO 15150 (2) | | | | ZMBN MAR-ECO 14976 | | | | ZMBN MAR-ECO 14878 | | | | | | |
|-------------------------------------|------------------------|-------|-------|-------|--------------------|----|-------|-------|--------------------|-------|----|-------|-------|-------|-------|
| | n | Mean | Min. | Max. | SD | n | Mean | Min. | Max. | SD | n | Mean | Min. | Max. | SD |
| L dermal hexactin distal ray | 23 | 0.233 | 0.128 | 0.362 | 0.059 | 17 | 0.254 | 0.128 | 0.355 | 0.054 | 16 | 0.201 | 0.121 | 0.312 | 0.047 |
| L dermal hexactin tangential ray | 25 | 0.232 | 0.163 | 0.327 | 0.039 | 19 | 0.231 | 0.170 | 0.383 | 0.046 | 17 | 0.210 | 0.163 | 0.263 | 0.028 |
| L dermal hexactin proximal ray | 17 | 0.834 | 0.554 | 1.250 | 0.170 | 17 | 0.760 | 0.412 | 1.349 | 0.224 | 15 | 0.673 | 0.440 | 1.136 | 0.184 |
| L atrial pentactin tangential ray | | | | | | 1 | 0.320 | 0.320 | 0.320 | | 1 | 0.270 | 0.270 | 0.270 | |
| L atrial pentactin distal ray | | | | | | 2 | 0.721 | 0.696 | 0.746 | 0.035 | | | | | |
| L distal ray of diactin comitalia | 25 | 0.313 | 0.213 | 0.369 | 0.043 | 15 | 0.310 | 0.227 | 0.355 | 0.034 | 15 | 0.228 | 0.227 | 0.334 | 0.028 |
| L proximal ray of diactin comitalia | 25 | 0.323 | 0.206 | 0.391 | 0.054 | 15 | 0.328 | 0.213 | 0.391 | 0.050 | 15 | 0.288 | 0.227 | 0.355 | 0.041 |
| D floricome | 25 | 0.152 | 0.090 | 0.185 | 0.021 | 12 | 0.125 | 0.106 | 0.140 | 0.010 | 15 | 0.154 | 0.140 | 0.168 | 0.009 |
| d floricome | 25 | 0.024 | 0.017 | 0.028 | 0.004 | 15 | 0.020 | 0.014 | 0.025 | 0.003 | 15 | 0.024 | 0.020 | 0.028 | 0.003 |
| D oxyhexaster | 25 | 0.152 | 0.090 | 0.185 | 0.021 | 15 | 0.117 | 0.095 | 0.129 | 0.010 | 15 | 0.105 | 0.078 | 0.118 | 0.010 |
| d oxyhexaster | 25 | 0.024 | 0.017 | 0.028 | 0.004 | 15 | 0.015 | 0.011 | 0.020 | 0.003 | 15 | 0.016 | 0.011 | 0.021 | 0.002 |

L, length; D, diameter; d, diameter of primary rosette.

Figure 3. *Euplectella gibbsa* sp. nov., holotype, lateral view. Scale bar: 50 mm.

Remarks

The numerous species of the genus *Euplectella* are separated into four main groups by the construction of their principal skeleton: (1) mainly stauractins; (2) mainly hexactins with a reduced proximal ray and some stauractins; (3) pentactins and some hexactins; (4) stauractins, hexactins, hexactins with a reduced proximal ray and hexactins with two reduced rays (proximal and distal), tauactins and diactins (K.R. Tabachnick, D. Janussen & L. L. Menshenina, unpublished data). The new species should be referred to the first group without hesitation; most of these sponges have notable secondary silica deposition (as in *E. aspergillum*), making the sponge rigid, at least in the lower part of the body. Only four species from this group have no fusion of the spicules: (1) *E. marshalli* Ijima, 1895; (2) *E. oweni* Herklots & Marshall, 1868; (3) *E. curvistellata* Ijima, 1901; and (4) *E. nobilis* Schulze, 1904. The first three are similar species known off Japan, whereas the fourth is found in the Atlantic, off the coast of Africa. The new species looks to be close to *E. nobilis*, but there are several differences. *E. gibbsa* has no sigmatomes and its hexasters are larger (see Table V). Furthermore, the pinular rays of dermal hexactins are spindle-like in *E. nobilis* and stout with a smaller number of spines in *E. gibbsa*.

***Malacosaccus* Schulze, 1886**

***Malacosaccus* aff. *heteropimularia* Tabachnick, 1990**

(Figure 5)

Material examined

ZMBN, MAR-ECO St. 72/386, cat. no. 15178.

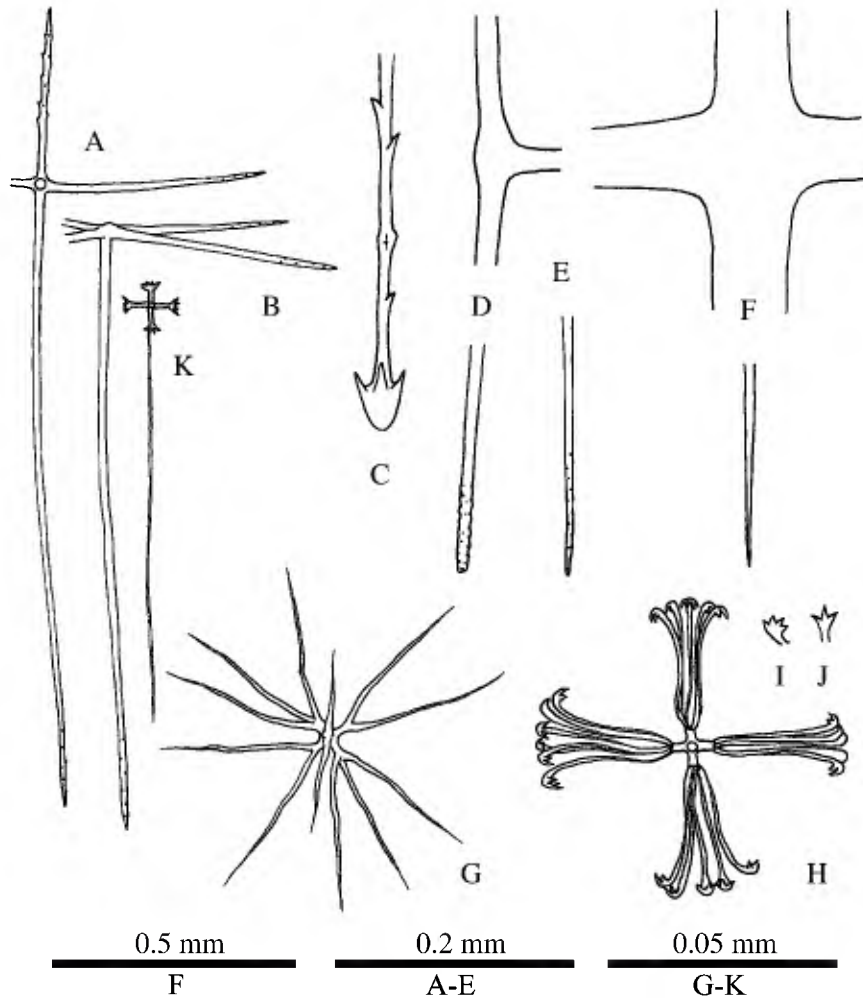


Figure 4. Spicules of *Euplectella gibbsa* sp. nov., holotype (cat. no. 14401). (A) Dermal hexactin; (B) atrial pentactin; (C) anchor; (D) choanosomal tauactin; (E) its outer end; (F) large choanosomal stauractin (principalia); (G) oxyhexaster; (H-J) floricome and its outer ends; (K) graphiocombe.

Description

Body: specimen incomplete lower part of the body; peduncle about 260 mm long and 5 mm in diameter, including tuft of basalia about 30 mm in diameter and remnants of the funnel-like body about 40 mm long.

Spicules: spicules of peduncle and basal tuft typical for all species of *Malacosaccus*, anchors and tauactins. Choanosomal spicules of the funnel-like body tauactins, stauractins, parattractins and pentactins with conically pointed, rounded smooth, or rarely rough outer ends; rays about 2.5/0.008 mm. Dermalia and atrialia hexactins with ray directed outside the body rough or pinular, spindle-like or clavate in shape; other rays with conically pointed smooth outer ends; ray directed outside wall 0.101–0.286 mm long ($n=17$; mean = 0.237 mm, SD = 0.051 mm); tangential rays 0.199–0.277 mm ($n=12$; mean = 0.239 mm, SD = 0.022 mm); ray directed into the wall about 0.672 mm long; diameter of

rays 0.011 mm, with widened clavate rays directed outside the body up to 0.022 mm in diameter.

Microscleres: mostly floricomes, rarely possible to find discohexasters similar to floricomes in shape, some oxyhexasters, oxyhemihexasters and oxyhexactins. Floricomes 0.067–0.112 mm in diameter ($n=25$, mean = 0.077 mm, SD = 0.010 mm) with primary rosette 0.011–0.022 mm in diameter ($n=25$, mean = 0.018 mm, SD = 0.002 mm); four to seven secondary rays with three or four very short teeth. Discohexasters 0.090–0.146 mm in diameter ($n=4$, mean = 0.104 mm, SD = 0.028 mm) with primary rosette 0.017–0.018 mm in diameter ($n=4$, mean = 0.017 mm, SD = 0.001 mm); outer ends have very fine teeth so it is also possible to call them onychoidal. Oxyoidal microscleres 0.073–0.123 mm in diameter ($n=14$, mean = 0.098 mm, SD = 0.016 mm), having curved rays up to two in number; primary rosette in oxyhexaster 0.017–0.025 mm in diameter ($n=11$, mean = 0.020 mm, SD = 0.004 mm).

Table V. Spicule dimensions of *Euplectella gibbsa*, sp. nov. and *E. nobilis* Schulze, 1904 (in mm).

| | <i>E. nobilis</i> HM 4392, type | | | | | <i>E. gibbsa</i> ZMBN MAR-ECO 14 401 | | | | |
|-----------------------------------|---------------------------------|-------|-------|-------|-------|--------------------------------------|-------|-------|-------|-------|
| | n | Mean | Min. | Max. | SD | n | Mean | Min. | Max. | SD |
| L dermal hexactin distal ray | 30 | 0.142 | 0.107 | 0.244 | 0.032 | 49 | 0.159 | 0.090 | 0.227 | 0.034 |
| L dermal hexactin tangential ray | 28 | 0.231 | 0.174 | 0.307 | 0.037 | 45 | 0.212 | 0.148 | 0.291 | 0.035 |
| L dermal hexactin proximal ray | 21 | 0.639 | 0.392 | 0.862 | 0.123 | 35 | 0.512 | 0.336 | 0.924 | 0.085 |
| L atrial pentactin tangential ray | 25 | 0.192 | 0.148 | 0.233 | 0.027 | 16 | 0.226 | 0.154 | 0.447 | 0.085 |
| L atrial pentactin distal ray | 23 | 0.632 | 0.400 | 0.851 | 0.126 | 16 | 0.418 | 0.174 | 0.646 | 0.137 |
| D floricome | 24 | 0.097 | 0.059 | 0.118 | 0.020 | 25 | 0.134 | 0.123 | 0.151 | 0.008 |
| d floricome | 24 | 0.021 | 0.015 | 0.026 | 0.002 | 25 | 0.020 | 0.014 | 0.028 | 0.003 |
| D sigmatocome | 18 | 0.070 | 0.052 | 0.104 | 0.011 | | | | | |
| d sigmatocome | 18 | 0.017 | 0.015 | 0.022 | 0.002 | | | | | |
| D oxyhexaster | 26 | 0.098 | 0.074 | 0.118 | 0.010 | 25 | 0.153 | 0.095 | 0.174 | 0.017 |
| d oxyhexaster | 26 | 0.016 | 0.009 | 0.022 | 0.003 | 25 | 0.020 | 0.011 | 0.025 | 0.004 |
| D graphiocombe | 5 | 0.374 | 0.326 | 0.414 | 0.035 | 9 | 0.453 | 0.403 | 0.504 | 0.029 |
| d graphiocombe | 8 | 0.020 | 0.015 | 0.023 | 0.003 | 25 | 0.021 | 0.012 | 0.024 | 0.002 |

L, length; D, diameter; d, diameter of primary rosette.

Remarks

As in the type, the new specimen of *M. heteropinularia* has small floricombe with short teeth at their

secondary rays. But unlike it, oxyoidal microscleres have very thin rays, and spiny hexactins with equal rays were not found. While subspecific status could

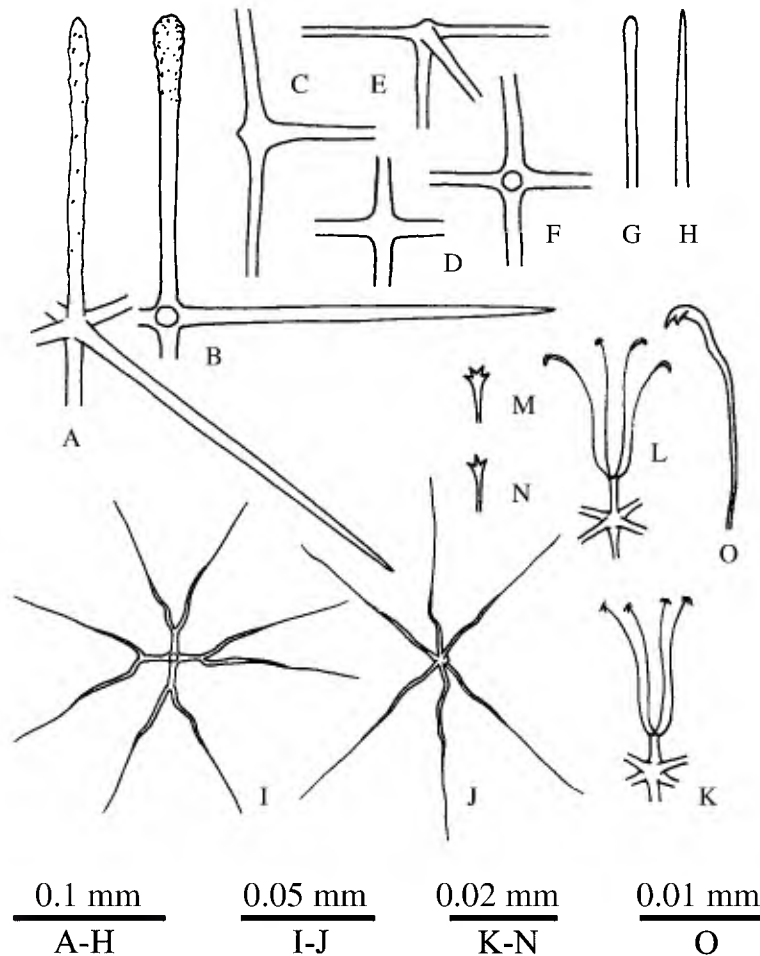


Figure 5. Spicules of *Malacosaccus* aff. *heteropinularia* Tabachnick, 1990 (cat. no. 15178). (A, B) Dermal/atrial hexactins; (C) choanosomal tauactin; (D) choanosomal stauractin; (E) choanosomal paratetractin; (F) choanosomal pentactin; (G, H) outer ends of choanosomal spicules; (I) oxyhexaster; (J) oxyhexactin; (K) discohexaster; (L-O) floricome and its outer ends.

be assigned to this specimen, its poor condition and small amount of dermal and atrial hexactins and oxyhexasters do not allow us to do so. Two other species of *Malacosaccus* common in the North Atlantic in adjacent areas, *M. unguiculatus* Schulze, 1886 and *M. floricomatus* Topsent, 1901, differ in their microscleres. *M. unguiculatus* has floricoles with large teeth, discohexasters and oxyhexasters with secondary rays more than two at each principal. *M. floricomatus* has floricoles with large teeth and large true discohexasters with easily recognizable discs.

Bolosominae Tabachnick, 2002

Amphidiscella Tabachnick & Lévi, 1997

Amphidiscella atlantica sp. nov.

(Figures 6, 7)

Holotype: ZMBN, MAR-ECO St. 72/386, cat. no. 15192.

Description

Body: funnel-like, 40 mm high and 55 mm in diameter in the upper part of the body, walls 7–8 mm thick; peduncle long, at least 90 mm (broken, basal portion absent) and thin, 2.5 mm in diameter.

Spicules: choanosomal spicules mostly diactins, sometimes tauactins, stauractins and pentactins. Diactins, 0.9–1.5/0.002–0.008 mm, with four rudimentary tubercles in the middle or a widening; outer ends rough and rounded. Spicules of the peduncle diactins fused to each other by secondary silica deposition, diameter 0.011–0.025 mm. Dermalia and atrialia as hexactins with rays 0.014–0.017 mm in diameter; outer ends of rays are rough, clavate, rounded or conically pointed. Distal ray of dermal hexactins 0.057–0.135 mm ($n=9$, mean = 0.087 mm, SD = 0.026 mm); tangential rays 0.220–0.369 mm ($n=11$, mean = 0.282 mm, SD = 0.045 mm); proximal ray 0.511 mm ($n=1$). Proximal ray of atrial hexactin 0.163–0.383 mm ($n=29$, mean = 0.244 mm, SD = 0.053 mm); tangential rays 0.483–0.781 mm ($n=20$, mean = 0.661 mm, SD = 0.089 mm); distal ray 0.518–1.491 mm ($n=7$, mean = 0.980 mm, SD = 0.370 mm).

Microscleres: only three types found: sigmatocomes, amphidiscs and staurodiscs. Sigmatocomes 0.319–0.426 mm in diameter ($n=25$, mean = 0.356 mm, SD = 0.031 mm); primary rosette 0.020–0.028 mm in diameter ($n=25$, mean = 0.024 mm, SD = 0.003 mm). Amphidisc shape typical for the genus with two rudimentary tubercles in the middle; total length 0.017–0.029 mm

($n=25$, mean = 0.025 mm, SD = 0.003 mm); length of the umbel 0.006–0.010 mm ($n=25$, mean = 0.008 mm, SD = 0.001 mm); diameter of the umbel 0.006–0.010 mm ($n=25$, mean = 0.008 mm, SD = 0.001 mm). Staurodiscs larger than amphidiscs, 0.036–0.043 mm in diameter ($n=2$, mean = 0.040 mm, SD = 0.005 mm), but umbels very similar; umbel length 0.005–0.007 mm ($n=2$, mean = 0.006 mm, SD = 0.001 mm); umbel diameter 0.008 mm ($n=2$, mean = 0.008 mm, SD = 0 mm).

Remarks

The new species differs from *A. caledonica* Tabachnick & Lévi, 1997 and *A. monai* Tabachnick, 1997 by absence of floricoles and branching rays in



Figure 6. *Amphidiscella atlantica* sp. nov., holotype, lateral view. Scale bar: 40 mm.

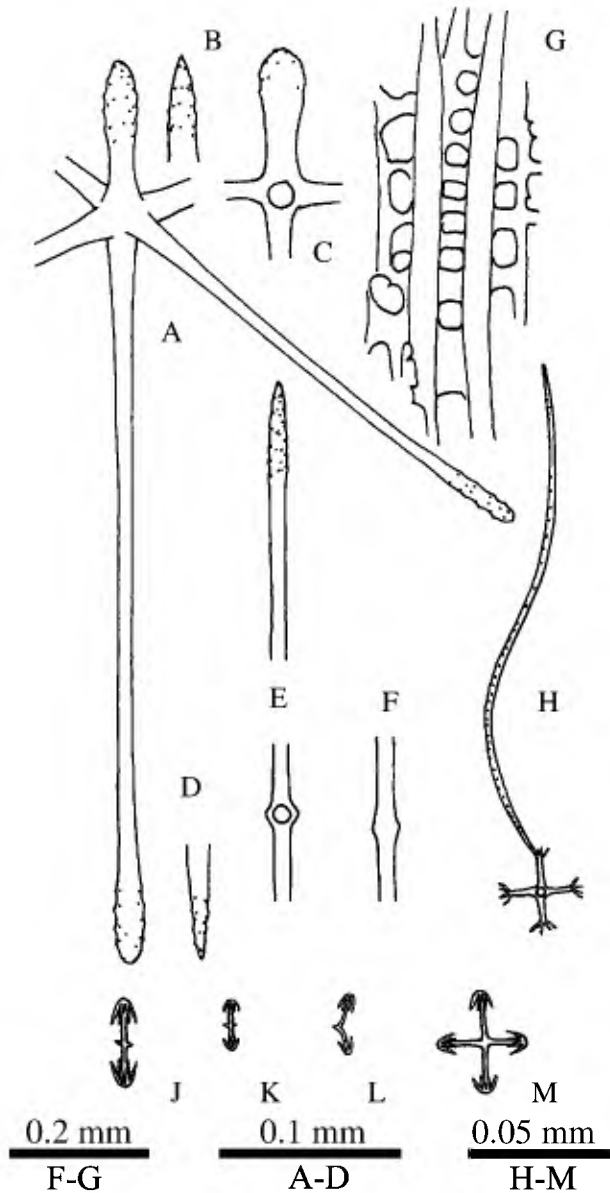


Figure 7. Spicules of *Amphidiscella atlantica* sp. nov., holotype (cat. no. 5192). (A–D) Dermal/atrial hexactin and their outer ends; (E, F) choanosomal diactin and its central part; (G) a fragment of the peduncle; (H) sigmatocome; (J, L) amphidiscs; (M) staurodisc.

discoidal spicules. As in *A. monai*, the new species has sigmatocomes. *A. atlantica* is very similar in spicule combination to the specimen taken off the Falkland Islands mentioned by Tabachnick (2002), differing only in spicule measurements and the presence of rare large discoidal spicules.

***Saccocalyx* Schulze, 1895**

***Saccocalyx pedunculata* Schulze, 1895**

Material examined

ZMBN, MAR-ECO St. 65/382, cat. no. 14906.

Description

Body: sponge represented by a large portion of the wall.

Spicules: choanosomal spicules as diactins, rare hexactins and stauractins. Dermal or atrial hexactins (in other specimens of *S. pedunculata* they are not distinguishable from each other) with pinular ray slightly widening in the middle or towards the distal end (as in the type specimen, specimens in the North Atlantic, and some in the middle Pacific); length of pinular ray 0.140–0.412 mm ($n=14$; mean = 0.262; SD = 0.081); tangential rays 0.120–0.308 mm long ($n=15$; mean = 0.209; SD = 0.054 mm); ray directed inside the body 0.148–0.798 mm long ($n=14$; mean = 0.455; SD = 0.151 mm).

Microscleres: specimen with complete set of microscleres typical for the species. Spirodiscohexasters 0.090–0.151 mm in diameter ($n=15$; mean = 0.119; SD = 0.019) with primary rosette 0.010–0.017 mm in diameter ($n=15$; mean = 0.012; SD = 0.002 mm). Anchorate discohexasters 0.050–0.140 mm in diameter ($n=15$; mean = 0.071; SD = 0.028 mm) with primary rosette 0.010–0.014 mm in diameter ($n=15$; mean = 0.012; SD = 0.001 mm). Drepanocomes 0.106–0.230 mm in diameter ($n=15$; mean = 0.193; SD = 0.035 mm) with primary rosette 0.011–0.017 mm in diameter ($n=15$; mean = 0.013; SD = 0.002 mm). Plumicommes 0.045–0.084 mm in diameter ($n=14$; mean = 0.055; SD = 0.012 mm) with primary rosette 0.011–0.017 mm in diameter ($n=15$; mean = 0.020; SD = 0.003 mm). One plumicome with only two primary rays.

Remarks

The spicules are typical for *S. pedunculata* and they do not differ from other specimens in their measurements (see Tabachnick 2002).

Bolosominae gen. sp. indet.

(Figure 8; Table VI)

Material examined

ZMBN, MAR-ECO St. 70/385, cat. no. 15556, 15570, 15584, 15598, 15612, 15626.

Description

Body: specimens as small ovoid sponges 1.5–2 mm high and 1–1.5 mm in diameter. All dried and attached to a large dead skeleton of *Herwigia falcifera*. Atrial cavity is suspected because of the presence of specific marginalia oscularia.

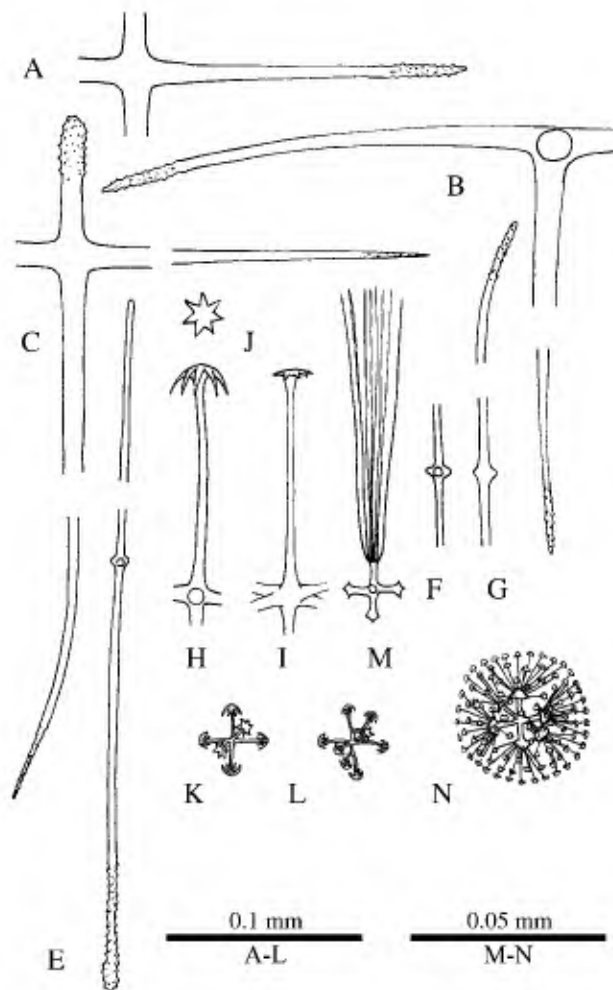


Figure 8. Spicules of Euplectellidae/Bolosominae gen. sp. (A-K, M, N) Cat. no. 15584; (L) cat. no. 15570. (A) Dermal stauractin; (B) dermal pentactin; (C) dermal? stauractin of prostalia oscularia (marginalia); (E) basal diactin; (F, G) choanosomal diactins; (H-J) large discohexasters; (K) microdiscohexactin; (L) microhemidiscohexaster; (M) graphiocomes; (N) spherical microdiscohexaster with numerous secondary rays.

Spicules: choanosomal spicules are diactins 1/0.007 mm with a widening or four rudimental tubercles in the middle; outer ends rough, rounded or conically pointed. Basalia as diactins with rounded or clavate outer ends; distal ray short, 0.08–0.27 mm long; proximal ray 0.76–0.99 mm long with diameter about 0.005 mm. Prostalia oscularia (=prostalia marginalia) as stauractins with one short ray directed upwards (probably above the osculum), 0.05–0.06 mm long rough and rounded; three other rays equal in size and shape to that of dermal pentactins and stauractins. Dermalia are pentactins and the rare stauractins with spiny conically pointed outer ends; tangential rays 0.091–0.327 mm long; proximal ray in pentactins 0.190–0.494 mm long, with diameter 0.011–0.013 mm.

Microscleres: several discoidal types: large and small discohexasters, small hemidiscohexasters spherical discohexasters with numerous secondary rays and graphiocomes. Large discohexasters 0.079–0.227 mm in diameter. Small discohexasters 0.023–0.043 mm in diameter. Hemidiscohexasters similar to small discohexasters with one or two rays branching; observed in only one specimen (cat. no. 15570) in low numbers; diameter 0.029–0.036 mm, with primary ray 0.005 mm long. Spherical discohexasters with numerous secondary rays 0.025–0.032 mm; diameter of the primary rosette 0.007–0.016 mm. Graphiocomes 0.083–0.234 mm; diameter of the primary rosette 0.011–0.020 mm.

Remarks

These sponges are doubtless representatives of Lyssacinosa, and their possession of graphiocomes suggests that they belong to Euplectellidae. Further attribution to any valid genus of Euplectellidae is impossible because their microsclere composition is not similar to any of the previously known genera. These sponges appear to represent a new genus, but they are very small and thus it is premature to formally describe a new genus based on this material. Presence of diactins as basalia raise the possibility that these sponges are part of the subfamily Corbitellinae but it is more likely that they are developing a peduncle and the attribution of this sponge to Bolosominae, as it is suggested here, is more reliable. Besides the peculiarities in their microsclere composition, these sponges represent the first known newly settled representatives of Euplectellidae, which warranted their careful description.

Corbitellinae Gray, 1872

Dictyaulus Schulze, 1895

Dictyaulus marecoi sp. nov.

(Figures 9 and 10; Table VII)

Holotype: ZMBN, MAR-ECO St. 70/385, cat. no. 15220. Paratype: ZMBN, MAR-ECO St. 62/380, cat. no. 15889.

Description

Body: typical 'Venus-flower basket' form. Holotype represented by upper part of the body, 160 mm high, broken close to the basal part, with maximum diameter of 70 mm and osculum of 50 mm in diameter, covered with a colander-like sieve-plate. Paratype represented by lower part of the body, situated inside a dead fragment of *Hertzwigia falci-fera*; 60 mm long and 25 mm in diameter, with a

Table VI. Spicule dimensions of *Bolosominae* gen. sp. (in mm).

| | ZMBN MAR-ECO 15 584 | | | | | ZMBN MAR-ECO 15 570 | | | | |
|--|---------------------|-------|-------|-------|-------|---------------------|-------|-------|-------|-------|
| | n | Mean | Min. | Max. | SD | n | Mean | Min. | Max. | SD |
| L dermal pentactin/stauractin tangential ray | 25 | 0.248 | 0.091 | 0.296 | 0.046 | 25 | 0.233 | 0.137 | 0.327 | 0.051 |
| L dermal pentactin proximal ray | 2 | 0.247 | 0.129 | 0.418 | 0.204 | 9 | 0.338 | 0.190 | 0.494 | 0.121 |
| D large discohexactin | 22 | 0.185 | 0.112 | 0.227 | 0.032 | 25 | 0.148 | 0.079 | 0.198 | 0.029 |
| D small discohexactin | 4 | 0.036 | 0.034 | 0.038 | 0.002 | 25 | 0.034 | 0.023 | 0.043 | 0.006 |
| D hemidiscohexaster | | | | | | 3 | 0.033 | 0.029 | 0.036 | 0.004 |
| D discohexaster with numerous secondary rays | 5 | 0.030 | 0.025 | 0.032 | 0.003 | 5 | 0.027 | 0.025 | 0.029 | 0.002 |
| d discohexaster with numerous secondary rays | 5 | 0.014 | 0.011 | 0.016 | 0.003 | 5 | 0.008 | 0.007 | 0.011 | 0.002 |
| D graphiocomes | 25 | 0.162 | 0.108 | 0.234 | 0.024 | 13 | 0.127 | 0.083 | 0.173 | 0.021 |
| d graphiocomes | 25 | 0.016 | 0.014 | 0.020 | 0.002 | 13 | 0.013 | 0.011 | 0.016 | 0.002 |

L, length; D, diameter; d, diameter of primary rosette.

bottom-plate similar in structure to the wall. Walls thin, about 2–4 mm in thickness; constructed of oblique (exterior), longitudinal (mediate), and circular (interior) beams. Lateral oscula numerous, rather regular in distribution, 1–4 mm in diameter. Sieve-plate irregular, usually triangular and rectangular openings 2–4 mm across. Choanosomal spicules mostly loose; some fusions only in the lower part of the body.

Spicules: choanosomal spicules mainly stauractins and diactins, some tauactins, rare pentactins and paratetractins; rays 0.4–13/0.003–0.1 mm in length with conically pointed or sometimes rounded outer ends smooth in thick spicules and rough in thin ones. Diactins are thinner, 0.003–0.040 mm in diameter, with a widening or four rudimentary tubercles in the middle. Spicules of the sieve-plate as in other representatives of Euplectelidae, often with curved and unequal rays; proportion of small hexactins notably larger than among choanosomal spicules which construct lateral wall. Dermal spicules as hexactins with rays equal in shape being smooth, stout and conically pointed, rarely distal ray clavate and slightly rough; distal ray 0.107–0.391 mm; tangential rays 0.089–0.518 mm; proximal ray 0.107–0.781 mm; diameter of rays 0.004–0.011 mm. Atrialia likely to be entirely absent.

Microscleres: floricones, drepanocomes, spiny microhexactins and pileate discohexasters common in both specimens. Anchorate discohexasters observed in the holotype only but they look to have autochthonic origin because such spicules are known in other species of the genus and no sponges which may have such spicules were collected at the station from which the holotype was collected. Floricones 0.095–0.118 mm in diameter with primary rosette 0.011–0.024 mm; secondary rays with three to five teeth. Drepanocomes 0.078–

0.126 mm in diameter with primary rosette 0.011–0.022 mm. Microhexactins with relatively short spines, 0.174–0.314 mm in diameter. Pileate discohexasters with many secondary rays terminating

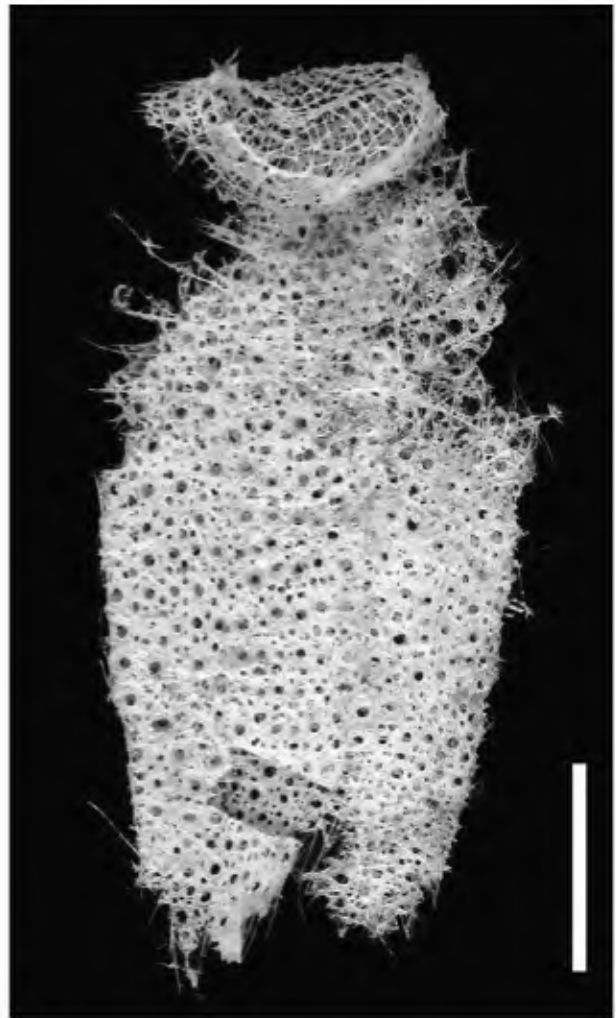


Figure 9. *Dictyautilus marecoi* sp. nov., holotype, lateral view. Scale bar: 50 mm.

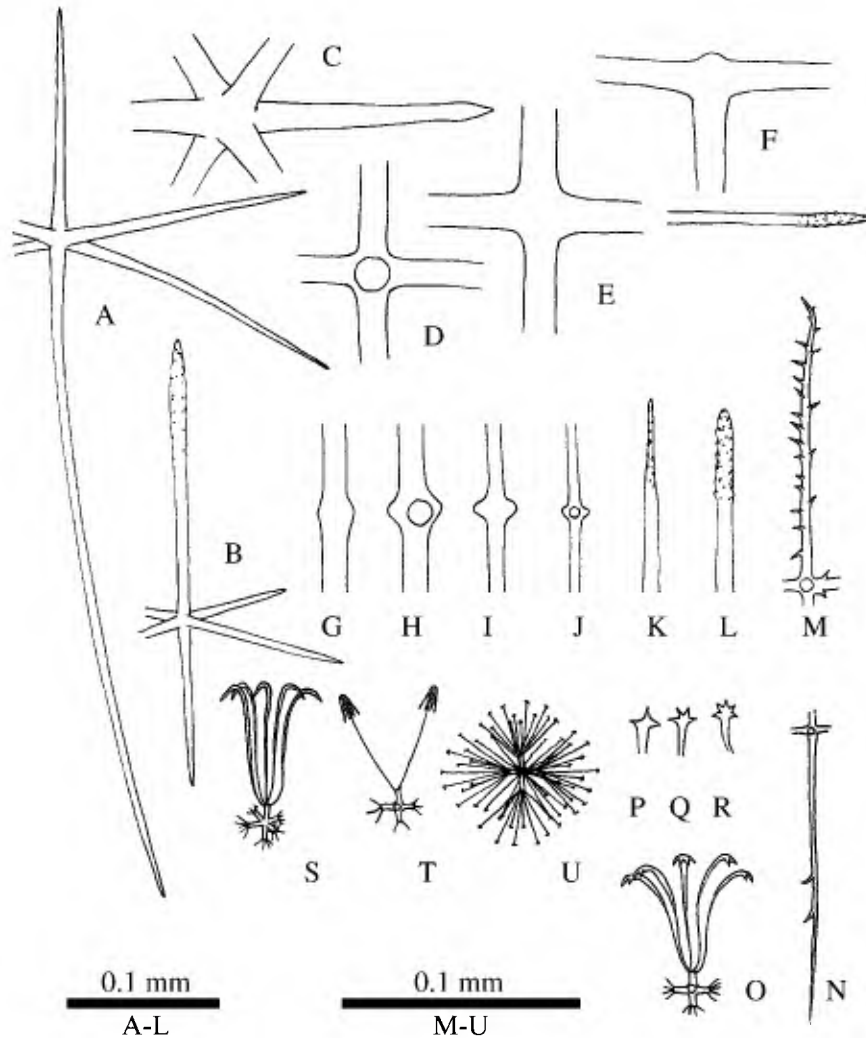


Figure 10. Spicules of *Dictyaulus marecoi* sp. nov., holotype (cat. no. 15889). (A, B) Dermal hexactins; (C) choanosomal hexactin; (D) choanosomal pentactin; (E) choanosomal stauractin; (F) choanosomal tauactin; (G–L) choanosomal diactins (their central parts and outer ends); (M, N) spiny hexactins; (O–R) floricome and its outer ends; (S) drepanome; (T) anchorate discohexaster; (U) spherical discohexaster with numerous secondary rays.

in very small discs; diameter 0.034–0.078 mm; diameter of the primary rosette 0.011–0.028 mm. Anchorate discohexasters with few, two to four, secondary rays; diameter 0.078–0.134; diameter of primary rosette 0.017–0.022 mm.

Etymology

The species is named after the MAR-ECO expedition.

Remarks

The two previously known species of *Dictyaulus*, *D. elegans* Schulze, 1895 (NW Indian ocean) and *D. starmeri* Tabachnick & Lévi, 2004 (SE Pacific ocean), have more types of microscleres than *D. marecoi*: three types of discoidal microscleres, one or two types of sigmatomes. The new species has

neither large discohexasters, as in *D. elegans*, nor discasters corresponding to them, as in *D. starmeri*. Further distinguishing *D. marecoi* are the large anchorate discohexasters (found in the holotype only) and the pileate discohexasters with many secondary rays having very small discs. The spicule measurements of corresponding spicules are very similar in these three species.

***Hertwigia* Schmidt, 1880**

***Hertwigia falcifera* Schmidt, 1880**

(Figures 11, 12)

Material examined

ZMBN, MAR-ECO St. 60/379, cat. no. 14920, 15539; St. 62/380, cat. no. 15889; St. 70/385, cat. no. 14752, 15262.

Table VII. Spicule dimensions of *Dictyaulus marecoi* sp. nov. (in mm).

| | ZMBN MAR-ECO 15220 (holotype) | | | | | ZMBN MAR-ECO 15889 (paratype) | | | | |
|----------------------------------|-------------------------------|-------|-------|-------|-------|-------------------------------|-------|-------|-------|-------|
| | n | Mean | Min. | Max. | SD | n | Mean | Min. | Max. | SD |
| L dermal hexactin distal ray | 30 | 0.154 | 0.107 | 0.213 | 0.029 | 21 | 0.184 | 0.128 | 0.391 | 0.057 |
| L dermal hexactin tangential ray | 31 | 0.179 | 0.089 | 0.355 | 0.055 | 26 | 0.195 | 0.121 | 0.528 | 0.075 |
| L dermal hexactin proximal ray | 15 | 0.473 | 0.107 | 0.667 | 0.164 | 15 | 0.509 | 0.320 | 0.781 | 0.121 |
| D floricome | 25 | 0.112 | 0.101 | 0.118 | 0.005 | 24 | 0.110 | 0.095 | 0.118 | 0.007 |
| d floricome | 25 | 0.018 | 0.014 | 0.024 | 0.003 | 24 | 0.016 | 0.011 | 0.020 | 0.002 |
| D pileate discohexaster | 25 | 0.052 | 0.034 | 0.078 | 0.010 | 22 | 0.050 | 0.039 | 0.067 | 0.008 |
| d pileate discohexaster | 25 | 0.015 | 0.011 | 0.022 | 0.004 | 22 | 0.016 | 0.011 | 0.028 | 0.004 |
| D anchorate discohexaster | 8 | 0.096 | 0.078 | 0.134 | 0.018 | | | | | |
| d anchorate discohexaster | 8 | 0.019 | 0.017 | 0.022 | 0.002 | | | | | |
| D drepanome | 5 | 0.106 | 0.078 | 0.126 | 0.118 | 25 | 0.110 | 0.095 | 0.118 | 0.007 |
| d drepanome | 5 | 0.019 | 0.017 | 0.022 | 0.003 | 25 | 0.016 | 0.011 | 0.020 | 0.002 |
| D microhexactin | 25 | 0.217 | 0.174 | 0.280 | 0.028 | 25 | 0.235 | 0.174 | 0.314 | 0.035 |

L, length; D, diameter; d, diameter of primary rosette.

Description

Body: most specimens represent broken fragments composed from plexiform, thin-walled (about 1 mm in thickness) tubes 6–35 mm in diameter. Two specimens possess a funnel-like body form with walls constructed from the plexiform tubes: (1)

(cat. no. 14752) 310 mm high, 300 × 400 mm in maximal diameter in the upper part of the body and 150 mm in diameter in the lower (basal) part of the body; wall about 100 mm in thickness, constructed of tubes of different diameter, usually inner (close to the secondary atrial cavity) with larger diameter up to 30 × 40 mm and the outer ones thinner up to 6 mm in diameter; (2) more or less complete specimen (one of three specimens in cat. no. 15262), 85 mm high and 100 × 120 mm in diameter, with wall composed of plexiform tubes 6 mm in diameter outside and 15 mm in diameter inside. Impossible to follow the true atrial and dermal surfaces in these adult sponges; initially these surfaces should be situated inside and outside the neanic tube, but in the adult sponge the diverse common cavaedia and



Figure 11. *Hertwigia falcifera* Schmidt, 1880 (cat. no. 14752), the largest known specimen. (Top) View from above; (bottom) lateral view. Scale bar: 100 mm.

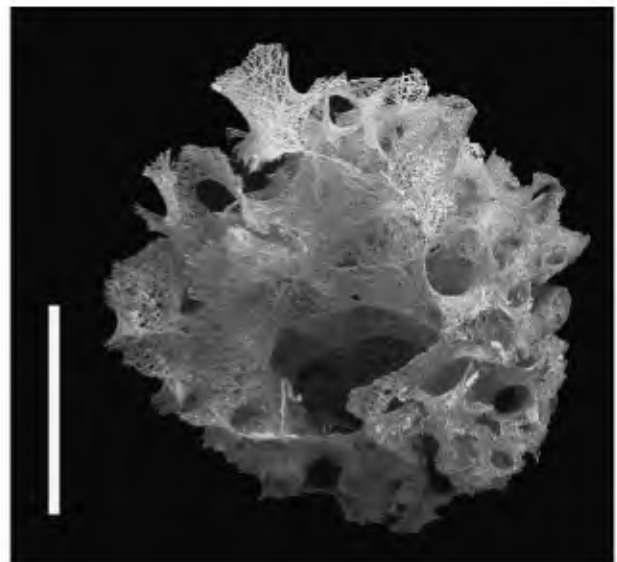


Figure 12. *Hertwigia falcifera* Schmidt, 1880 (cat. no. 15262), a specimen with a secondary atrial cavity clearly visible. Scale bar: 50 mm.

atrial surfaces often and many times come together one with the other.

Spicules: no loose spicules found. Wall constructed from choanosomal fused spicules typical for *H. falcifera*.

Remarks

The peculiarity of body construction in *Hertwigia falcifera* among other tubular Corbitellinae could be a feature used to distinguish a new subfamily in the future.

Heterotella Gray, 1867

Heterotella midlatlantica sp. nov.

(Figures 13, 14)

Holotype: ZMBN, MAR-ECO St. 56/378, cat. no. 15455.

Description

Body: sponge with 'Venus flower basket' form, consisting of two parts: small base, 110 mm high and 40 mm in diameter, in the lower part and large upper part 350 mm high and about 110 mm in diameter; entire length of the body 460 mm. Upper part with a well-distinguished ring of the osculum about 60 mm in diameter with no sieve-plate; sieve-plate probably destroyed and lost when capturing because minute remnants show that this oscular edge carried some structures of the sieve-plate. Walls thin, about 2–3 mm in thickness, constructed of some oblique (exterior), longitudinal (mediate) and circular (interior) beams; in the upper part some longitudinal (exterior) and circular (interior) beams present. Wall penetrated by numerous not regularly situated lateral oscula 1–6 mm in diameter. Choanosomal spicules in lower part of the body possess notable synapticula fusions, rendering the wall rigid; fusions in the upper parts not numerous, leaving the wall flexible.

Spicules: choanosomal spicules mostly diactins, rarely tauactins and pentactins. Thin diactins have a widening in the middle or four rudimental tubercles; thick ones have a widening or are stout, with outer ends smooth rounded or conically pointed. Diactins 1.2–30/0.004–0.16 mm in length. Dermalia and atrialia hexactins with smooth, thin (0.013–0.018 mm in diameter) rays and smooth conically pointed outer ends; distal ray 0.099–0.398 mm ($n=17$, mean = 0.223 mm, SD = 0.088 mm), tangential rays 0.085–0.376 mm ($n=21$, mean = 0.223 mm, SD = 0.082 mm), proximal ray 0.426–1.299 mm ($n=19$, mean = 0.838 mm, SD = 0.201 mm). Atria-



Figure 13. *Heterotella midlatlantica* sp. nov., holotype, lateral view. Scale bar: 100 mm.

lia as pentactins (it is possible that these spicules are also dermal as though for *H. pomponiae* Reiswig, 2000, but they are usually found in the preparations of the atrial skeleton). Atrial pentactins with rounded, smooth tangential outer ends and rounded, slightly rough distal outer ends; tangential rays 0.099–0.213 mm long ($n=23$, mean = 0.167 mm, SD = 0.032 mm), distal ray 0.533–1.143 mm ($n=17$, mean = 0.908 mm, SD = 0.176 mm); ray diameter 0.006–0.012 mm.

Microscleres: microscleres floricoles, sigmatocomes (probably not fully grown floricoles), graphiocomes, and spiny and smooth hexactins. Floricoles 0.090–0.118 mm in diameter ($n=24$, mean = 0.107 mm, SD = 0.008 mm), diameter of primary rosette 0.016–0.028 mm ($n=25$, mean = 0.020 mm, SD = 0.004 mm), secondary rays with three or four teeth. Sigmatocomes rare, 0.100 mm in diameter with primary rosette 0.020 mm in diameter. Graphiocomes reconstructed as spicules 0.437–0.633 mm in diameter ($n=19$, mean = 0.568 mm, SD = 0.043 mm), with primary rosette 0.028–0.042 mm in diameter ($n=25$, mean = 0.034 mm, SD = 0.004 mm). Hexactins with numerous relatively short spines or sometimes

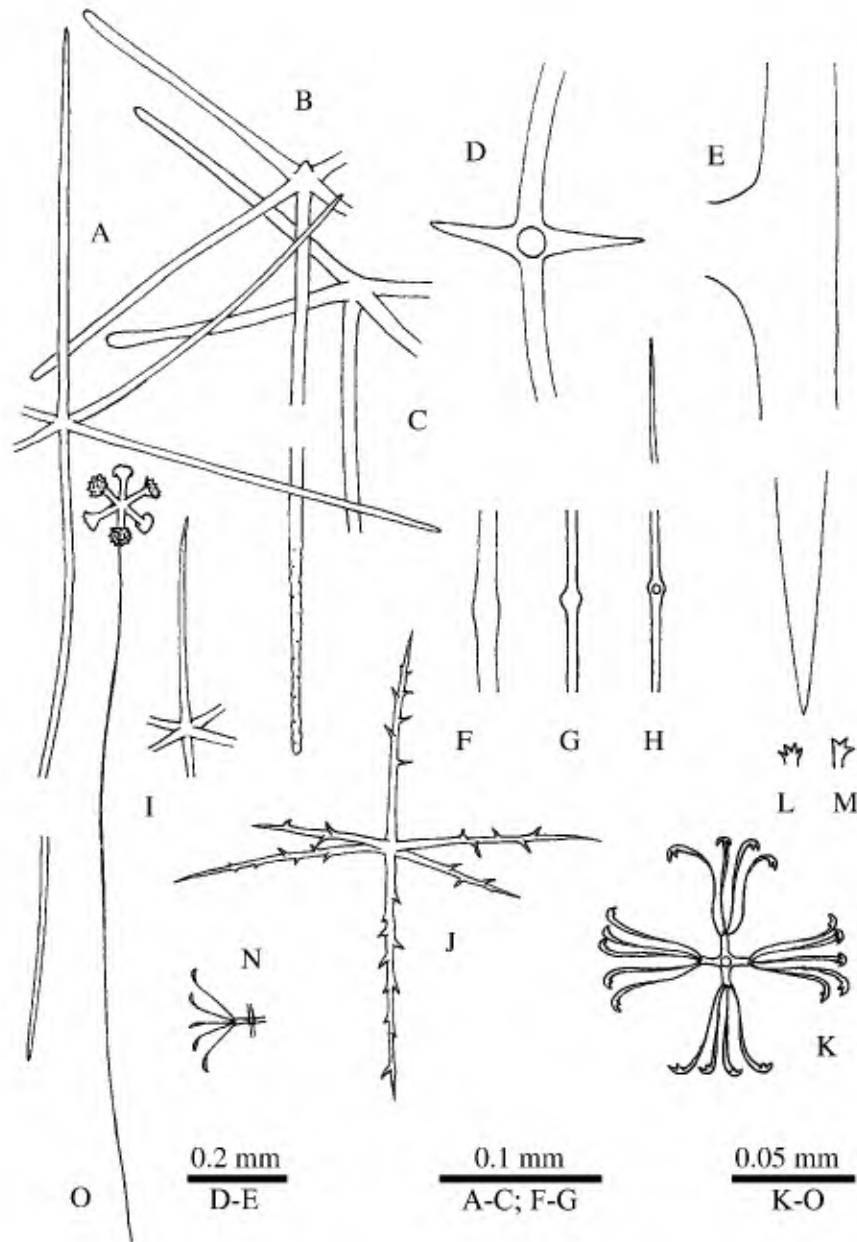


Figure 14. Spicules of *Heterotella midatlantica* sp. nov., holotype (cat. no. 15455). (A) Dermal hexactin; (B, C) atrial pentactins; (D) large choanosomal pentactin; (E) large choanosomal tauactin; (F-H) choanosomal diactins; (I) oxyhexactin; (J) spiny oxyhexactin; (K-M) floricome and its outer ends; (N) sigmatocome; (O) graphiocome.

smooth rays, 0.174–0.381 mm in diameter ($n=25$, mean = 0.258 mm, SD = 0.055 mm); diameter of rays 0.002–0.004 mm.

Etymology

The species name is given due to its location in the middle Atlantic.

Remarks

Before now *Heterotella* contained three species: *H. corbicula* (Bowerbank, 1862) (West Indian Ocean);

H. pomponae Reiswig, 2000 (West Atlantic); *H. pacifica* Tabachnick & Lévi, 2004 (South-West Pacific). The new species has three important features which allow it to be distinguished: (1) absence of large pinular hexactins as in *H. pomponae* (present in *H. pacifica* and *H. corbicula*); (2) diameter of floricomes (0.090–0.118 mm) is similar to that in *H. corbicula* (0.059–0.141 mm) (in the other two species they are smaller: 0.043–0.090 mm in *H. pomponae* and 0.047–0.079 mm in *H. pacifica*); and (3) absence, as in *H. pacifica*, of oxyoidal microscleres, hexactins which have rare very long spines, referred to as oxyhexasters in *H. pomponae* and in

H. corbicula. The sigmatocomes in *H. pomponae* are not less than fully grown floricomae as suggested for the new species. Current descriptions of the different species of *Heterotella* show that they are distinguished by various combinations of features rather than by individual peculiarities. Thus, new investigations of sets of specimens collected from close locations is necessary to understand which features may or may not vary intraspecifically.

Rossellidae Schulze, 1885

Rossellinae Schulze, 1885

Asconema Kent, 1870

Asconema fristedti nordazoriensis Tabachnick et Menshenina, 2007

Material examined

ZMBN, MAR-ECO St. 60/379, cat. no. 15402; St. 70/385, cat. no. 15528; IORAS, *Akademik Mstislav Keldysh*, 49th cruise, St. 4535 (52°58'N, 35°1'W, depth 2156 m), cat. no. 5/2/3173.

Remarks

This is a new species that was described separately together with the revision of the genus.

***Asconema?* sp.**

Material examined

ZMBN, MAR-ECO St. 40/367, cat. no. 15010; St. 66/382, cat. no. 15034, 15080, 15094, 15108.

Remarks

These sponges are represented by small fragments or portions of spicule mats that contain very few informative spicules and thus their exact identification is impossible.

Caulophacus Schulze, 1886

Caulophacus (Caulophacus) arcticus (Hansen, 1885)

(Table VIII)

Material examined

IORAS, *Akademik Mstislav Keldysh*, 49th cruise, St. 4540 (52°47'N, 34°45'W, depth 4313 m), cat. no. 5/2/3174.

Description

Body: mushroom-like with peduncle 65 mm long and 5 mm in diameter and body 50 mm in diameter and 4 mm in thickness with folded margin.

Remarks

The investigated specimen is very likely a representative of *C. (Caulophacus) arcticus*, which would make it the most southern location. 60°N was reported once before (Koltun 1967). Some differences in spicule measurements are noted but they do not preclude the identification to *C. (Caulophacus) arcticus*. In addition, rare discohexasters with two or three secondary rays were found in

Table VIII. Spicule dimensions of *Caulophacus (Caulophacus) arcticus* (Hansen, 1885) (in mm).

| | From Koltun (1967) | | IORAS 5/2/3174 | | | | |
|---|--------------------|-------|----------------|-------|-------|-------|-------|
| | Min. | Max. | n | Mean | Min. | Max. | SD |
| L dermal hexactin/pentactin pinular ray | 0.055 | 0.120 | 25 | 0.057 | 0.042 | 0.106 | 0.013 |
| L dermal hexactin/pentactin tangential ray | 0.090 | 0.140 | 25 | 0.076 | 0.042 | 0.095 | 0.011 |
| L dermal hexactin proximal ray | 0.040 | 0.100 | 21 | 0.052 | 0.036 | 0.081 | 0.011 |
| L atrial hexactin/pentactin pinular ray | 0.110 | 0.500 | 11 | 0.376 | 0.210 | 0.568 | 0.126 |
| L atrial hexactin/pentactin tangential ray | 0.130 | 0.198 | 18 | 0.119 | 0.087 | 0.174 | 0.024 |
| L atrial hexactin distal ray | | 0.110 | 3 | 0.119 | 0.078 | 0.162 | 0.043 |
| D dermal discohexactin | | | 25 | 0.154 | 0.130 | 0.176 | 0.016 |
| D atrial discohexactin | | | 25 | 0.150 | 0.115 | 0.184 | 0.020 |
| D discohexactin (both dermal and atrial) | 0.145 | 0.210 | 50 | 0.152 | 0.115 | 0.184 | 0.018 |
| D dermal lophodiscohexaster | | | 13 | 0.086 | 0.043 | 0.137 | 0.028 |
| d dermal lophodiscohexaster | | | 13 | 0.054 | 0.025 | 0.094 | 0.020 |
| D atrial lophodiscohexaster | | | 14 | 0.091 | 0.056 | 0.112 | 0.020 |
| d atrial lophodiscohexaster | | | 14 | 0.057 | 0.029 | 0.070 | 0.014 |
| D lophodiscohexaster (both dermal and atrial) | 0.050 | 0.220 | 27 | 0.089 | 0.043 | 0.137 | 0.024 |
| d lophodiscohexaster (both dermal and atrial) | | | 27 | 0.055 | 0.025 | 0.094 | 0.017 |
| D discohexaster | | | 2 | 0.120 | 0.101 | 0.140 | 0.028 |
| d discohexaster | | | 2 | 0.028 | 0.028 | 0.028 | 0 |

L, length; D, diameter; d, diameter of primary rosette.

the new specimen. These are similar in shape and size to hemidiscohexasters, also with two or three secondary rays, which are known in the new specimen as well as in previously described specimens. There are some peculiarities which are common for *Caulophacus* but not described for *C. arcticus* (possibly not found by previous investigators). For instance, among the large hexactins it is possible to find spicules with one ray directed outside the body, which are rough close to their proximal ends.

Rossella Carter, 1872

Rossella nodastrella Topsent, 1915
(Table IX)

Material examined

MNHN (p1429), Biacores, *Jean Charcot*, St. ChG 180 (37°57.50'N, 25°33'W, depth 1235–1069 m).

Description

Body: conical sponge 30 mm high, 30 mm in diameter, with large osculum and vast atrial cavity.

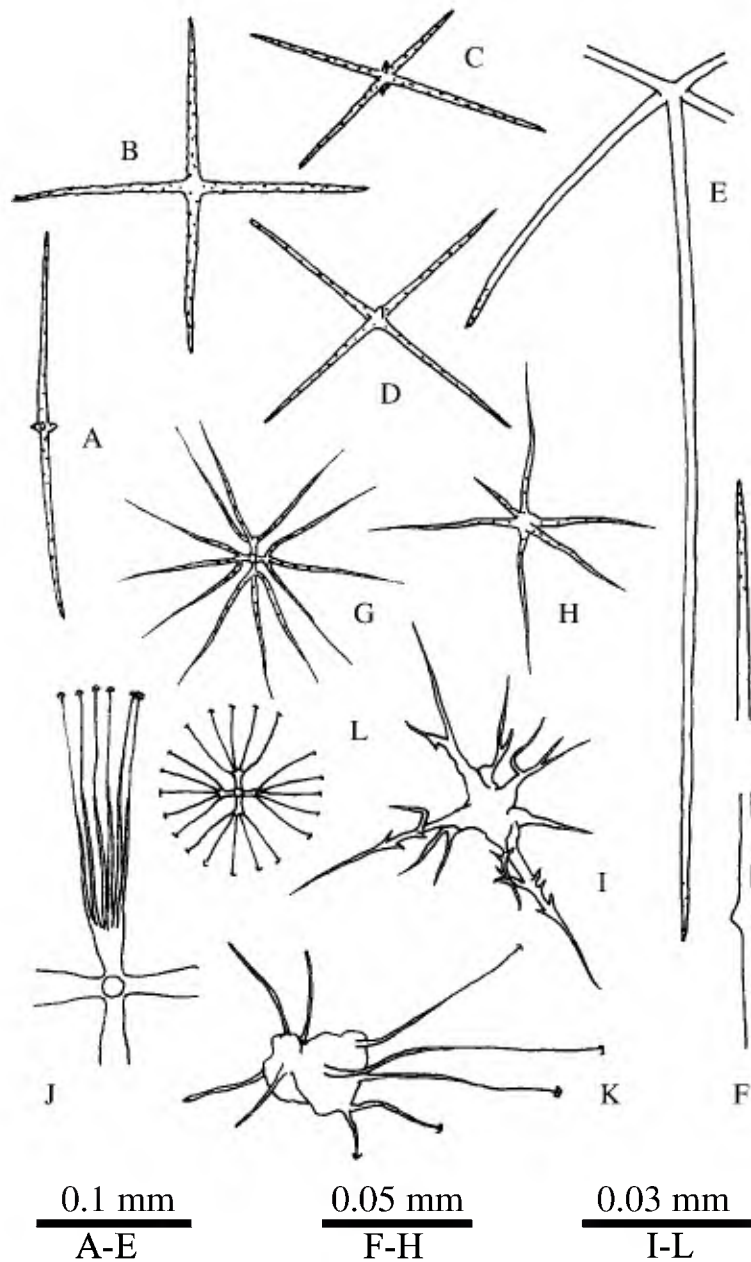


Figure 15. Spicules of *Rossella* aff. *nodastrella* Topsent, 1915. (A–H, J, L) Cat. no. 15668; (I, K) cat. no. 15654. (A) Dermal diactin; (B–D) dermal stauractins; (E) hypodermal pentactin; (F) choanosomal diactin; (G) oxyhexaster; (H) oxyhexactin; (I) abnormal oxyoidal microsclere; (J) calycocone; (K) abnormal discohexaster; (L) spherical microdiscohexaster.

Table IX. Spicule dimensions of *Rossella nodastrella* Topsent, 1915 (in mm).

| | <i>R. nodastrella</i> off Azores | | | | | | <i>R. aff. nodastrella</i> from the Charlie-Gibbs area | | | | | | |
|-------------------------------|----------------------------------|-------|-------|--------------|-------|-------|--|-------|----|--------------------|-------|-------|-------|
| | From Topsent (1915) | | | MNHN (p1429) | | | ZMBN MAR-ECO 15654 | | | ZMBN MAR-ECO 15668 | | | |
| | Mean | Min. | Max. | n | Mean | Min. | Max. | SD | n | Mean | Min. | Max. | SD |
| L dermal stauractin ray | 0.160 | | | 25 | 0.128 | 0.100 | 0.148 | 0.115 | 25 | 0.102 | 0.076 | 0.126 | 0.012 |
| L atrial hexactin ray | 0.200 | | | 25 | 0.186 | 0.130 | 0.296 | 0.039 | 25 | 0.089 | 0.072 | 0.104 | 0.016 |
| D calyccome | | 0.070 | 0.200 | 25 | 0.156 | 0.111 | 0.215 | 0.026 | 3 | 0.022 | 0.020 | 0.025 | 0.003 |
| d calyccome | | | | 25 | 0.032 | 0.013 | 0.048 | 0.009 | 3 | 0.022 | 0.020 | 0.025 | 0.003 |
| D discaster | 0.170 | | | 16 | 0.144 | 0.118 | 0.185 | 0.017 | | | | | |
| d discaster | | 0.020 | 0.025 | 17 | 0.023 | 0.011 | 0.033 | 0.006 | | | | | |
| D oxyhexaster/oxyhemihexaster | | 0.110 | 0.120 | 25 | 0.113 | 0.081 | 0.137 | 0.016 | 25 | 0.100 | 0.083 | 0.115 | 0.008 |
| d oxyhexaster/oxyhemihexaster | 0.008 | | | 25 | 0.010 | 0.007 | 0.037 | 0.006 | 25 | 0.009 | 0.006 | 0.013 | 0.002 |
| D microdiscohexaster | | 0.027 | 0.037 | | | | | | 3 | 0.029 | 0.029 | 0.029 | 0 |
| d microdiscohexaster | | | | | | | | | 3 | 0.008 | 0.008 | 0.009 | 0.001 |

L₂ length; D, diameter; d, diameter of primary rosette.

Remarks

Most measurements are given in Table IX. This specimen corresponds closely to the description of Topsent (1915), but there are a few differences. It is probably not important that tauactins and diactins were rarely present among the dermal stauractins, hypodermal spicules have orthotropical rays, and oxyoidal microscleres are oxyhexasters and oxyhemihexasters. However, other differences between the two known specimens, such as in spicule measurements and the absence of microdiscohexasters in the specimen described herein, may indicate that the two specimens represent distinct species. However, microscleres could potentially be found after more exhaustive spicule preparation.

Rossella aff. nodastrella Topsent, 1915 (Figure 15; Table IX)

Material examined

ZMBN, MAR-ECO St. 70/385, cat. no. 15668, 15654.

Description

Two small specimens about 2 mm in diameter attached to a skeleton of dead *Hertwigia falcifera*. Due to poor fixation (they were dried) it is impossible to say anything about atrial cavity and osculum.

Spicules: choanosomal spicules diactins 0.9–1.5/0.004–0.007 mm with a widening in the middle and rough conically pointed outer ends. Hypodermal spicules pentactins with rough conically pointed or rounded outer ends; tangential rays 0.2–0.3 mm long, proximal one 0.4–0.6 mm long; ray diameter 0.006–0.011 mm. Dermal spicules mostly stauractins with rough conically pointed rays 0.07–0.126/0.006 mm; occasional stauractins with one or two rudiments instead of distal and proximal rays; tauactins and diactins rare.

Microscleres: calyccomes 0.068–0.108 mm in diameter with primary rosette 0.011–0.025 mm in diameter. An abnormal discohexaster was encountered once in cat no. 15654. Spherical microdiscohexasters found in very small numbers in cat. no. 15654, 0.029 mm in diameter with primary rosette 0.008–0.009 mm in diameter. Oxyoidal microscleres as oxyhexasters, oxyhemihexasters and rare oxyhexactins, sometimes with spines; diameter 0.058–0.115 mm, diameter of primary rosette of oxyhexaster 0.006–0.014 mm.

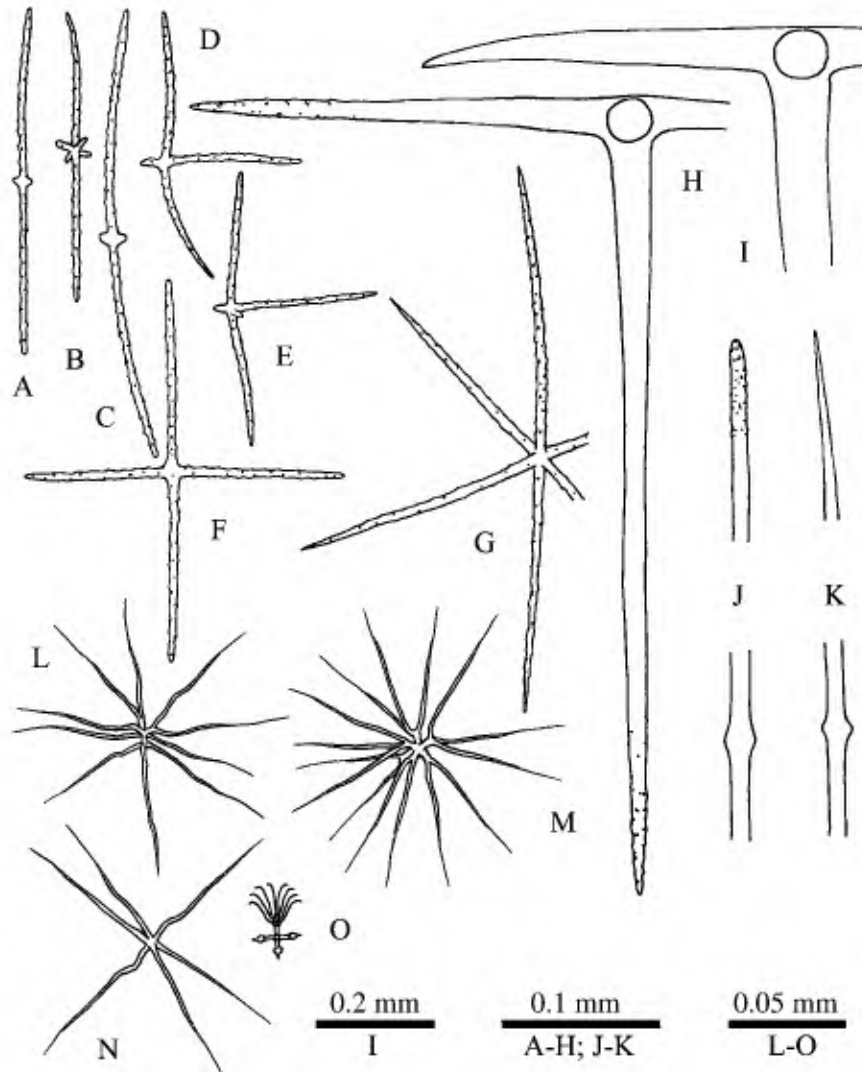


Figure 16. Spicules of *Doconestes* aff. *sessilis* Topsent, 1928 (cat. no. 14766). (A–C) Dermal diactins; (D, E) dermal tauactins; (F) dermal stauractin; (G) atrial? hexactin; (H) orthotropical hypodermal pentactin; (I) achorate hypodermal pentactin (prostalia pleuralia); (J, K) choanosomal diactin; (L) hemioxyhexaster; (M) oxyhexaster; (N) oxyhexactin; (O) strobiloplumicome.

Remarks

Two specimens from the Charlie-Gibbs Fracture Zone notably differ from the description of *R. nodastrella* in their spicule measurements (see Table IX), as well as their lack of discasters and spherical microdiscohexasters (in the holotype they are figured as stellate). Both of these specimens are juveniles and it is possible that the spicule differences are due to this fact. Thus, we consider them to be problematic representatives of *R. nodastrella* (all of them have dermal stauractins). Even within *R. nodastrella*, these sponges could represent a new subspecies. However, they are too small to be assigned a type status and it is possible that dermal stauractins represent a juvenile feature.

Some calycocomes were found in other fragments of hexactinellid spicule mats composed of spicules

of different Rossellidae (cat. no. 15388, 15024, 15038); these calycocomes are likely spicules of *Rossella*; their diameter is more than 0.22 mm, their primary rosette is 0.037–0.059 mm in diameter.

Lanuginellinae Gray, 1872

Doconestes Topsent, 1928

Doconestes aff. *sessilis* Topsent, 1928
(Figure 16; Table X)

Material examined

ZMBN, MAR-ECO St. 70/385, cat. no. 14766.

Description

Body: ovoid about 12 × 10 mm with some prostalia lateralialia of pentactins with short tangential rays

Table X. Spicule dimensions of *Doconestes sessilis* Topsent, 1928 (in mm).

| | Holotype from Topsent (1928) | | | ZMBN MAR-ECO 14766 | | | | |
|---|------------------------------|-------|-------|--------------------|-------|-------|-------|-------|
| | Mean | Min. | Max. | n | Mean | Min. | Max. | SD |
| L dermal diactin tangential ray | | 0.160 | 0.195 | 25 | 0.107 | 0.078 | 0.140 | 0.017 |
| L atrial hexactin ray | | | | 5 | 0.184 | 0.154 | 0.224 | 0.034 |
| D oxyhexactin/oxyhemihexaster/oxyhexaster | | 0.100 | 0.110 | 25 | 0.113 | 0.090 | 0.146 | 0.013 |
| d oxyhexaster | | | | 3 | 0.008 | 0.008 | 0.008 | 0.000 |
| D strobiloplumicome | 0.040 | | | 25 | 0.041 | 0.032 | 0.047 | 0.004 |
| d strobiloplumicome | | | | 25 | 0.013 | 0.009 | 0.018 | 0.002 |

L, length; D, diameter; d, diameter of primary rosette.

protruding more than 6 mm from the body. Sponge destroyed rendering it impossible to find the osculum. Sponge attached to a large specimen of *Hertwigia falcifera* by a basyphitouse mode of fixation.

Spicules: choanosomal spicules diactins 0.9–16/0.008–0.062 mm, with a widening in the middle and conically pointed or rounded smooth or rough outer ends. Pentactins of two types: anchorate serving as prostalia lateralia and orthotropical situated beneath the dermal layer. Anchorate pentactin rays about 0.08 mm in diameter with conically pointed smooth outer ends; tangential rays about 0.6 mm long; proximal ray over 6 mm long. Hypodermal pentactin rays 0.018–0.043 mm in diameter with conically pointed rough outer ends 0.213–0.667 mm long; proximal ray usually 1.5–2 times longer than tangential rays. Dermalia mostly diactins (lying in tangential plane), also some tauactins, stauractins and paratropical diactins with rough rays and conically pointed or rounded outer ends. Diactines with two or four rudimental tubercles in the middle. Other dermalia also often with rudimentary tubercles instead of some rays. Ray of dermal diactin 0.078–0.140/0.003–0.008 mm. Atrialia as hexactins with all rays nearly equal in length 0.154–0.224/0.004–0.008 mm, rough and conically pointed; ray directed proximally appears a little more spined.

Microscleres: microscleres strobiloplumicomes and oxyoidal spicules. (Several discohexasters of two different sizes seem to be allochthonic.) Oxyoidal microscleres mostly oxyhemihexasters, some oxyhexactins and oxyhexasters with one to three secondary rays; 0.090–0.146 mm in diameter with primary rosette in oxyhexasters about 0.008 mm in diameter; rays slightly curved. Strobiloplumicomes 0.032–0.047 mm in diameter with primary rosette 0.009–0.018 mm in diameter.

Remarks

It is impossible to be sure of the specific identification of the newly found specimen because the description of *D. sessilis* by Topsent (1928) was made on a fragment of the basal part of the body

which may not have had some spicules found in the new specimen. Differences in the spicule measurements do not look to be significant except that the dermal diactins are larger in the type specimen. Another difference is the presence of other rare spicules in addition to the dermal diactins in the new specimen. Hypodermal pentactins also vary: in the type specimen they have short proximal rays and no prostalia lateralia were observed. Redescription of new sponges from the type location is necessary to be certain of the specific identification.

Lophocalyx Schulze, 1887

Lophocalyx atlantiensis Menshenina, Tabachnick, Lopes et Hajdu, 2007

Material examined

ZMBN, MAR-ECO St. 62/380, cat. no. 15318; St. 70/385, cat. no. 14822.

Remarks

This is a new species that was described by Menshenina, Tabachnick, Lopes & Hajdu separately.

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