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Sponge biodiversity of South Georgia island with descriptions of fifteen new species

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Abstract

Sponge samples were taken by SCUBA diving from sixteen sites on the north coast of South Georgia island, south west Southern Ocean. Fifteen new species are described: *Iophon husvikensis* sp. nov., *Clathria* (*Clathria*) *stromnessa* sp. nov., *Clathria* (*Axosuberites*) *rosita* sp. nov., *Clathria* (*Microciona*) *matthewsi* sp. nov., *Lissodendoryx* (*Ectyodoryx*) *collinsi* sp. nov., *Hymedesmia* (*Hymedesmia*) *barnesi* sp. nov., *Hymedesmia* (*Stylopus*) *pharos* sp. nov., *Myxilla* (*Burtoanchora*) *ponceti* sp. nov., *Tedania* (*Tedaniopsis*) *aurantiaca* sp. nov., *Tedania* (*Tedaniopsis*) *wellsae* sp. nov., *Mycale* (*Mycale*) *brownorum* sp. nov., *Mycale* (*Mycale*) *cartwrighti* sp. nov., *Haliclona* (*Soestella*) *crowtheri* sp. nov., *Microxina myxa* sp. nov. and *Calyx shackletoni* sp. nov. Information is also provided on the distribution and *in situ* external appearance of other sponge species such as *Cinachyra barbata* Sollas 1886, *Polymastia invaginata* Kirkpatrick 1907, *Iophon unicorne* Topsent 1907, *Phorbas glaberrimus* (Topsent 1917), *Myxilla* (*Ectyomyxilla*) *keruelensis* (Hentschel 1914) and *Rossella nuda* Topsent 1901. These results increase the previously reported low sponge endemism in South Georgia, which now better aligns with the high endemism of other groups. However, because we sampled areas that have been poorly sampled in the Southern Ocean / Antarctic region (shallow subtidal, rocky), many of these species may have wider polar distributions. The effect of the Polar Front as a dispersal barrier to neighbouring biogeographic regions is discussed.

Key words: sponge, South Georgia, Antarctic, Southern Ocean, biogeography, SCUBA diving, taxonomy, endemic

Introduction

The remote sub-Antarctic island of South Georgia is located on the northern extension of the Scotia Arc, which links the Antarctic Peninsula to the Patagonian continental shelf (Fig. 1). Biogeographically South Georgia is considered part of the South Georgia district of the West Antarctic sub-region (Amphipods: De Broyer and Rauscher 1999; Molluscs: Linse 2002). South Georgia is considered a relatively old island with respect to other Scotia Arc islands (such as the South Sandwich Islands and South Orkney Islands) as it split from the Gondwana supercontinent approximately 30 Ma during the mid-Cenozoic (Dalziel and Elliot 1971). The island is also somewhat isolated, being separated from its closest neighbour by both distance and deep water (Hogg *et al.* 2011). The Southern Ocean is generally very deep with few continental shelf areas (Clarke and Johnston 2003), which suggest that a high degree of endemism may exist amongst the spatially disparate shallow coastal island habitats, especially amongst Phyla with poor dispersal capacities such as Porifera.

South Georgia is located just south of the Polar Front (PF), a northerly jet of the Antarctic Circumpolar Current (ACC) that is detectable down to 1000 m depth. This major oceanographic feature is a potential constraint on the northward dispersal of many Antarctic species (Clarke *et al.* 2005). To the south of South Georgia is the Southern ACC Front (SACCF) and the island's position between the PF and SACCF results in the shelf being both the warmest (~4°C) and the area with the biggest seasonal range (~5°C) of sea surface temperatures within the Southern Ocean (Barnes *et al.* 2006a). Regionally, coastal water is retained on the South Georgia shelf and may, in part, explain its high productivity which in turn supports commercial fisheries and a high diversity of marine bird and

mammal populations (Atkinson *et al.* 2001). South Georgia has therefore been considered to be a biodiversity hotspot in the Southern Ocean (Hogg *et al.* 2011). South Georgia's biodiversity, however, may be particularly vulnerable to impacts of predicted rapid ocean warming due to its close proximity to the PF and SACCF (Barnes *et al.* 2009).

In spite of many studies conducted in the Antarctic and Southern Ocean, some areas in the South Atlantic Ocean, such as South Georgia, are still unsatisfactorily sampled. This has resulted in the sponge fauna of South Georgia's shallow water habitats being grossly underestimated and poorly known, particularly the shallow water species. Whilst three expeditions, the Swedish Antarctic expedition (1901–03) (Burton 1934), the Terra Nova expedition (1910–12) (Burton 1929) and the Soviet Antarctic Expedition, whaling fleet 'Slava' 1957–1959 (Koltun 1964) have made significant collections from the deeper regions off South Georgia only two, very limited, collections have been made from the littoral and shallow water habitats by Burton (1930) and Barnes *et al.* (2006b). In total 81 species have been previously recorded from the island (Hogg *et al.* 2011; Sarà *et al.* 1992).

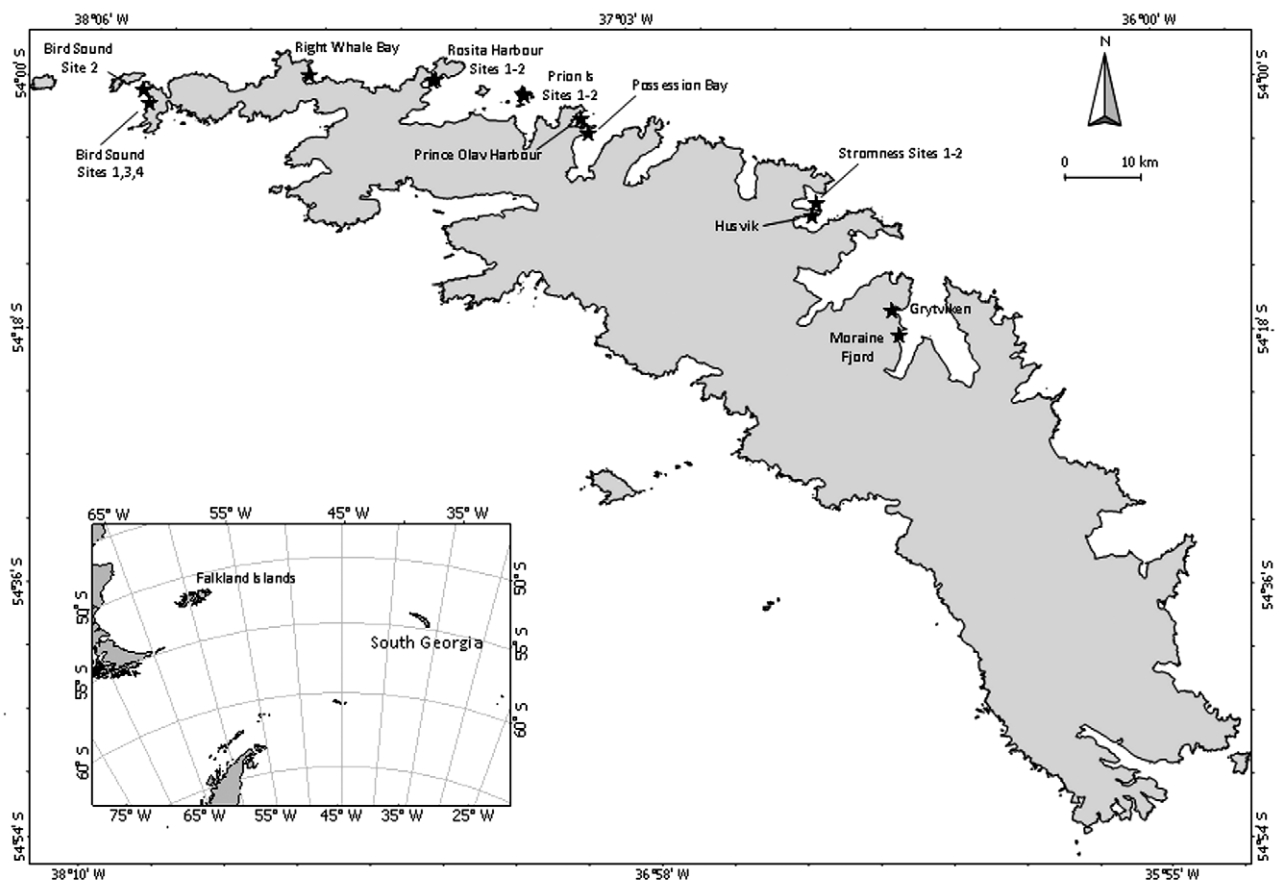


FIGURE 1. Location of South Georgia in the Southern Ocean (inset) and sample stations.

Recent work has revealed the potential for diving surveys in studying sponge biodiversity (Picton and Goodwin 2007; Willenz *et al.* 2009; Goodwin *et al.* 2011a) particularly in areas where many species are small and in habitats that are difficult to sample by other means (Vacelet and Perez 1998). Sampling by SCUBA diving enables the study of bedrock habitats and encrusting species, which are likely to be under-sampled by remote methods, and consequently has the potential to significantly increase the number of species recorded (Picton and Goodwin 2007; Willenz *et al.* 2009; Goodwin *et al.* 2011a). Additionally SCUBA diving surveys enable the *in situ* appearance of species to be recorded providing information of great use and value to field surveyors (Willenz *et al.* 2009). The present study aims to increase our understanding of the sponge fauna of South Georgia, and also to provide an illustration of all the identified sponges collected.

TABLE 1. Species recorded at each dive sampling site. Filled squares are records with samples, unfilled squares indicate photographic records only.

Species	1. Bird Sound (Site 1) 54°02.058'S, 38° 00.242'W	2. Bird Sound (Site 2) 54°01.149'S, 38° 01.026'W	3. Bird Sound (Site 3) 54°02.095'S, 38° 00.187'W	4. Bird Sound (Site 4) 54°02.069'S, 38° 00.251'W	5. Right Whale Bay 54°00.173'S, 37° 40.856'W	6. Rosita Harbour (site 1) 54°00.715'S, 37° 26.049'W	7. Rosita Harbour (Site 2) 54°00.649'S, 37° 25.618'W	8. Prion Island (Site 1) 54°001.590'S, 37°15.178'W	9. Prion Island (Site 2) 54°001.862'S, 37° 15.032'W	10. Prince Olav Harbour 54°03.579'S, 37° 08.203'W	11. Possession Bay, Jagged Point 54°04.514'S, 37° 07.188'W	12. Green Island, Stromness (1) 54°09.448'S, 36° 39.752'W	13. Green Island, Stromness (2) 54°09.381'S, 36° 39.852'W	14. Husvik 54°10.285'S, 36° 40.412'W	15. Gritviken 54°16.937'S, 36° 30.475'W	16. Morrine Fjord 54°18.800'S, 36° 29.600'W
<i>Cinachya barbata</i> Sollas, 1886																
<i>Polymastia invaginata</i> Kirkpatrick, 1907																
<i>Iophon husvikensis</i> sp. nov.																
<i>Iophon unicorn</i> Topsent, 1907																
<i>Clathria (Clathria) stromnessa</i> sp. nov.																
<i>Clathria (Axosuberites) rosita</i> sp. nov.																
<i>Clathria (Microciona) matthewsi</i> sp. nov.																
<i>Lissodendoryx (Ectyodoryx) collinsi</i> sp. nov.																
<i>Hymedesmia (Hymedesmia) barnesi</i> sp. nov.																
<i>Hymedesmia (Stylopus) pharos</i> sp. nov.																
<i>Phorbas glaberrimus</i> (Topsent, 1917)																
<i>Myxilla (Burtonanchora) poncetii</i> sp. nov.																
<i>Myxilla (Ectomyxilla) kerguelensis</i>																
<i>Tedania (Tedaniopsis) aurantiaca</i> sp. nov.																
<i>Tedania (Tedaniopsis) wellsae</i> sp. nov.																
<i>Mycale (Mycale) brownorum</i> sp. nov.																
<i>Mycale (Mycale) cartwrighti</i> sp. nov.																
<i>Haliclona (Soestella) crowtheri</i> sp. nov.																
<i>Microxina myxa</i> sp. nov.																
<i>Calyx shackletoni</i> sp. nov.																
<i>Aplysilla</i> sp.																
<i>Rossella nuda</i> Topsent, 1901																

Materials and Methods

Specimens were collected by SCUBA diving from sixteen sites on the north coast of South Georgia (Fig. 1, Table 1). The survey was part of a large multi-institutional program to quantitatively survey the shallow subtidal, continental shelf, and shelf break benthic habitats of South Georgia. For safety, SCUBA diving depths were limited to 18m because of a lack of a recompression chamber. Sponges were selected by eye: the divers attempted to sample species that looked different from those previously sampled during the dive. The aim was to sample as many different species as possible, rather than gaining any quantitative information. Once selected, three photographs of each specimen were taken *in situ* using a housed digital SLR camera (Nikon D300 in Subal housing with Ikelite DS125 substrobe and 60mm macro lens). A small piece (approximately 1cm² of tissue) was then removed. After collection the samples were transferred to 95% ethanol for storage.

Tissue slides were prepared by sectioning a very thin portion of tissue at a 90 degree angle through the sample. This was then dehydrated in absolute ethanol for four minutes and placed in clove oil for a further four minutes to clarify the tissue before being mounted on a microscope slide in Canada balsam. A coverslip was then placed on the slide which was then kept at 50°C for at least 48h to allow the mountant to dry. Spicule preparations were prepared by dissolving the tissue in a drop of concentrated nitric acid directly on a microscope slide. The slide was heated over a spirit burner to aid the reaction. Once the acid had burnt off, the remaining spicules were rinsed in water and ethanol and then mounted in Canada balsam as above.

The tissue slide was used primarily for identification to genus level. Spicule measurements were taken from the spicule preparations; 20 spicules (unless otherwise specified in the text) of each type were measured using ProgRes® CapturePro 2.7 Software (JENOPTIK Optical Systems, Jena, Germany). Type material is deposited in the zoology collections of the Ulster Museum, National Museums Northern Ireland. Material in these is indicated by BELUM (Belfast Ulster Museum) Mc (Porifera collections).

Information on extant species was obtained from the World Porifera Database (van Soest *et al.*, 2012). Type specimens were examined from several collections; those examined are listed in the text, institutional abbreviations used are as follows: BMNH—Natural History Museum, London; NMSZ—Zoology collections of the National Museums of Scotland, ZMB—Zoologisches Institut und Zoologisches Museum der Universität Hamburg, MNHN—Muséum National d'Histoire Naturelle, Paris.

The study sites

The shallow reefs sampled were rocky habitats with large kelp species *Macrocystis pyrifera* and *Himantothallus grandifolius*, a dense understory turf red algae, and an assemblage of epibenthic macrofauna. Sponge specimens were often collected from vertical or overhanging rock surfaces, with fewer macrophytes, and higher density of encrusting fauna. Sites varied from mid-fjord to more open ocean locations, with coincident variability in surface lowered salinity, stratification, light field, and turbidity (glacial flour) due to varying catchment areas and presence or absence of nearby glaciers (Meredith *et al.* 2005; Young *et al.* 2011).

Results

Class DEMOSPONGIAE Sollas, 1885

Order SPIROPHORIDA Bergquist & Hogg, 1969

Family TETILLIDAE Sollas, 1886

Genus *Cinachyra* Sollas, 1886

***Cinachyra barbata* Sollas, 1886**

(Figure 2)

Synonymy: *Cinochyra barbata* Sollas, 1886 (misspelling of the genus).

Cinachyra barbata Sollas, 1888.

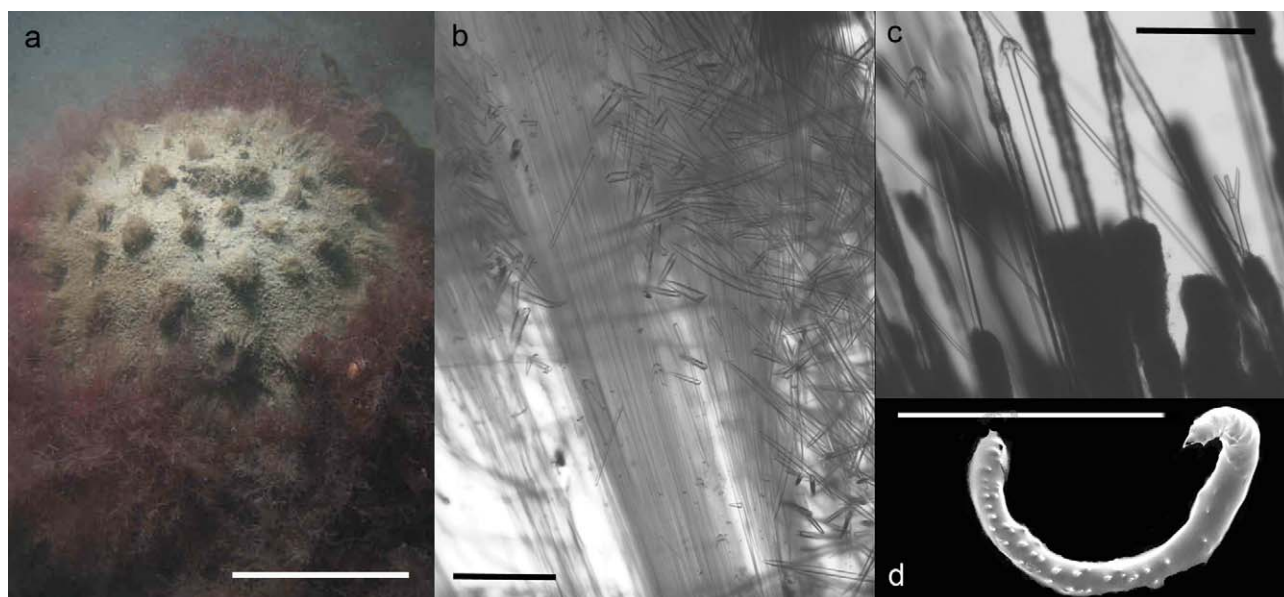


FIGURE 2. *Cinachyra barbata* Sollas, 1886 a) External appearance, scale bar 10cm; b) Cortical skeleton showing radiating bundles of large oxea and confused cortical oxea, scale bar 500µm; c) spicule bundles protruding through ectosome with ends of protriaenes visible., scale bar 500µm; d) sigmaspire, scale bar 10µm.

Material: All samples in 95% ethanol, tissue section and spicule preparation on slides. BELUM Mc7577. Morrairie Fjord, South Georgia (54° 18.800'S, 36° 29.600'W); depth range: 13–17.5m; collected by C. Goodwin and J. Brown, 18th November 2010.

Comparative material examined: BMNH 1908.2.5.52 *Cinachyra barbata* (Sollas). Antarctic expedition root tuft. Dried specimen.

BMNH 08.2.5.212 and 213. *Cinachyra barbata* (Sollas). National Antarctic Expedition, Hut point, winter quarters. Dried specimens.

External morphology: *In situ appearance:* Massive globular sponge 25cm in diameter. Exterior heavily silted and hispid with numerous circular pore fields (porocalicies), up to 1cm in diameter, fringed by rings of spicules which protrude far beyond the ectosome (Fig. 2a).

Preserved appearance: Transverse slice of sponge. Robust, uncompressible with grey choanosome and white cortex 5mm in diameter. Fringe of brown spicules mostly ~1cm in length but some tufts up to 3cm.

Skeleton: The globular part has a radiate skeleton with bundles of long oxeas radiating out towards the periphery (Fig. 2b), the peripheral bundles consist of oxeas and protriaenes, the latter protrude beyond the surface (Fig. 2c). The cortex is reinforced by cortical oxeas, strewn at all angles, and sigmaspire microscleses. Anatriaenes only occur in the basal mass where they function as anchoring spicules, this was not sampled with this specimen.

Spicules: Choanosomal oxea: up to 8000µm, sharply pointed, straight or curved.

Protriaenes: In two distinct categories; up to 13,000 by 30µm with cladi up to 180 by 16µm and smaller hair like 130 by 4µm with cladi 16–30µm (measurements from van Soest & Rützler, 2002).

Cortical oxea: 587 (742) 897 by 26.7 (41.2) 58.5µm, fusiform, bluntly pointed.

Sigmaspines: 8.7 (10.2) 12.6µm (Fig. 2d).

Anatriaenes (up to 40,000 by 24µm) are present in the type but not recorded here as the basal mass was not sampled.

Remarks: The presence of porocalicies (pore bearing pits) and a cortical region reinforced with short oxeas assign this specimen to the genus *Cinachyra* Sollas, 1886. There are three valid species: *Cinachyra barbata* Sollas, 1886; *Cinachyra antarctica* (Carter, 1872) and *Cinachyra helena* Rodriguez and Muricy, 2007; the two former have been recorded in the Antarctic but the latter is only currently known from Brazil. The size of the cortical oxeas and sigmaspires and the external form in our specimen are a good match for *Cinachyra barbata*, it was too difficult to extract and measure the larger spicules but in any case measurements given in the type description are not very precise and unlikely to aid diagnosis. *C. barbata* may be distinguished from *C. antarctica* by its lack of sigmaspires.

Distribution: This species was originally described from Balfour Bay, Kerguelen (from more than 60 syntypes) and is found on sediment rich bottoms from 18–549 m on Antarctic shores: Wilhelm II Coast, Budd Coast, Victoria Land, South Shetlands, Lars Christensen, McMurdo Sound (Burton 1929; Koltun 1964; van Soest and Rützler 2002) and Annenkov Island and Larsen Harbour, South Georgia (Burton 1940).

Order HADROMERIDA Topsent, 1894

Family POLYMASTIIDAE Gray, 1867

Genus *Polymastia* Bowerbank, 1864

***Polymastia invaginata* Kirkpatrick, 1907**

(Figure 3)

Synonymy: *Polymastia invaginata* Kirkpatrick, 1907.

Polymastia invaginata var. *gaussi* Hentschel, 1914 is regarded as a synonym by Plotkin and Janussen (2008).

Material: All samples in 95% ethanol, tissue section and spicule preparation on slides. BELUM Mc7610. Rosita Harbour Site 2, South Georgia (54°00.649'S, 37° 25.618'W); depth 11.5m; collected by C. Goodwin, J. Brown, and S. Brown, 20th November 2010. BELUM Mc7618 and BELUM Mc7620. Right Whale Bay, South Georgia (54°00.173'S, 37° 40.856'W); depth 18m; collected by C. Goodwin, J. Brown and S. Brown, 21st November 2010. BELUM Mc7648. Jagged Point, Possession Bay, South Georgia (54°04.514'S, 37° 07.188'W); depth 10.4m; collected by C. Goodwin, D. Poncet and P. Brewin, 23rd November 2010. BELUM Mc7660. Husvik, South Georgia (54°10.285'S, 36° 40.412'W); depth 18m; collected by C. Goodwin, D. Poncet and P. Brewin, 26th November 2010.

Comparative material examined: BMNH 03.2.5.78 *Polymastia invaginata*. Discovery Antarctic Expedition McMurdo Bay ~20fms. W.Q.28.2.02. Specimen in alcohol. This specimen is the figured half specimen in PL XIV Fig. 5 of the description.

External morphology: *In situ appearance:* Brown hispid mound attached to bedrock bearing single, lemon yellow, smooth surfaced, large papillae with large terminal oscule. Individuals up to 20cm in height (Fig. 3a). Often occur in clusters of several individuals.

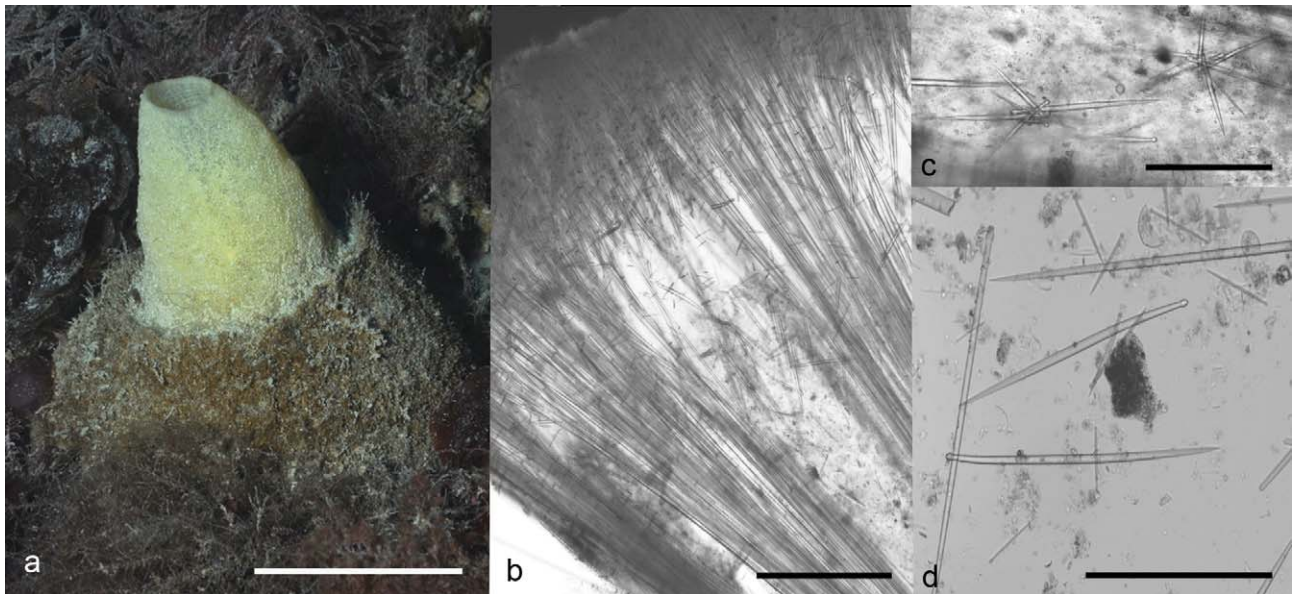


FIGURE 3. *Polymastia invaginata* Kirkpatrick, 1907 a) *In situ* appearance specimen Mc7660, scale bar 10cm; b) Skeleton Mc7610, scale bar 500µm, ectosome to top left; c) Stellate clusters of tyloes Mc7610, scale bar 100µm; d) Spicules Mc7660, scale bar 200µm.

Preserved appearance: Transverse slice of basal mound of specimen. Tissue very tough. Choanosome grey, cortical layer white and 2–3mm thick. A fringe of dark grey hairs ~5mm long present on the surface.

Skeleton: Radiate skeleton of bundles of large styles, these penetrate the ectosome and form the thick surface pile (Fig. 3b). Stellate groups of small tylostyles are present between the fibres (Fig. 3c). The ectosome is formed of a dense tylostyles, positioned vertically with their points towards the surface. This layer forms a fibrous cortex to the sponge, easily visible on slides, around 0.5–1cm thick.

Spicules (Fig. 3d): **Styles:** 1825 (2462)3076 by 22.1 (26.9) 42.1µm—although many broken and difficult to measure so longer spicules may be present.

Tylostyles: 119 (307) 625 by 6.3 (10.1) 13.6µm. Fusiform tylostyles with a neat swelling at their head. Some forming stellate clusters between the fibres but these do not seem to represent a separate size category.

Remarks: Our specimens are a good match with the type description and specimens and correspond to the external form and spiculation of other specimens assigned to this species (Brueggeman, 1998; Hentschel 1914; Koltun 1964; Plotkin and Janussen, 2008). However, like previous authors, we did not record the sceptre-like spicules noted by Plotkin and Janussen (2008) in the cortical palisade and our styles are of a larger size than those noted by Boury-Esnault and van Beveren (1982). *Polymastia invaginata* can be distinguished from other Antarctic and Southern Atlantic species of *Polymastia* by its single inhalant papillae, densely hispid surface and single spicule layer in the cortex (Plotkin and Janussen, 2008).

Kirkpatrick (1907) noted that the papillae in all of his specimens was ‘invaginated’, flush with the surface of the basal mound, this is presumably the origination of the species name. He was studying preserved material and this may have been an artifact of preservation, in all our living specimens the papillae stood proud.

Distribution: Originally recorded from Winter Quarters (18–55m depth) and from off Mount Erebus (914m depth). Widespread in the Antarctic and sub-Antarctic: records from Kerguelen and Heard Islands (Boury-Esnault and Van Beveren 1982) McMurdo Sound (Burton 1929), South Georgia, South Orkneys and South Shetlands (Burton 1932) in depths of 18–1080m. *Polymastia invaginata* var. *gaussi* Hentschel, 1914 was regarded as a synonym by Burton (1932) but this is a much smaller sponge (maximum 8mm high) and has smaller spicules (styles up to 1792µm, tylostyles 120–600µm) so is a distinct species.

Order POECILOSCLERIDA Topsent, 1928

Sub-order MICROCIONINA Hajdu, van Soest and Hooper, 1994

Family ACARNIDAE Dendy, 1922

Genus *Iophon* Gray, 1867

Iophon husvikensis sp. nov.

(Figure 4)

Type material: Holotype: BELUM Mc7673. Sample in 95% ethanol, tissue section and spicule preparation on slides; Husvik, South Georgia (54°10.285'S, 36° 40.412'W), depth 18m; collected by C. Goodwin, D. Poncet and P. Brewin, 26th November 2010.

Paratypes: BELUM Mc7666. Sample in 95% ethanol, tissue section and spicule preparation on slides, Husvik, South Georgia (54°10.285'S, 36° 40.412'W); depth 18m; collected by C. Goodwin, D. Poncet and P. Brewin, 26th November 2010. BELUM Mc7647. Sample in 95% ethanol, tissue section and spicule preparation on slides. Bird Sound, Site 3, South Georgia (54°02.069'S, 38° 00.251'W); depth 6m; collected by J. Brown and S. Brown, 22nd November 2010.

Etymology: Named after the type locality, Husvik Harbour, South Georgia

External morphology: *In situ appearance:* Thick yellow crust with a smooth surface and occasional large, irregularly spaced, oscules, patches up to 30cm in diameter (Fig. 4a).

Preserved appearance: Firm chocolate brown thick crust with a glassy smooth ectosome.

Skeleton: The choanosomal skeleton is an isodictyal reticulation of bundles of 2–4 styles, with some ascending columns of 3–4 styles visible. The ectosome is formed from a dense tangential layer of tornotes. Microscleres abundant throughout tissue (Fig. 4b).

Spicules: Measurements from Mc7673.

Styles: 270(319)342 by 10.1(15.3)20.9µm, fat styles which come to an abrupt point, the majority are curved (Fig. 4c).

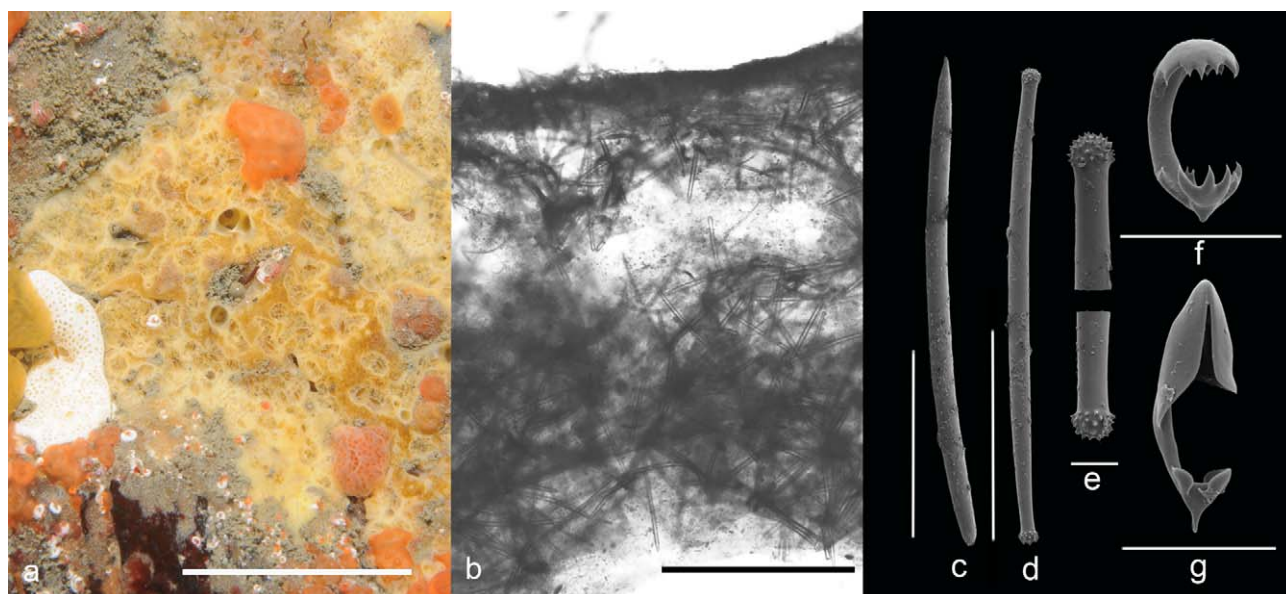


FIGURE 4. *Iophon husvikensis* sp. nov. a) *In situ* appearance specimen Mc7673; b) Skeleton Mc7673, ectosome to top, scale bar 500µm; c) style, scale bar 100µm, d) tylote, scale bar 100µm, e) tylote ends, scale bar 10µm, f) bipocoelle, scale bar 10µm, g) anisochelae, scale bar 10µm.

Tylotes: 195(220)238 by 8.4(10.5)14.8µm with robustly spined, neatly rounded, tylote ends (Fig. 4d, e).

Bipocoelles: 8(11)13µm aniso clawed ends, one of which bears a spur (Fig. 4f).

Chelae: 12(16)20µm spurred anisochelae (Fig. 4g).

Remarks: Seventeen valid species of *Iophon* are currently known from the Antarctic or sub-Antarctic, seven of which have smooth styles as choanosomal megascleres (Table 2). All of these differ from this species in spicule form. *Iophon abnormalis* (Ridley and Dendy, 1887), and *I. radiatum* Topsent, 1901 have much larger chelae; *I. timidum* Desqueyroux-Faúndez and van Soest, 1996 does not possess bipocoelles; *I. chilense* Desqueyroux-Faúndez and van Soest, 1996 has much smaller styles; and *I. pluricornis* var. *trulliferum* Hentschel, 1914 has much larger styles and tylotes and smaller bipocoelles. *Iophon hesperidesi* Rios, Cristobo and Urgorri, 2004 has similar sized spicules but can be distinguished by the possession of unusual spoon shaped bipocoelles and also has less robustly spined ectosomal tylotes. *Iophon pluricornis* Topsent, 1907 can be distinguished from this and other Antarctic *Iophon* species by the possession of a category of entirely spined ectosomal tylotes in addition to those spined only on their ends (Topsent 1913).

Iophon unicorn Topsent, 1907

(Figure 5)

Synonymy: *Iophon unicornis* Topsent, 1907.

Iophon spatulatum Kirkpatrick, 1907.

Material: All samples in 95% ethanol, tissue section and spicule preparation on slides. BELUM Mc7634 and BELUM Mc7635. Bird Sound Site 1, South Georgia (54°02.058'S, 38° 00.242'W); depth 18m; collected by C. Goodwin, S. Cartwright and P. Brickle, 22nd November 2010. BELUM Mc7636. Bird Sound Site 2, South Georgia (54°01.149'S, 38° 01.026'W); depth 18m; collected by C. Goodwin, S. Cartwright and P. Brickle, 22nd November 2010.

Comparative material examined: MNHN DT1665 *Iophon unicornis* Topsent, 1907. Île Anvers, collected by 'Le français'. Microscope preparations of tissue section and spicules.

External morphology: *In situ appearance:* Bright yellow thickly encrusting sponge with papillate mammiform processes, often bearing terminal oscules (Fig. 5a).

Preserved appearance: Chocolate brown crust, firm but compressible. Surface composed of flattened lobes with thin edges.

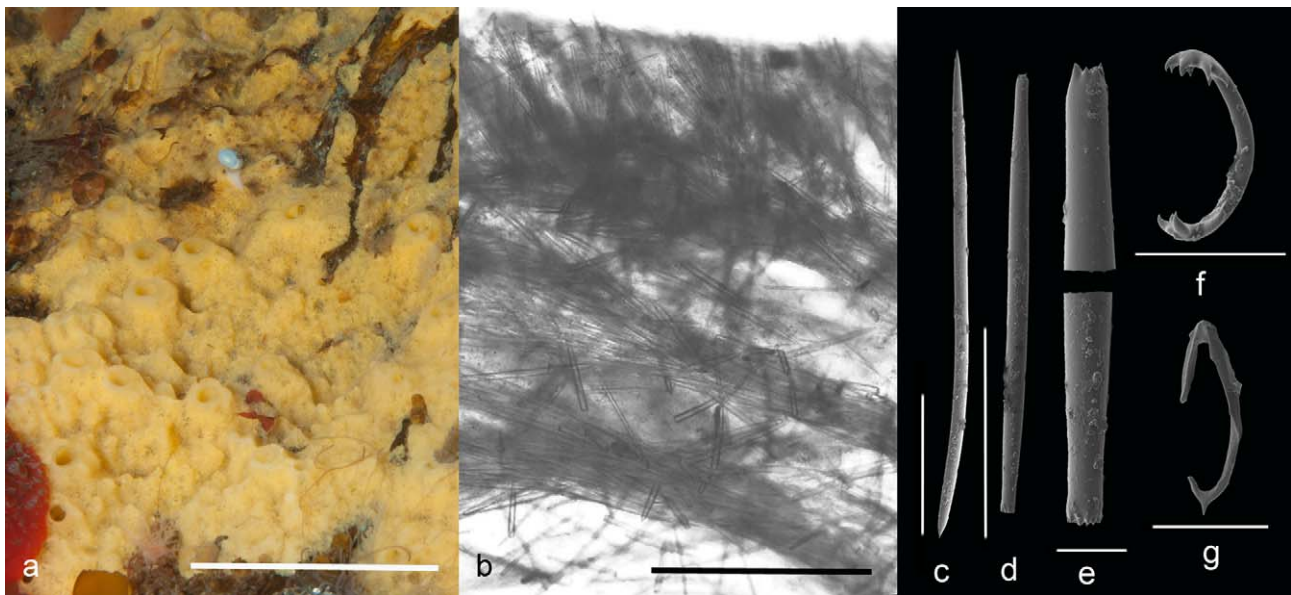


FIGURE 5. *Iophon unicorne* Topsent, 1907 a) *In situ* appearance specimen Mc7636, scale bar 10cm; b) Skeleton Mc7636, ectosome to top, scale bar 500µm; Spicules Mc7636 c) style, scale bar 100µm, d) tylote, scale bar 100µm, e) tylote ends, scale bar 10µm, g) bipocoele, scale bar 10µm, g) anisochelae, scale bar 10µm.

Skeleton: The choanosomal skeleton consists of pronounced ascending columns of oxea up to 10 spicules in width, overlain by an irregular triangular isotropic reticulation of bundles of 1–3 oxea. The ectosome is comprised of brushes of strongyles, which fan out towards the surface (Fig. 5b).

Spicules: Measurements from BELUM Mc7636.

Choanosomal oxote styles: 314(341)394 by 11.7(16.6)21.2µm, stylote oxea with abruptly pointed ends, often bent near to one of the ends (Fig. 5c).

Ectosomal strongyles: 204(228)246 by 8.4(11.0)13.3µm, fusiform strongyles with flattened ends which bear a variable number of large spines (Fig. 5d,e).

Bipocoeles: 12.6(14.8)17.9µm, thin curved bipocoeles with numerous claws at each end (Fig. 5f).

Anisochelae: 16.8(18.0)19.7µm, spurred anisochelae (Fig. 5g).

Remarks: The spicule categories of our specimens are similar in size to those of the type but have shorter oxea (spicules measurements from type: oxea 398(439)473 by 10(15)18µm, strongyles 212(234)248 by 8(11)14µm, chelae 17(20)24µm, Table 2). The form of the oxea is similar to those of the type but the strongyles differ slightly in that those in the type tend to have more pronounced swelling at the ends. Whilst the chelae are a similar form and size we could not find bipocoeles in the type to compare. Topsent (1907) does not record biopocoeles as being present in the species description but Rios (2006) made new preparations from the type specimen and found them to be common; they are of a similar size and form to those of our specimens.

Iophon flabellodigitatus Kirkpatrick, 1907, is currently regarded as a synonym of *I. unicorne* (van Soest *et al.* 2012), Rios (2004) regarded them as separate species but on further examination reconsidered (Rios, 2006). The ectosomal strongyles of the type of *I. flabellodigitatus* differ from those of *I. unicorne* in having one end with a very large spine, but otherwise have similarly formed and sized spicules.

Topsent (1907) recognised that the oxea-like choanosomal spicules in this species were superficially similar to oxea but considered the mucron to be ornamentation, similar to basal spination of styles found in other *Iophon* species, and consequently regarded them as modified acanthostyles. This has been followed by Rios (2004; 2006) who terms the spicules styles with mucronate ends.

Distribution: The type locality is Île Anvers (Anvers Island) on the Antarctic Peninsula. The species is widely distributed in the Antarctic with records from Bransfield Strait, Bellingshausen Sea, Ross Sea, Kerguelen Island, South Orkney Islands, South Shetland Islands, and Weddell Sea (Kirkpatrick 1908; Topsent 1913, 1917; Hentschel 1914; Desqueyroux-Faúndez 1989; Pansini *et al.* 1994; Gutt and Koltun 1995; Rios 2006). Burton (1929) considered the majority of Antarctic species of *Iophon* to be synonyms so it is not clear if his specimens include this species.

TABLE 2. *Iophon* species from the southern Atlantic and Antarctic

Species	Choanosomal megascleres μm	Echinating acanthostyles μm	Ectosomal spicules μm (tylotes unless specified)	Chelae	Bipocelles	External appearance/Notes/Distribution
<i>Iophon pictoni</i> Goodwin, Jones, Neely and Brickle, 2011.	Acanthostyles 132–150	n/a	135–150	17	n/a	Type locality Falkland Islands. Bright yellow thick crust.
<i>Iophon proximum</i> (Ridley, 1881)	Acanthostyles 106–272	83–157	109–252	10–35	6–16 (rare)	Encrusting (on <i>Zygochlamys patagonica</i>), irregular and massive forms. Chile, Argentina and Falkland Islands.
<i>Iophon proximum reticulare</i> Hentschel, 1914	Acanthostyles 104–152	n/a	120–160, ends spined	18–24	none	Type from Kerguelen, Antarctica.
<i>Iophon gaussi</i> Hentschel, 1914	Oxeote, smooth 465–560 480–620	n/a	288–360 225–290, ends spined	16 9–19	11 10–13 c-shaped, spined shafts.	Antarctic. Originally <i>I. spatulatus</i> var. <i>gaussi</i> . Measurements in bold Hentschel (1914), normal font from Rios (2006) measurements from other Antarctic specimens.
<i>Iophon terranova</i> Calcinaï and Pansini, 2000	Oxeote, smooth 200–580, also juvenile thin styles 375–540 single spine on head.	n/a	265–275	51–64	9–15	Massive/sub cylindrical. Antarctic, type locality Terra Nova Bay and Faraglione, Ross Sea.
<i>Iophon tubiforme</i> Desqueyroux–Faundez and van Soest, 1996	Oxeote, smooth 150–272	n/a	141–243, ends spined	8–19	6–19 (rare)	Chile. Sponge in form of several joined tubes.
<i>Iophon aceratum</i> Hentschel, 1914	Oxeote, smooth 592–640	n/a	320–408, ends spined	20–24	12–13	Type massive, 2.5 cm long. Type locality Gauss station, Antarctic.
<i>Iophon flabellodigitatum</i> Kirkpatrick, 1907	Oxeote, smooth with mucron on head 590 by 25	n/a	344 by 12.5, ends spined	35 17.5	5.5–11	Large digitate growth in one plane with oscules along edge. Type locality Winter Quarters, Antarctic.
<i>Iophon flabellodigitatum</i> var. <i>gaussi</i> Hentschel, 1914	Style 344–376	n/a	208–272	17–20	15–16	Massive 6 cm long. Type Kerguelen, Antarctic. Hentschel doesn't mention if styles are oxeote/mucronate and terms them 'styles' (he uses 'Amphiox' for oxeote spicules).
<i>Iophon unicorn</i> Topsent, 1907	Oxeote styles with mucronate ends/short pointed oxeas 435–470 370–575	n/a	240 270–390 unequal tomotes, style like with spined ends.	18–20 22.5–25	none 13–20 abundant	Massive yellow attached to algae. Antarctic, Falkland Islands (Burton 1934). Bold Topsent's original sizes. Normal from Rios (2006) schizotype measurements. Topsent described no bipocelles in type but Rios (2006) found them to be present. Rios (2006) considers this a synonym of <i>Iophon flabello-digitatus</i> Kirkpatrick, 1907, revising (Rios et al. 2004).

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TABLE 2. (Continued)

Species	Choanosomal megascleres μm	Echinating acanthostyles μm	Ectosomal spicules μm (tylotes unless specified)	Chelae	Bipocelles	External appearance/Notes/Distribution
<i>Iophon spatulatum</i> Kirkpatrick, 1907	Oxete 462 by 25	n/a	225 by 12.5, 18.7 spined ends	12.5, 18.7	13.6, rare	Slender, cylindrical, branched. Currently regarded as a synonym of <i>I. unicolore</i> (Koltun 1964; Desqueyroux-Faundez and van Soest 1996).
<i>Iophon unicolore</i> Topsent, 1907 Mc7636	Oxete 314–394 by 12–21	by	204–246 by 8–13	17–20	13–18 elongate	Type is massive specimen (7x4cm) attached to algae. Type locality Île Anvers, 25m. Widely distributed in Antarctic, our specimens are thick yellow encrustations.
<i>Iophon chilense</i> Desqueyroux-Faúndez and van Soest, 1996	Styles—microspined shaft but some only spined at base. 257–308	n/a	207–259, ends	spined 18–29, 10–16	10–16	Occurs on calcareous polychaete tubes and shells. Chile.
<i>Iophon hesperidesi</i> Rios, Cristobo and Urgorri ,2004	Styles—smooth shaft, n/a sparse spines at base 345–410	n/a	207–285, ends	spined 19–35	9–11	Type locality Livingstone Island, Antarctic. Encrusting on seaweed. Antarctic. Rare acanthostyles but shaped like tylotes and could be modified versions. Bipocelles spoon shaped with one end with numerous teeth and one with 10–12 spines.
<i>Iophon timidum</i> Desqueyroux-Faúndez and van Soest, 1996	Styles—smooth shaft, n/a sparse spines at base 186–259	n/a	150–250	10–16 5–10	n/a	Massive spherical to oval sponge. Chile. Small chelae incurved contracted ‘as in fear’
<i>Iophon abnormalis</i> (Ridley and Dendy, 1887)	Styles, almost smooth 390–500		235–300	30–49 7.5–15	5–10	Massive cylindrical. Sizes taken from Rios (2006). Antarctic.
<i>Iophon pluricorne</i> Topsent, 1907	Styles, almost smooth 400	n/a	280 tylotes, spined at ends but some spined all length.	26–30, 14	11	Thinly encrusting. Type locality Île Booth-Wandel, Antarctic.
<i>Iophon radiatum</i> Topsent, 1901	Styles, almost smooth 460–580	n/a	280–390, spined ends.	14–17, 53–70 Largest in rosettes.	6–16	Type is small fragment attached onto a branching coral, other piece is a small crust. Type locality Antarctic, also recorded Chile, Falkland Islands (Burton 1934) and South Georgia (Burton 1940).
<i>Iophon pluricorne</i> var. <i>trulliferum</i> Hentschel ,1914	Styles, almost smooth spined base 368–456	n/a	248–328, spined ends	14–29	6.5–7	Type locality Gauss station, Antarctic
<i>Iophon husvikensis</i> sp. nov. (Mc7673)	Styles, smooth 320–370 by 10–20	n/a	195–238 by 8–15, spined ends	12–20	8–13	Yellow encrusting species. Type locality South Georgia.

Family MICROCIONIDAE Carter, 1875
 Sub-Family MICROCIONINAE Carter, 1875
 Genus *Clathria* Schmidt, 1862
 Subgenus *Clathria* Schmidt, 1862

Clathria (Clathria) stromnessa sp. nov.

(Figure 6)

Type material: Holotype: BELUM Mc7690. Sample in 95% ethanol, tissue section and spicule preparation on slides; Green Island, Stromness, Site 2, South Georgia (54°09.381'S, 36° 39.852'W); depth 17.4m; collected by C. Goodwin, J. Brown, and S. Brown, 28th November 2010.

Paratype: BELUM Mc7674. Sample in 95% ethanol, tissue section and spicule preparation on slides, Green Island, Stromness, Site 1, South Georgia (54°09.448'S, 36° 39.752'W); depth 17.4m; collected by C. Goodwin, P. Brickle and S. Cartwright, 27th November 2010.

Etymology: Named after the type locality, Stromness, South Georgia

External morphology: In situ appearance: Lobed massive (type specimen maximum diameter 20cm) rust orange sponge with large oscules on top of lobes (Fig. 6a).

Preserved appearance: Grey, firm, with a slightly hispid surface.

Skeleton: The choanosomal skeleton is an irregular reticulation of bundles of 4–6 smooth styles (Fig. 6b), there is no differentiation between axial and extra-axial regions. The ectosome is formed of brushes of styles. Toxa and chelae microscleres are present throughout the tissue.

Spicules: Measurements from Mc7690.

Choanosomal styles: 424(495)563 by 17(26)31µm. Fat smooth styles, the majority are gently curved (Fig. 6c). **Ectosomal styles:** 232(292)414 by 3(6)7µm. Thin styles, the heads are microspined, bearing several short blunt spines (Fig. 6d, e).

Chelae: 10(12)14µm. Typical clathriid palmate isochelae (Fig. 6f).

Toxa: 45(150)477µm, thin smooth toxas, very wide ranging in size. Some of the smallest have a pronounced central flexion and upturned points (Fig. 6g).

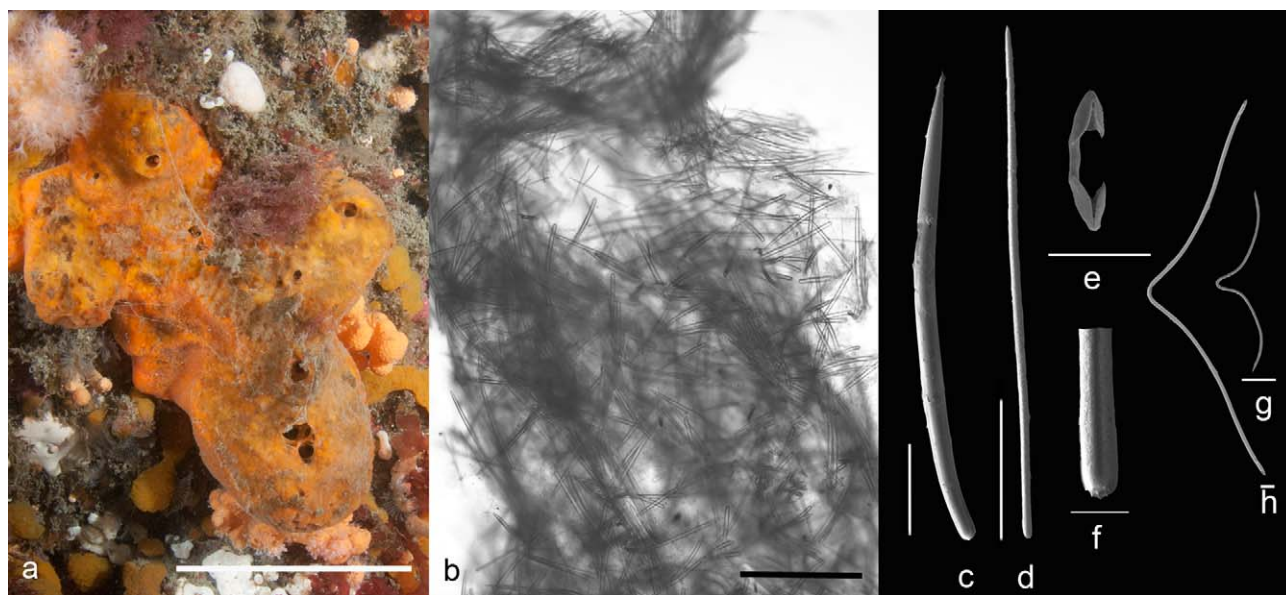


FIGURE 6. *Clathria (Clathria) stromnessa* sp. nov. a) *In situ* appearance specimen Mc7690 b) Skeleton Mc7690, ectosome to top, scale bar 500µm; Spicules Mc7690 c) style, scale bar 100µm, d) ectosomal style, scale bar 100µm, e) chelae, scale bar 10µm, f) ectosomal style head, scale bar 10µm, g, h) toxas, scale bar 10µm.

Remarks: We have assigned this species to *Clathria (Clathria)* rather than one of the other seven sub-genera on the basis of the lack of differentiation between the axial and extra-axial regions of the choanosome and the presence of a reticulate skeleton and only a single category of auxillary style (Hooper 2002). This species is

unusual in not possessing any echinating acanthostyles, however these can be secondarily lost in this subgenus (Hooper 2002). The subgenus *Clathria* (*Isociella*) lacks echinating acanthostyles but has a regular renieroid reticulate skeleton with plumose multispicular tracts connected by paucispicular ones (Hooper 2002), whereas the skeleton of our species is irregularly reticulate. From the South Atlantic and Antarctic *C. papillosa* Thiele, 1905 and *C. paucispicula* (Burton, 1932) are the only species in *Clathria* (*Clathria*), which do not possess any echinating spicules. However, the former has strongylote ectosomal spicules and bipocoelles and should probably be reassigned to *Iophon*, and the latter lacks any microscleres. The large size of the toxa is also unusual; *C. toxipraedita* Topsent, 1913 (type locality Burdwood Bank to the south of Falkland Islands and north west of South Georgia) has toxa up to 1750µm but possesses echinating acanthostyles.

Subgenus *Axosuberites* Topsent, 1893

Clathria (*Axosuberites*) *rosita* sp. nov.

(Figure 7)

Type material: **Holotype:** BELUM Mc7611. Sample in 95% ethanol, tissue section and spicule preparation on slides; Rosita Harbour Site 2, South Georgia (54°00.649'S, 37° 25.618'W); depth 11.5m; collected by C. Goodwin, J. Brown, and S. Brown, 20th November 2010.

Paratypes: Samples in 95% ethanol, tissue section and spicule preparation on slides. BELUM Mc7619. Right Whale Bay, South Georgia (54°00.173'S, 37° 40.856'W); depth 18m; collected by C. Goodwin, J. Brown and S. Brown, 21st November 2010. BELUM Mc7664. Husvik, South Georgia (54°10.285'S, 36° 40.412'W); depth 18m; collected by C. Goodwin, D. Poncet and P. Brewin, 26th November 2010. BELUM Mc7679 and BELUM Mc7683 Green Island, Stromness, Site 1, South Georgia (54°09.448'S, 36° 39.752'W); depth 17.4m; collected by C. Goodwin, P. Brickle and S. Cartwright, 27th November 2010. BELUM Mc7688. Green Island, Stromness, Site 2, South Georgia (54°09.381'S, 36° 39.852'W); depth 17.4m; collected by C. Goodwin, J. Brown, and S. Brown, 28th November 2010.

Etymology: Named for the type locality Rosita Harbour, South Georgia

External morphology: *In situ appearance:* Massive yellow to pale orange cushion shaped or thickly encrusting sponge with small lobes over its surface which may develop into short branches in some specimens. Occasional large oscules visible (Fig. 7a).

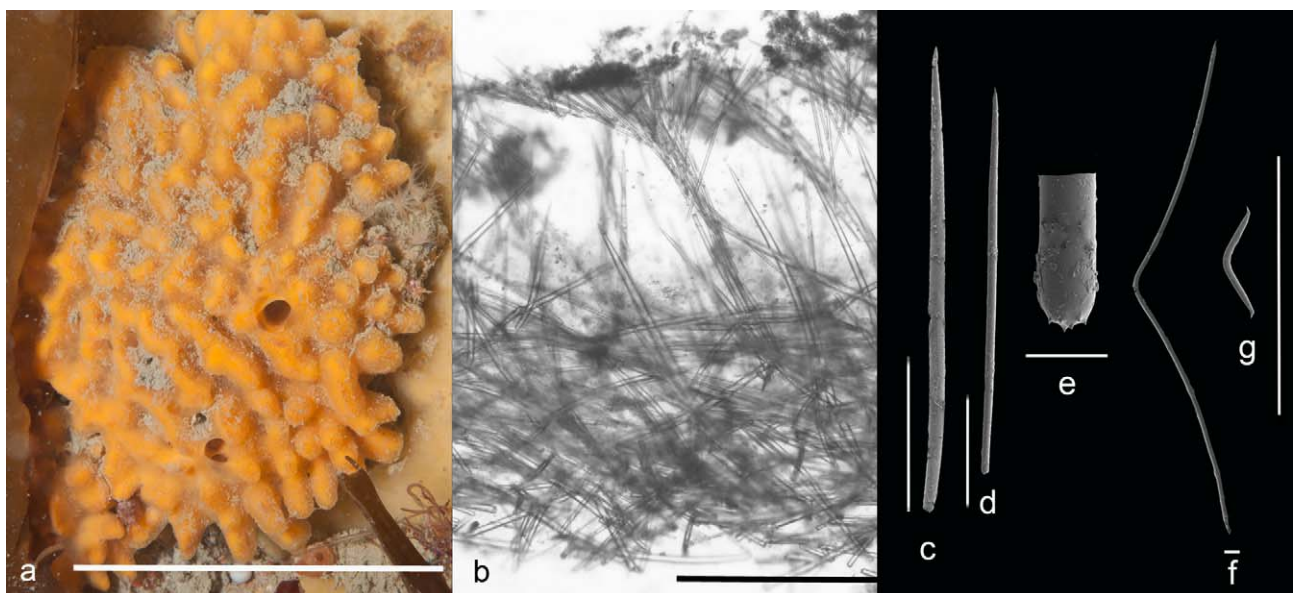


FIGURE 7. *Clathria* (*Axosuberites*) *rosita* sp. nov. a) *In situ* appearance specimen Mc7611, scale bar 10cm; b) skeleton Mc7611, ectosome to top, scale bar 500µm; c) choanosomal/sub-ectosomal style, scale bar 100µm, d) ectosomal style, scale bar 100µm, e) spined end of ectosomal style, scale bar 10µm, f) large toxa, scale bar 10µm, g) small toxa, scale bar 10µm.

TABLE 3. *Clathria* (*Axosuberites*) species from the Antarctic and South Atlantic.

Species	Choanosomal styles μm	Ectosomal styles μm	Toxa μm	Chelae μm	External appearance /Notes/Distribution
<i>C. georgiaensis</i> Hooper, 1996	360–510	230–320	30–540	9–15	Subspherical massive sponge. New name for <i>O. thielei</i> Burton, 1932. Recorded from South Georgia.
<i>C. flabellata</i> (Topsent, 1916)	540–1000 by 22	250–650 by 6–13	10–280	n/a	Stipitate, thin, flabelliform sponge. Type locality Antarctic, also Ross Sea (Burton 1929), Wilkes Land, Oates coast, Victoria Land, Graham Coast, MacRobertson Coast (Koltun 1964), South Georgia (Burton 1932) South Shetland Islands (Rios 2004)
<i>C. marplatensis</i> (Cuartas, 1992)	270–590 by 10–18	400–600 by 2–5	560–1000 235–400 1100–1400	20–22	Erect with ramifying branches. Three types of toxa. Type locality Argentina (Cuartas 1992).
<i>C. nidificata</i> (Kirkpatrick, 1907)	1000 by 50 400–1200 by 15–60	406 by 9 300–535 by 9–10	638 by 6 Up to 638	n/a	Massive inverted pyramid shape. Koltun (1964) reports it is often stalked at base. Bold measurements from type description, remainder Koltun (1964). South Georgia, Antarctic shores (McMurdo Sound (Burton 1929), Banzare Coast, Wilkes Land, Victoria Land, South Shetland Islands, MacRobertson Coast (Koltun 1964)
<i>C. ramea</i> (Koltun, 1964)	700–1500 by 21–42	550–870 by 8–10	190–350	n/a	Digitiform, slightly branching. Type locality MacRobertson coast, Antarctic
<i>C. macrotoxa</i> (Bergquist & Fromont, 1988)	370–720 by 15–28	320–510 by 4–5	230–530 by 2–4.5 42–53	20–24	Massive sponge with large oscules. Type locality New Zealand
<i>C. multitoxaformis</i> (Bergquist & Fromont, 1988)	280–500	200–390	150–230 135–230 35–48	18–25	Erect branching sponge. Type locality New Zealand
<i>C. parva</i> Lévi, 1963	175–300 by 20–23	400–850 by 23–27	100	8	Thin ramifying branches. Has rare acanthostyles. Type locality South Africa.
<i>C. rosita</i> sp. nov. Mc7679	503–805 by 19–37	208–395 by 5–11	33–328 7–16	n/a	Massive crust with ridged surface. Type locality South Georgia.

Preserved appearance: Grey, firm with hispid surface composed of numerous small, finger-like, ridges.

Skeleton: The choanosomal skeleton is a confused mesh-like reticulation of bundles of 2–4 choanosomal styles, which fan out and become plumose in the ectosome. Well differentiated axial skeleton with a larger category of sub-ectosomal styles, of the same form as those in the choanosome, joining the plumose end of the choanosomal skeleton and protruding through the surface. The ectosomal skeleton consists of brushes of small styles, microspined on the head, each of which is supported by the tip of a protruding sub-ectosomal style of the choanosomal skeleton (Fig. 7b).

Spicules: Measurements from Mc7611.

Choanosomal Styles: 272(311)385 by 11(15)19µm smooth styles, often slightly curved (Fig. 7c).

Sub-ectosomal styles: 357(597)1012 by 15(20)31µm of the same form as the choanosomal styles but the majority are larger in size (Fig. 7c).

Ectosomal styles: 197(243)334 by 4.9(6.9)9.6µm. Microspined on the head (Fig. 7d,e).

Toxa: 51(149)327µm (Fig. 7f), Small toxa: 15(22)34µm, fat oxborn shaped toxa (Fig. 7g).

Remarks: These specimens have been assigned to *Clathria* (*Axosuberites*) on the basis of their distinctive plumose extra axial skeleton which is well differentiated from the reticulate axial choanosomal skeleton (Hooper 2002). Several *Clathria* (*Axosuberites*) species have been reported from Antarctica and the Southern Ocean (Table 3). Three of these have been recorded from South Georgia. The majority of species can be easily distinguished from our specimens as they possess chelae (Table 3). The three species from the area without chelae, *C. flabellata* (Topsent, 1916) and *C. nidificata* (Kirkpatrick, 1907), and *C. ramea* (Koltun, 1964), can be distinguished by their external form (fan shaped, pyramid shaped and ramifying respectively rather than encrusting) and the much larger size of their ectosomal and choanosomal styles (Table 3). This new species also possesses a second category of small toxa (7–16µm) in addition to the larger category of toxa found all species. However, a wide size range of toxa is also reported from *C. georgiaensis* Hooper, 1996 and *C. flabellata* (Topsent, 1916) and although not mentioned in the descriptions these could represent a separate category.

Subgenus *Microciona* Bowerbank, 1862

Clathria (*Microciona*) *matthewsi* sp. nov.

(Figure 8)

Type material: Holotype: BELUM Mc7606. Sample in 95% ethanol, tissue section and spicule preparation on slides; Rosita Harbour Site 2, South Georgia (54°00.649'S, 37° 25.618'W); depth 11.5m; collected by C. Goodwin, J. Brown, and S. Brown, 20th November 2010.

Paratypes: Samples in 95% ethanol, tissue section and spicule preparation on slides. BELUM Mc7625. Right Whale Bay, South Georgia (54°00.173'S, 37° 40.856'W); depth 18m; collected by C. Goodwin, J. Brown and S. Brown, 21st November 2010. BELUM Mc7631 and BELUM Mc7632. Bird Sound Site 1, South Georgia (54°02.058'S, 38° 00.242'W); depth 18m; collected by C. Goodwin, S. Cartwright and P. Brickle, 22nd November 2010. BELUM Mc7667. Husvik, South Georgia (54°10.285'S, 36° 40.412'W); depth 18m; collected by C. Goodwin, D. Poncet and P. Brewin, 26th November 2010. BELUM Mc7678. Green Island, Stromness, Site 1, South Georgia (54°09.448'S, 36° 39.752'W); depth 17.4m; collected by C. Goodwin, P. Brickle and S. Cartwright, 27th November 2010.

Etymology: Named for marine mammal biologist Dr Leonard Harrison Matthews who worked on South Georgia during the Discovery Antarctic Investigations.

External morphology: In situ appearance: Lemon to custard yellow thinly encrusting (<3mm thick) sponge forming small patches, up to 15cm maximum diameter, on bedrock. The surface of the sponge is smooth without obvious exhalant canals or oscules (Fig. 8a).

Preserved appearance: Thin cream crust with a smooth surface.

Skeleton: The choanosome is plumose with ascending choanosomal columns of primary acanthostyles very strongly echinated by secondary acanthostyles. Columns placed closely so that the ends of the echinating acanthostyles intermesh. The ectosomal skeleton consists of brushes of a separate category of ectosomal styles (Fig. 8b).

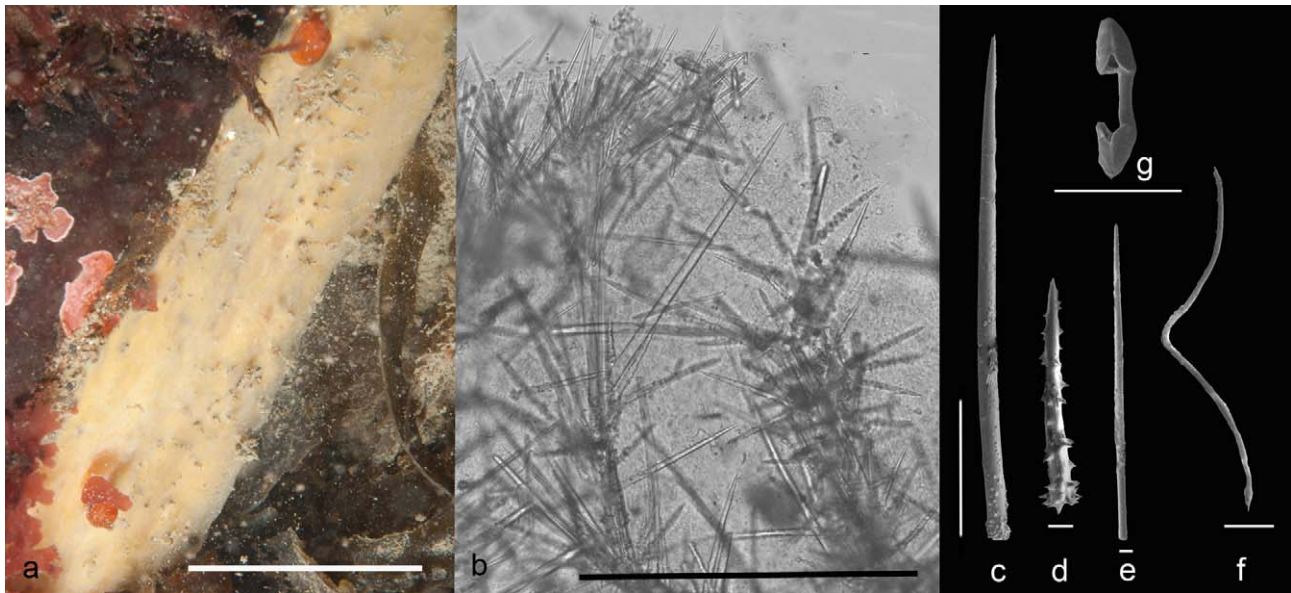


FIGURE 8. *Clathria (Microciona) matthewsi* sp. nov. a) *In situ* appearance specimen Mc7606, scale bar 5cm; b) Skeleton Mc7606, ectosome to top, scale bar 500µm; c) Primary acanthostyle, scale bar 100µm, d) Secondary acanthostyle, scale bar 10µm, e) ectosomal style, scale bar 10µm, f) toxa, scale bar 10µm, g) chelae, scale bar 10µm.

Spicules: Measurements from Mc7606.

Primary acanthostyles: 244(354)432 by 15.8(18.3)24.5µm. Head not tylote. Spined only basally, to about 1/8 up shaft from the head, with small spines (Fig. 8c).

Secondary acanthostyles: 85(108)196 by 9.3(13.8)20.8µm. Entirely spined with large conical spines along their entire length, head not tylote (Fig. 8d).

Ectosomal styles: 168(217)254 by 7.6(9.2)11.5µm. Microspined on head (Fig. 8e).

Toxa: 59(86)121µm with spined ends (Fig. 8f).

Chelae: 9(10)11µm very abundant (Fig. 8g).

Remarks: We have assigned these specimens to the subgenus *Clathria (Microciona)* on the basis of their encrusting growth form and plumose skeletal architecture (Hooper 2002). There are four species of *Clathria (Microciona)* which have been recorded from the Antarctic and South Atlantic: *C. antarctica* (Topsent, 1917), *C. basispinosa* (Burton, 1934), *C. tuberculata* (Burton, 1934), and *C. sigmoidea* (Cuartas, 1992). However, none of these possess chelae and therefore can be readily distinguished from our specimens.

Sub-order MYXILLINA Hajdu, van Soest and Hooper, 1994

Family COELOSPHAERIDAE Dendy, 1922

Genus *Lissodendoryx* Topsent, 1892

Subgenus *Ectyodoryx* Lundbeck, 1909

Lissodendoryx (Ectyodoryx) collinsi sp. nov.

(Figure 9)

Type material: Holotype: BELUM Mc7676. Sample in 95% ethanol, tissue section and spicule preparation on slides; Green Island, Stromness, Site 1, South Georgia (54°09.448'S, 36° 39.752'W); depth 17.4m; collected by C. Goodwin, P. Brickle and S. Cartwright, 27th November 2010.

Paratype: BELUM Mc7681. Sample in 95% ethanol, tissue section and spicule preparation on slides; Green Island, Stromness, Site 1, South Georgia (54°09.448'S, 36° 39.752'W); depth 17.4m; collected by C. Goodwin, P. Brickle and S. Cartwright, 27th November 2010.

Etymology: Named after Dr Martin Collins, current South Georgia Chief Executive Officer and Director of Fisheries, and member of the Shallow Marine Surveys Group, who generously provided accommodation to researchers pre- and post survey.

External morphology: *In situ* appearance: Massively encrusting peach sponge with irregular lobed surface. Texture of sponge surface smooth (Fig. 9a).

Preserved appearance: White sponge, firm but compressible. Smooth ectosomal layer.

Skeleton: The choanosomal skeleton is formed of a loose, confused, reticulation of columns of styles echinated by acanthostyles. Ascending columns up to 15 spicules thick joined by bundles of 1–3 spicules. Columns anastomose frequently. The ectosomal skeleton consists of brushes of tornotes (Fig. 9b).

Spicules: Measurements from Mc7676.

Choanosomal styles: 301(342)396 by 9.1 (12.3) 15.2 μ m. Smooth styles which come to an abrupt point (Fig. 9c).

Echinating acanthostyles: 95(121)178 by 3.8(7.3)13.9 μ m. Parallel sided then coming to an abrupt point. Entirely spined with small, neat conical spines (Fig. 9d).

Ectosomal tornotes: 216(256)295 by 5.4 (7.8)10.9 μ m (Fig. 9e, f).

Microscleres: absent.

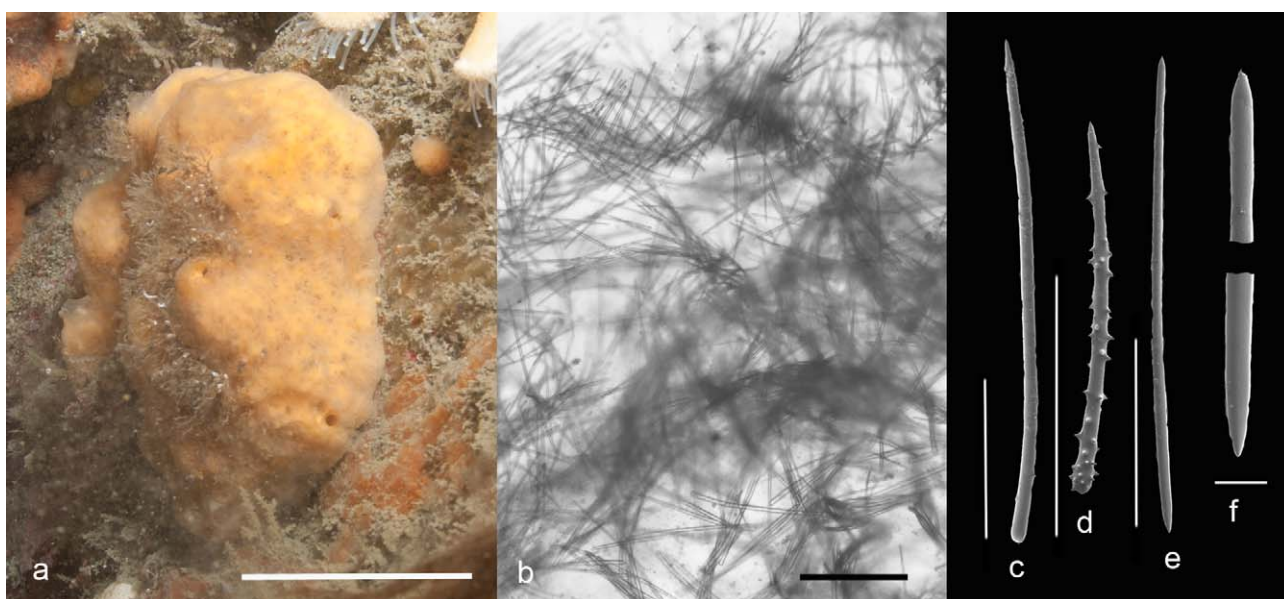


FIGURE 9. *Lissodendoryx (Ectyodoryx) collinsi* sp. nov. a) *In situ* appearance specimen Mc7676, scale bar 5cm; b) Skeleton Mc7676, ectosome to top, scale bar 500 μ m; Spicules Mc7676 c) choanosomal style, scale bar 100 μ m, d) echinating acanthostyle, scale bar 100 μ m, e) tornote, scale bar 100 μ m, f) tornote ends, scale bar 10 μ m.

Remarks: These specimens have been assigned to the genus *Lissodendoryx* on the basis of the presence of a choanosomal skeleton of styles and acanthostyles and the presence of ectosomal tornotes. The presence of echinating acanthostyles in the skeletal tracts assigns this to the subgenus *Lissodendoryx (Ectyodoryx)* (van Soest 2002a). All other Antarctic or South Atlantic species have chelae or sigma microscleres (Table 4).

Family HYMEDESMIIDAE Topsent, 1928

Genus HYMEDESMIA Bowerbank, 1864

Subgenus *Hymedesmia* Bowerbank, 1864

Hymedesmia (Hymedesmia) barnesi sp. nov.

(Figure 10)

Type material: Holotype: BELUM Mc7627. Sample in 95% ethanol, tissue section and spicule preparation on slides; Right Whale Bay, South Georgia (54°00.173'S, 37° 40.856'W); depth 18m; collected by C. Goodwin, J. Brown and S. Brown, 21st November 2010.

Paratype: BELUM Mc7677. Sample in 95% ethanol, tissue section and spicule preparation on slides; Green Island, Stromness, Site 1, South Georgia (54°09.448'S, 36° 39.752'W); depth 17.4m; collected by C. Goodwin, P. Brickle and S. Cartwright, 27th November 2010.

TABLE 4. *Lissodendoryx* (*Ectyodoryx*) species from the Antarctic and southern Atlantic. Information from type descriptions and (indicated by ¹) Rios (2006).

Species	Large acanthostyles/ styles μm	Echinating acanthostyles/ μm	Ectosomal spicules μm	Chelae μm	Sigmas μm	External appearance /Distribution
<i>Lissodendoryx</i> (<i>Ectyodoryx</i>) <i>collinsi</i> sp. nov.	301–396	95–121	216–295	None	None	Massive lobed peach crust. South Georgia.
<i>Lissodendoryx</i> (<i>Ectyodoryx</i>) <i>anacantha</i> (Hentschel, 1914) ¹	350–640	195–290	235–305	20–25	37–51, 16–24	Massive with tubular ramifications. Antarctic.
<i>Lissodendoryx</i> (<i>Ectyodoryx</i>) <i>antarctica</i> (Hentschel, 1914) ¹	185–340	100–225	122–245	20–33, 15–20	102–245, 17–31	Massive tubular sponge. Antarctic.
<i>Lissodendoryx</i> (<i>Ectyodoryx</i>) <i>jasonensis</i> Goodwin <i>et al.</i> , 2011	262–312	107–135	150–192	22–32	None	Massive pale yellow lump with veined surface. Falkland Islands.
<i>Lissodendoryx</i> (<i>Ectyodoryx</i>) <i>minuta</i> (Calcinai and Pansini, 2000)	219–260	102–132	183–199	14–18, 20–30	20–56	Overgrowing serpulid tubes. Antarctic.
<i>Lissodendoryx</i> (<i>Ectyodoryx</i>) <i>nobilis</i> (Ridley and Dendy, 1886)	520	180	330	44 very abundant	90? rare. Foreign?	Massive, lobate or encrusting. Antarctic
<i>Lissodendoryx</i> (<i>Ectyodoryx</i>) <i>patagonica</i> (Ridley and Dendy, 1886)	420	175	300	40 strongly curved shaft	None	Massive lobe surface traversed by furrows. SW Patagonia.
<i>Lissodendoryx</i> (<i>Ectyodoryx</i>) <i>ramilobosa</i> (Topsent, 1916) ¹	350–670	185–273	210–610	17–30	50–72, 16–22	Massive with lobed branches. Antarctic, South Georgia (Burton 1934)

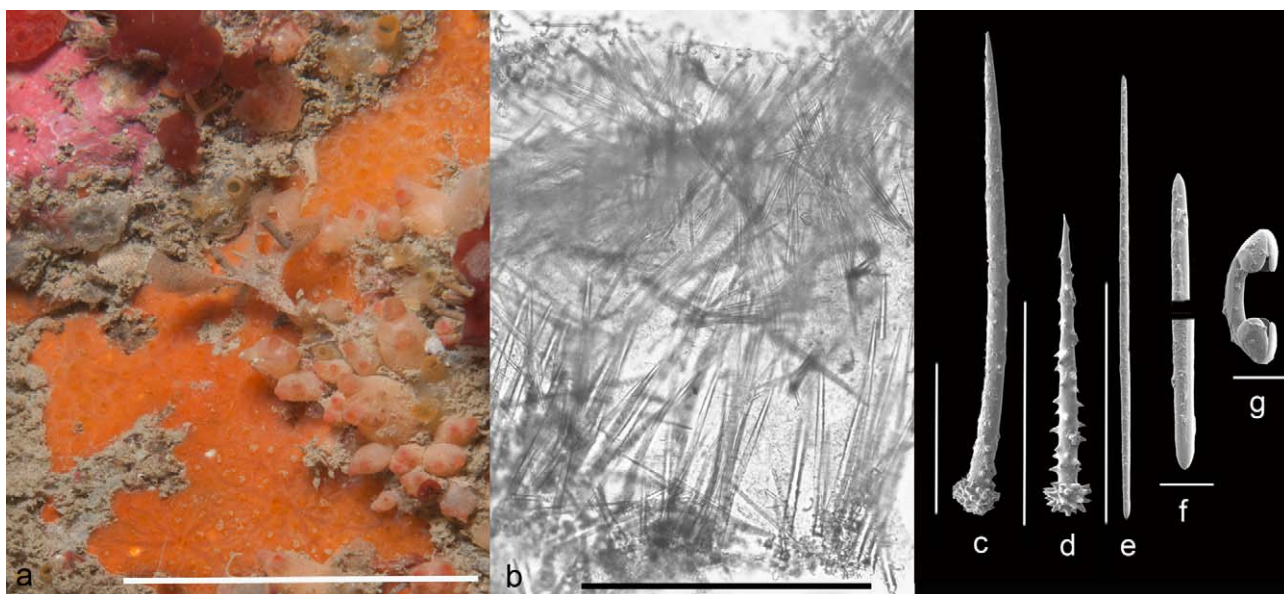


FIGURE 10. *Hymedesmia (Hymedesmia) barnesi* sp. nov. a) *In situ* appearance specimen Mc7627, scale bar 5cm; b) Skeleton Mc7627, ectosome to top, scale bar 500µm; Spicules Mc7627 c) primary acanthostyle, scale bar 100µm, d) echinating acanthostyle, scale bar 100µm, e) ectosomal spicule, scale bar 100µm, f) ectosomal spicule ends, scale bar 10µm, g) chelae, scale bar 100µm.

Etymology: Named after Dr David Barnes of British Antarctic Survey, project leader of the ‘Mapping the Benthic Biodiversity of South Georgia’ Darwin Initiative, in recognition of his support of this work.

External morphology: *In situ appearance:* Thinly encrusting (<3mm), bright orange, crust with pore sieves. Star shaped patterns of exhalant channels also visible (Fig. 10a). Encrusting on bedrock, patches up to 15cm in diameter.

Preserved appearance: Thin white crust.

Skeleton: Typical hymedesmoioid skeleton with a dense basal layer of primary and echinating acanthostyles with ascending columns of the ectosomal spicules 3–6 spicules thick. Thick ectosomal layer of chelae (Fig. 10b).

Spicules: Measurements from Mc7627.

Primary acanthostyles: 272(317)392 by 22(29)39µm at head. Tylote head bearing short rounded spines. Spined up to 1/3 of the shaft (Fig. 10c).

Echinating acanthostyles: 102(138)161 by 9.3(17.2)24.5µm at head. Entirely spined with conical pointed spines (Fig. 10d).

Ectosomal spicules: styles/tornotes 188(249)276 by 5.1(6.8)9.5µm. Fusiform with the ends variable in form: the majority are styles with one rounded, sometimes slightly tylote, and one pointed end but in some spicules the rounded end is modified into a point (Fig. 10e,f).

Chelae: 23.6(27.7)30.7µm (Fig. 10g).

Remarks: The majority of *Hymedesmia (Hymedesmia)* species occurring in the Antarctic have much bigger spicules or they possess sigma microscleres (Table 5). The size range of the spicules in this species is similar to *H. gaussiana* Hentschel, 1914. Unfortunately the type specimen of this species (ZMH collection) was destroyed in the Second World War and so is not available for examination. However, it differs in having strongyles as ectosomal spicules and entirely spined large acanthostyles.

Subgenus *Stylopus* Bowerbank, 1864

Hymedesmia (Stylopus) pharos sp. nov.
(Figure 11)

Type material: Holotype: BELUM Mc7626. Sample in 95% ethanol, tissue section and spicule preparation on slides; Right Whale Bay, South Georgia (54°00.173’S, 37° 40.856’W); depth 18m; collected by C. Goodwin, J. Brown and S. Brown, 21st November 2010.

TABLE 5. *Hymedesmia* (*Hymedesmia*) species from the Antarctic and southern Atlantic.

Species	Primary Acanthostyles μm	Echinating acanthostyles μm	Ectosomal spicules μm	Chelae	External appearance/Notes/Distribution
<i>H. anisostromgyloxeia</i> Bergquist and Fromont, 1988	190–315 by 6–8	95–125 by 5–7.5	Anisotornotes 235–320 by 3–6.5	24–33	Encrusting. Orange to orange–brown. New Zealand. Authors termed tornotes ‘anisostromgyloxeia’.
<i>H. antarctica</i> Boury–Esnault and Van Beveren, 1982.	320–525 smooth at tip	109–186, entirely spined	Tornotes 422–593	22–36	Type locality Antarctic. Boury–Esnault and Van Beveren (1982) raised Hentschel’s variety <i>H. simillima</i> var. <i>antarctica</i> to species status. Recorded South Georgia by Burton (1932).
<i>H. decepta</i> (Kirkpatrick, 1907)	468 by 23.5	None	Strongyles 238 by 4.6 with pointed mucro at one end.	19.5 15.3	Originally described as <i>Myxilla decepta</i> . Reddish–brown encrusting. Currently classified as <i>Hymedesmia</i> (van Soest <i>et al.</i> 2012) but may require revision. Larger chelae arcuate, smaller unguiferate, also possesses ‘chelate bipocoella’ 8 μm . Type locality Winter Quarters, Antarctica.
<i>H. simillima</i> var. <i>antarctica</i> Hentschel, 1914 (synonym of <i>H. antarctica</i>).	184–472, 1 category	None	Tornotes 400–488	30–38	From Hentschel (1914)
<i>H. gaussiana</i> Hentschel, 1914	256–312 entirely spined.	132–152	Strongyles 344–392	30–37	Type locality Antarctic.
<i>H. laevis</i> Thiele, 1905	240	120	Strongyles 160	30	Also has sigmas 25 μm . Type locality Calbuco, Chile. Recorded Falkland Islands Burton (1932) but specimen has mucronate rather than strongylote tornotes so unlikely to be same species.
<i>H. leptochela</i> Hentschel, 1914	312–512 spined on basal 1/2 only	128–192 entirely spined	Polytyle strongly- es 312–364	26–30	Type locality Antarctic.
<i>H. lundbecki</i> Dendy, 1924	250–470 by 12 tylote head. Spined head only.	None.	Polytyle strongyles. 600 by 12.	60 strongly curved.	New Zealand. Encrusting on bryozoan.
<i>H. mariondufresni</i> Boury–Esnault & Van Beveren, 1982	243–512, smooth at tip	121–211, entirely spined	Tornotes 205–397	23–36	Differs from <i>H. antarctica</i> in that tornotes shorter than acanthostyles (Boury–Esnault and Van Beveren 1982).
<i>H. microstrongyla</i> Bergquist and Fromont, 1988	118–260 by 5–11	53–113 by 5.4–7	Strongyloxeia 103–145 by 3–5	18–30	Auckland, New Zealand. Orange–brown, thin.
<i>H. tenuissima</i> Thiele, 1905	260	100	Oxeas 200	30	Also has sigmas 45 μm . Type locality Calbuco, Chile.
<i>H. unguifera</i> Burton, 1929	540 spined base only	162 entirely spined, tylote head	Tylotes 235	24 12	Type locality McMurdo Sound, Antarctic. Thin encrustation on algae. Smaller chelae are unguiferate.
<i>H. barnesi</i> sp. nov.	272–392 spined base only	102–161, entirely spined	Styles/tornotes 188–276	24–30	Bright orange encrusting species with prominent pore sieves. Type locality South Georgia.

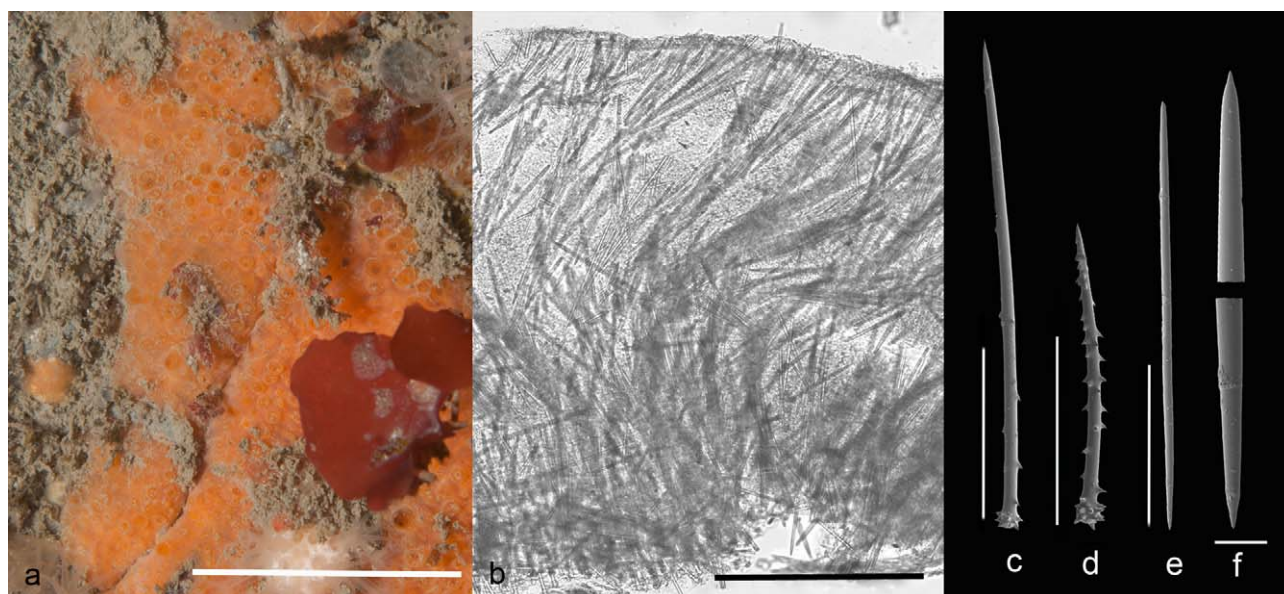


FIGURE 11. *Hymedesmia (Stylopus) pharos* sp. nov. a) *In situ* appearance specimen Mc7626, scale bar 5cm; b) Skeleton Mc7626, ectosome to top, scale bar 1000µm; Spicules Mc7626 c) primary acanthostyle, scale bar 100µm, d) echinating acanthostyle, scale bar 100µm, e) ectosomal spicule, scale bar 100µm, f) ectosomal spicule ends, scale bar 10µm.

Paratypes: Samples in 95% ethanol, tissue section and spicule preparation on slides. BELUM Mc7668 and BELUM Mc7669. Husvik, South Georgia (54°10.285'S, 36° 40.412'W); depth 18m; collected by C. Goodwin, D. Poncet and P. Brewin, 26th November 2010. BELUM Mc7680. Green Island, Stromness, Site 1, South Georgia (54°09.448'S, 36° 39.752'W); depth 17.4m; collected by C. Goodwin, P. Brickle and S. Cartwright, 27th November 2010.

Comparative material examined: *Hymedesmia longuiroides* Burton Spicule preparation slide BMNH 28.11.15468a.

Etymology: Named for the expedition vessel the M.V. *Pharos* S.G. and her crew (as a noun in apposition).

External morphology: *In situ appearance:* Bright orange thinly encrusting (<3mm) sponge with densely packed pore sieves. Encrusting on bedrock, patches up to 20cm in diameter (Fig. 11a).

Preserved appearance: Thin white crust.

Skeleton: Basal layer of acanthostyles with ascending columns of 2–6 ectosomal oxeas (Fig. 11b).

Spicules: Measurements from Mc7626.

Primary acanthostyles: 252(283)314 by 8.8(12.5)17.1µm. Head very slightly tylote. Entirely but sparsely spined, spines smaller than those on the echinating acanthostyles (Fig. 11c).

Echinating acanthostyles: 136(150)168 by 8.0(11.5)14.9µm. Head not tylote. Entirely spined, spines on shaft have tips curved down towards head (Fig. 11d).

Ectosomal tornotes: 205(240)282 by 4.6(6.6)8.4µm Fusiform, oxea like, tornotes with abrupt points (Fig. 11e, f).

Remarks: The majority of Southern Ocean and Antarctic *Hymedesmia (Stylopus)* species have strongyles or tylo-strongyles as ectosomal spicules (Table 6). *Hymedesmia (Stylopus) longuiroides* Burton, 1932 has similar sized spicules and tornotes as ectosomal spicules and was described from Shag Rocks between South Georgia and the Falkland Islands. This possesses acanthostyles of a similar length but in contrast to our species the larger acanthostyles are almost entirely spined with just a small gap at the tip, and spines on both categories of acanthostyles are smaller and denser. This species is very similar in appearance to *Hymedesmia (Hymedesmia) barnesi* sp. nov.; however it lacks visible surface channels and on microscopic examination can be readily distinguished from *H. barnesi* by its lack of chelae.

TABLE 6. *Hymedesmia (Stylopus)* species from the Antarctic and South Atlantic.

Species	Primary Acanthostyles µm	Echinating acanthostyles µm	Ectosomal spicules µm	External appearance/Notes/Distribution
<i>H. (Stylopus) dermatata</i> var. <i>antarctica</i> Hentschel, 1914	352–480	128–144	Strongyles 296–328	Type locality Antarctic.
<i>H. (Stylopus) longurius</i> var. <i>antarctica</i> Hentschel, 1914—accepted as <i>H. (Stylopus) antarctica</i>	160–400	None	Strongyles 336–432	Type locality Antarctic.
<i>H. (Stylopus) fristedti</i> (Topsent, 1916)	210–700 biggest spined only on basal 1/2	None	Tylo–strongyles 280–350	Type locality Antarctic.
<i>H. (Stylopus) longurioides</i> Burton, 1932	350 almost entirely spined	105	Tomotes 320	Type locality Shag Rocks. Listed on World Porifera Database as <i>Phorbas</i> .
<i>H. (Stylopus) australis</i> Bergquist & Fromont, 1988	215–330 by 3.5–9 spined at head.	90–140 by 3.5–7.5	Strongyles 250–360 by 2.5–5	Type locality New Zealand. Orange with large pore fields in life but turns purple in alcohol.
<i>H. (Stylopus) lissostyla</i> (Bergquist & Fromont, 1988)	220–360 by 4.5–10 spined base only.	100–145 by 3.5–9	Styles 190–250 by 3–4	Type locality Leigh, New Zealand. Orange–red thinly encrusting, often on algae.
<i>H. (Stylopus) pharos</i> sp. nov.	252–314, all spined but sparse at tip	136–168	Tomotes 205–282	Type locality South Georgia. Bright orange thinly encrusting sponge with densely packed pore sieves.

Genus *Phorbas* Duchassaing and Michelotti, 1864*Phorbas glaberrimus* (Topsent, 1917)

(Figure 12)

Synonymy: *Clathrissa glaberrima* Topsent, 1917.*Anchinoe glaberrima* (Topsent, 1917).

Material: Samples in 95% ethanol, tissue section and spicule preparation on slides; BELUM Mc7651. Jagged Point, Possession Bay, South Georgia (54°04.514'S, 37° 07.188'W); depth 10.4m; collected by C. Goodwin, D. Poncet and P. Brewin, 23rd November 2010. BELUM Mc7671. Husvik, South Georgia (54°10.285'S, 36° 40.412'W); depth 18m; collected by C. Goodwin, D. Poncet and P. Brewin, 26th November 2010. BELUM Mc7675. Green Island, Stromness, Site 1, South Georgia (54°09.448'S, 36° 39.752'W); depth 17.4m; collected by C. Goodwin, P. Brickle and S. Cartwright, 27th November 2010. BELUM Mc7687 and BELUM Mc7689. Green Island, Stromness, Site 2, South Georgia (54°09.381'S, 36° 39.852'W); depth 17.4m; collected by C. Goodwin, J. Brown, and S. Brown, 28th November 2010.

Comparative material examined: NMHN DT734 *Phorbas glaberrimus* (Topsent, 1916) Holotype. From near Terre Alexandre. Spicule preparation and tissue section on slides.

External morphology: *In situ appearance:* Massively thickly encrusting sponge with the surface rising up into one or more mounds. Specimens very variable in size but can be quite large with diameters of greater than 30cm. Sponge encrusting on bedrock and are frequently overgrown by ascidians and bryozoans. Surface covered with large pore sieves (up to 1.5cm in diameter) and large, irregularly scattered, oscules, which can reach 2cm in diameter, are present. Sponge white to peach in colour but with a patchily dark chocolate brown surface layer present in some specimens, possibly formed of algae. The pore sieves often have a slightly lighter rim than the main sponge body. (Fig. 12a).

Preserved appearance: Firm but compressible grey sponge with pore sieves clearly visible on the tough ectosomal layer.

Skeleton: Choanosomal skeleton composed of a basal layer of acanthostyles from which thick ascending columns of up to 20 oxea ascend. Acanthostyles echinate the lower parts of these columns. In the ectosome the ends of the columns of oxea fan out to form a continuous surface layer. Chelae are very abundant and scattered throughout tissue (Fig. 12b).

Spicules: Measurements from Mc7689.

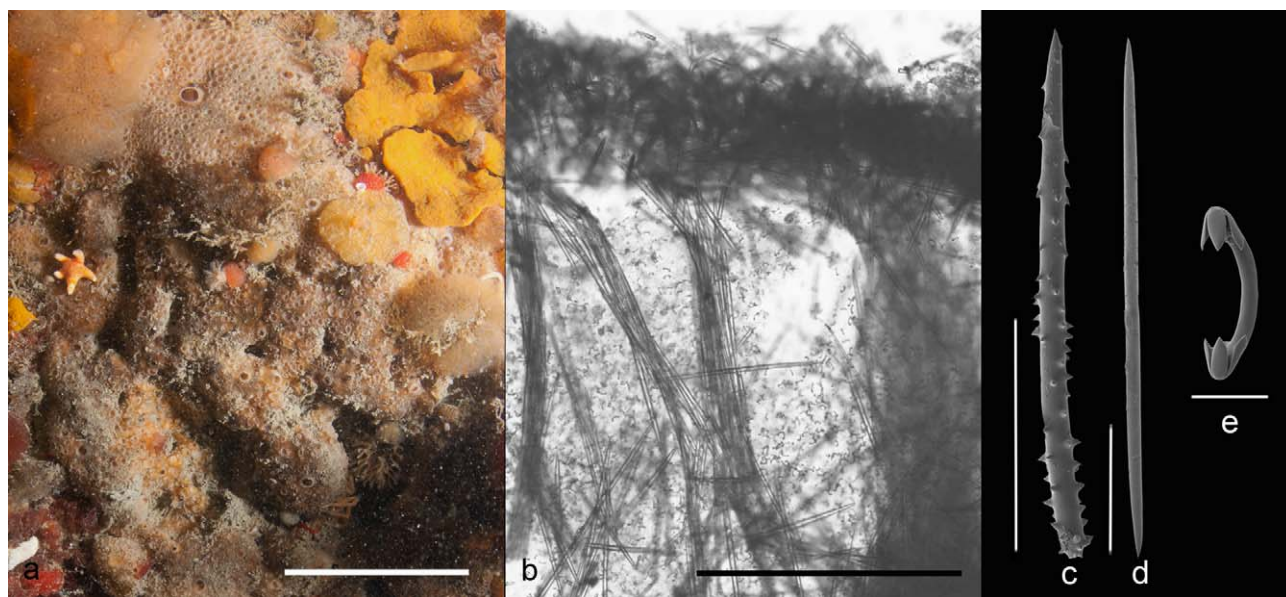


FIGURE 12. *Phorbas glaberrimus* (Topsent, 1917). a) *In situ* appearance specimen Mc7687, scale bar 10cm; b) Skeleton Mc7689, ectosome to top, scale bar 500µm; Spicules Mc7689 c) acanthostyle, scale bar 100µm, d) ectosomal oxea, scale bar 100µm, e) chelae, scale bar 10µm.

Acanthostyles: 216(264)313 by 9.5(14.1)19.7µm. Parallel sided with an abrupt point. Head not tylote. Strongly spined along whole length (Fig. 12c).

Ectosomal oxea: 365(428)476 by 9.9(13.0)17.9µm. Fusiform with abrupt points (Fig. 12d).

Chelae: 18.9(22.4)25.4µm (Fig. 12e).

Remarks: *Phorbas glaberrimus* (Topsent, 1917) was originally described from 297m in the Antarctic and appears to be a good match for these specimens, although Topsent reports slightly larger oxea (530–600 by 20–22µm). Rios (2006) reports smaller oxea of 420–590µm, more similar to the range in our specimens, and Koltun (1964) also gives a wider range (382–600µm). Rios (2006) reports two categories of acanthostyles (200–260 and 300–350µm), the acanthostyles of Mc7689 could be sub-divided into two length categories 216–233µm and 271–313µm but this division is not apparent in the other specimens and not obvious when viewed down the microscope.

Distribution: This species is widely distributed in the Antarctic: Alexander I land (Topsent 1917), Wilhelm II coast, Banzare coast, Wilkes Land, Victoria Land, Princess Astrid Coast (Koltun 1964), MacRobertson Coast (Koltun 1976), Weddell Sea (Barthel *et al.* 1990; Gutt and Koltun 1995), Ross Sea (Pansini *et al.* 1994), South Trinidad Island and Bransfield Strait (Rios 2006) from depths 90–1370m. Burton (1929) also erroneously reported it as a synonym of *Pyloderma latrunculioides* (Ridley and Dendy, 1886) from the Antarctic but it is not clear which of his specimens are this species. There are no previous published records from South Georgia.

Family MYXILLIDAE Topsent, 1928

Genus *Myxilla* Schmidt, 1862

Subgenus *Burtonanchora* de Laubenfels, 1936

Myxilla (*Burtonanchora*) *ponceti* sp. nov.

(Figure 13)

Type material: **Holotype:** BELUM Mc7572. Sample in 95% ethanol, tissue section and spicule preparation on slides; Floating Dock, Grytviken, South Georgia (54° 16.937'S, 36° 30.475'W); depth range: 0–6.6m; collected by C. Goodwin and S. Cartwright, 18th November 2010.

Paratypes: Samples in 95% ethanol, tissue section and spicule preparation on slides. BELUM Mc7573. Floating Dock, Grytviken, South Georgia (54° 16.937'S, 36° 30.475'W); depth range: 0–6.6m; collected by C. Goodwin and S. Cartwright, 18th November 2010. BELUM Mc7600. Prion Island Site 2, South Georgia (54°001.862'S, 37° 15.032'W); depth 18m; collected by C. Goodwin, D. Poncet, and P. Brewin, 19th November 2010. BELUM Mc7655. Prince Olav Harbour, South Georgia (54°03.579'S, 37° 08.203'W); depth 18m; collected by C. Goodwin, D. Poncet, and S. Brown, 23rd November 2010.

Etymology: Named for Dion Poncet, member of the expedition dive team, who alerted us to this 'probable sponge' under Grytviken jetty, and whose knowledge of South Georgia was invaluable to this survey.

External morphology: *In situ appearance:* Specimens are large (10–20cm maximum dimension), smooth surfaced, lobed sponges, carrot orange in colour, bearing large terminal oscules on the ends of the lobes. The two largest specimens are fan shaped and bear the oscules in a line along the edge of the fan. They are attached by the base of the specimen to the substrate; the attachment point is quite broad in some specimens but in the fan shaped specimens is smaller and might be considered a stalk (Fig. 13a).

Preserved appearance: Tissue firm but compressible. Ectosome is a dark brown, choanosome a paler brown.

Skeleton: Choanosomal skeleton consists of ascending fibres of 4–10 styles joined by smaller, shorter, fibres of 1–3 styles. There is an ectosomal palisade of tylotes. Chelae scattered throughout skeleton and not forming rosettes (Fig. 13b).

Spicules: Measurements from Mc7572.

Choanosomal subtylostyles: 281(325)369 by 12.2(14.3)18.7µm. Smooth styles, often slightly curved. Some have a faint swelling at the head (Fig. 13c).

Ectosomal tylotes: 197(276)324 by 6.9(10.3)14.5µm. Anisotylotes in which one or both ends are swollen. In some one end has a mucronate point (Fig. 13d).

Chelae: In two categories 31(40)49 and 57(66)72µm (Fig. 13e).

TABLE 7. *Myxilla* (*Burtonanchora*) species from the Antarctic and Southern Atlantic.

Species	Choanosomal styles μm	Ectosomal spicules μm	Chelae μm	Other Microscleres μm	External appearance/Notes/ Distribution
<i>Myxilla</i> (<i>Burtonanchora</i>) <i>basimucronata</i> Burton, 1932	Smooth styles 470 by 17 bearing basal mucron.	Tornotes 250 by 8. Ends with terminal mucron and numerous microspines.	2 sizes: 21, 42	2 categories of sigmata: 25, 42	Small sponge, sub-ramose with flattened branches or lobes. South Georgia 106–198m. Currently classified in <i>Myxilla</i> (<i>Myxilla</i>) (van Soest <i>et al.</i> 2012).
<i>Myxilla</i> (<i>Burtonanchora</i>) <i>asigmata</i> (Topsent, 1901)	715–775 by 20 Smooth	Tylotes 380 by 7–8.	60–70 (3 teeth)	None	Irregular mass with connulose surface 9x4x7mm. Type location Antarctic 450m. Distribution Antarctic and sub-Antarctic including South Georgia (Burton 1932). See Rios and Cristobo (2007).
<i>Myxilla</i> (<i>Burtonanchora</i>) <i>hastata</i> Ridley and Dendy, 1886	Smooth styles 770 by 40	Tornotes 350 by 10	25–40	70 sigmas	Flattened sheet largest piece 69 by 62 by 6mm. Wrinkled surface with pores in irregular groups. Rio del Plata, Argentina, 600 fathoms.
<i>Myxilla</i> (<i>Burtonanchora</i>) <i>lissostyla</i> Burton, 1938	Smooth styles 800 by 35	Strongyles with spined ends 350 by 10	11	None	Massive sponge with uneven, shaggy, surface. Chelae with thin, rounded shaft and pointed alae. Antarctic.
<i>Myxilla</i> (<i>Burtonanchora</i>) <i>magna</i> Topsent, 1916	500–570 by 27–29 Smooth, strongly curved	Tylotes 280–300 by 10 most with terminal spines	73–80 (3 teeth) 23–27	14–17 normally but up to 19–22; 4–7	Massive sponge, able to grow very large. Prominent network of veins on surface. Large oscules often on mounds. Listed as junior synonym of <i>Myxilla</i> (<i>Myxilla</i>) <i>mollis</i> Ridley and Dendy, 1886 in (van Soest <i>et al.</i> 2012).
<i>Myxilla</i> (<i>Burtonanchora</i>) <i>mollis</i> Ridley and Dendy, 1886	Smooth styles 700 by 20 μm	Tylotes with minutely spined oval heads 400 by 10.	50	Sigmas 63	Encrusting a worm-tube, 12mm thick. Very bad condition specimen—prevents detailed description. Type locality off mouth of Rio de la Plata, 600 fathoms. Is currently listed as <i>Myxilla</i> (<i>Myxilla</i>) in van Soest <i>et al.</i> (2012).
<i>Myxilla</i> (<i>Burtonanchora</i>) <i>pistillaris</i> Topsent, 1916	480–500 Smooth, curved	Curved or flexuose tylotes with spined ends 300 by 10	37–73	Raphides in trichodragmata 90	Simple column 20 by 3–14mm. Yellow-brown when living. Type locality Antarctica, collected by the 'Porquoi-pas?', precise locality not given.
<i>Myxilla</i> (<i>Burtonanchora</i>) <i>ponceti</i> sp. nov.	281(325)369 by 12.2(14.3)18.7	Tylotes 197(276)324 by 6.9(10.3)14.5	31(40)49 57(66)72	None	Large, carrot orange, lobed. South Georgia.

Remarks: *Myxilla* (*Burtonanchora*) is defined by possession of smooth rather than spined choanosomal styles. There are several species of Antarctic *Myxilla* (*Burtonanchora*) species (Table 7). However, all of these can be distinguished by having much larger choanosomal styles or the presence of sigmata. *Myxilla* (*Burtonanchora*) *pistillaris* Topsent, 1916 is most similar but has larger styles (480–500µm) and possesses raphides which are not present in this species.

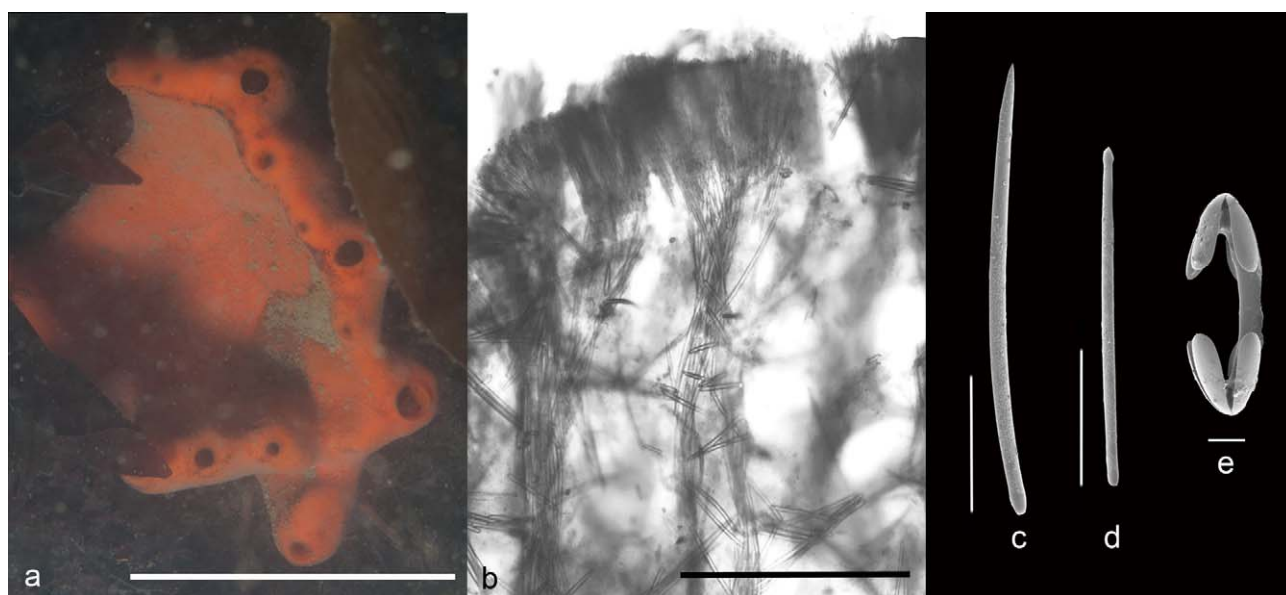


FIGURE 13. *Myxilla* (*Burtonanchora*) *ponceti* sp. nov. a) *In situ* appearance specimen Mc7573, scale bar 10cm; b) skeleton Mc7572, ectosome to top, scale bar 500µm; c) style, scale bar 100µm, d) ectosomal tylote, scale bar 100µm, e) chelae, scale bar 10µm.

Subgenus *Ectomyxilla* Hentschel, 1914

Myxilla (*Ectomyxilla*) *kerguelensis* (Hentschel, 1914)

(Figure 14)

Synonymy: *Ectomyxilla kerguelensis* Hentschel, 1914.

Myxilla kerguelensis (Hentschel, 1914).

Crellomyxilla intermedia Dendy, 1924.

Not *Myxilla tornotata* Brøndsted, 1924.

Material: Samples in 95% ethanol, tissue section and spicule preparation on slides; BELUM Mc7589, BELUM Mc7591, BELUM Mc7595 and BELUM Mc7596. Prion Island Site 2, South Georgia (54°001.862'S, 37°15.032'W); depth 18m; collected by C. Goodwin, D. Poncet, and P. Brewin, 19th November 2010. BELUM Mc7684. Green Island, Stromness, Site 1, South Georgia (54°09.448'S, 36°39.752'W); depth 17.4m; collected by C. Goodwin, P. Brickle and S. Cartwright, 27th November 2010.

Comparative material examined: ZMH S2325 *Ectomyxilla kerguelensis*, S2319 *Acanthoxa werthii*

External morphology: *In situ appearance:* Thickly encrusting orange sponge, some specimens very thick and mounded. Scattered large oscules up to 0.5cm in diameter. Surface with a honeycomb appearance due to patches of ostia (Fig. 14a).

Preserved appearance: Very firm, pale yellow, crust with some inclusions of grey sediment grains. Spaces visible in choanosome. Ectosome is glassily smooth but is not easily detachable.

Skeleton: Choanosome: Dense reticulation of bundles of 2–3 acanthostyles, predominantly large acanthostyles but some small acanthostyles are scattered through the bundles. Sigmas and chelae scattered abundantly through the tissue. Ectosome: Palisade of tornotes covered with tangential crust of the small acanthostyles (Fig. 14b).

Spicules: Measurements from Mc7589.

Choanosomal acanthostyles: 203(226)245 by 15(19)25 μ m. Parallel sided acanthostyles with large, conical spines. End terminates in an abrupt, unspined point (Fig. 14c).

Ectosomal acanthostyles: 74(91)109 by 7(10)13 μ m. Similar in form to the choanosomal acanthostyles but with much larger spines relative to the shaft (Fig. 14d).

Ectosomal tornotes: 174(190)210 by 7(9)12 μ m. Fusiform tornotes with mucronate points (Fig. 14e).

Chelae: 18(20)23 μ m (Fig. 14f).

Sigmas: 18(24)29 μ m (Fig. 14g).

Remarks: The specimen appears to be a good match for the type description. There is a slight difference in that the type specimens are reported as massive and ‘mostly in rounded form’ with the largest piece 11.5cm wide and 7cm high, rather than thickly encrusting. However, it seems that specimens might be quite variable in form, as samples collected in this survey range from thickly encrusting to massive mounds (Mc7596 and Mc7684 were approximately 10cm high). Hentschel (1914) reports that some of his specimens were found on whale bones which may indicate that they were actually very thickly encrusting. In terms of speculation, the chelae (12.5–19 μ m), small acanthostyles (56–75 μ m) and sigmas (17–22 μ m) reported from the type are slightly smaller than those of our specimens. However, Boury-Esnault and Van Beveren (1982) described a larger size range in their specimens, similar to that found in ours. It was not possible to examine the type as the type specimen jar was found to contain a specimen of *Acanthoxa werthii* Hentschel, 1914 (now reassigned to *Spanioplone werthii* (Hentschel, 1914)).

The species *Crellomyxilla intermedia* Dendy, 1924, described from New Zealand (Dendy 1924), is currently regarded as a synonym. This has similar sizes spicules and ectosomal acanthostyles to the type specimen of *M. kerguelensis*. Dendy describes two categories of chelae, but Burton (1929) on re-examination of the type found only one category. Burton (1929, 1934) also considered *Myxilla tornotata* Brøndstedt, 1924 a synonym, despite noting it differed in having microspined ends to the tornotes. However, the two species can be separated by the size of the sigmas and the size and form of the ectosomal spicules (Lévi 1956; Boury-Esnault and Van Beveren 1982) and have been recorded sympatrically from the Kerguelen Islands (Boury-Esnault and Van Beveren 1982).

Distribution: Other than the type locality, Kerguelen (Lévi 1956; Boury-Esnault & Van Beveren 1982), this species has been recorded from McMurdo sound (Burton, 1929), although these specimens differ from the type description in that they are flabellate specimens with chelae up to 33 μ m, and New Zealand (as *Crellomyxilla intermedia*) (Dendy 1924). There are no previous records from South Georgia.

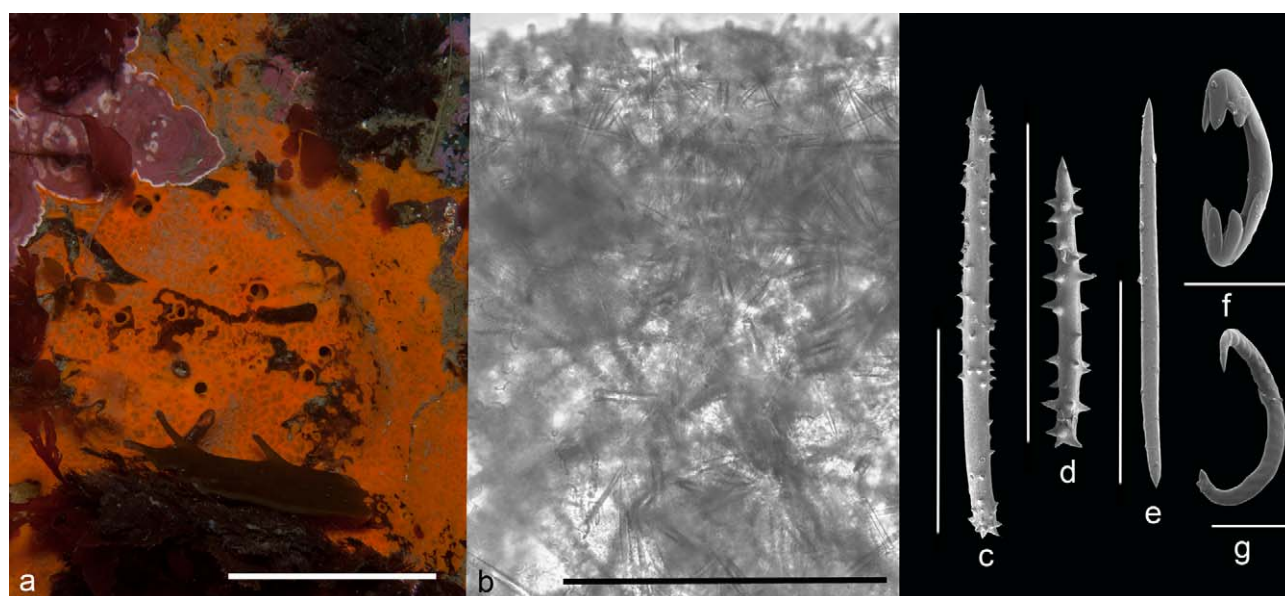


FIGURE 14. *Myxilla* (*Ectyomyxilla*) *kerguelensis* (Hentschel, 1914) a) *In situ* appearance specimen Mc7589, scale bar 5cm; b) skeleton Mc7589, ectosome to top, scale bar 500 μ m; Spicules Mc7589 c) large acanthostyle, scale bar 100 μ m, d) small acanthostyle, scale bar 100 μ m, e) ectosomal tornote, scale bar 100 μ m, f) chelae, scale bar 10 μ m, g) sigma, scale bar 10 μ m.

Family TEDANIIDAE Ridley and Dendy, 1886**Genus *Tedania* Gray, 1867****Subgenus *Tedaniopsis* Dendy, 1924*****Tedania (Tedaniopsis) aurantiaca* sp. nov.**

(Figure 15)

Type material: Holotype: BELUM Mc7661. Husvik, South Georgia (54°10.285'S, 36° 40.412'W); depth 18m; collected by C. Goodwin, D. Poncet and P. Brewin, 26th November 2010.

Paratypes: Samples in 95% ethanol, tissue section and spicule preparation on slides. BELUM Mc7583. Prion Island Site 1, South Georgia (54°001.590'S, 37°15 .178'W); depth 17.6m; collected by C. Goodwin, D. Poncet, and P. Brewin, 19th November 2010. BELUM Mc7624. Right Whale Bay, South Georgia (54°00.173'S, 37° 40.856'W); depth 18m; collected by C. Goodwin, J. Brown and S. Brown, 21st November 2010. BELUM Mc7652. Jagged Point, Possession Bay, South Georgia (54°04.514'S, 37° 07.188'W); depth 10.4m; collected by C. Goodwin, D. Poncet and P. Brewin, 23rd November 2010. BELUM Mc7659. Husvik, South Georgia (54°10.285'S, 36° 40.412'W); depth 18m; collected by C. Goodwin, D. Poncet and P. Brewin, 26th November 2010. BELUM Mc7670. Husvik, South Georgia (54°10.150'S, 36° 39.322'W); depth 18m; collected by D. Poncet, P. Brewin, C. Goodwin 26th November 2010.

Comparative material examined: MNHN DT1667 *Tedania (Tedaniopsis) charcoti* Topsent, 1908 Holotype. Ile Booth-Wandel 'Le Francais'. Microscope preparations.

ZMB S2315 *Tedania vanhoeffeni* var. *gracilis* Hentschel, 1914 (Holotype *T. gracilis* (Hentschel, 1914)), specimen and spicule preparation and tissue section prepared from specimen.

BMNH 79.12.27.12 *Tedania tenuicapitata* Ridley, 1881, Holotype. Tissue section and spicule preparation slides.

Etymology: From the Latin *aurantiacus*, meaning orange-coloured.

External morphology: In situ appearance: Mustard yellow to cadmium orange lobed crust with large oscules. In thicker, larger, specimens the oscules may be raised on mammiform processes (Fig. 15a).

Preserved appearance: Cream sponge composed of rounded lobes, firm, not compressible. Ectosome very smooth.

Skeleton: The choanosomal skeleton is a loose reticulation of bundles of 2–3 styles. The ectosomal skeleton consists of bundles of tornotes, which fan out to form a tangential surface layer. Onychaetes are scattered abundantly throughout the choanosome and ectosome (Fig. 15b).

Spicules: Measurements from Mc7661.

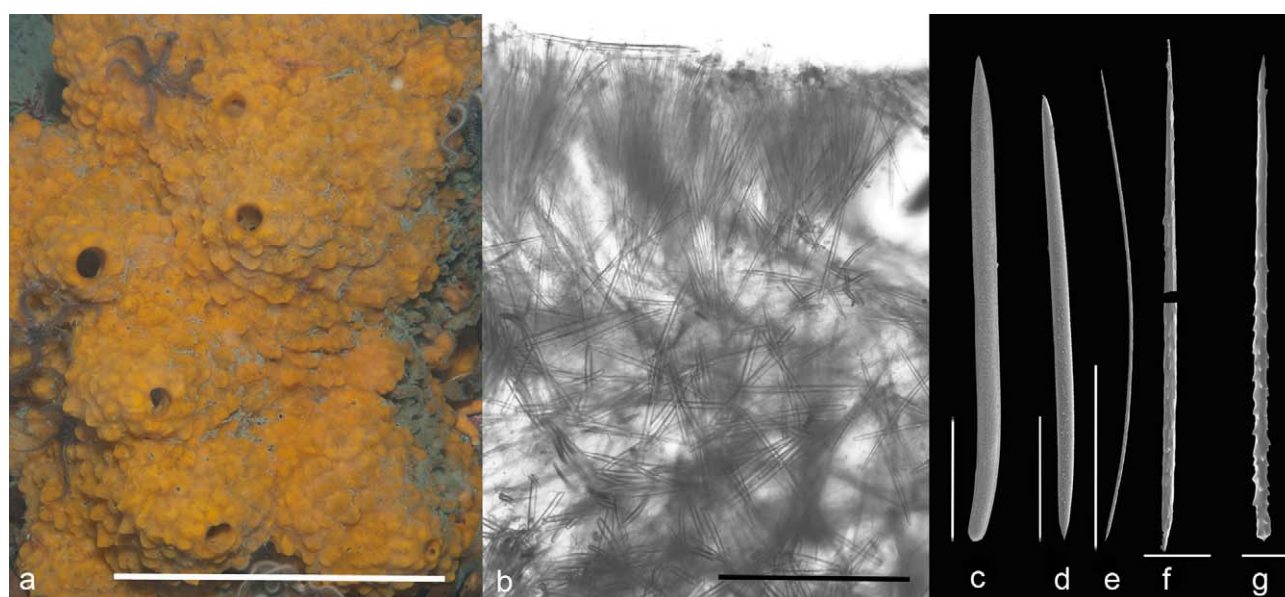


FIGURE 15. *Tedania (Tedaniopsis) aurantiaca* sp. nov. a) *In situ* appearance specimen Mc7661, scale bar 10cm; b) Skeleton Mc7661, ectosome to top, scale bar 500µm; Spicules Mc7661 c) style, scale bar 100µm, d) ectosomal tornote, scale bar 100µm, e) large onychaete, scale bar 100µm, f) large onychaete ends, scale bar 10µm, g) small onychaete, scale bar 10µm.

Styles: 356(407)447 by 17(21)25µm. Often slightly curved, parallel sided then tapering at the end to a sharp point (Fig. 15c).

Ectosomal tornotes: 335(359)403 by 10(13)16µm. Fusiform anisotornotes (Fig. 15d).

Onychaetes: two categories 74(90)125 and 235(261)283 by 1.7(2.1)2.8µm a few intermediates (172,206µm). The largest are pointed at both ends, the smaller with one pointed and one rounded end (Figs 15 e, f, g).

Remarks: Desqueyroux-Faúndez and van Soest (1996) reassessed the genera *Tedania* and *Trachytodania*, and reclassified the species present into three sub-genera: *Tedania* (*Tedaniopsis*) with long styles 300–700 µm, *Tedania* (*Tedania*) with short styles 150–300 µm and mucronate tornotes, and *Tedania* (*Trachytodania*) with smooth or spined short styles 150–300 µm and oxeote or mucronate tornotes (see also van Soest 2002b). The redescription of *Tedania* (*Trachytodania*) was based on the fact that no basal acanthostyles, the characterizing feature of the genus, could be found in the type species. *Trachytodania* has since been re-established as a valid genus by Cristobo and Urgorri (2001) who re-examined the type and located basal acanthostyles. This species confirms to the current definition of *Tedania* (*Tedaniopsis*) as it possesses styles longer than 350µm (Desqueyroux-Faúndez and van Soest 1996).

There are many Southern Ocean species within this subgenus but the majority have spicules that are much larger (Table 8). Three species have spicules of a similar range: *T. gracilis* (Hentschel, 1914) is the most similar in spicule size but has larger styles and shorter tornotes (Table 8). Comparison with the specimen designated as the holotype showed this has much thinner, longer styles (552(591)653 by 12(15)16µm) and thinner ectosomal spicules (397(437)490 by 6(9)13µm), however, this specimen may not be the one described in type description as it appears to differ in spiculation and is a thinly encrusting species on a bryozoan rather a sea urchin. *T. charcoti* Topsent, 1908 has much thinner styles (420–450 by 13µm in description, 401(434)466 by 9(13)16 µm from our measurements of type) and smaller tornotes (305–340 by 10µm from description, 280–350 by 8(10)14µm from our measurements). *Tedania tenuicapitata* Ridley, 1881 has much smaller styles (296–387µm), tornotes (185–270µm), and onychaetes (132–327, 52–75µm) (Table 8).

***Tedania* (*Tedaniopsis*) *wellsae* sp. nov.**

(Figure 16)

Type material: Holotype: BELUM Mc7578. Sample in 95% ethanol, tissue section and spicule preparation on slides. Prion Island Site 1, South Georgia (54°00'1.590'S, 37°15' .178'W); depth 17.6m; collected by C. Goodwin, D. Poncet, and P. Brewin, 19th November 2010.

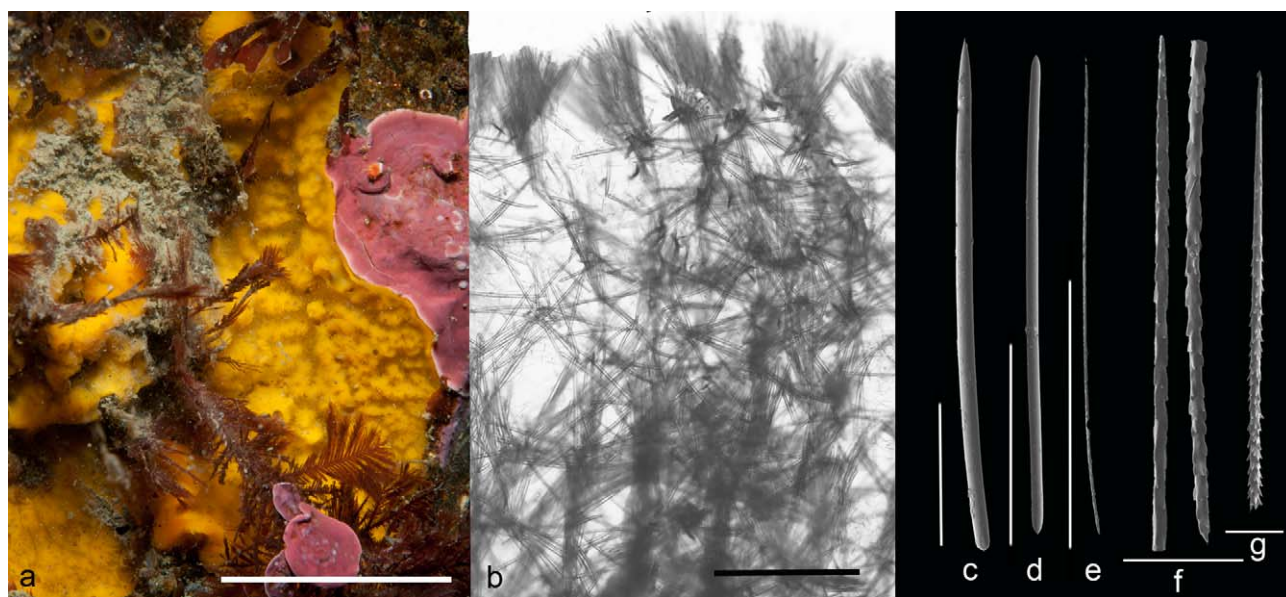


FIGURE 16. *Tedania* (*Tedaniopsis*) *wellsae* sp. nov. a) *In situ* appearance specimen Mc7578, scale bar 5cm; b) Skeleton Mc7578, ectosome to top, scale bar 500µm; Spicules Mc7578 c) style, scale bar 100µm, d) ectosomal tornote, scale bar 100µm, e) large onychaete, scale bar 100µm, f) large onychaete ends, scale bar 10µm, g) small onychaete, scale bar 10µm.

TABLE 8. *Tedania* (*Tedaniopsis*) species from the Antarctic and South Atlantic

Species	Choanosomal megascleres μm	Tornotes μm	Onychaetes μm	External appearance/Notes/Distribution
<i>Tedania</i> (<i>Tedaniopsis</i>) <i>lanceata</i> Koltun, 1964	400–480 with lanceolate tips	Anisotornotes 360–400 by 14–16	270–320 Onychaete 2 not measured.	Globular sponge, type up to 5cm high, surface uneven with coarse tubercles. Type locality South Sandwich Islands. Measurements from re-measurement of specimen designated by Koltun (type missing) by (Bertolino et al. 2007).
<i>Tedania</i> (<i>Tedaniopsis</i>) <i>turbinata</i> (Dendy, 1924)	Strongyles 500 by 25	340 by 6 tylo-tornotes with microspined ends	600 by 4 180 by 2	Large stipitate sponge forming thick walled shallow cup. Measurements from description of type in van Soest (2002b). Type locality New Zealand.
<i>Tedania</i> (<i>Tedaniopsis</i>) <i>charcoti</i> Topsent, 1908	Styles 410–549	314–353	235–365 98–127	Massive to lamillate sponge. Type locality Port Charcot, Antarctic. Also recorded Chile (Desqueyroux-Faundez and van Soest 1996), South Georgia, Falkland Islands, Antarctic (Burton, 1934). Sizes from re-measurement of type (Desqueyroux-Faundez & van Soest 1996).
<i>Tedania</i> (<i>Tedaniopsis</i>) <i>cristagalli</i> Dendy, 1924	Styles 1360–1700	Tomotes 320 by 4	400 by 3	Laterally compressed, massive, lobose sponge. Type locality New Zealand. Notable for great length of styles. Skeleton not reticulate but consists of 'loose whisks' of styles.
<i>Tedania</i> (<i>Tedaniopsis</i>) <i>gracilis</i> (Hentschel, 1914)	Styles 376–512	Tomotes 328–344	216–280 80–104	Massive sponge. Type locality Gauss station, Antarctic. 350–385m. Antarctic (Koltun 1964).
<i>Tedania</i> (<i>Tedaniopsis</i>) <i>infundibuliformis</i> Ridley and Dendy, 1886	Styles 500 x 12	Tomotes 280 by 6	360 60–70	Cup shaped. Type locality SW Patagonia, Chile. Sizes from re-measurement of type (Desqueyroux-Faundez & van Soest 1996).
<i>Tedania</i> (<i>Tedaniopsis</i>) <i>massa</i> Ridley and Dendy, 1886	Styles 700 by 30	450 by 13	Up to 800, collected into fibres.	Massive 'cake-like' sponge attaining enormous dimensions. Type locality New South Wales, Straits of Magellan, Rio de la Plata. Shag Rocks (Burton 1934), Antarctic (Burton 1929, Koltun 1964).
<i>Tedania</i> (<i>Tedaniopsis</i>) <i>oxeata</i> Topsent, 1916	Oxea 680–850 by 30–43	Tomotes 450–770 by 15–18	500 80–106	Description of external appearance not given in type description. Type locality Marguerite Bay, Antarctic. Widespread in Antarctic (Rios 2006).
<i>Tedania</i> (<i>Tedaniopsis</i>) <i>sarai</i> Bertolino, Schejter, Calcinaï, Cerrano and Bremec, 2007	Styles 387–469 by 10–13	Anisotornotes 275–375 by 5–8	388–490 by 2.6 4–122 by 1	Massive, cavemous sponge with smooth surface. Type locality Argentine Sea submarine canyon 360m in depth.
<i>Tedania</i> (<i>Tedaniopsis</i>) <i>tantula</i> (Kirkpatrick, 1907)	Styles 437 by 19	Tomotes 395 by 7.25	650 by 2.5 162 by 2.5	Tubular or cup shaped sponge (Rios 2006). Regarded as synonym of <i>T. massa</i> by Burton (1932) and Desqueyroux-Faundez & van Soest (1996) and possible synonym by van Soest (2002) but Rios (2006) considers it a distinct species. Widespread around Antarctic—very abundant.
<i>Tedania</i> (<i>Tedaniopsis</i>) <i>tenicipitata</i> Ridley, 1881	Styles 296–387 by 12–13	Tomotes 185–270 by 4	132–327 52–75	Massive sponge with very soft and fragile texture, surface bearing scattered shallow pits from .17 to 1mm in diameter. Spicule sizes from re-measurement of type (Desqueyroux-Faundez & van Soest 1996). Type locality Madre de Dios Island, SW Patagonia, Chile.
<i>Tedania</i> (<i>Tedaniopsis</i>) <i>vanhoeffeni</i> Hentschel, 1914	Styles 616–728 by 17–21	Strongyles 336–376 by 6	440–480 by 1.5 88–112 by 2	Globular massive sponge (Rios 2006). Type locality Gauss Station, Antarctic 380–385m. Kerguelen (Boury-Esnault & Van Beveren 1982), Antarctic (Rios 2006). Strongyles have microspined ends.
<i>Tedania</i> (<i>Tedaniopsis</i>) <i>aurantiaca</i> sp. nov.	Styles 356(407)447 by 17(21)25	Tomotes 335(359)403 by 10(13)16 μm	74(90)125 and 235(261)283 by 1.7(2.1)2.8 μm	Mustard yellow lobed thick crust with large oscules. South Georgia.
<i>Tedania</i> (<i>Tedaniopsis</i>) <i>wellsae</i> sp. nov.	301(335)382 by 9.6(13.6)17.3	Tomotes 241(309)278 by 6.7(9.4)11.7	63(74)86 and 159(190)206 by 1.4(2.2)2.9 μm	Custard yellow, thin (<5mm), crust. South Georgia.

Paratypes: Samples in 95% ethanol, tissue section and spicule preparation on slides. BELUM Mc7637. Bird Sound Site 2, South Georgia (54°01.149'S, 38° 01.026'W); depth 18m; collected by C. Goodwin, S. Cartwright and P. Brickle, 22nd November 2010. BELUM Mc7642. Bird Sound, Site 4, South Georgia (54°02.095'S, 38° 00.187'W); depth 6m; collected by J. Brown and S. Brown, 22nd November 2010.

Comparative material examined: BMNH 79.12.27.12 *Tedania tenuicapitata* Ridley, 1881, Holotype. Tissue section and spicule preparation slides.

Etymology: Named after Dr Emma Wells, the algal taxonomist on this expedition.

External morphology: *In situ appearance:* Custard yellow thin (<5mm) crust. Encrusting on bedrock or algae and forming patches up to 15cm in diameter. Bumpy surface with veins visible in between bumps (Fig. 16a).

Preserved appearance: Cream crust. Firm, not compressible. Surface in brain-like folds (Fig. 16a).

Skeleton: The choanosomal skeleton is formed of ascending columns of 4–6 styles irregularly branched and connected with small columns 2–3 styles wide. The onychaetes combined into the choanosomal fibres and brushes but many free onychaetes also present in the choanosomal tissue. The ectosomal skeleton consists of a palisade of tornotes (Fig. 16b).

Spicules: Measurements from Mc7578.

Styles: 301(335)382 by 9.6(13.6)17.3µm. Some faintly curved (Fig. 16c).

Ectosomal tornotes: 241(309)278 by 6.7(9.4)11.7µm. Anisotornotes with mucronate ends (Fig. 16d).

Onychaetes: 63(74)86 and 159(190)206 by 1.4(2.2)2.9µm. The large are pointed at both ends, the small have one pointed and one rounded end (Fig. 16e, f, g).

Remarks: This species can be separated from others in the subgenus by the size range of its spicules (Table 8). They are similar in size range to *Tedania* (*Tedaniopsis*) *tenuicapitata* Ridley, 1881 which has similarly sized styles (296–387µm) and tornotes (185–270 µm), but much longer large onychaetes (132–327 and 52–75µm). However, comparison with the type specimen shows that all spicules are much less robust and it does not have the pronounced ascending skeletal columns found in this species. It differs from *Tedania* (*Tedaniopsis*) *aurantiaca* sp. nov. in having an encrusting rather than massive external form and the smaller size of its styles, ectosomal tornotes and onychaetes.

Sub-order MYCALINA Hajdu, van Soest and Hooper, 1994

Family MYCALIDAE Lundbeck, 1905

Genus *Mycale* Gray, 1867

Subgenus *Mycale* Gray, 1867

Mycale (*Mycale*) *brownorum* sp. nov.

(Figure 17)

Type material: **Holotype:** Sample in 95% ethanol, tissue section and spicule preparation on slides. BELUM Mc7588. Prion Island Site 2, South Georgia (54°001.862'S, 37° 15.032'W); depth 18m; collected by C. Goodwin, D. Poncet, and P. Brewin, 19th November 2010.

Paratypes: Samples in 95% ethanol, tissue section and spicule preparation on slides. BELUM Mc7586. Prion Island Site 2, South Georgia (54°001.862'S, 37° 15.032'W); depth 18m; collected by C. Goodwin, D. Poncet, and P. Brewin, 19th November 2010. BELUM Mc7593. Prion Island Site 2, South Georgia (54°001.862'S, 37° 15.032'W); depth 18m; collected by C. Goodwin, D. Poncet, and P. Brewin, 19th November 2010. BELUM Mc7621. Right Whale Bay, South Georgia (54°00.173'S, 37° 40.856'W); depth 18m; collected by C. Goodwin, J. Brown and S. Brown, 21st November 2010.

Etymology: Named after Dr Judith Brown, Diving Officer for the expedition and her husband, Steve Brown, member of the expedition dive team.

External morphology: *In situ appearance:* Yellow crust, up to 10mm thick. On the surface of the sponge the ectosomal spicule mesh is visible, giving a honeycomb appearance. Three specimens were growing over algae attached to bedrock. One specimen (Mc7621) is a thicker crust in which the surface has developed into a series of small lumps (Fig. 17a).

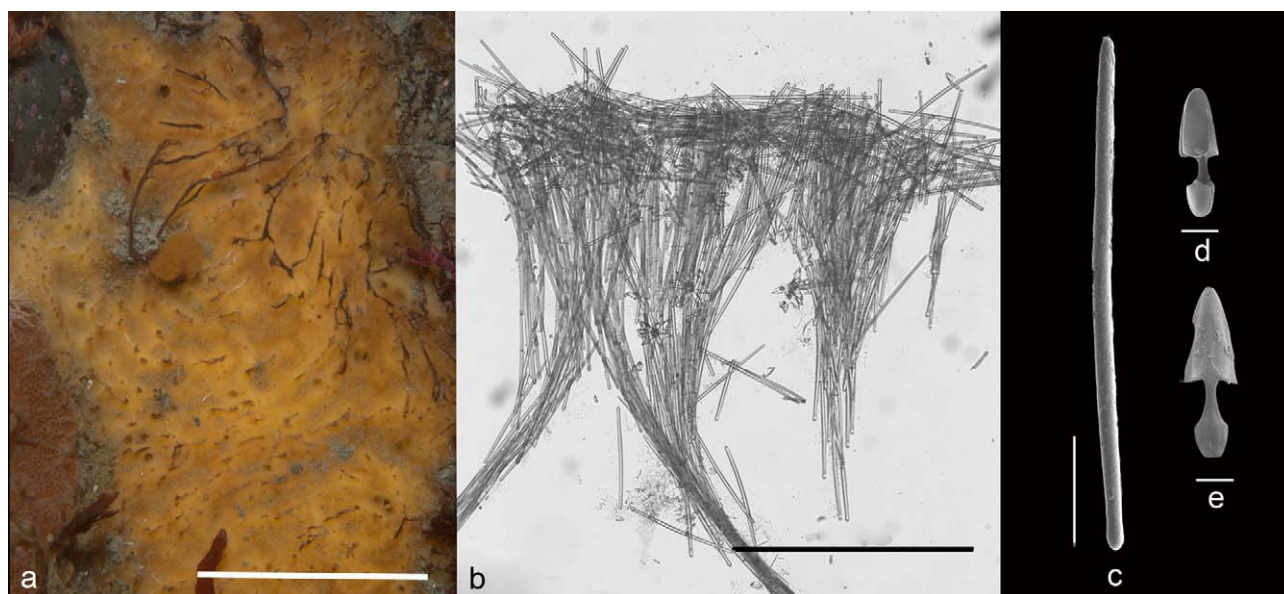


FIGURE 17. *Mycale (Mycale) brownorum* sp. nov. a) *In situ* appearance specimen Mc7588, scale bar 5cm; b) Skeleton Mc7588, ectosome to top, scale bar 1000µm; Spicules Mc7588 c) mycalostyle, scale bar 100µm, d) chelae front, scale bar 10µm, e) chelae back, scale bar 10µm.

Preserved appearance: Fragile white specimen which breaks easily into strands formed by the columns of the choanosomal skeleton. The ectosomal layer is more solid and glassily smooth.

Skeleton: The choanosomal skeleton is formed of thick (up to 15 spicules wide) ascending columns of mycalostyles which divide towards the ectosome in a dendritic pattern. The ectosome is a tangential confused layer of mycalostyles. Chelae present throughout skeleton, the larger category are in rosettes (Fig. 17b).

Spicules: Measurements from Mc7588.

Mycalostyles: 448(601)537 by 11.4(15.6)20.3µm base with an oval tylote, other end coming to a rounded point (Fig. 17c).

Anisochelae: two categories 30.5(44.4)52.6 and 67.2(81.7)88.0µm (Fig. 17d, e).

Remarks: This species can be distinguished from most species the subgenus *Mycale (Mycale)* by its smaller mycalostyle size or the categories of microscleres, which are present (Table 9). It has a similar size range of mycalostyles to *M. doellojuradoi* Burton, 1940 but this has three categories of chelae, the smallest being 18µm. Descriptions of other species in the genus were examined in case of taxonomic confusions; these could be distinguished by differences in the size of mycalostyles or the categories of microscleres present.

***Mycale (Mycale) cartwrighti* sp. nov.**
(Figure 18)

Type material: Holotype: Sample in 95% ethanol, tissue section and spicule preparation on slides. BELUM Mc7590. Prion Island Site 2, South Georgia (54°001.862'S, 37° 15.032'W); depth 18m; collected by C. Goodwin, D. Poncet, and P. Brewin, 19th November 2010.

Paratypes: Sample in 95% ethanol, tissue section and spicule preparation on slides. BELUM Mc7638. Bird Sound Site 2, South Georgia (54°01.149'S, 38° 01.026'W); depth 18m; collected by C. Goodwin, S. Cartwright and P. Brickle, 22nd November 2010.

Etymology: Named after Steve Cartwright, member of the expedition dive team.

External morphology: In situ appearance: Thickly encrusting lemon yellow sponge (up to 10mm thick) in large patches (>15cm) with sparsely scattered large oscules. Sub-ectosomal spaces clearly visible through ectosome giving the sponge surface a slightly lumpy appearance (Fig. 18a).

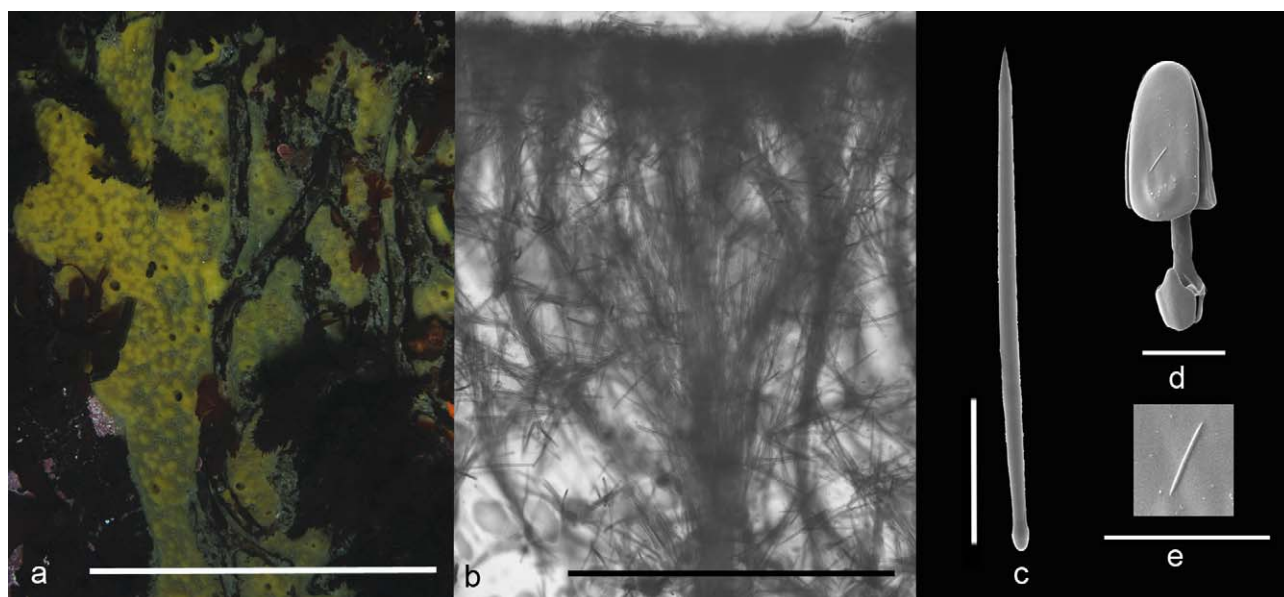


FIGURE 18. *Mycale (Mycale) cartwrighti* sp. nov. a) External appearance specimen Mc7590, scale bar 10cm; b) Skeleton Mc7590, scale bar 1000µm; c) style, scale bar 100µm, d) chelae, scale bar 10µm, d) microxea, scale bar 10µm.

Preserved appearance: Very pale yellow crust. Choanosome firm but compressible, ectosome visible as a separate, harder layer.

Skeleton: The choanosomal skeleton is formed of thick (up to 20 spicules wide) ascending columns of mycalostyles which anastomise and coalesce. The ascending columns are joined by shorter, thinner columns (1–3 spicules in width). The ectosomal skeleton is formed by the choanosomal columns fanning out at the surface to form a confused tangential ectosomal layer of mycalostyles. Chelae and trichodragmata present throughout skeleton, chelae do not form rosettes (Fig. 18b).

Spicules: Measurements from Mc7590.

Styles: 349 (407)451 by 9.3 (12.6)16.9µm. Mycalostyles with a neat rounded head and abruptly tapered tip (Fig. 18c).

Chelae: 23(35)47µm—rarely 70µm in Mc7638. Typical mycalid anisochelae with the lower front alae coming to a blunt point (Fig. 18d).

Microxea: 12 (23)40µm, very small microxea <5µm were also visible on the SEM (Fig. 18e).

Remarks: This species can be distinguished from the majority of other *Mycale (Mycale)* species by the possession of small microxea/trichodragmata which is unusual in the genus *Mycale* (Table 9). Of those species which do possess these *Mycale (Mycale) macrochela* Burton, 1932 has sigmas and smaller chelae (7–35µm), *Mycale (Aegogropila) meridionalis* Lévi, 1963 has trichodragmata 16–17µm but also has sigmas and smaller mycalostyles, *Mycale (Aegogropila) nodulosa* Goodwin *et al.*, 2011a has similar sized spicules but possesses sigmas, a second minute (5µm) category of microxea and has a clearly reticulate ectosomal skeleton which assigns it to a different subgenus, and *Mycale (Carmia) diminuta* Sarà, 1978 has similarly sized mycalostyles but larger trichodragmata (45–60µm). *Mycale (Mycale) brownorum* sp. nov. can be distinguished as it also lacks microxea microscleres.

Order HAPLOSCLERIDA Topsent, 1928

Suborder HAPLOSCLERINA Topsent, 1928

Family CHALINIDAE Gray, 1867

Genus *Haliclona* Grant, 1836

Subgenus *Soestella* De Weerd, 2000

Haliclona (Soestella) crowtheri sp. nov.

(Figure 19)

TABLE 9. *Mycale* (*Mycale*) species from the Antarctic and South Atlantic.

Species	Mycalostyles µm	Chelae µm	Sigmas µm	Trichodragmata /Other microscleres (specified) µm	External appearance/Notes /Distribution
<i>M. anisochela</i> Lévi, 1963	950–1050 by 26–28	220; 60–65; 30	32–52	Raphides 50	Sub-globose sponge with large oscules on top of little mounds. Type locality South Africa.
<i>M. doellojuradoi</i> Burton, 1940	500 by 11	60; 40; 18	None	None	External appearance not known; type was badly macerated. Type appeared to have a tangential dermal reticulation of subtylostyles—should probably be classified as <i>Mycale</i> (<i>Aegogropila</i>). Larger chelae in rosettes. Type locality Argentina.
<i>M. lapidiformis</i> (Ridley and Dendy, 1886)	900 by 20	94	None	None	Massive ‘boulder-like’ sponge with a minutely hispid surface. Originally <i>Esperella lapidiformis</i> . Type locality Rio de la Plata 1097m, Argentina.
<i>M. macrochela</i> Burton, 1932	530 by 17	7; 22; 35	100	35	Lamellar sponge with large oscules. Type locality Clarence Island, South Shetland Islands 342m
<i>M. thielei</i> Hajdu & Desqueyroux–Faúndez, 1994	370–470 by 13–19	50–74; 33; 20–22	13–19	None	Light yellow, massive, globular or drop like sponge. Frequently association with the scleractinian coral <i>Desmophyllum dianthus</i> (Hajdu and Desqueyroux–Faúndez 1994; Willenz <i>et al.</i> 2009). Chile.
<i>M. trichela</i> Lévi, 1963	625–725 by 20	34–45; 25–27; 15–18	None	None	Massive, lightly convex, sponge. Larger chelae in rosettes. South Africa.
<i>M. tridens</i> Hentschel, 1914	640–896 by 17–20	98–120; 27–41	112–136; 40–55	None	Thickly encrusting or irregularly massive sponge. Antarctic
<i>M. brownorum</i> sp. nov.	448–537 by 11–20	30–53; 67–88	None	None	Thin yellow encrusting sponge with visible surface mesh. Larger chelae in rosettes. Type locality South Georgia.
<i>M. cartwrighti</i> sp. nov.	349–451 by 9–17	23–47	None	12–40, and 5 Microxea	Thick yellow encrusting sponge with large oscules. Chelae not in rosettes. Type locality South Georgia.

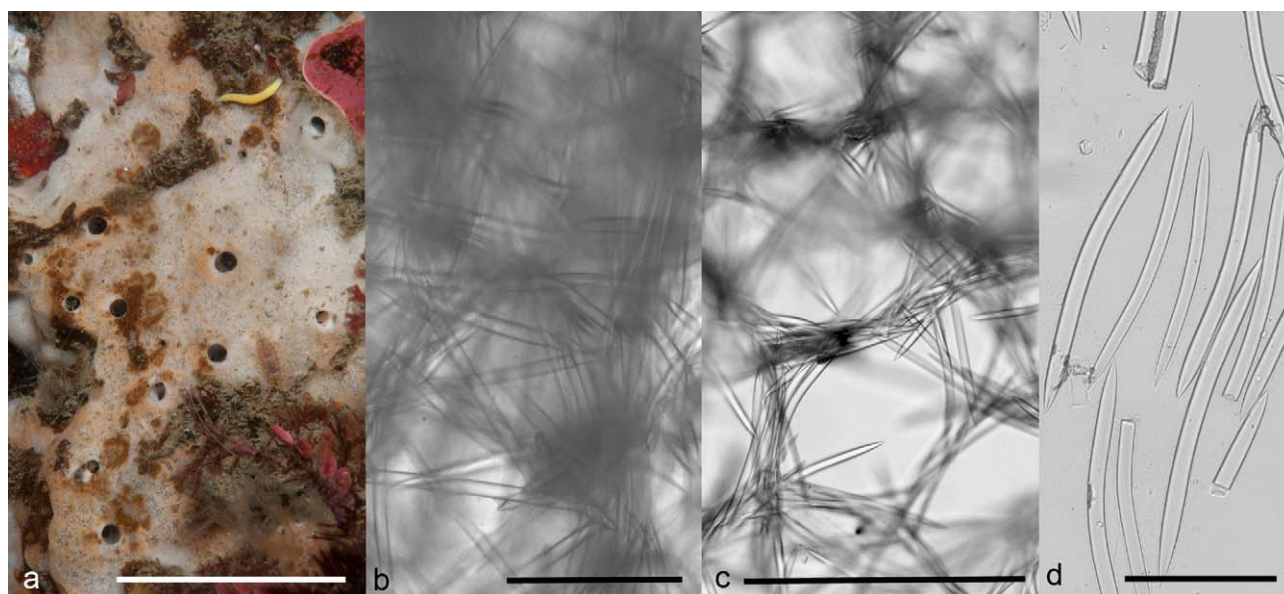


FIGURE 19. *Haliclona (Soestella) crowtheri* sp. nov. a) *In situ* appearance specimen Mc7579, scale bar 10cm; b) choanosomal skeleton Mc7579, scale bar 100µm; c) ectosomal skeleton Mc7579, scale bar 500µm; d) Spicules Mc7579, scale bar 100µm.

Type material: Holotype: Sample in 95% ethanol, tissue section and spicule preparation on slides. BELUM Mc7579. Prion Island Site 1, South Georgia (54°001.590'S, 37°15'178'W); depth 17.6m; collected by C. Goodwin, D. Poncet, and P. Brewin, 19th November 2010.

Paratypes: Sample in 95% ethanol, tissue section and spicule preparation on slides. BELUM Mc7587 and BELUM Mc7594. Prion Island Site 2, South Georgia (54°001.862'S, 37°15.032'W); depth 18m; collected by C. Goodwin, D. Poncet, and P. Brewin, 19th November 2010. BELUM Mc7612. Rosita Harbour Site 2, South Georgia (54°00.649'S, 37°25.618'W); depth 11.5m; collected by C. Goodwin, J. Brown, and S. Brown, 20th November 2010. BELUM Mc7623. Right Whale Bay, South Georgia (54°00.173'S, 37°40.856'W); depth 18m; collected by C. Goodwin, J. Brown and S. Brown, 21st November 2010. BELUM Mc7633. Bird Sound Site 1, South Georgia (54°02.058'S, 38°00.242'W); depth 18m; collected by C. Goodwin, S. Cartwright and P. Brickle, 22nd November 2010.

Etymology: Named for the former Head of the Department of Natural Sciences National Museums Northern Ireland, Dr Peter Crowther, who retired this year after many years of service to the museum; in recognition of his support of this work when in post.

External morphology: *In situ appearance:* Thickly encrusting white sponge (up to 15mm thick) forming large patches (up to 20cm in diameter) on bedrock. Smooth surface bearing numerous large oscules (up to 1cm in diameter) (Fig. 19a).

Preserved appearance: Thick crust with very hard texture. Choanosome brick red in Mc7612 but white in some specimens and patchily red in others. The ectosome is a white, easily detachable, smooth layer.

Skeleton: Confused choanosomal skeleton with primary columns of 4–7 spicules joined by unispicular secondary lines. Some rounded meshes present (Fig. 19b). Detachable white ectosome formed of hexagonal meshes of oxea, each side composed of single bundle of oxea 2–3 spicules thick (Fig. 19c).

Spicules: Measurements from Mc7579.

Oxea: 266(299)321 by 11(17)20µm—occasional very thin (<1µm oxea) of a similar length are also present (Fig. 19d).

Remarks: This species is assigned to *Haliclona* as it is a Chalindae with unispicular secondary lines (de Weerd 2002). The presence of a specialised ectosomal skeleton with rounded meshes assigns it to the subgenus *Haliclona (Soestella)* (de Weerd 2002).

Two other species of *Haliclona (Soestella)* have been recorded from this region: *H. auleta* (Thiele, 1905) from Calbuco, Chile and *H. chilensis* (Thiele, 1905). However, these both possess much smaller oxeas (150 and 130–200µm respectively).

The taxonomy of this genus is still confused so species from other sub-genera were considered. Although descriptions of other species from different genera in the family occurring in the region have been examined none can be found in which such a distinctive ectosomal skeleton is described.

Family NIPHATIDAE van Soest, 1980

Genus *Microxina* Topsent, 1916

Microxina myxa sp. nov.

(Figure 20)

Type material: Holotype: Sample in 95% ethanol, tissue section and spicule preparation on slides. BELUM Mc7691. Green Island, Stromness, Site 2, South Georgia (54°09.381'S, 36° 39.852'W); depth 17.4m; collected by C. Goodwin, J. Brown, and S. Brown, 28th November 2010.

Comparative material examined: MNHN DT691, DT692, DT693 *Microxina charcoti* Topsent, 1916 Holotype. Slides of tissue section and spicule preparations.

Etymology: From the Greek *myx* meaning slime or mucus. Named for the copious amounts of mucus produced when sampled.

External morphology: In situ appearance: White vase shaped sponge with central aquiferous cavity up length terminating in a large oscule. Length of cylinder approximately 20cm. Surface covered in spiky projections formed from the ends of the skeletal fibres. Produced large amount of slime when collected and removed from water (Fig. 20a).

Preserved appearance: Very soft with the appearance of matted fur. Produced copious slime even after some time in ethanol.

Skeleton: The choanosomal skeleton is an irregular mesh formed of ascending, anastomosing, columns of oxeas (4–10 spicules thick), joined by paucipicular secondary columns (1–2 spicules thick) and single oxea (Fig. 20b). The ectosomal skeleton is formed from the ends through the surface of the sponge (Fig. 20c).

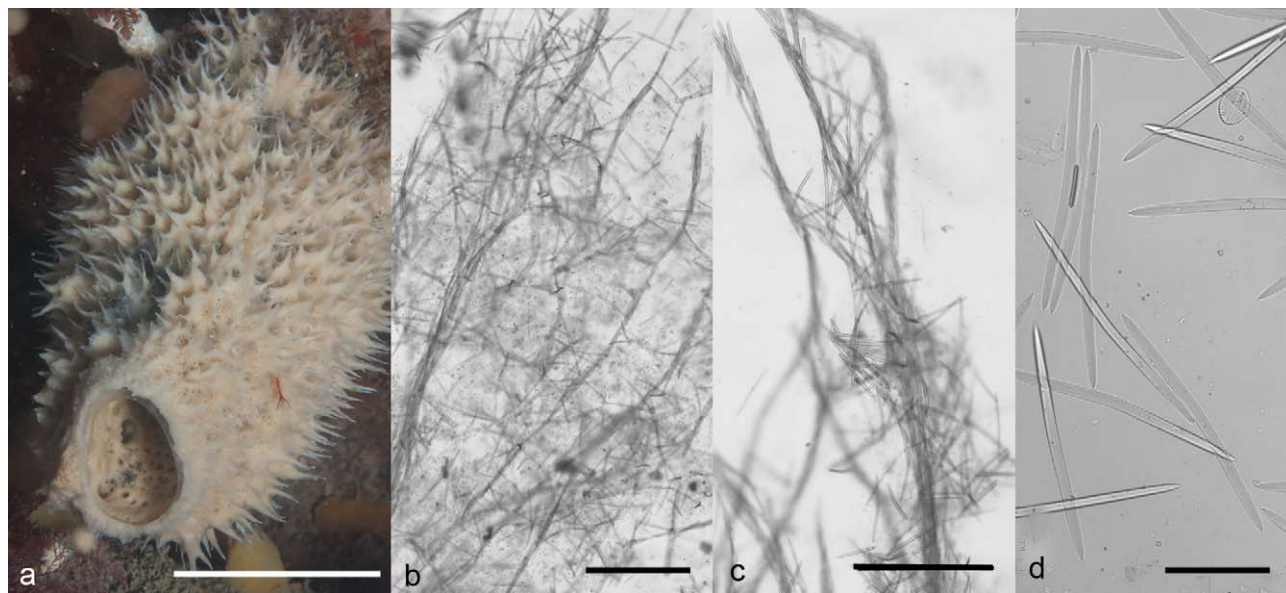


FIGURE 20. *Microxina myxa* sp. nov. a) *In situ* appearance, scale bar 5cm; b) choanosomal skeleton, ectosome to top, scale bar 500µm; c) ectosomal skeleton, scale bar 500µm; d) spicules, scale bar 100µm.

Spicules: Oxea: 225 (248) 271 by 9.0 (10.9) 13.7µm. Majority centrally curved (Fig. 20d). No microscleres.

Remarks: We have assigned this specimen to the family Niphatidae on the basis of its skeletal form; this family can be distinguished from the closely related Callyspongiidae as it has a rather disordered choanosomal skeleton rather than a neat rectangular mesh (van Soest & Hooper 2002). The family Niphatidae contains Haplosclerida with a three dimensional ectosomal skeleton of multispicular fibres. Nine genera are currently

considered valid and separated on the presence of microscleres and the form of the ectosomal skeleton (Desqueyroux-Faúndez and Valentine 2002a), however, there remains some confusion between the genera and species assigned to the family require thorough revision (Desqueyroux-Faúndez and Valentine 2002a). Of those genera recorded in the South Atlantic and Antarctica, *Hemigellius* and *Haliclonissa* have finely hispid and *Amphimedon* a smooth surface whereas *Dasychalina*, *Pachychalina* and *Microxina* have connulose to spiny surfaces. *Microxina* is characterised by the presence of microxea and *Dasychalina* and *Pachychalina* may be separated as *Pachychalina* has a choanosomal skeleton with thick tracts connected by much thinner secondary tracts whereas in *Dasychalina* the fibres have no clear orientation and there is no distinction between primary and secondary tracts (Desqueyroux-Faúndez and Valentine 2002a).

This sponge has the strongly spined surface, tubular body with large cavity characteristic of the type specimen of the genus *Microxina* Topsent 1916. However, microxea spicules are not present. Topsent (1916) originally erected the genus for *M. charcoti*, which has strong fibres of oxeas with smaller thinner ‘microxeas’ in between them and defined the genus as Gelliinae with microxea microscleres. There are currently seven species assigned to this genus (Table 10). These have a variety of microscleres including sigma, toxa and microxea. Wiedenmayer (1989) synonymised *Hemigellius* Burton, 1932 with *Microxina* determining that separation based on microsclere type was not valid as some species have both microxea and sigmata (e.g. *M. bendeni* Topsent, 1901), this was followed by Calcinai and Pansini 2000 in their designation of two new species. Desqueyroux-Faúndez and Valentine (2002a) retained *Hemigellius* as a valid genus, characterised by a fine surface hispidation rather than strong spines and we also do not support the synonymy of *Hemigellius* and *Microxina* but we do support the view that the genus could contain species with a variety of microscleres. We would therefore propose that species without microscleres could also be included, with the defining characteristics of the genus being a loose skeleton of multispicular fibres joined by paucispicular tracts, the ends of which project through the surface to form pronounced spines. Therefore we tentatively place *M. myxa* in *Microxea* where it seems to share the characteristics of *M. charcoti* and *M. bendeni*. However it should be noted that this genus, like other Niphatidae, requires a complete revision, some species currently placed here such as *M. sarai* might be better transferred to *Hemigellius*.

Several other species in the family Niphatidae are found in the Antarctic and sub-Antarctic: *Dasychalina magellanica* (Thiele, 1905), *Dasychalina validissima* (Thiele, 1905), *Pachychalina glacialis* (Burton, 1934), *Pachychalina erinacea* Goodwin *et al.*, 2011a, *Haliclonissa verrucosa* Burton, 1932, *Haliclonissa sacciformis* Burton, 1932, and several species in the genera *Hemigellius* and *Amphimedon*. Because of the confusion of the taxonomy of this family we compared this species with these. *Dasychalina validissima* has oxeas of a similar size (250µm), but these are much thicker and its skeleton is formed of very thick fibres (20–30 spicules thick). *Dasychalina magellanica* (Thiele, 1905) has oxeas of a similar length (190µm), however, the ascending fibres terminate abruptly at the surface and it consequently lacks the spiny projections characteristic of this species. *Pachychalina erinacea* Goodwin *et al.*, 2011 has smaller oxea (114–206µm), the terminal ends of the fibres form shorter spines and it is lobed rather than cup shaped. *Pachychalina glacialis* (Burton, 1934) is a branching species with a ‘hirsute’ rather than connulose surface. *Haliclonissa verrucosa* has a spiny surface but much larger oxeas (369–422µm). *Haliclonissa sacciformis* has similar sized oxea (320 by 7µm) but has a ‘minutely pilose surface having the appearance of fine velvet’.

Order HAPLOSCLERIDA Topsent, 1928

Suborder PETROSINA Boury-Esnault and Van Beveren, 1982

Family PHLOEODICTYIDAE Carter, 1882

Genus *Calyx* Vosmaer, 1885

Calyx shackletoni sp. nov.

(Figure 21)

Type material: **Holotype:** Samples in 95% ethanol, tissue section and spicule preparation on slides. BELUM Mc7585. Prion Island Site 1, South Georgia (54°00'1.590"S, 37°15'1.178"W); depth 17.6m; collected by C. Goodwin, D. Poncet, and P. Brewin, 19th November 2010.

TABLE 10. *Microxina* species from the Antarctic and South Atlantic.

Species	Oxea μm	Microscleres μm	Skeleton	Appearance	Notes/Distribution
<i>Microxina charcoti</i> Topsent, 1916	459 (512)600 by 20(25)29	Microxea 45(73)95 by 3–4	Network of multipisular fibres.	Tubular and ramified with a central deep aquiferous cavity. Surface strongly spined by long spines up to 10mm long.	Type locality Marguerite Bay, Antarctic
<i>Microxina benedeni</i> (Topsent, 1901)	750 by 35–40	Sigmata 45–50	Radial spicule tracts with ends piercing surface	Globular with a large terminal oscule. Bristling with spikes 2–5mm long.	Originally described as <i>Gelliodes benedeni</i> . Type locality Antarctic. .
<i>Microxina lanceolata</i> Calcinai and Pansini, 2000	390 (450) 525 by 11(16)20	Sigmata 25–60	Ascending paucispicular tracts connected by 2–3 transverse spicules. Ectosomal perpendicular tufts of oxea.	Dichotomously branching cylindrical branches from a common base. Up to 40cm high. Surface areolate.	Type locality Terra Nova Bay, Antarctic
<i>Microxina</i> <i>phakellioides</i> (Kirkpatrick, 1907)	835 by 42.25	Sigmata 81 Toxa 130	Close-set tracts joined by 'cross bars'.	Cup shaped with coarsely pilose outer surface.	Originally described as <i>Sigmaxinyssa phakellioides</i> (type of new genus). Type locality Antarctic.
<i>Microxina sarai</i> Calcinai and Pansini, 2000	209–382 by 14–20	Sigmata 16–24, 36–62 Microxeas 50–80	Tracts of 6–10 oxea joined by tracts of 1–3. Ends of tracts penetrate the dermal membrane. Ectosomal tangential crust of oxeas.	Massive amorphous with lobate processes.	Ectosomal skeleton not shared by other species in genus. Type locality Terra Nova Bay, Antarctic.
<i>Microxina simplex</i> (Topsent, 1916)	880–910 by 33	Trichodragmata 80–100 by 10	Not noted.	Simple column. Surface covered with 'aspérités', rugosities, similar in structure to <i>Axinella</i> .	Originally described as <i>Thrinacophora simplex</i> . Type locality Antarctic.
<i>Microxina subtilis</i> (Pulitzer-Finali, 1982)	135–165 by 2.7–4	Sigmatas 22–32 Toxas 40–45	Irregular network of paucispicular tracts joined by unispicular fibres.	Cushion shaped with a few scattered oscules.	Originally described as <i>Gelliuss subtilis</i> from Great Barrier Reef, Australia
<i>Microxina myxa</i> sp. nov.	225–271 by 9–13.7	None	Irregular mesh formed of anastomosing columns of oxea (4–10 spicules in width) joined by columns 1–2 spicules in width.	Vase shaped sponge terminating in large oscule. Covered in spiky projections.	Type locality South Georgia.

Paratypes: Samples in 95% ethanol, tissue section and spicule preparation on slides. BELUM Mc7622 and BELUM Mc7628. Right Whale Bay, South Georgia (54°00.173'S, 37° 40.856'W); depth 18m; collected by C. Goodwin, J. Brown and S. Brown, 21st November 2010. BELUM Mc7665. Husvik, South Georgia (54°10.280'S, 36° 40.422'W); depth 8.9m; collected by J. Brown, S. Brown, E. Wells 26th November 2010.

Other specimens: Samples in 95% ethanol, tissue section and spicule preparation on slides.

BELUM Mc7580, BELUM Mc7582 and BELUM Mc7585; Prion Island Site 1, South Georgia (54°001.590'S, 37°15 .178'W); depth 17.6m; collected by C. Goodwin, D. Poncet, and P. Brewin, 19th November 2010. BELUM Mc7604. Rosita Harbour Site 1, South Georgia (54°00.715'S, 37° 26.049'W); depth 16.4m; collected by C. Goodwin, P. Brickle, and S. Cartwright, 20th November 2010. BELUM Mc7614, BELUM Mc7615 and BELUM Mc7616. Rosita Harbour Site 2, South Georgia (54°00.649'S, 37° 25.618'W); depth 11.5m; collected by C. Goodwin, J. Brown, and S. Brown, 20th November 2010. BELUM Mc7649. Jagged Point, Possession Bay, South Georgia (54°04.514'S, 37° 07.188'W); depth 10.4m; collected by C. Goodwin, D. Poncet and P. Brewin, 23rd November 2010. BELUM Mc7658 and BELUM Mc7662. Husvik, South Georgia (54°10.285'S, 36° 40.412'W); depth 18m; collected by C. Goodwin, D. Poncet and P. Brewin, 26th November 2010.

Comparative material examined: NMS.Z.1921.143.1419 *Gellius arcuarius* (Calyx) type specimen in alcohol, tissue section and spicule preparation prepared from type.

MNHN DT703 *Calyx stipitatus* Topsent, 1916, Type specimen tissue section and spicule preparation. Images of the preserved type specimen.

BMNH 28.2.15.106 Discovery investigations *Calyx arcuarius* (Topsent) R.N.XCIV.IV. Stn 175. Specimen in alcohol.

BMNH 28.2.15.117 Discovery investigations *Calyx arcuarius* (Topsent) R.N.LXI.IV. Stn 160. Specimen in alcohol.

BMNH 26.10.26.235 Terra Nova Antarctic expedition 1910-13. *Calyx stipitatus* (Topsent). Specimen in alcohol.

ZMB 4835 *Siphonochalina linea* (?) *gaussina*. Hentschel, 1914 Type specimen tissue slide and images of preserved specimen.

Etymology: Named, in recognition of its probable pan-Antarctic presence, after Sir Ernest Shackleton, polar explorer, and also for the Shackleton Scholarship Fund, which supported this work.

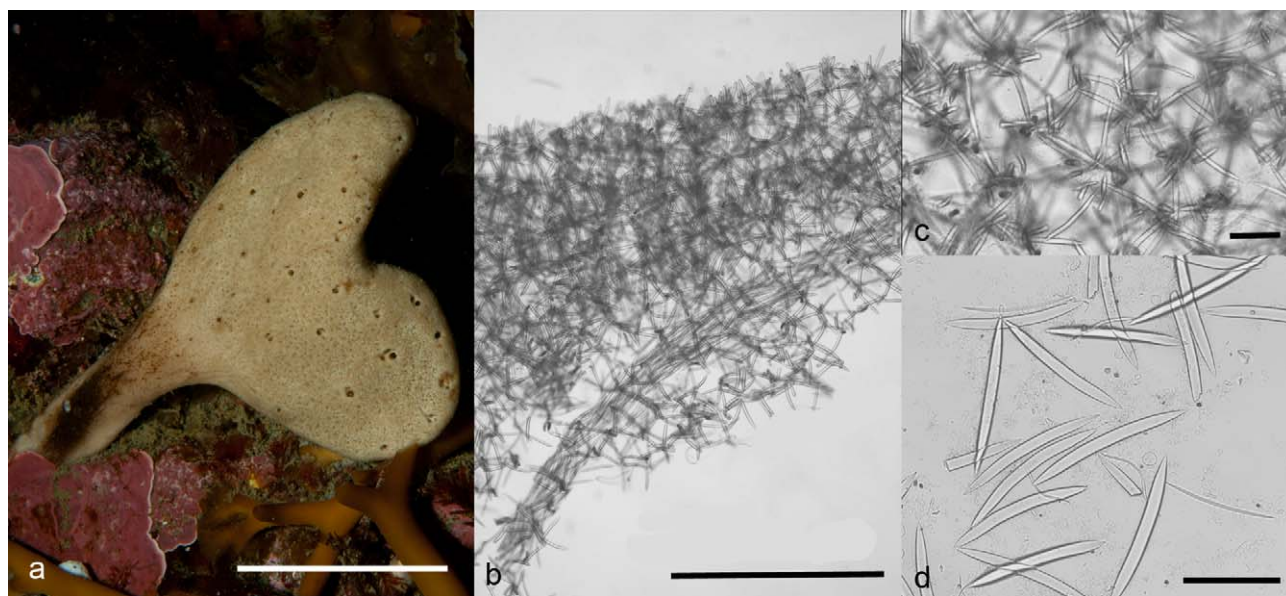


FIGURE 21. *Calyx shackletoni* sp. nov. a) *In situ* appearance specimen Mc7585, scale bar 5cm; b) Choanosomal skeleton specimen Mc7585, ectosome to top, scale bar 1000µm c), ectosomal skeleton Mc7585, scale bar 100µm; d) Spicules Mc7585, scale bar 100µm.

TABLE 11. *Calyx shackletoni* specimens. Spicule measurements give range with average in brackets apart from where rare in which case individual measurements are separated by commas.

Specimen	Designation	External appearance	Oxea μm	Toxa μm
Mc7585	Holotype	Heart shaped lobe on stalk. Stalk 4cm in length and lobe 6cm.	144(158)178 by 12(16)22	54(80)100
Mc7622	Paratype	Small flattened lobe 3cm in length	142 (162)175 by 10(15)21	31(72)105
Mc7628	Paratype	Large, oval, stalked lobe 15cm in length with prominent oscules	173(189)213 by 12(17)20	34(66)118
Mc7665	Paratype	Flattened lobe 10cm in length	171 (182)198 by 12(14)18	37 (80) 115
Mc7580	None	Flattened stalked lobe 5cm high	152 (170)189 by 10(13)18	36(54)99—rare
Mc7582	None	Lobe 15cm in diameter with prominent oscules.	134(161)183 by 10 (13)17	30(38)92—rare
Mc7604	None	Rounded stalked lobe 5cm high	149(168)182 by 9(14)18	46(51)84
Mc7614	None	Flattened cylinder 10cm high	144 (163)172 by 13(18)21	36(52)94—rare
Mc7615	None	Rounded stalked lobe 8cm high	148(167)185 by 11(17)24	29(57)78—rare
Mc7616	None	Massive stalked pyramid shaped sponge >25m high with ends developing into rounded branches	149 (175) 198 by 14(18)20	88—very rare
Mc7649	None	Massive sponge >20cm high, composed of several flattened branches	154(182)204 by 13(16)19	12,116—very rare
Mc7658	None	Massive sponge > 20cm in height. Fan shaped with the ends developing into flattened branches.	170(195)214 by 13(16)22	71(83)96—rare
Mc7662	None	Triangular lobe 5cm in length with large oscules	156(183)205 by 11(16)22	43,102,103—very rare

External morphology: *In situ appearance:* The type specimen is in the form of a cream heart shaped, stalked lobe and is 10cm high (Fig. 21a). The appearance of the paratypes and other specimens is variable (Table 11) but all have some sort of stalk. The largest specimens reach over 20cm in height. The larger specimens are stalked lobes; in some of these the ends are developed into flattened branches (Fig. 21a). Sponges are pale yellow to cream in colour and have prominent oscules. The skeletal tracts are often visible through the surface visible as a mesh like pattern of lines and numerous large oscules are scattered over the sponge surface.

Preserved appearance: The type specimen is buff coloured and has a tough texture. The colour of other specimens ranges from cream to pale brown in colour but most have a tough texture.

Skeleton: The choanosomal skeleton has a regular appearance with ascending tracts of oxeas 2/3 spicules thick joined by single oxeas. There are also irregular thicker fibres of oxea up to 10 spicules thick (bottom right Fig. 21b). The base of the stalk is made up of several of these thicker fibres intertwined. The ectosome forms an irregular hexagonal to triangular mesh of oxeas, sides two spicules thick, joined by abundant sponging at the nodes (Fig. 21c).

Spicules: (Fig. 21d): **Oxea:** Chunky short oxea slight variation in length between specimens (Table 11), in the type 144(158)178 by 12(16)22µm. The oxea are normally slight bent a third from each end giving an angular curve to the spicule. Thin oxea 1–2µm in width are also present.

Toxa: Toxa in the type specimen are an ox-horn shape, 54(80)100µm, and very abundant. The largest are similar in width to the thin oxea. In the paratypes toxa are abundant but in several of the other specimens they were so rare as to appear to be absent on initial inspection.

Remarks: Burton (1932) recorded several specimens, which have a similar external form to ours (from branching to flabellate) and similar with oxea size (180–280 by 11–18µm), although the width of the skeletal oxea tracts is reported as 20–40 spicules thick. He also noted the variable presence of toxa and concluded that these were of no taxonomic significance and therefore *Calyx stipitatus* Topsent, 1916, which he identified his specimens with, was a junior synonym of *Gellius arcuarius* Topsent, 1913; he supposed the type specimen of the latter was a small broken piece of a fan. However, *Gellius arcuarius*, from examination of the type specimen, is a thin, probably encrusting, species (described by Topsent as 20x12x3mm), which has similar sized toxa (70–110µm) but much larger oxea (350–400 by 12–15µm) and a confused choanosomal skeleton rather than the neat reticulation found in the genus *Calyx*. It conforms to the current definition of *Haliclona* (*Gellius*) and should be reassigned to this genus. In contrast *Calyx stipitatus* is described as a stalked sub-triangular species with prominent oscules and an ectosomal unispicular reticulation of oxea (300–325 by 17µm in description, we measured as 232(278)313 by 13(17)22µm in the type) but does not possess toxa. To add to the confusion between these species Desqueyroux-Faúndez & Valentine (2002b) in Fig. 3A depict the holotype RSME 1921.143.1419 as a flabellate stalked specimen but this image does not match the specimen held in the museum's collections.

Our specimens have a similar skeleton to the type of *Calyx stipitatus* and match the definition of the genus (Desqueyroux-Faúndez and Valentine 2002b), but differ from *C. stipitatus* in that they possess smaller oxea and have toxa. The only other species of *Calyx* described from the Antarctic is *Calyx kerguelensis* (Hentschel, 1914), which Burton (1934) reported from South Georgia, however this species has oxea ranging from 260–320µm and sigma 22–40µm. In view of the confusion in Haplosclerid taxonomy we have examined descriptions of other Antarctic species within the family. *Cladocroce gaussiana* (Hentschel, 1914) (originally described as *Siphonochalina* (?) *gaussiana*) as figured in de Weerd (2002), p857, has a similar external appearance and choanosomal skeleton. However these Figures are taken from various different museum specimens rather than the type. The type specimen does have a similar skeletal form and possess toxas similar to those of our specimens. However, both the toxa and the oxea of the type specimen are substantially larger (130–150µm and 240–280µm respectively—Hentschel (1914) gives 80–152 and 232–264µm). The type specimen is a small elongated fragment and it is difficult to determine external form, however, it was much less robust in texture than our specimens. We are unable to find any matching species within the Haplosclerida, consequently we assign these specimens as a new species.

Distribution: It seems likely that our specimens are con-specific with some of Burton's specimens assigned to *C. arcuarius* from the Antarctic, South Georgia and Shag Rocks (Burton 1929; 1932; 1934) and in view of the similarity in appearance to other Antarctica specimens (Brueggeman 1998) this species may be widespread and common in the Antarctic.

Order DENDROCERATIDA Minchin, 1900
Family DARWINELLIDAE Merejkowsky, 1879
Genus *Aplysilla* Schulze, 1878

***Aplysilla* sp.**

Material: Samples in 95% ethanol, tissue section and spicule preparation on slides. BELUM Mc7584. Prion Island Site 1, South Georgia (54°001.590'S, 37°15.178'W); depth 17.6m; collected by C. Goodwin, D. Poncet, and P. Brewin, 19th November 2010. BELUM Mc7592. Prion Island Site 2, South Georgia (54°001.862'S, 37°15.032'W); depth 18m; collected by C. Goodwin, D. Poncet, and P. Brewin, 19th November 2010. BELUM Mc7639. Bird Sound Site 2, South Georgia (54°01.149'S, 38°01.026'W); depth 18m; collected by C. Goodwin, S. Cartwright and P. Brickley, 22nd November 2010.

External morphology: Lemon yellow sponge with prominent connules.

Skeleton: No spicules are present, skeleton consists of unbranched spongin fibres.

Remarks: This bright yellow species is similar in appearance to the European *Aplysilla sulfurea* Schulze, 1878 but has more pronounced connules. Burton (1930) reported *Aplysilla sulfurea* from 20m in West Cumberland Bay but given the distance from the type locality this identification would seem unlikely. As the taxonomy of keratose sponges, and particularly Southern Ocean and Antarctic *Aplysilla* species, is confused we have refrained from identifying our specimens to species level and merely note its presence on South Georgia to alert future researchers to these specimens.

Class HEXACTINELLIDA Schmidt, 1870
Subclass HEXASTERPHORA Schulze, 1886
Order LYSSACINOSIDA Zittel, 1877
Family ROSSELLIDAE Schulze, 1885
Subfamily ROSSELLINAE Schulze, 1885
Genus *Rossella* Carter, 1872

***Rossella nuda* Topsent, 1901**
 (Figure 22)

Material: Samples in 95% ethanol, tissue section and spicule preparation on slides. BELUM Mc7650. Jagged Point, Possession Bay, South Georgia (54°04.514'S, 37°07.188'W); depth 10.4m; collected by C. Goodwin, D. Poncet and P. Brewin, 23rd November 2010.

Comparative material examined: BMNH *Rossella nuda* (Topsent) Discovery Antarctic Collection 1926-27. Dried specimens RN CLVI II, R.N. CKVI I

External morphology: In situ appearance: Large (maximum diameter > 100cm) vase shaped white sponge with lobose surface (Fig. 22a).

Preserved appearance: Small slide of edge of sponge. Tough with a very hispid surface like a mat of hairs.

Skeleton: Skeleton composed of free diactines with hypodermal diactines and pentactines, outer dermal spicules spined pentactines and hexactines.

Spicules: Hypodermal diactines: (not measured, Barthel and Tendal (1994) report 2500–3500µm) Spined hexactine (Fig. 22b).

Calycocome: very rare, one measured: 211µm in diameter (Fig. 22c).

Oxyhexaster: diameter 101(181)247µm (Fig. 22d).

Microdiscohexaster: diameter 30(32)35µm (Fig. 22e).

Remarks: In the original description Topsent lists the microscleres as oxyhexasters 120µm in diameter, calycocomes of a uniform diameter (250µm), microdiscohexasters 40–50µm in diameter, and larger discohexasters 100µm in diameter. The latter were only noted in small quantities and we didn't find them in our specimen.

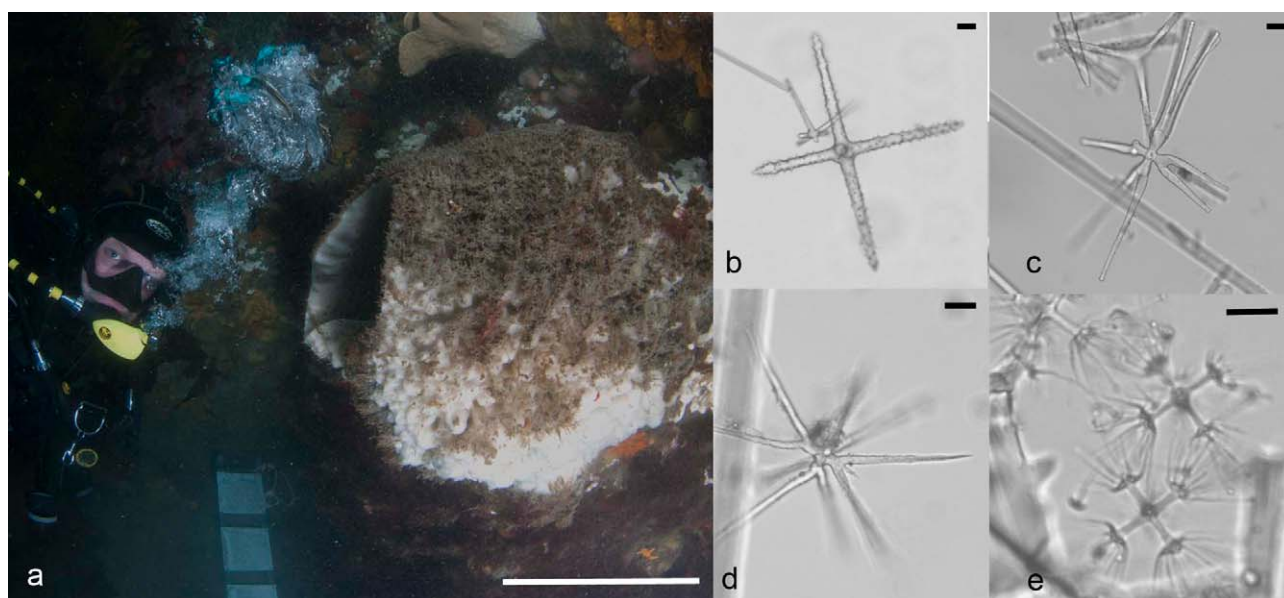


FIGURE 22. *Rossella nuda* Topsent 1901 a) Specimen *in situ*, scale bar 50cm; b) Inner dermal hexactine; c) Calyccome; d) oxyhexaster; e) Microdiscohexaster. All scale bars 10µm.

Distribution: This specimen was situated in a small cave at 8m, attached to bedrock. *Rossella nuda* has been recorded on the Victoria Land coast from the eastern Weddell Sea to the Ross Sea, including McMurdo Sound, and the Bellingshausen Sea (Topsent 1901; Kirkpatrick 1907; Burton 1929; Koltun 1976; Barthel and Tendal, 1994; Janussen and Reischwig 2009); South Georgia (Burton 1940 but no details given, Barnes *et al.* 2006b) and the Falkland Islands (Burton 1940 but no details given) and the coast of Argentina (Burton 1940); from depths of 18–1579m. Burton (1929) recognised five species of *Rossella* including *R. nuda* but Koltun (1976) only recognised *R. antarctica* and *R. racovitzae* one of which he regarded as a ‘highly polymorphic species’, many species have since been reinstated by Barthel and Tendal (1994). Barnes *et al.* (2006b) recorded specimens of *Rossella nuda* from Moraine Fjord on South Georgia at 18m, which were the shallowest known records for *R. nuda* at that time.

Discussion

Of the 22 species recorded from this survey, 15 are new to science and two species, *Myxilla* (*Ectomyxilla*) *kerguelensis* and *Phorbastriopsis glaberrimus*, are new records for South Georgia. Comparatively few sponge collections have been made from South Georgia, and the majority of the material that has been collected is from deep-water around its coast. In addition, many of the species described here were encrusting on bedrock, a habitat unlikely to have been sampled effectively by previous surveys, as remote methods such as dredging and trawling were used. Other studies have indicated that many of the encrusting sponges of shallow bedrock habitats remain undescribed, even in well-studied areas such as the United Kingdom (Picton and Goodwin 2007; Goodwin and Picton, 2009). Worldwide, Porifera remain an historically understudied group and the potential for discovery of new species is high; although only 8553 valid recent sponge species are currently recognised, at current discovery rates, this is predicted to increase to around 12,000 by the end of the current century (van Soest *et al.* 2012).

The marine fauna of South Georgia is noted for its high levels of endemism, Hogg *et al.* (2011) reported endemic levels of 45–50% for bryozoans, cnidarians and molluscs. However, their study found that endemism for demosponges at 2.7% was comparatively low. Whilst our study has increased the number of endemic species reported from South Georgia the rate still remains lower than for other groups. Many sponge species have a circum-Antarctic distribution which appears to be relatively homogenous, this may result in low levels of regional endemism (Koltun 1970; Sara *et al.* 1992; McClintock 2005; Rios 2006). Having said this, the circum-polar distribution of many sponge species is baffling given the restricted dispersal potential of the phylum (Maldonado and Young 1996; Maldonado and Bergquist 2002). In our study we found several species, which appear to have a circum-Antarctic distribution, including *Polymastia invaginata* and *Rossella nuda*.

The Antarctic Circumpolar Current (ACC) is thought to homogenise the Antarctic sponge fauna (Griffiths 2010). However, the very short planktonic larval period of sponges (Maldonado 2006) usually restricts long-range larval dispersal in this phylum (Maldonado and Young 1996; Maldonado 2006). As larval duration in Antarctic invertebrates can be substantially longer than in temperate or tropical systems (reviewed in Pearse *et al.* 1991) this could result in greater dispersal capacities, although requires investigation (McClintock *et al.* 2005). Burton (1932) also hypothesised that dispersal by floating propagules or sponge fragments might be possible, and as sponges may encrust a variety of substrates there is potential for dispersal on drifting material. An alternative, and perhaps more likely, hypothesis is that gradual movement of sponge species over long time periods (e.g. stepping stone dispersal) has resulted in their wide distributions (Koltun 1970; Sarà *et al.* 1992). Although the bathyal depths that separate South Georgia and other sub-Antarctic islands from the continent would act as a barrier to depth restricted species, many Antarctic sponges are found in a wide depth range (Koltun 1964; Koltun 1970; McClintock *et al.* 2005) and therefore may be able to cross these divides.

The majority of Antarctic sponges described so far appear to be eurybathic (Koltun 1970; McClintock *et al.* 2005). Koltun (1970) attributed this to the lack of continental discharge and the presence of oceanic waters close to the continental shores. It is therefore possible that the new species described here are also more widely distributed within the Antarctic. However, whilst eurybathic sponges may be able to disperse widely across the Antarctic, and possibly into the Magellanic province, some species may be restricted to shallow water and consequently have a more limited distribution. If the species described here are restricted to shallow water the rate of endemism in South Georgia's sponges is likely to be greater than currently supposed. Thus far little sampling has been undertaken in the Antarctic in circalittoral depth zones (<50m) (McClintock *et al.* 2005); previous to this study only 15% of sampling on South Georgia had been in the circalittoral (Downey and Griffiths 2012; Downey *et al.* 2012). In other areas, including the Weddell Sea, depth has been shown to restrict sponge species distribution, with distinct faunas found in particular bathymetric zones, (Voultsiadou 2005; Longo *et al.* 2005; Bertolino *et al.* 2007; van Soest *et al.* 2007; Goodwin *et al.* 2011b; Göcke and Janussen 2011; Downey *et al.* 2012). Depth has been shown experimentally to be linked to larval dispersal and settlement success, and affect adult sponge physiology (Maldonado and Young 1998). Whilst ice scour and anchor ice prevent establishment of sponge communities in many areas of the nearshore Antarctic (McClintock *et al.* 2005), further study of those which do have well developed communities will help to establish whether depth zonation is important in structuring Antarctic sponge communities.

The degree of affinity of the Antarctic and sub-Antarctic fauna with the neighbouring Magellanic biogeographic province has been debated with Sarà (1992) reporting a high degree of affinity, attributed to the faunal exchanges along the Scotia Arc, whereas Rios (2006) viewing it as a distinct biogeographic entity. Burton (1932; 1934) reports many species from both the Antarctic and sub-Antarctic and the Falkland Islands. Generally the regions are regarded as distinct with the Antarctic Polar Front, which can be detected as deep as 1000m, forming a natural barrier (Griffiths 2010; Campos *et al.* 2011). An analysis of sponge literature records (largely for South Georgia those of Burton's studies) by Downey *et al.* (2012) reported a South American influence on the sub-Antarctic fauna, particularly that of South Georgia. However, previous studies, using the same methodology, of the shallow water sponges of the Falkland Islands (Goodwin *et al.* 2011a, author's unpublished data) did not find any of the species reported in this study from South Georgia. Sponges can be taxonomically difficult and it has been demonstrated that many wide-ranging species are in fact complexes of morphologically cryptic but genetically distinct entities (e.g. Nichols and Barnes 2005). Here, because of the diving methodology used, we were able to use living, *in situ*, form as an additional identification character, which has helped distinguish between morphologically conservative species. It may be that some of Burton's specimens are in fact distinct species. For example, *Halichondria (Eumastia) attenuata* Topsent, 1915 which was described from shallow water in the Falkland Islands (Topsent 1915) was reported by Burton from both the shallow water in the Falkland Islands and South Georgia (1934), it has also been reported from Bransfield Strait in Antarctica (Campos *et al.* 2007) but the external and spicule form make this identification doubtful (Goodwin *et al.* 2011a). Whilst the oxea spicules have few identification characters it has a very distinctive external appearance. This species was one of the most widespread and abundant species in the Falkland Islands but was not present in our samples and it is likely it is not in fact present on South Georgia. Further studies using this diving methodology, and incorporating molecular methods, will help establish the biogeographic affinities of these regions.

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