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Deep-sea Hexactinellida (Porifera) of the Weddell Sea

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Abstract

New Hexactinellida from the deep Weddel Sea are described. This moderately diverse hexactinellid fauna includes 14 species belonging to 12 genera, of which five species and one subgenus are new to science: *Periphragella antarctica* n. sp., *Holascus pseudostellatus* n. sp., *Caulophacus (Caulophacus) discohexactinus* n. sp., *C.* (*Caulodiscus*) *brandti* n. sp., *C.* (*Oxydiscus*) *weddelli* n. sp., and *C.* (*Oxydiscus*) n. subgen. So far, 20 hexactinellid species have been reported from the deep Weddell Sea, 15 are known from the northern part and 10 only from here, while 10 came from the southern area, and five of these only from there. However, this apparent high "endemism" of Antarctic hexactinellid sponges is most likely the result of severe undersampling of the deep-sea fauna. We find no reason to believe that a division between an oceanic and a more continental group of species exists. The current poor database indicates that a substantial part of the deep hexactinellid fauna of the Weddell Sea is shared with other deep-sea regions, but it does not indicate a special biogeographic relationship with any other ocean.

1. Introduction

The most obvious characteristic of the Antarctic benthos, observed by generations of scientists, is the exorbitant occurrence of glass sponges, Hexactinellida, all around the continent (Topsent, 1912; Burton, 1932; Ushakov, 1963; Koltun, 1969, 1970; Dell, 1972; Voss, 1988; Barthel et al., 1990; Barthel and Tendal, 1994; Gutt and Koltun, 1995). Not only are the species abundant, some of them also grow very large, up to 2 m high and 1.4 m in diameter, and become old, probably more than 1500 years (Dayton, 1979; Gatti, 2002). They are extremely slow-growing and seemingly reproduce only at long time intervals (Dayton, 1979; Dayton et al., 1974). Large hexactinellids provide shelter, support, nursery ground, and, despite their low content of organic matter (Barthel, 1995), food for a diverse associated fauna comprising many phyla (Kunzmann, 1996). While their living tissues represent only a modest biomass, the

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silicious spicules of hexactinellids become an important ecological factor. After the death of the sponges, the megascleres do not dissolve but accumulate on the bottom and over large areas to form spicule mats commonly about 50 cm thick but occasionally exceeding 2 m (Koltun, 1968; Dayton et al., 1974; Gallardo, 1987). The mats structure the fauna living in and on them (Barthel, 1992a, b; Barthel and Gutt, 1992; Barthel and Tendal, 1994).

The dominance of the large hexactinellids is a shelf phenomenon gradually abating with increasing depth and transition into the deep-sea environment. This phenomenon is unique because the Antarctic shelf with the outer edge at 400–600 m and occasionally down to 800 m, is deeper than that of the other continents. In addition, the hydrographic features of this shelf are deep-sea-like, with highly stable temperature, salinity and oxygen conditions. According to the latest survey the dominant species belong to genera within the family Rossellidae, seven species to *Rossella* and one to *Scolymastra* (Barthel and Tendal, 1994). They extend from 20–50 m down to 400–600 m, with only one reaching deeper; specific details of this general pattern may be altered by future revision of the genus *Rossella*.

From about 500 m depth, deep-sea conditions seem to prevail and the hexactinellid faunal composition gradually changes to comprise species of well-known deep-sea genera, such as *Bathydorus*, *Caulophacus* and *Chonelasma*. Unfortunately, there are only few collections from depths between 600 and 2000 m, but the impression from these is that the slope sponge fauna is a mixture of shelf species extending downwards and abyssal species invading shallower areas. So far, no signs of what would be an endemic bathyal sponge fauna have been found (Barthel and Tendal, 1989).

Considering the enormous size of the area, there are only few records at greater depths from 2000 to 2500 m downwards. A total of 26 nominal hexactinellid species have been found in this region that could be called "the Antarctic abyssal zone". More than half have been taken only in that area, but to interpret this as high "endemism" (about 70%) would be misleading, as most of these species have been encountered only once. The 12 hitherto reported deep-sea samples yielding hexactinellids from this region are distributed with 1 species at 1000–2000 m, four at 2000–3000 m, four at 3000–4000 m, and three at 4000–5000 m (Lévi, 1964; Barthel and Tendal, 1992, 1994, a.o.).

Geographically, the Weddell Sea can be considered an extension of the South Atlantic Ocean. At depths of more than 4000 m it opens to the western Atlantic deep basins, and towards the east to the Cape Basin, and through the Atlantic–Indian Antarctic Basin to deep parts of the Indian Ocean. At the 3000 m level, there is a connection to the Pacific (Patterson and Whitworth, 1990). These connections seem to be very old, dating back to the first opening of the south Atlantic and the isolation of the Antarctic continent in the Cretacous (Crame, 1999).

Here, new hexactinellid samples taken in the abyssal Weddell Sea by the expeditions EPOS 3 (1989), EASIZ I (1996) and ANDEEP II (2002) are described, classified and discussed. The 10 new sampling localities are distributed with five at 1000–2000 m, two at 2000–3000 m, and three at 4000–5000 m (details in Table 1).

2. Historical review of Antarctic deep-sea Hexactinellida

The 1000 m depth contour can be chosen as an arbitrary albeit realistic boundary between the shelf and the deep-sea faunal regions around Antarctica. Following this distinction, the British "Challenger" Expedition 1873–1876 was the first expedition to record Antarctic deep-sea Hexactinellida. Geographically most came from what is called, using ocean-surface geographic terminology, the Subantarctic Region of the southern Indian Ocean. However, the deep-sea bottom of the area is under the influence of the very cold Antarctic Bottom Water (Ostapoff, 1965; Mantyla and Reid, 1983). The "Challenger" obtained 10 subantarctic species of hexactinellid sponges, all of them new to science (Schulze, 1886, 1887: *Chonelasma lamella* at 1007 m; *Hyalonema clavigerum*, *Aulocalyx irregularis* and *Caulophacus latus* at 2928 m near the Crozet Islands; *Holascus fibulatus*,

Table 1
List of deep-sea stations where Hexactinellida were collected, PS XIX/4-ANDEEP II, ANT VII/4-EPOS, leg. 3, ANT XIII/3-EASIZ I

ANT XIX/4, ANDEEP	Date	Depth	Gear	Temp. at max. depth measured	Pos.-Lat	Pos.-Lon
# 132-3	6.03.2002	2086–2081 m	AGT	−0.645 °C	65° 18.55′ S–65° 17.30′ S	53° 22.73′ W–53° 23.20′ W
# 133-3	7.03.2002	1123–1123 m	EBS	−0.713 °C	65° 20.40′ S–65° 20.09′ S	54° 14.11′ W–54° 14.36′ W
# 133-4	7.03.2002	1114–1115 m	AGT	−0.713 °C	65° 20.35′ S–65° 19.64′ S	54° 14.42′ W–54° 14.35′ W
# 133-5	7.03.2002	1120 m	MUC	−0.713 °C	65° 20.18′ S	54° 14.36′ W
# 134-3	8.03.2002	4053–4066 m	AGT	−0.466 °C	65° 19.96′ S–65° 19.51′ S	48° 8.57′ W–48° 3.60′ W
# 137-3	14.03.2002	4995–4973 m	AGT	−0.499 °C	63° 46.29′ S–63° 44.35′ S	33° 46.54′ W–33° 49.01′ W
# 138-4	16.03.2002	4553–4548 m	AGT	−0.437 °C	62° 58.26′ S–62° 57.83′ S	27° 55.53′ W–27° 50.70′ W
ANT VII/4, EPOS, st.: # 252	6.02.1989	1153–1223 m	AGT	0.386 °C	74° 28.2‘ S–74° 31.6′ S	29° 41.9‘W–29° 17.9′ W
# 253	7.02.1989	2012–1996 m	AGT	−0.018 °C	74° 09.5‘ S–74° 08.0′ S	29° 41.4′ W–30° 03. 3′ W
ANT XIII/3, EASIZ st.: # 39-18	15.02.1996	1538–1543 m	AGT 4b	—	73° 16. 7′ S–73° 16, 1′ S	21° 25.5′ W–21° 24.7′ W

The depths and positions refer to the times when the gear was on bottom and off bottom, respectively. AGT = agassiz trawl, EBS = epibenthic sledge, MUC = multicorer.

Malacosaccus vastus and *Bathydorus spinosus* near Kerguelen Island at 2516–2928 m; *Hyalonema conus* at 3294 m, *Holascus polajevii*, and *Balanites pipetta* at 3569 m far south of Australia).

The "Challenger" was also the first expedition to record hexactinellids at great depths close to the Antarctic continental margin with one species at 3614 off Wilkes Land (Schulze, 1886, 1887: *Polyrhabdus oviformis*). Subsequently, the German Deep-Sea Expedition ("Valdivia") 1898–1899 collected off Enderby Land, where three species new to science were taken at 4636 m (Schulze, 1904: *Holascus tenuis*, *H. obesus*, and *Caulophacus valdiviae).* In 1901–1903, the German Southpolar-Expedition ("Gauss") off Wilhem II Land collected five species at depths greater than 1000 m, two of them new to science, and one a new subspecies (Schulze and Kirkpatrick, 1910a, b: *Hyalonema drygalskii* at 2725 m, *Caulophacus antarcticus* at 2725–3397, *Chonelasma lamella* Schulze, 1886, subspecies *choanoides*, *Bathyxiphus subtilis* Schulze, 1899 (?) at 915–1251 m and *Aulocalyx irregularis*). The British–Australian–New Zealand Expedition (BANZ) 1929–1931 recorded hexactinellids at two deep stations off Queen Mary Land (Koltun, 1976: *Rossella racovitzae* Topsent, 1901 at 1266 m and *Bathydorus spinosus* Schulze, 1886) at 2267 m.

The records of Hexactinellida from the deep region of the Weddell Sea all originate from The Scottish National Antarctic Expedition (Scotia) 1902–1904. Ten species were encountered, six of them new to science and one a new variety (Topsent, 1910, 1913, 1915, 1920): *Malacosaccus pedunculatus*, *M. coatsi* and *Caulophacus scotiae* from 2580 m in the eastern part; *Bathydorus levis* Schulze, 1895, var. *ciliatus* from 4795 m likewise in the eastern part, off the Coats Land; *Acoelocalyx brucei* and *Doccosaccus ancoratus* from 4548 m in the northern part; *Caulophacus instabilis* from 3248 m likewise in the northern part, south of the South Orkney Islands; *Calycosoma validum* Schulze, 1899 from 3248 m in the western part), and two species referable only to genus (*Hyalonema* sp. and *Chonelasma* sp.) from 2580 m in the eastern part.

3. Material and methods

Most samples were taken with Agassiz trawl, but the epibenthic sledge (Brandt and Barthel, 1995) has also proven to be useful, yielding gently treated specimens in good condition; in one single case a larger hexactinellid was taken by the multicorer (station data given in Table 1). The catch was sorted on deck immediately after sampling. The sponges were fixed in 4% formaldehyde-seawater buffered with borax, and after 1week, washed and transferred to 70% ethanol in distilled water with PBS buffer for long-term storage. Small samples for electron microscopy and molecular biology were taken from the fresh specimens and treated separately.

For light microscopy, spicule preparations were made by a method developed by K.R. Tabachnick: A $K_2Cr_2O_7$ solution was made with distilled water ($K_2Cr_2O_7$ powder:Water $\approx$1:1 vol%), and H_2SO_4 (96% conc.) was added ($K_2Cr_2O_7$ Solution: $H_2SO_4 \approx$1:1vol%). After cooling, the solution was filtered to remove residue. A dry sponge sample was placed on a microscope slide, 1–2 drops of distilled water and 1–2 drops (depending on sample size) of the $K_2Cr_2O_7$ solution were added. The microscope slide was heated (ca. 50–70 °C) for a few minutes to let the solution react. After evaporation of the fluid, the slide was removed from the heat and immediately placed on a cold surface and a few drops of distilled water were added. The water solution was removed by one or several small pieces (at one time) of normal filter paper. Water was added again and the spicules carefully stirred by needle, and again filter paper was used to remove excess water (occasionally it was necessary to repeat washing or acid digestion). The dry preparations were covered by Canada balsam and cover glass. This method provides high concentrations of spicules because the sample material is treated directly and remains on the microscope slide. The preparations were examined in a ZEISS Axiolab microscope. For SEM, sponge samples were first dissolved in H_2O_2; the resulting clean spicules were mounted on SEM pegs and, after drying, the samples were sputter-coated and examined by a CAMScan CS24.

The sponges from the ANDEEP expedition are deposited at Senckenberg Forschungsinstitut und Naturmuseum (SMF), whereas sponges from the EPOS- and EASIZ expeditions are kept at the Zoological Museum, University of Copenhagen (ZMUC). Preliminary surveys of the sponges from the European Polarstern Study (EPOS, "Polarstern") in 1989, and the Expedition ANTARKTIS XIII/3 (EASIZ I) in 1996 are published by Barthel et al. (1990, 1997), and by Koltun (2002). Preliminary data on the Porifera collected during the ANDEEP II-expedition are given by Janussen (2003). Terminology used in this paper follows Tabachnik and Reiswig (2002).

4. Systematics

Porifera Grant, 1836
Hexactinellida Schmidt, 1870
Hexactinosida Schrammen, 1903

4.1. Euretidae Zittel, 1877

4.1.1. Chonelasma Schulze, 1886

Chonelasma choanoides Schulze, 1886
Figs. 1, 2E, 3A, Table 2.

Material: One large specimen and several fragments from ANDEEP (SMF no. 45) and numerous fragments from three other stations (EPOS, EASIZ)

Locality: Weddell Sea (ANDEEP St. 132-3, EPOS St. 252 and 253, EASIZ St. 39-18) depth 1150 m—2085 m.

Description:

Body: The basal part, 180 mm high, of the large sponge and a 20 mm fragment, may be from the same specimen. From a 100 mm broad basal plate the funnel-shaped body opens upward. Wall thickness is 5–6 mm, but the wall has tubular extensions and "foldings", which make it appear much thicker. The dense cortical layers are penetrated by diplorhysis in regular arrangement. Dermal surface is partly covered by a pattern of fine dendritic ridges. Pores of the dermal side are in irregular quadrunx arrangement while those of the atrial side are in regular quadrunx array.

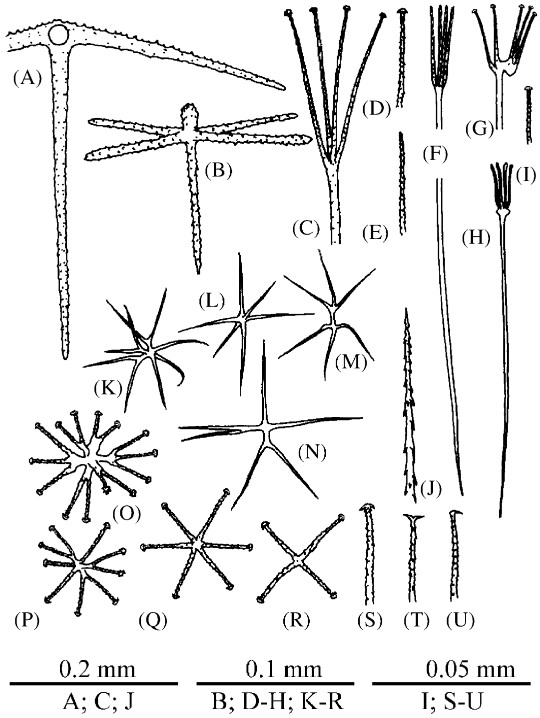

Fig. 1. *Chonelasma choanoides* Schulze, 1886. (A), dermal hexactine; (B) atrial hexactine; (C) large scopule; (D) and (E) tines of large scopules; (F) and (G) mediate scopule; (H) small scopule; (I) tine of small scopule; (J) uncinate; (K) oxyhemihexaster, (L) oxyhexactine; (M) and (N) abnormal oxyoidal microscleres; (O) discohexaster; (P) discohemihexaster; (Q) discohexactine; (R) discostauractine; (S) discoidal outer end of microscleres; and (T) and (U) onychoidal outer ends of same spicules.

Dictyonal skeleton shows an irregular framework of tuberculated rays of hexactines; mesh size is 200–300 μm.

Spicules: Loose spicules are rare in the SMF 45 specimen but numerous in the other fragments. They include: uncinates, dermal and atrial pentactins, scopules with 3–5 long thin tines carrying well-defined discoidal endings, and few oxyhexasters. Dermalia and atrialia are mostly pentactines, rarely hexactines with rudimental outward directed ray. The rays of these spicules are rough with numerous short spines on the outer side of the tangential rays. Uncinates are long and slender. Scopules occur in several forms: large ones with 3–5 tines (usually 4) terminating in discs (rarely with tyloidal outer ends) and rough surface; intermediate scopules similar to the large ones but about half their size with smooth surfaces; small ones carying 4–6 (usually 5) tines with tyloidal or discoidal outer ends, smooth in light microscopy. Microscleres are represented by discoidal, onychoidal and oxyoidal forms of hemihexasters in nearly equal proportions. Sometimes it is possible to find all transitions of these types, or derivatives with reduced number of rays. Discohexasters are rare. Dimensions of dermal and atrial spicules, scopules and microscleres are given in Table 2.

Remarks: *Chonelasma lamella choanoides* was described by Schulze and Kirkpatrick (1910a, b) as a subspecies of *C. lamella* from off Wilhelm II Land, and it is widely distributed around Antarctica, whereas *C. lamella* seems to be known only from its type locality south of New Zealand. We here follow Reiswig and Wheeler (2002) and consider *Chonelasma choanoides* as a separate species. *C. choanoides* has large scopules with long tines and well-defined discoidal endings of the long tines and oxyhexasters and hemioxyhexasters, while *C. lamella* has oxyhexasters, discohexactins, disco- and onychohexasters and its scopules have short tines and mostly no well-defined ending discs (although a very small disc may be present as in *C. lamella* figured by Reiswig and Mehl (1994; Fig. 9). Also, the pentactins of the two species are different: Those of *C. lamella* have stout paratangential rays with strong spines on top, whereas those of *C. choanoides* have longer paratangential rays and a finer ornamentation (compare Reiswig and Mehl, 1994: Figs. 9, 18, 19). Unfortunately, *C. choanoides* was originally described from a fragment with poor content of loose spicules and its identity with our material, represented by several fragments with large amounts of such spicules, was based on the similarity of several types of scopules (the large ones ending in discs). The irregular outer shape with fold-like ridges cavities in our specimens of *Chonelasma* differs from both *C. choanoides* and *C. lamella* as figured by Schulze (1887), Schulze and Kirkpatrick (1910b) and Reiswig and Wheeler (2002), but this may be a matter of intraspecific variation.

Distribution: Partly described as *C. lamella*: Circumantarctic (Barthel and Tendal, 1994),

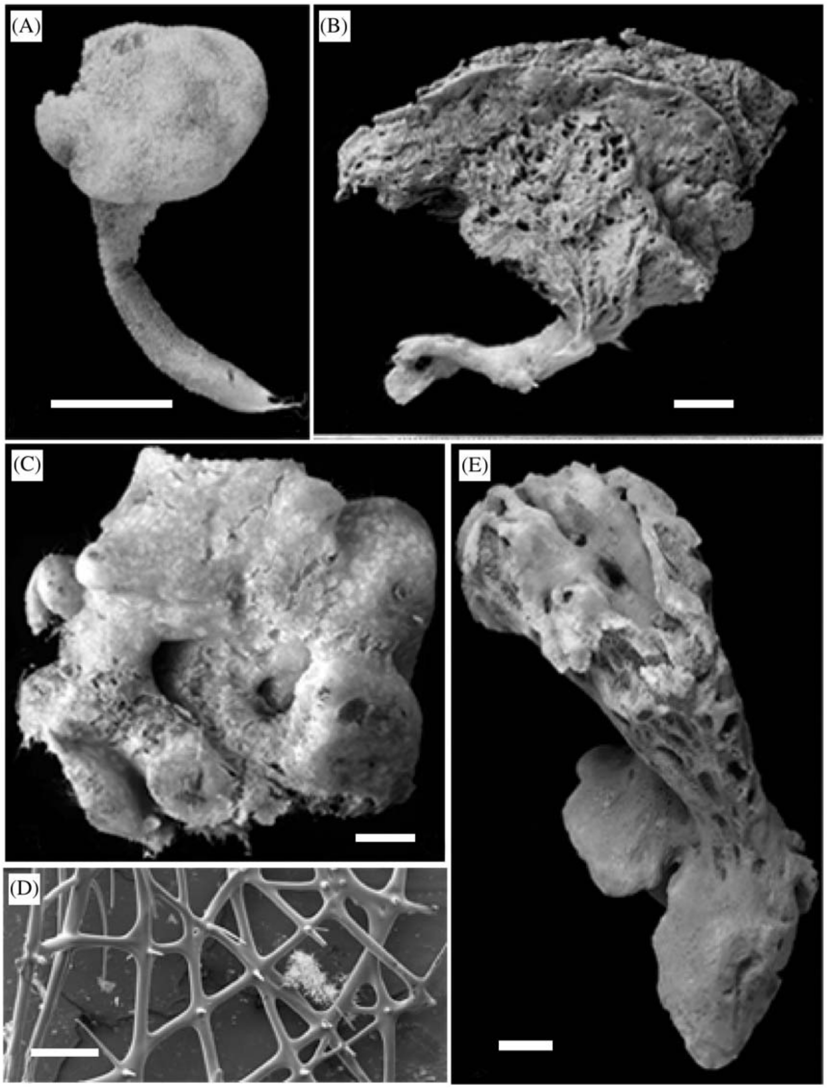

Fig. 2. (A) *Caulophacus* (*Caulodiscus*) *brandti*, Holotype (SMF 51); (B) *Caulophacus* (*Oxydiscus*) *weddelli*, Holotype (SMF 52); (C) *Sympagella johnstoni* (SMF 55); (D) *Periphragella antarctica*, Holotype, dictyonal skeleton, SEM (SMF 46); and (E) *Chonelasma choanoides* (SMF 45). Figs. (A)–(C), (E) scale 10 mm, (D): scale 300 μm.

South Pacific, South Indian Ocean (Schulze, 1887), North Atlantic (Burton, 1928), depth 430–3397 m.

4.1.2. Periphragella Marshall, 1875

Periphragella antarctica n. sp.

Figs. 4, 2D, 3C, D, Table 3.

Etymology: *antarctica* after first occurrence of *Periphragella* in the Antarctic Ocean.

Material: One specimen, the holotype (SMF no. 46).

Locality: Weddell Sea, ANDEEP st. 133-3, depth 1123 m.

Description:

Body: The sponge body, which because of its fragility is now fragmented, was originally about 80 mm high. It shows a system of irregularly anastomosing tubes, about 3 mm in diameter,

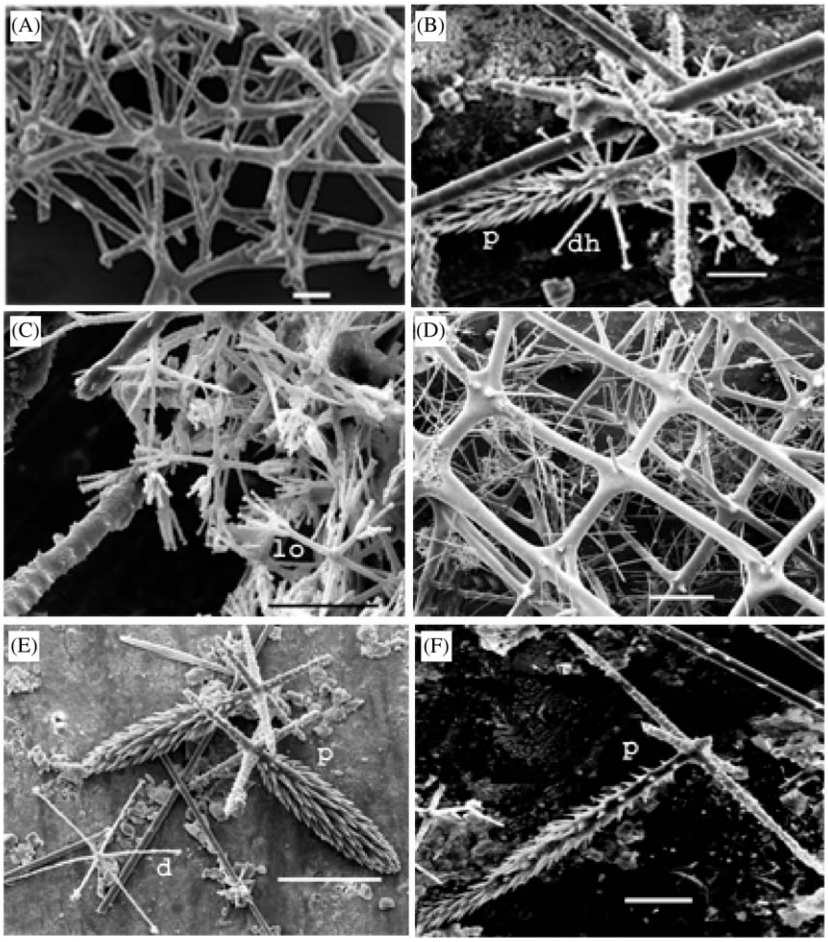

Fig. 3. (A) *Chonelasma choanoides* (SMF 45), dictyonal skeleton; (B) *Sympagella johnstoni* (SMF 55), pinular hexactine (p) and discohexaster (dh) with long secondary rays; (C)–(D) *Periphragella antarctica*, Holotype (SMF 46), dictyonal skeleton with numerous lophohexasters (lo); (E) *Caulophacus* (*Caulodiscus*) *brandti*, Holotype (SMF 51), pinular hexactines (p) and discohexactine (d); (F) *Caulophacus* (*Oxydiscus*) *weddelli* , Holotype (SMF 52), pinular pentactine (p) with rudimentary 6th ray. (A) and (E) scale 100 μm, (B), (C) and (F) scale 30 μm, (D) scale 300 μm.

which were arranged around a large central funnel. The extremely fragile skeletal framework shows large regular meshes and consists in some areas of only one single layer of hexactins, sometimes two layers. The dictyonal meshes are large and mostly rectangular, sometimes triangular. Dimensions of rectangular meshes are ca. 300×800 μm, dictyonal beams are rough and 20–50 μm in diameter. Free rays of dictyonal framework are directed distally and proximally, they are 50–150 μm long.

Spicules: Dermalia and atrialia are pentactines and hexactines in nearly equal proportions, the hexactine has a short distally directed unpaired ray, spiny or rough, all the rays have outer ends rounded or lanceolate with rough surface. Uncinates are 550–1700 μm long and 3–5 μm thick. The scopule is presented by a single type with 3–4 rough tines terminating in discoidal outer ends; its shaft is smooth 0.003 μm in thickness with lanceolate rough outer end. *Microscleres*: Two types of microscleres are found: oxyhexasters and lophotylohexasters. Oxyhexasters show 2–3, rarely 4–5, secondary rays. Lophotylohexasters have 4 to 10, usually 8 secondary rays. Rarely oxyhexasters

Table 2
Spicule dimensions (μm) of *C. choanoides*, EPOS # 253 (AG 13) Specimen

C. choanoides, SMF 45	*N*	Avg.	Min.	Max.	Std.
L dermal pentactine tangential ray	5	150	97	194	36
L dermal pentactine distal ray	1	143	143	143	
L atrial pentactine tangential ray	25	152	92	204	29
L atrial pentactine proximal ray	7	86	61	102	13
L ray of choanosomal hexactine	4	108	87	148	27
L large discoscopule	3	740	638	867	117
1 tine of large discoscopule	18	151	112	184	20
L mediate scopule	2	368	357	378	15
1 tine of mediate scopule	3	57	53	61	4
L small scopule	25	223	172	286	25
1 tine of small scopule	25	29	21	38	4
D discohexasters, hemidiscohexast.,onychohex., hemionychohex.	33	78	55	97	11
D discohexasters, hemidiscohexast., onychohex., hemionychohex.	33	19	8	29	5
D discohexactine and onychohexatine	25	79	63	151	18
D oxyhemihexaster	12	88	63	109	14
d oxyhemihexaster	12	20	17	25	2
D oxyhexactine	15	90	59	109	13

L—length, *D*—diameter, *d*—diameter of primary rosette, *N*—number of specimens, avg.—average size, std.—standard deviation.

with thick, rough rays were observed; both primary and secondary rays are about 5 μm thick. An exceptional oxydiaster similar to oxyhexasters in its dimensions was found. Dimensions of dermal and atrial hexactins, oxyhexasters and scopules are given in Table 3.

Remarks: This new sponge definitely belongs to the genus *Periphragella*, despite the fact that its rigid skeleton sometimes consists of only a single layer of dictyonal hexactins, which was considered earlier to be a farreoid feature (Reid, 1958–1964). This conclusion is based on the assumption that our sponge is a young specimen according to the structure of its dictyonal skeleton, such as single-layered areas and large, very fragile, rectangular meshes. This type of skeleton is very similar to the inner (atrial or primary) framework of previously found young specimens of *Periphragella* (K.R.T., pers. obs.), whose external shape is that of a large central funnel with plexiform lateral tubular outgrowths and rectangular skeletal meshes as in our specimen. Microsclere composition of *P. antarctica* is characteristic of *Periphragella*. The presence of dermal or atrial hexactines with short distally directed rays in our new species does not contradict the diagnosis of *Periphragella* by Ijima (1927). According to Reiswig and Wheeler (2002), five valid species of the genus *Periphragella* exist, one of which (*P. lusitanica* Topsent, 1890, former *Chonelasma schulzei* Topsent, 1890) was described only once without any loose spicules and with an external shape very different from all other species of the genus. A key of the other, better known four species of *Periphragella* is given below. *P. irregularis* Ijima, 1927 is similar to our new species in the overall shape of scopules and the presence of dermal–atrial hexactines, but *P. antarctica* differs from *P. irregularis* by having discs at the tines of its scopules and by the possession of lophotylohexasters. *Periphragella elisae* Marshall, 1875, including its synonym *P. japonica* Ijima, 1927, differs from *P. antarctica* in having no dermal or atrial hexactines, its scopules show club-shaped secondary rays and tylohexasters are stellate.

Distribution: Weddell Sea, about 1120 m.

Key to species of *Periphragella*

1. Dermalia and atrialia are pentactins only 3
2. Dermalia and atrialia hexactins and pentactines 4

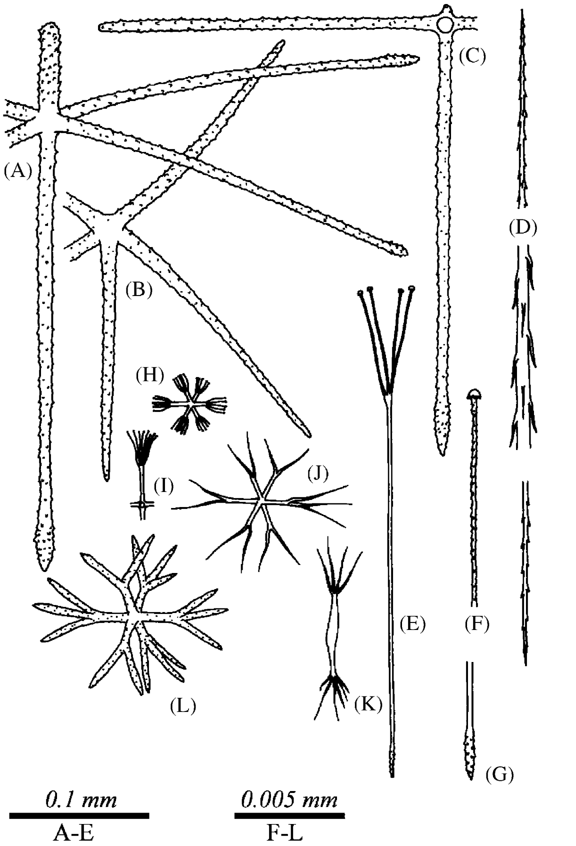

Fig. 4. *Periphragella antarctica* n. sp. (A) dermal or atrial hexactine; (B) and (C) dermal or atrial pentactines; (D) uncinate; (E) scopule; (F) tine of scopule; (G) outer end of scopule; (H) and (I) lophotylohexasters; (J) oxyhexaster; (K) oxydiaster; (L) thick-rayed oxyhexaster.

3a. Oxy- and discohexasters with long principal rays *P. elisae*
3b. Oxy- and discohexasters with short principal and long secondary rays *P. challengeri*
4a. Tyloscopules, lophotylohexasters absent *P. irregularis*
4b. Scopules with discoidal tines, lophotylohexasters present *P. antarctica*

4.1.3. *Bathyxiphus* Schulze, 1899

Bathyxiphus cf. *subtilis*

Material: Three dead mudfilled skeletons, SMF no. 47.

Locality: Weddell Sea, ANDEEP st. 132-3, depth 2086–2081 m.

Description:

Dead skeletons, 40–85 mm in length, with the form of a thin sword-blade on a round basal plate. The dictyonal skeletons are devoid of soft parts or loose spicules, but because of the typical form they are referred to the genus *Bathyxiphus*, of which the only described species is *B. subtilis* Schulze, 1899.

Remarks: Dead and probably mudfilled skeletons of *Bathyxiphus* are commonly found all over the Antarctic Ocean at depths of about 2000–3400 m (Barthel and Tendal, 1994). They are tentatively determined as *Bathyxiphus* cf. *subtilis,* as this is the only known species of this genus. *B subtilis* was first described from the E-Pacific, S of the Guadeloupe Island (California) (Schulze, 1899); dead skeletons referred to by Schulze (1887) as "Dictyonine", collected from the

Table 3
Spicule Dimensions (µm) of *P. antarctica*, holotype

P. antarctica, SMF 46	*N*	Avg.	Min.	Max.	Std.
L dermal or atrial hexactine, ray directed outside body	20	65	20	102	23
L dermal or atrial hexactine or pentactine, tangential ray	50	255	138	337	39
L dermal or atrial hexactine or pentactine, ray directed inside body	49	269	117	408	60
L scopule	9	326	265	383	39
L tine of scopule	14	72	31	117	22
D lophotylohexaster	25	48	34	71	10
d lophotylohexaster	25	24	17	38	5
D oxyhexaster	25	81	50	97	11
d oxyhexaster	25	35	23	42	5

Legend as in Table 2.

Atlantic and Pacific Oceans, are actually *Bathyxiphus* sp. (Schulze 1899), and a dead skeleton of this genus was found in the Pacific also by Wilson (1904).

Distribution: Circumantarctic (Barthel and Tendal, 1994; Schulze and Kirkpatrick, 1910b). Atlantic and Pacific Ocean (Schulze, 1887, 1899; Wilson, 1904). Depth 915–3397 m.

4.2. *Lyssacinosida Zittel, 1877*

4.2.1. *Rossellidae Schulze, 1885*

4.2.1.1. *Rossella Carter, 1872.* *Rossella racovitzae* Topsent, 1901a

Material: five specimens from ANDEEP (SMF no. 48), one from EASIZ and one from EPOS.

Locality: Weddell Sea, ANDEEP II, st. 133-3, EASIZ 39-18 (AGT 4b), EPOS St. 253 (AGT 13), 1120–2012 m depth.

Description:

Body: Rather small, rounded or oval sponges, 20–50 mm in length.

Spicules: The numerous and very long prostalia with sharply pointed rays are smooth diactins and pentactins, the latter with their tangential rays in orthotropal or paratropal arrangement forming a "veil" around the sponge body. Basalia are diactins and very few anchorate pentactins. Autodermalia are pentactins and stauractins, which are very spiny with rounded ray tips and commonly with a rudimentary distal ray. Microscleres are calycocomes without terminal discs, ca. 440 μm with primary rosette 100 μm in diameter; oxyhexasters and hemioxyhexasters, 120–150 μm in diameter; discohexasters ca. 200 μm with the primary rosette 20 μm in diameter; aniso-discohexasters, ca. 36 μm with primary rosette ca. 6 μm in diameter.

Remarks: *R. racovitzae* is widely distributed on the Antarctic shelf. Our specimens are comparatively small, but their spicules correspond well with other descriptions of this species (Barthel and Tendal, 1994, a. o.).

Distribution: Circumantarctic, 20–2012 m.

4.2.1.2. *Acanthascus Schulze, 1886.* *Acanthascus* (*Rhabdocalyptus*) Schulze, 1886

Acanthascus (*Rhabdocalyptus*) *australis* Topsent, 1901a, b

Material: Three specimens from EASIZ.

Locality: Weddell Sea, EASIZ st. 39-18 (AGT 4b), depth 1538–1543 m.

Description:

Body: This species is represented by fragments, one of which seems to be tubular. The confused spicule positions and their (partly damaged) condition in light microscopy correspond to spicule mats and it is obvious that the sponges were captured in a condition of disintegration, except for one fragment which contains spicules in natural position.

Spicules: Choanosomal spicules are diactines. Hypodermalia are pentactines with rough and spiny tangential rays. Only one dermal spicule was found, a tauactine with rough conically pointed outer ends, its ray is 0.2/0.015 mm. Atrialia are relatively numerous hexactines with rough and conically pointed rays. The proximal ray is about 0.5 mm long, distal one is 0.26 mm long, tangentials 0.13 mm long, diameter is 0.006–0.015 mm. *Microscleres*: Discoctasters and various oxyoidal forms: oxyhexasters, oxyhemihexasters and oxyhexactines with 4–5 rays. The discoctasters have 1–4 secondary rays, they are 0.15–0.17 mm and their primary rosette 0.06–0.07 mm in diameter. Oxyoidal microscleres are 0.09–0.14 mm in diameter.

Remarks: The differences between the spicule dimensions of our new specimens and that described by Topsent are not significant. The oxyoidal microscleres are smaller: 0.09–0.14 mm in diameter in our specimen and 0.14–0.16 mm in the type material (Topsent, 1910), and the discoctasters are smaller as well, respectively, 0.15–0.17 and 0.18 mm in diameter. No microdiscohexasters are present. This species has been considered a synonym of *Rossella antarctica* (Burton, 1929; Barthel and Tendal, 1994), but was recently revived (Tabachnick, 2002b). Another specimen described as *Rhabdocalyptus australis* by Okada (1932) seems to be erroneousely identified; its description is insuffcent for comparison and the same is true for the data on dimensions of large spicules, choanosomal diactines and hypodermal pentactines.

Distribution: This species was previously known only from a single report off Antarctica (west of

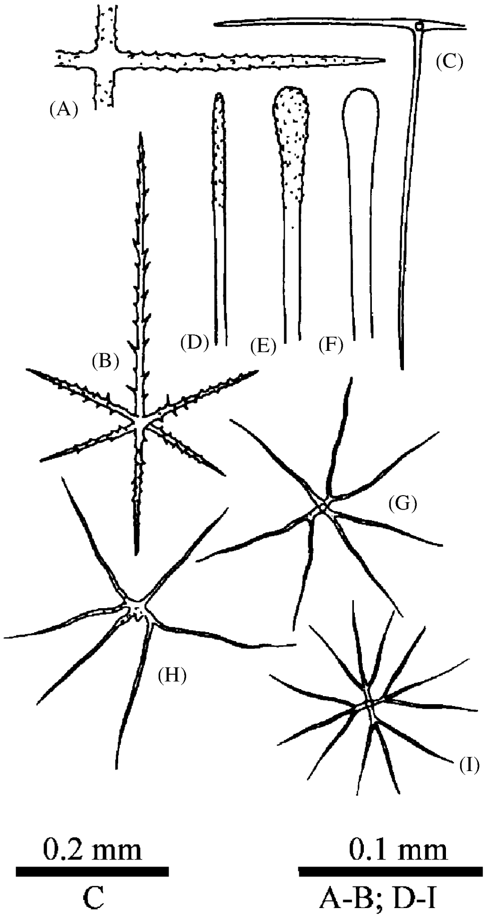

Fig. 5. *Bathydorus spinosus* Schulze, 1886. (A) dermal stauractine; (B) atrial hexactine; (C) hypodermal or hypoatrial pentactine; (D)–(F) outer ends of choanosomal diactines; (G) oxyhemihexaster; (H) abnormal oxyhemihexaster; and (I) oxyhexaster.

the Antarctic Peninsula), depth 450 m. In the light of unpublished materials of the 'Eltanin' expedition the distribution of this species appears to be circumantarctic. Depth 450–1543 m.

4.2.1.3. *Bathydorus* Schulze, 1886. *Bathydorus spinosus* Schulze, 1886

Fig. 5, Table 4.

Material: Two fragments from ANDEEP (SMF no. 50) and one fragment from EPOS.

Locality: ANDEEP, st. 135-5, EPOS st. 253 (AGT 13), depth 1996–4682 m.

Body: One specimen (SMF 50) is presented by a small fragment of the upper oscular edge of a larger sponge body. Another fragment is about 100×25 mm and 4 mm in thickness.

Spicules: Choanosomal spicules are diactins several mm long, 0.006–0.011 mm in diameter. The oscular edge is fringed by long and thick protruding diactins about 0.044 mm in diameter with rounded or clavate, rough or smooth outer ends. Hypodermalia are pentactines with tangential rays smooth or rough and conically pointed outer ends. Dermalia are stauractines with rough or spiny rays and conically pointed outer ends. Atrialia are hexactines with spiny rays and conically pointed outer ends. *Microscleres*: Hemioxyhexasters, partly abnormal forms, oxyhexactines and oxyhexasters with rough rays.

Spicule dimensions are given in Table 4.

Distribution: Circumantarctic, 569–4847 m (Barthel and Tendal, 1994; Topsent, 1901b), South Atlantic (Schulze, 1887).

Table 4
Spicule dimensions (μm) of *B. spinosus*

B. spinosus	EPOS, # 253 (AG 13)					ANDEEP, # 135, SMF 50				
	N	Avg.	Min.	Max.	Std.	N	Avg.	Min.	Max.	Std.
L dermal stauractine ray	25	112	71	199	30	11	68	51	87	12
L atrial pinular hexact., prox. ray	10	118	92	153	22	23	108	56	133	20
L atrial pinular hexact., tang. ray	11	74	46	102	17	25	72	41	97	11
L atrial pinular hexact., distal ray	11	78	66	97	10	19	72	51	97	11
D hemioxyhexaster, oxyhexaster or oxyhexactine	25	125	97	151	13	25	124	105	143	10

Legend as in Table 2.

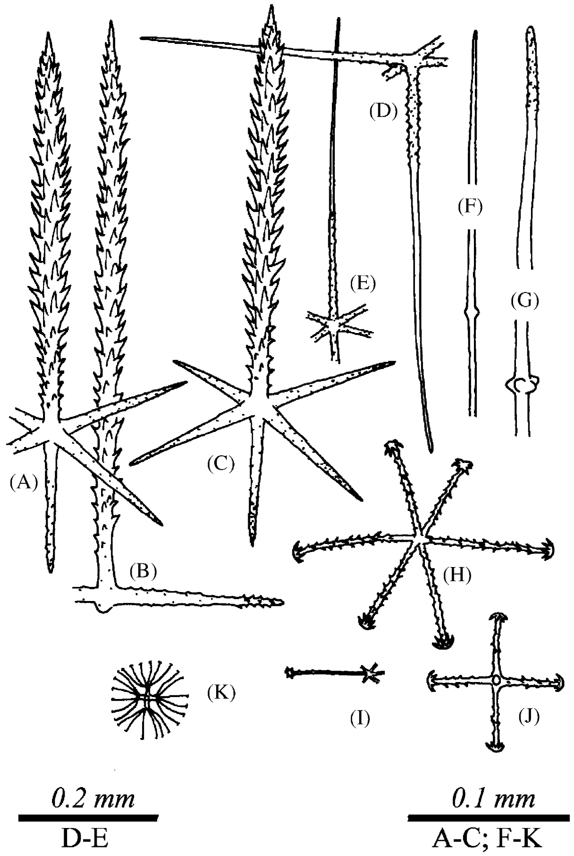

Fig. 6. *Caulophacus* (*Caulophacus*) *discohexactinus* sp.n. (A) Pinular hexactine from one side of the body; (B) pinular pentactine from another side of the body; (C) pinular hexactine from another side of the body; (D) hypodermal or hypoatrial pentactine; (E) choanosomal hexactine; (F) and (G) choanosomal diactines; (H)–(J) discohexactines; and (K) discohexaster.

4.2.1.4. Caulophacus Schulze, 1885, emended. Syn. *Caulophacella* Lendenfeld, 1915 (reasons for this new synonymy are given below).

The diagnosis of *Caulophacus* given by Tabachnick (2002, p. 1465) is emended, and its last sentence is changed into:

"Microscleres are spicules of hexactinous or hexasterous forms with discoidal, onychoidal and oxyoidal terminationes".

4.2.1.4.1. Caulophacus (Caulophacus) Schulze, 1885. Definition: Microscleres mainly with discoidal terminations (Tabachnick, 2002b).

A key to species of *Caulophacus (Caulophacus)* is published in Tabachnick and Lévi (2004).

Caulophacus (*Caulophacus*) *discohexactinus* sp.n. Fig. 6, Table 5.

Etymology: The species is named after its diagnostic feature of having microscleres mostly in the form of discohexactines.

Material: One specimen, the holotype, from EPOS, (ZMUC no. Hex-1)

Locality: Weddell Sea, EPOS St. 252 (AGT 12), depth 1153–1223 m.

Description:

Body: The sponge, an incomplete specimen, is flat and irregular in outline, 5×3 cm, 1–3 mm thick.

Spicules: Choanosomal spicules are hexactines and diactines. The diactines, about 0.7/0.007 mm, have a four rudimental tubercles in the middle, their outer ends are rounded and roughened or conically pointed and smooth. The hexactines have rays spiny at their bases with outer ends

Table 5
Spicule dimensions (μm) of *Caulophacus* (*Caulophacus*) *discohexactinus*

Caulophacus (*Caulophacus*) *discohexactinus*, ZMUC Hex-1	*N*	Avg.	Min.	Max.	Std.
L pinular hexact. or pentact. from one side, pinular ray	25	319	209	408	41
L pinular hexact. or pentact. from one side, tangent. ray	25	105	66	153	23
L pinular hexact. from one side, ray directed inside the body	22	105	71	133	14
L piunular hexact. from another side, pinular ray	25	249	184	275	26
L pinular hexact. from another side, tangent. ray	25	97	61	138	18
L pinular heact. From another side, ray directed inside the body	25	102	87	117	8
D discohexactine	25	153	82	173	19
D discohexaster	1	46	46	46	
d discohexaster	1	13	13	13	

Legend as in Table 2.

rounded or conically pointed, smooth. Hypodermalia and/or hypoatrialia are pentactines with tangential rays smooth or spiny at their bases, and the unpaired ray directed inside the body is always spiny at its base; the outer ends are conically pointed and smooth; ray diameter is 0.02 mm.

Dermalia and atrialia are pinular hexactines, rarely pentactines; the pinular ray is conical in shape or spindle-like; the other rays are rough, conically pointed or rounded. These spicules from different surfaces of the body wall differ, especially in the size of pinular rays (Table 5). *Microscleres*: Mostly discohexactines rarely it is possible to find hemidiscohexasters and occasionally discohexasters. The only discohexaster found is spherical with numerous (6–8 on each principal) secondary rays. Spicule dimensions are given in Table 5.

Remarks: The new species could be referred to *Caulophacus* (*Caulophacus*) because of the observation of a single small discohexaster and a few hemidiscohexasters. This feature makes it an outstanding species of this subgenus, whose other representatives are characterized by the presence of numerous discohexasters, mostly of various types, such as the lophodiscohexasters and "discomultiasters" in the type species of the subgenus, *C.* (*C.*) *latus*. In *C. C. antarcticus* the dermal pinular rays are clavate in shape, whereas they are spindle-like in our new species. Also, the discohexasters are very different in shape: thick secondary rays in 'antarcticus' and thin in *C. C. discohexactinus. C.* (*C.*) *instabilis* has small (0.16–0.24 mm), oval, dermal and atrial pinular rays. Discohexactines, the most common microscleres in our new species, are very rare in *C. C. instabilis. C.*(*Caulophacus*) *scotiae* has very small dermal pinular rays (0.14–0.16 mm) and common lophodiscohexasters, which are absent in *C. C. discohexactinus*.

Distribution: Weddell Sea, depth 1153–1223 m.

4.2.1.4.2. Caulophacus (Caulodiscus) Ijima, 1927. Definition: Microscleres with various terminations: discoidal, onychoidal, oxyoidal (Tabachnick, 2002b).

Caulophacus (*Caulodiscus*) *brandti* sp. n.

Figs 7, 2A, 3E, Table 6.

Etymology: Named after the scientific leader of the Antarctic deep-sea research program ANDEEP, Angelika Brandt.

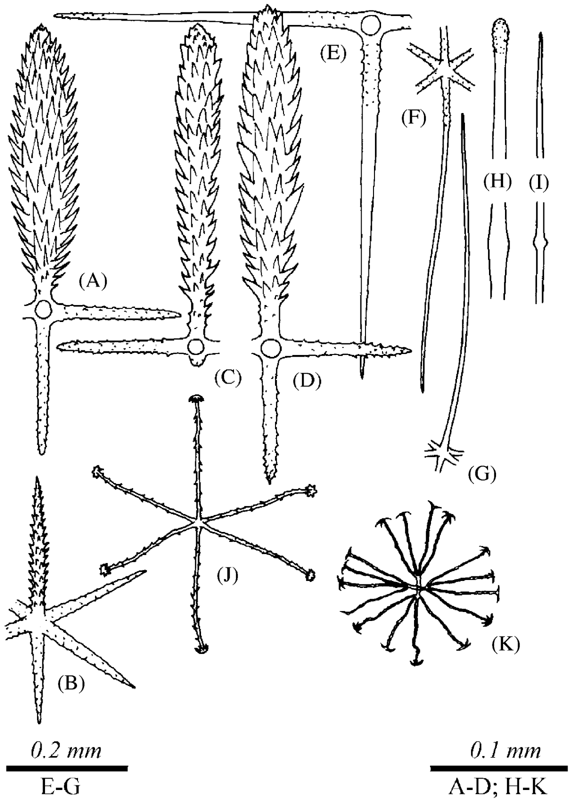

Fig. 7. *Caulophacus* (*Caulodiscus*) *brandti* sp.n. (A) and (B) dermal hexactines; (C) atrial pentactine; (D) atrial hexactine; (E) hypodermal pentactine; (F) and (G) choanosomal hexactines; (H) and (I) choanosomal diactines; (J) discohexactine; and (K) onychohexaster.

Material: Four specimens and one fragment from ANDEEP. The holotype (SMF no. 51) is fungiform, the disc is 22 mm in diameter and 10 mm in thickness, the peduncle is about 25 mm long, 3.5 mm in diameter. Two paratypes and one lamellate fragment (SMF 63): one fungiform 10 mm in diameter with short broken peduncle; one fungiform the disc is 20 mm in diameter, 10 mm in thickness, the peduncle is about 20 mm long and 4 mm in diameter. One poorly preserved specimen (SMF 64).

Locality: Weddell Sea, ANDEEP st. no. 134-3, depth 4053–4066 m.

Description:

Body: Fungiform *Caulophacus.* The discoidal part of the body is 10–22 mm in diameter and

Table 6
Spicule dimensions (μm) of *Caulophacus* (*Caulodiscus*) *brandti*

Caulophacus (Caulodiscus) brandti	Holotype, SMF 51					Paratypes, SMF 63, 64				
	N	Avg.	Min.	Max.	Std.	*N*	Avg.	Min.	Max.	Std.
L dermal pinular hexact., pinular ray	26	223	56	260	38	43	192	95	235	35
L dermal pinular hexact., tangent. ray	26	106	77	122	10	43	93	64	117	16
L dermal pinular hecact., ray directed inside the body	26	104	82	122	9	43	94	54	110	15
L atrial pinular hexactine or pentact. pinular ray	25	276	184	367	34	40	256	166	319	38
L atrial pinular heact. Or pentact., tangent. ray	25	102	77	138	16	40	104	79	125	14
L atrial pinular hexact., ray directed inside the body	24	105	92	122	10	31	103	52	120	17
D discohexactine	25	153	128	179	14	26	156	133	171	18
D onychohexaster	25	106	92	130	11	40	108	84	129	12
d onychohexaster	25	12	8	21	3	40	12	8	15	2

Legend as in Table 2.

10–20 mm in thickness; the hollow stalks are 20–30 mm in length and 2–4 mm in diameter. *Spicules*. Choanosomal spicules are diactines and hexactines. The diactines are about 1.3/0.006 mm, with a small inflation in the middle and clavate, rounded or conically pointed rough outer ends. Choanosomal hexactines are rare, their rays are about 0.6/0.01 mm; they usually have some spines at their bases, but sometimes they are smooth; the outer ends are conically pointed, smooth or rough. Hypodermalia and hypoatrialia are pentactines with rays as in choanosomal hexactines; their diameter is about 0.02 mm. Dermalia are pinular hexactines. The pinular ray is oval or spindle-like, rarely conical in shape; the other rays are rough with rounded or conically pointed outer ends. *Microscleres*: Discohexactines, rarely hemidiscohexasters and onychohexasters. The onychohexasters have mostly four secondary rays each bearing 2–4 terminal teeth.

Spicule dimensions are given in Table 6.

Remarks: The subgenus *Caulodiscus* comprises only few species: *C.*(*C.*) *lotifolium* (Ijima), 1903—off Japan; *C.*(*C.*) *valdiviae* Schulze, 1904—off Antarctica (S of Kerguelen); *C.(C.) polyspicula* Tabachnick, 1990—off SW Africa and *C.(C.) onychohexactinus*—off New Caledonia (Tabachnick and Lévi, 2004). The new species differs from all other species of the subgenus in its microsclere combination, comprising only discohexactines and onychohexasters; discohexasters and onychohexactines are absent. It differs from the most similar, known Antarctic species *C. (C.) valdiviae* by having onychohexasters with short principal and long secondary rays.

Distribution: Weddell Sea, depth 4053–4066 m.

Key to species of *Caulophacus* (*Caulodiscus*)

1. Hexasters have short pricipal rays notably smaller than the secondary rays 2
1a. Hexasters have long principal rays, close in their dimensions to the secondary rays *C.* (*C.*) *valdiviae*
2a. Pinular rays of conical shape (thickest at base) common among dermal or atrial spicules 3
2b. Pinular ray ovoid, spindle-like or clavate and only rarely conical in shape 4
3a. Discohexasters are spherical with few secondary rays *C.(C.) lotifolium*
3b. Discohexasters are stellate with numerous secondary rays *C.* (*C.*) *onychohexactinus*
4a. Discohexasters and onychohexactines present *C. (C.) polyspicula*
4b. Discohexasters and onychohexactines absent *C. (C.) brandti*

4.2.1.4.3. Caulophacus (Oxydiscus) n. subgen.
Etymology: This subgenus is named to reflect the combination of oxyoidal and discoidal microscleres in the type species.

Type species: *Caulophacus* (*Oxydiscus*) *weddelli*, sp. n.

Definition: *Caulophacus* with microscleres having oxyoidal and sometimes also discoidal (discohexactins only) terminations.

Remarks: This subgenus is characterized by its peculiar microsclere combination, having numerous oxyhexasters while discohexactines may also be present. Our new subgenus of *Caulophacus* erected here is intermediate between the genus *Caulophacella* and the other two subgenera of *Caulophacus*, *C.*(*Caulophacus*) and *C.*(*Caulodiscus*). According to the description by Lendenfeld (1915), the only species of *Caulophacella*, *C. tenuis*, was based on a fragment, and the external body shape of this sponge is unknown. In the light of the subgenus *Oxydiscus*, which is characterized by microscleres with both oxyoidal and discoidal endings, *Caulophacella* ought to be synonymized with *Caulophacus* as a new subgenus, *Caulophacus* (*Caulophacella*), which is characterized by microscleres with exclusively oxyoidal endings.

Caulophacus (*Oxydiscus*) *weddelli* sp. n.

Fig. 8, 2B, 3F, Table 7.

Etymology: *weddelli* refers to the type locality of this species in the Weddell Sea.

Type Material: The holotype is the only specimen, it is broken into two pieces: one almost complete and one fragment (SMF no. 52).

Locality: Weddell Sea, ANDEEP station 137-3, depth 4995–4973 m.

Diagnosis: Body is funnel-like. Choanosomal spicules are diactines and hexactines. Hypodermalia and hypoatrialia are pentactines. Dermalia and atrialia are pinular pentactines and hexactines. Microscleres have discoidal and oxyoidal terminations: discohexactines, oxyhexasters and rarely hemioxyhexasters, but no discohexasters or hemidiscohexasters.

Description:

Body: Funnel-shaped sponge body with a widely open atrial cavity, 85 mm in diameter, and with a 45 mm long peduncle on a small basal plate. Wall thickness is 3–4 mm.

Spicules: The peduncle consists of long diactins with many synapticular junctions and conically pointed or clavate rough terminations; they are 10–30 µm in thickness. Furthermore, it contains the oxyhexasters considered as typical of the species and pinular pentactins with slightly clavate pinular rays, 170–260 µm long, tangential rays 60–70 µm and rudimental proximal ray 5–10 µm long; thickness of rays ca. 5 µm. Choanosomal

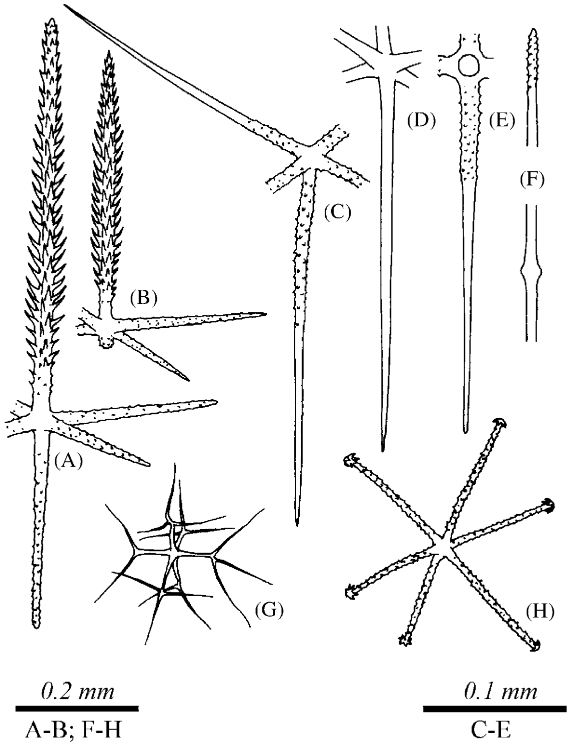

Fig. 8. *Caulophacus* (*Oxydiscus*) *weddelli* sp. n. (A) dermal pinular hexactine; (B) atrial pinular pentactine; (C) hypodermal pentactine; (D) and (E) choanosomal hexactines; (F) choanosomal diactine; (G) oxyhexaster; and (H) discohexactine.

spicules are diactines and hexactines. The diactines have an inflation in the middle and rough rounded outer ends. They are ca. 2200 µm long and 10 µm thick. The hexactines have rounded or conically pointed rays which may be entirely smooth or spiny at their bases. Hypodermal and hypoatrial pentactines are similar to each other, often their rays directed inside the body; all the rays are spiny at the bases; their outer ends are smooth and rounded or conically pointed. In their dimensions, these rays are similar to those of the choanosomal hexactines but the proximal ray is about 1.5 times larger than the tangential ones. Dermalia are pinular pentactines and some hexactines. Atrialia are pentactines and hexactines in almost equal proportions. Dermal and atrial spicules are similar to each other and have similar dimensions, but the atrial ones are generally slightly larger. The pentactines have a rudimental tubercle

Table 7
Spicule dimensions (μm) of *Caulophacus* (*Oxydiscus*) *weddelli*

Caulophacus (Oxydiscus) weddelli, SMF 52	*N*	Avg.	Min.	Max.	Std.
L dermal pinular hexactine, pinular ray	25	180	82	316	60
L dermal pinular hexactine, tangential ray	25	93	46	133	23
L dermal pinular hexactine, proximal ray	25	31	5	122	40
L atrial pinular hexactine, pinular ray	25	211	107	357	50
L atrial pinular hexactine, tangential ray	25	114	71	143	20
L atrial pinular hexactine, distal ray	25	59	8	148	55
D discohexactine	25	211	122	265	30
D oxyhexaster	25	151	122	204	17
d oxyhexaster	25	59	41	77	10

Legend as in Table 2.

representing the reduced unpaired ray directed inside the body. The pinular rays of these spicules are thickest at the bases; they carry relatively short spines and their outer ends are rounded or finely pointed. Other rays are spiny or rough with rounded or conically pointed outer ends. *Microscleres*: These are represented by two forms: discohexactines and oxyhexasters, rarely hemioxyhexasters. The discohexactines have rough or spiny rays 4–6 μm thick. In the oxyhexasters, each primary ray carries usually 2–3, rarely 1 (hemioxyhexaster) or 4–5 secondary rays. Dimensions of discohexactines, hexasters and of dermal and atrial hexactins are given in Table 7.

Remarks: The new species definitely belongs to the genus *Caulophacus*; it is pedunculate, with pinular dermal and atrial spicules and specific choanosomal hexactines bearing spines at the bases of their rays. So far, oxyoidal microscleres were reported from species of two subgenera of *Caulophacus*, *C.*(*Caulophacus*) and *C.*(*Caulodiscus*), only as rare spicules (Tabachnick, 2002b), which may even be of allochthonous origin. In *Caulophacus* (*Oxydiscus*) *weddelli*, most of the microscleres are of this type. *C.* (*O.*) *tenuis* (Lendenfeld, 1915) has oxyoidal microscleres only; no discohexactines.

Species distribution: Weddell Sea, depth 4995–4973 m.

Caulophacus sp.

Material: Six more or less complete stalks and several fragments (SMF no. 53)

Locality: Weddell Sea, ANDEEP st. 134-3, depth 4053–4066 m.

Description:

Body: Long rigid stalks which are strongly thickening upwards and fixed to a hard substrate by a round basal plate. The incompletely preserved, dead macerated stalks are up to 25 cm in length, ca. 10 mm in diameter at the base and 30 mm in the upper part.

Spicules: The numerous spicules are very long diactins fused by secondary synapticular junctions and ending with tuberculate thickenings.

Microscleres: Only few discohexactins, ca. 100 μm in diameter, were found.

Remarks: The generic assignment is established by the external shape and by the possession of discohexactins. Very similar, long and hard stalks stalks, also deprived of microscleres, were described by Topsent (1910, 1913, 1915) as *Caulophacus scotiae*. The isolated stalks are insufficient for species identification, therefore we here refrain from species assignment.

4.2.1.5. Sympagella Schmidt, 1870, emended. Emended diagnosis (of Tabachnick, 2002b): Basiphytous, often pedunculate Lanuginellidae, with or without prostalia lateralia; dermalia consist of pinular hexactines and pentactines; microscleres are discohexactines, discohexasters, onychohexasters and strobiloplumicomes.

Sympagella johnstoni (Schulze, 1886)

Figs 9, 2C, 3B, Tables 8–10.

Material: Three specimens from ANDEEP, SMF no. 54, 55 and 56, and three specimens from EASIZ.

Locality: Weddell Sea, ANDEEP st. 133-3 (EBS), depth 1123–1123 m (SMF 56), 133-4 (AGT), depth 1114–1115 m (SMF 54) and 133-5 (MUC), depth 1120 m (SMF 55) and three fragments from EASIZ, st. 39-18 (AGT 4), depth 1538–1543 m.

Description:

Body: The most complete specimen, broken into two pieces (SMF 55), is irregularly funnel-like, with a deep central cavity and rather few conules. It measures 85 mm in height and 75 mm in width; wall thickness about 7 mm at the base becoming thinner upwards; the conules are 1–5 mm long. Colour is light grey. Because both basal and upper parts are missing, it cannot be determined whether the sponge is basiphytous or lophophytous, but the former is the most probable because no proximal ends of root tuft spicules are observed. Prostalia lateralia are diactins and a few pentactins gathered in small tufts protruding 5–7 mm beyond the conules. Another sponge, grey in colour (SMF 54) came up totally fragmented, and from the many pieces it can be seen that it was originally a rather large, probably funnel-shaped specimen of *Sympagella johnstoni*. Wall thickness is 5–10 mm. The third specimen (SMF 56) is a juvenile which was fixed to a few long diactine prostalia lateralia of a *Rossella antarctica* in a way that the prostalia pierce through the basal part the small sponge. The oval sponge body is 9 mm long; no osculum observed. The EASIZ- specimens are fragmentary.

Spicules: Choanosomal spicules are diactines. The larger ones measure about 10.000/500 μm (length/width) with conically pointed or rounded, smooth or rough endings. In the specimen SMF 55, they sometimes serve as prostalia lateralia protruding from the cones of the body wall. The smaller diactines are about 1800/10 μm, with or without a central inflation and conically pointed or clavate rough outer ends. The smallest specimen (SMF 56), beside the normal diactines, has a type with four rudimental rays in the middle and finely pointed outer ends. Hypodermalia are pentactines and hexactines with a short rough ray directed distally. The hexactines are conically pointed and slightly rough; their proximal rays have rough or spiny ends. In most specimens, the hypodermal and hypoatrial pentactines prevail over the

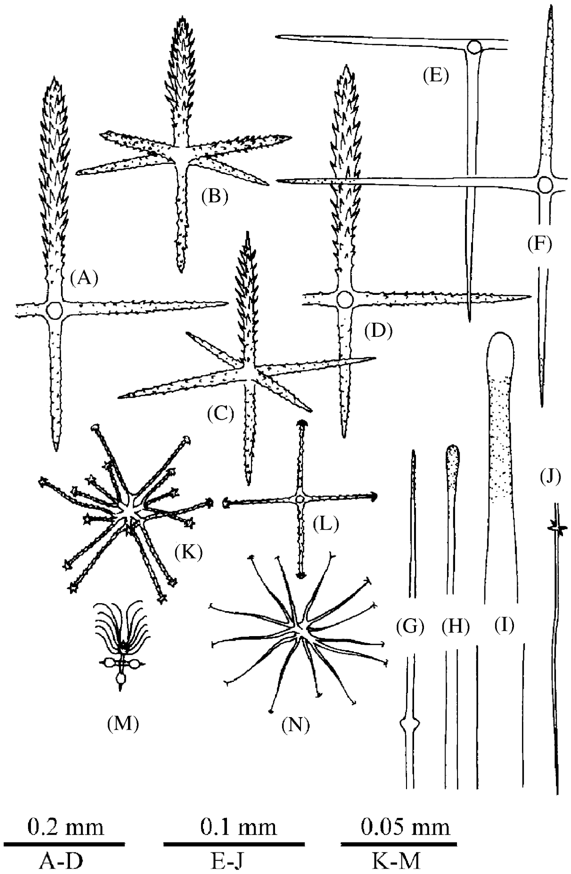

Fig. 9. *Sympagella johnstoni* (Schulze, 1886); (A) and (B) dermal pinular hexactines; (C) and (D) atrial pinular hexactines; (E) hypodermal pentactine; (F) large hypoatrial hexactine; (G)–(J) choanosomal diactines; (I) large choanosomal diactine; (J) small choanosomal diactine; (K) discohexaster; (L) discohexactine; (M) onychohexaster; and (N) strobiloplumicome.

corresponding hexactines. Dermal and atrial spicules are pinular hexactines. The pinular ray is thickest at the base and has short spines; ray tip is conically pointed. Rarely it is possible to find hexactines with two pinular rays, and in the smallest specimen there are hexactines, not pinular, with all rays equal in shape and size. *Microscleres*: Onychohexasters and very similar discohexasters with 2–3, rarely 4, secondary rays which are spiny in discohexasters and nearly smooth in onychohexasters. Rare discohexactines and strobiloplumicomes

Table 8
Spicule dimensions (μm) of *S. johnstoni*, specimens from Antarctic

S. johnstoni, Antarctic	SMF 56					SMF 54					SMF 55				
	N	Avg.	Min.	Max.	Std.	*N*	Avg.	Min.	Max.	Std.	*N*	Avg.	Min.	Max.	Std.
L dermal pin. hexact., pinul. ray	25	108	61	143	22	15	121	60	173	37	25	127	77	168	22
L dermal pin. hexact., tang. ray	25	102	71	128	16	15	96	66	133	18	25	91	71	107	11
L dermal pin. hexact., prox. ray	25	89	15	184	29	15	97	56	121	17	25	85	66	107	11
L atrial pin. hexact., pinul. ray						15	136	102	184	22	25	114	77	173	25
L atrial pin. hexact., tang. ray						15	88	61	117	18	25	94	61	122	16
L atrial pin. hexact., distal ray						15	86	61	102	11	25	81	56	128	17
D discohexaster/onychohexaster	17	81	76	92	5	15	84	67	97	8	25	85	63	01	10
d discohexaster/onychohexaster	17	15	8	21	3	15	15	11	19	2	25	16	11	21	3
D discohexactine	1	134	134	134		2	118	113	122	6	1	147	147	147	
D onychohexactine															
D strobiloplumicome	1	38	38	38		15	44	34	50	6	25	50	34	67	9
d strobiloplumicome	1	15	15	15		15	20	17	23	2	25	21	13	27	3

Legend as in Table 2.

Table 9
Spicule dimensions (μm) of *S. johnstoni* (Schulze, 1887) holotype, from the Naturkundemuseum Humboldt-Universität zu Berlin, HM 5379

S. johnstoni (Schulze, 1887) holotype, HM 5379	*N*	Avg.	Min.	Max.	Std.
L dermal pinular hexactine, pinular ray	25	92	63	118	.014
L dermal pinular hexactine, tangential ray	25	82	67	93	.008
L dermal pinular hexactine, proximal ray	25	71	48	89	.010
L atrial pinular hexactine, pinular ray	25	99	59	133	.016
L atrial pinular hexactine, tangential ray	25	85	67	107	.012
L atrial pinular hexactine, distal ray	25	72	44	81	.010
D discohexaster or onychohexaster	50	86	56	118	.014
d discohexaster or onychohexaster	50	13	7	19	.003
D discohexactine	1	104	104	104	
D strobiloplumicome	14	81	59	100	.012
d strobiloplumicome	14	40	33	44	.004

Legend as in Table 2.

are present. Spicule dimensions are given in Tables 8 and 9.

Remarks. This species was originally described by Schulze (1886) as the type species of his genus *Aulascus*. Unfortunately, the original description of this species was based on a single fragment, and both descriptions (in Schulze 1886 and 1887) and also the figures are rather poor. *A. johnstoni* was later transferred into *Sympagella johnstoni* by Ijima (1903). The species has never again been recorded, except from our three new specimens from the Weddell Sea. One of the authors (K.R.T) has re-examined the type of *S. johnstoni* (an incomplete specimen from R.V. "Challenger", st. 145a, which has been broken into three fragments and stored in the Natural History Museum London, BMNH 1887.10.20.034, and in the Naturkundemuseum Berlin, HM 5379 and HM 3929), and found it very similar to our Antarctic specimens both in spicule types and dimensions (see Tables 8–10): *S. johnstoni* contains large hexactines with one ray rough, as does our *Sympagella* from the Weddell

Table 10
Comparison of spicule dimensions between *S. anomala* and *S. johnstoni* (in μm)

Comparison *S. anomala—S. johnstoni*:	*S. anomala*		*S. johnstoni*			
	Japan, BMNH 1898.12.19.022		Type, BMNH 1887.10.20.034		Antarctic SMF 54, 55, 56	
	Min.	Max.	Min.	Max.	Min.	Max.
L dermal pinular hexactine, pinular ray	41	148	63	118	61	168
L dermal pinular hexactine, tangential ray	48	100	67	93	71	133
L dermal pinular hexactine, proximal ray	41	93	48	89	15	184
L dermal pinular hexactine, pinular ray	56	204	59	133	77	184
L dermal pinular hexactine, tangential ray	37	111	67	107	61	122
L dermal pinular hexactine, distal ray	48	100	44	81	56	128
D discohexaster or onychohexaster	52	104	56	118	63	101
d discohexaster or onychohexaster	7	11	7	19	8	21
D discohexactine			104	104	113	147
D strobiloplumicome	30	81	59	100	34	67
d strobiloplumicome	11	26	33	44	13	27

Legend as in Table 2.

Sea, and the form of spicules is identical. *S. anomala* (which has also been re-examined recently by KRT) was described by Ijima (1903) from the Sagami Bay. It was differenciated from *S. johnstoni* by the presence of hypodermal and hypoatrial pentactines in *S. anomala* and the apparent absence of hypoatrial pentactines in *S. johnstoni*. However, we disagree with this differenciation noted by Ijima (1903), because the Antarctic *S. johnstoni* specimens have hypoatrial spicules which are both pentactines and large hexactines with rough central rays directed outside the body. *S. johnstoni* possesses large choanosomal hexactines which are absent in *S. anomala*. Microscleres are very similar in shape and size, but the rare discohexaster type with long principal rays described for the Japanese specimens was not observed in the Antarctic material. *S. anomala* has pinules with their pinular rays lanceolate in shape and thickest in the middle, whereas the pinules of the Antarctic *S. johnstoni* are columnar in shape and thickest at the base. However, it is uncertain, whether or not these features should be considered significant to distinguish species of *Sympagella*. Because of their similarity, it is very possible that these two species may eventually be considered as subspecies of *S. johnstoni*: *S johnstoni johnstoni* and *S. johnstoni anomala*. However, further investigations of the range of variation within the genus *Sympagella* are necessary, which should take place within a thorough revision of this genus.

Prostalia lateralia are absent in the present diagnosis of the genus *Sympagella*, given by Tabachnick (2002b), and therefore this generic diagnosis is here amended to include possible prostalia.

Species distribution: Off Prince Edwards Island (Indian Ocean, Subantarctic) and Weddell sea, 574–1120 m.

4.2.2. *Euplectellidae* Gray, 1867

Euplectellinae Gray, 1867

4.2.2.1. *Malacosaccus* Schulze, 1886. *Malacosaccus cf. pedunculatus* Topsent, 1910

Material: Four fragments belonging to the same specimen (SMF no. 57).

Locality: Weddell Sea ANDEEP st.138-4, depth 4553–4548 m.

Description:

Body: Irregular grey fragments with ca.1 mm large (exhalant?) pores and a wall thickness of ca. 10 mm.

Spicules: Choanosomal spicules are heavily broken but it can be observed that they represent a morphological lineage from hexactines, with rays

4–6 μm in thickness, to diactines. Dermal or atrial spicules are pinular hexactines with pinular rays usually clavate, sometimes columnar in shape with few short spines, the other rays are conically pointed. Length of pinular and tangential rays is about 0.3 mm, maximal diameter of the pinular rays is up to 0.02 mm.Diameter of tangential rays 0.04 mm, length of ray directed inwards is about 1.5 mm; ray thickness is 0.01–0.013 mm. *Microscleres*: Microscleres are floricomes and onychohexasters. The floricomes are 0.160–0.200 mm in diameter with primary rosette 0.008–0.024 mm in diameter. The onychohexasters are very rare; their diameter is about 0.112 mm; the primary rosette is about 0.024 mm.

Remarks: *Malacosaccus pedunculatus* was known from one fragmented specimen taken at 2580 m in the Eastern Weddell Sea (Topsent, 1910, 1913; Barthel and Tendal, 1994). Because both the holotype and our specimen are described from poor fragments their exact comparison is impossible. This is why we refer our specimen to *M. pedunculatus* Topsent, 1910; (1913) with some hesitation.

Distribution: Weddel sea, depth 2580-4553 m.

Malacosaccus coatsi Topsent, 1910

Material: 3 fragments from EASIZ

Locality: Weddell Sea, EASIZ st. 39-18 (AGT 4), depth 1538–1543 m.

Description:

Body: External shape is unknown because this species is known only from small fragments. The largest of our fragments measures 12 × 8 × 5 mm.

Spicules: Choanosomal spicules are mostly pentactines, sometimes hexactines and paratetractines. They have conically pointed or clavate smooth outer ends; ray diameter is 0.006–0.020 mm. The spicules of the stalk are tauactines with rays 0.006–0.160 mm in diameter and anchors with spiny shafts 0.007–0.030 mm in diameter and discs with numerous teeth about 0.026 mm long and 0.037 mm in diameter. Dermalia are hexactines with spindle-like distal ray covered by short spines; they are about 0.23/0.02 mm; the tangential ray is rough, about 0.34/0.01 mm.Atrialia are probably hexactines with all the rays similar in shape; they are conically pointed, rough 0.19–0.26/0.010–0.015 mm. *Microscleres*: Microscleres are floricomes and discohexasters. The discohexasters are spherical with four (rarely two) secondary rays, 0.081–0.100 mm in diameter with primary rosette 0.005 mm in diameter. The floricomes have 4–6 rays; they are 0.096–0.133 mm, with primary rosette 0.007–0.009 mm, in diameter.

Remarks. Our specimen is represented by poor fragments, and they contain many foreign spicules (of *Acanthascus (Rhabdocalyptus) australis*, *Sympagella johnstoni* and *Hyalonema* sp.); hence exact comparison with type description (Topsent, 1910, 1913) is difficult. Unlike the original description, we did not find any oxyhexasters at all (they are rare in the type specimen) but the dimensions of the microscleres and also the shape of dermal and atrial spicule are very similar.

Distribution: Weddel sea, depth 1538–2600 m.

4.2.2.2. *Holascus* Schulze, 1886. *Holascus* cf. *obesus* Schulze, 1904

Fig. 10, Table 11.

Material: 1 small specimen, SMF no. 58. For comparison, we studied fragments of the holotype: HM 3619 and 4334 (Museum für Naturkunde, Humboldt-Universität zu Berlin).

Locality: Weddell Sea, ANDEEP st. 134-3, depth 4053–4066 m.

Description:

Body: The almost complete, small, tubular sponge is ca. 17 mm long with a root tuft which measures about 1/4 of the total length and a deep atrial cavity without a sieve- plate. The atrial surface shows rounded pores, regularly arranged, about 0.3 mm in diameter. The outer surface is smooth; wall thickness ca. 1 mm.

Spicules: Large choanosomal spicules are hexactines and paratetractines. Also, spiny shafts of anchors are found in the choanosomal skeleton. Dermalia are hexactines with pinular ray. The pinular ray is thickest at the base and conically pointed with short spines; the other rays are conically pointed with rare short spines; the proximal ray protrudes into the atrial cavity, but specific atrialia are absent. *Microscleres*: Oxyhexasters and graphiocomes. The oxyhexasters have 2–4 secondary rays. Spicule dimensions are given in Table 10.

Remarks: The investigated specimen is very similar to *H. obesus* Schulze (1904). However, during reinvestigation of the holotype we succeeded in finding a broken fragment of a calycocome (its primary rosette is 0.060 mm in diameter). The presence of calycocomes was not described previously for this species, so they were probably not discovered by Schulze. In our Antarctic specimen, we find no calycocomes, perhaps because they are very rare. Another difference is the presence of oxyhexasters and hemioxyhexasters with 2–3 secondary rays in the holotype of *H. obesus* (these spicules have 2–4 secondary rays in our specimen). Furthermore, the size of pinular hexactines is generally larger in *H. obesus* than in our specimen (however, the size ranges of pinules in both specimens partly overlap). The lack of material to estimate the possible variability of the species makes the definite attribution of our new *Holascus* specimen problematic, but we still, with some hesitation, refer to it as *H.* cf. *obesus.* A very similar species, *H. stellatus*, from the closest locality in the Antarctic has a sieve -plate, which our specimen of *Holascus* does not possess, and it also possesses oxyhexasters with secondary rays more stout and curved than in our specimen.

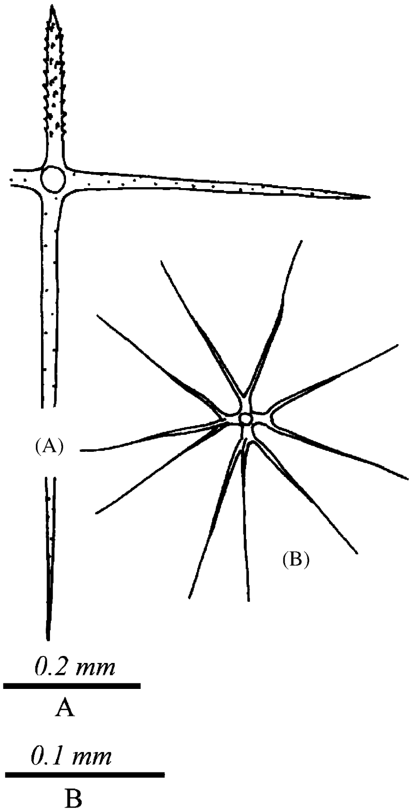

Fig. 10. *Holascus obesus* Schulze, 1904. (A) dermal pinular hexactine; and (B) oxyhexaster.

Species distribution: The species is known only from a damaged specimen from off Enderby Land (Schulze, 1904; Barthel and Tendal, 1994) and from the Weddell Sea. Depth 4053–4636 m.

Holascus pseudostellatus, sp.n.

Fig. 11, Table 12.

Synonymy: *H. stellatus* Schulze, 1887: 86; H. sp. Schulze, 1887, PL. XV, Figs. 14–23.

Ethymology: The name is given for a second specimen, which was collected together with and

Table 11
Spicule dimensions of *H. obesus* (in μm)

	H. obesus (holotype)					*H.* cf. *obesus* (SMF58)				
	N	Avg.	Min.	Max.	Std.	*N*	Avg.	Min.	Max.	Std.
L pinular hexactine, pinular ray	49	267	184	311	27	27	198	102	270	39
L pinular hexactine, tangential ray	30	228	168	321	33	24	278	143	383	60
L pinular hexactine, proximal ray	14	1188	306	2244	486	12	936	316	1836	431
D oxyhexaster	24	150	122	184	16	15	152	112	173	15
d oxyhexaster	24	16	10	20	4	15	18	10	26	4
D graphiocome						5	679	235	969	292
d graphiocome	12	42	31	51	6	5	37	26	46	8

Legend as in Table 2.

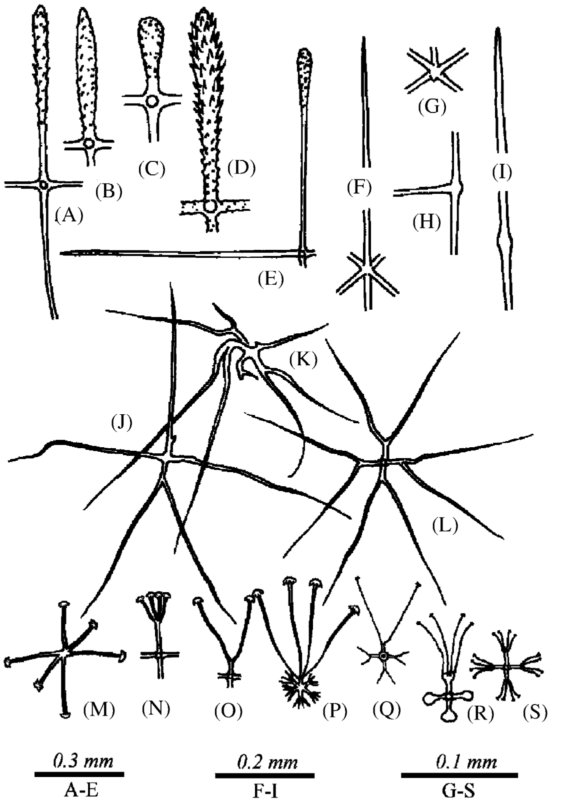

Fig. 11. *Holascus pseudostellatus* sp.n. (A)–(E), dermal or atrial hexactines; (F) choanosomal hexactine; (G) choanosomal pentactine; (H) choanosomal tauactine; (I) choanosomal diactine; (J)–(K), oxyhemihexaster; (L) oxyhexaster; (M) discohexactine; and (N)–(S), discohexasters.

partly described as *H. stellatus* by Schulze (1887), and which we now recognize as a new species.

Material: The holotype, SMF 59. Another specimen (BMNH 1887.10.20.018), here designated paratype , originated from the "Challenger" Expedition, was stored under the label *H. stellatus* under which name it was described, but was figured as *H.* sp. (Schulze, 1887, Pl. XV footnotes).

Locality: Weddell Sea, ANDEEP st. 134-3, depth 4053–4066 m, South Atlantic, R.V. "Challenger", sta. 325, 36° 44′ S 46° 16′ W, depth 4853 m.

Description:

Body: The holotype is a wall fragment, 30 × 55 mm, and about 8 mm thick, of a larger sponge. The outer surface is partly torn off although it appears smooth; the inner surface is penetrated by circular pores, ca. 1 mm in diameter. The other specimen, now the paratype, was figured by Schulze (1887, Pl. XV, Fig. 14). It is a circular fragment, probably from the upper part of the body about 18 mm in diameter, with walls 1.5 mm in thickness.

Spicules: Choanosomal spicules are pentactines and hexactines and rarely diactines with smooth or rough rounded outer ends, their rays are about 0.8/0.003–0.006 mm. The BMNH 1887.10.20.018 specimen contains some shafts of anchorate spicules which are spiny about 0.015 mm in diameter. Dermalia and atrialia are pinular hexactines. The pinular ray is clavate or spindle-like; other rays are conically pointed with rough outer ends; ray diameter is 0.015 mm. *Microscleres*: Discohexasters, rarely hemidiscohexasters and discohexactines, oxyhexasters, oxyhemihexasters and hexactines. The BMNH 1887.10.20.018 also contains few graphiocomes and floricomes (may be foreign in origin). Discohexasters and hemidiscohexasters have mostly 4, sometimes 2–8, secondary rays on each primary ray. Discohexactines were not found in the specimen BMNH 1887.10.20.018, but same type of spicule was figured by Schulze (1887: Pl. XV, Fig. 22). Oxyhexasters and oxyhexactines differ in diameter between the holotype and BMNH 1887.10.20.018, the former being about 2 × the size of the latter. The oxyhexasters and hemioxyhexasters have 1–3 secondary rays on each primary one. The oxyhexactines are 0.081–0.218 mm in diameter. Graphiocomes and floricomes were figured for the BMNH 1887.10.20.018 and also found in the reinvestigated material. The floricome is 0.076 mm with primary rosette 0.018 mm in diameter. The graphiocome is presented by primary rosette only 0.037 mm in diameter. One large spherical discohexaster 0.190 mm in diameter with primary rosette 0.03 mm in diameter was also found in the BMNH 1887.10.20.018 specimen. Spicule dimensions are given in Table 12.

Remarks: The new species seems close to *H. stellatus*, to which it was referred by Schulze (1887), but the differences are sufficient to distinguish a new species, as suggested in the

Table 12
Spicule dimensions (µm) of *H. stellatus* and *H. pseudostellatus*

	H. stellatus					*H. pseudostellatus*									
	Holotype					Holotype, SMF 59					BMNH 1887.10.20.018				
	N	Avg.	Min.	Max.	Std.	*N*	Avg.	Min.	Max.	Std.	*N*	Avg.	Min.	Max.	Std.
L dermal hexatine distal	21	325	266	372	28	26	308	209	347	25	15	315	241	407	44
L dermal hexatine tangential	12	372	236	494	63	5	334	219	372	64	3	334	281	389	54
L dermal hexatine proximal	10	1109	646	1520	251						3	1172	1110	1221	57
L atrial pentactine proximal	13	285	205	350	48	27	274	117	326	51	1	274	274	274	
L atrial pentactine tangential	12	281	236	350	34	2	334	311	357	32	1	241	241	241	
L atrial pentactine distal	4	789	532	1102	266	1	663	663	663		1	703	703	703	
D discohexaster or hemidiscoh.						27	95	38	113	16	15	75	65	86	6
d discohexaster or hemidiscoh.						27	22	17	38	4	15	13	7	18	3
D discohexactine						2	70	65	76	7					
D oxyhexaster or oxyhemihex.	25	91	65	122	12	22	173	139	239	25	15	107	74	148	21
d oxyhexaster or oxyhemihex.	25	17	9	22	3	22	23	19	32	3	15	18	11	22	4
D oxyhexactine	25	93	76	122	12	5	186	151	218	30	4	107	81	148	30
D graphiocome	25	851	526	1125	138										
d graphiocome	7	31	27	36	3						1	37	37	37	

Legend as in Table 2.

revision of the Euplectellidae by Tabachnik, 2002a. The choanosomal skeleton consists mostly of hexactines and pentactines in *H. pseudostellatus* and of stauractines, tauactines and diactines together with large ‘‘principalia’’ of hexactines and pentactines in *H. stellatus*. Microscleres with discoidal outer ends seem to be absent in *H. stellatus*, although one microsclere of this type was figured by Tabachnik (2002a) only after Schulze (1887) who described and documented the two specimens simultaneously. The holotype and the other specimen (BMNH 1887.10.20.018) of *H. pseudostellatus* are somewhat different from each other, the most notable difference is the dimensions of oxyoidal microscleres, but this feature is regarded as interspecific variation.

Species distribution: S-W Atlantic, 4853 m, Weddell Sea , 4053–4066 m.

5. Discussion

The taxonomy of the class Hexactinellida is very incomplete in the sense that probably not even half of its species are known to science. This is obvious from the fact that many of the hexactinellids species collected during recent deep-sea expeditions are new. Furthermore, many hexactinellid taxa are known only from one, sometimes even only a fragmented specimen. In such cases when also no fossil representatives of the taxon are known, it is impossible to make a complete description of the body form. This is the case with the species *Fieldingia lagettoides* Schulze, 1887, type species of the genus *Fieldingia*, on which the family Fieldingidae and order Fieldingida are based (Tabachnick and Janussen, 2004). Sometimes later expeditions provide further and better specimens of poorly known taxa, as the new specimens of *Sympagella johnstoni* and *Holascus obesus* collected during the ANDEEP II-expedition and described herein. This made it possible to complete and/or revise the original description. To allow later recognition, it is sometimes necessary to describe and name new taxa, even if the material is poor. The sponges collected during the ANDEEP II expedition contribute significantly to Porifera taxonomy, and this is especially true for the Hexactinellida. Among five new species found are a new subgenus of *Caulophacus* and the first Antarctic representative of the rigid genus *Periphragella*.

Sampling at depths greater than ca. 1000 m has rarely been done in the Weddell sea. The results from ANDEEP, EPOS and EASIZ can be compared only to those from the Scottish Antarctic National Expedition (Scotia) 1902–1904. "Scotia" carried out 11 trawlings at depths exceeding 1000 m in the Weddell Sea (Bruce, 1908). Four trawls contained sponges and all four also included hexactinellids. During ANDEEP II, 12 trawlings were made, 11 of which contained sponges and six included hexactinellids. These figures, especially those from ANDEEP, correspond well with the results of other deep-sea expeditions, especially those in different parts of the Atlantic (Tendal, 1973).

"Scotia" collected eight recognizable hexactinellid species, of which six were regarded as new to science; the two others were referable only to genus (Topsent, 1913, 1915, 1920). The three new expeditions (EPOS, EASIZ I and ANDEEP II) collected 14 species, five of which are described as new, and one referable only to genus. Only two species are in common between the old expedition and the new ones, *Malacosaccus pedunculatus* and *M. coatsi*. Both the large number of new species and species new to the area, but recorded elsewhere, indicate that the composition of the deep-sea hexactinellid fauna of the Weddell Sea (and in Antarctica as a region) is still poorly known.

The investigated localities fall into two groups, one south of South Orkney Islands where "Scotia" and ANDEEP collected, and one off Coats Land where "Scotia", EPOS and EASIZ worked. Of the 20 named hexactinellid species now reported from the deep Weddell Sea, 15 are known from the northern part and 10 of those only from here, while 10 were taken in the southern area, and five of those only from there. Comparison of morphologies gives no reason to believe that a division between an oceanic and a more continental group of species exists. The low number (five) of common species, together with the fact that seven of the 20 species are known only from the type locality and two more are hesitatingly identified from their second record, is a further indication of the poor knowledge of the distribution of the hexactinellid fauna in this area.

Only five species have been recorded from other oceans: *Chonelasma choanoides* seemingly with worldwide distribution, *Bathyxiphus* cf. *subtilis* from the Atlantic Ocean and the Pacific, *Bathydorus spinosus* and *Calycosoma validum* from the Atlantic Ocean, and *Sympagella johnstoni anomala* from the Pacific. These sparse data indicate that a substantial part the deep hexactinellid fauna of the Weddell Sea is shared with other deep-sea regions, but the poor database presently available provides no indication of a special biogeographic relationship with any ocean.

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