

A new species of *Phorbas* (Porifera: Poecilosclerida) from the Bellingshausen Sea, Antarctica

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Phorbas is a common genus with cosmopolitan distribution. A new species of sponge, *Phorbas megasigma* sp. nov. (Porifera: Poecilosclerida: Hymedesmiidae) is described from material collected during the third Spanish expedition on the study of the Antarctic benthos, 'Bentart 03'. *Phorbas megasigma* is closely related to *P. nexus* but differs in the possession of arcuate chelae and very big sigmata as microscleres.

INTRODUCTION

During the Spanish Antarctic survey Bentart 03 (Antarctic Benthos) 2003, sponges were collected from several locations, principally in the Bellingshausen Sea and surrounding areas such as the Gerlache Strait, at depths from 48 to 2045 m. The collection contained material of a species of *Phorbas* Duchassaing & Michelotti, 1864, which appeared to differ from the eight *Phorbas* species recorded from Antarctic waters so far: *P. areolata* (Thiele, 1905), *P. glaberrima* (Topsent, 1916), *P. affinis* (Brøndsted, 1924), *P. longurioides* (Burton, 1932), *P. antarctica* (Burton, 1940), *P. acanthochela* (Koltun, 1964), *P. nexus* (Koltun, 1964) and *P. domini* (Boury-Esnault & Van Beveren, 1982). The present study gives the description of this new material.

MATERIALS AND METHODS

The material examined originates from the Bellingshausen Sea (Antarctica), 70°44'28"S 81°28'37"W (Figure 1), and was collected at a depth of 494 m by a 2.01-m Agassiz trawl in February 2003 on mixed bottoms (mud and sand with a few gravels).

The specimens were preserved in 70% ethanol. In order to study the spicules, the organic matter was digested with nitric acid taken to boiling point following the methods of Rützler (1978) and Cristobo et al. (1993). Spicules were examined with a Leica S440 scanning electron microscope. The data for spicule sizes are based on 25 measurements for each spicule category, comprising minimum, maximum and average lengths in micrometres (µm). The classification

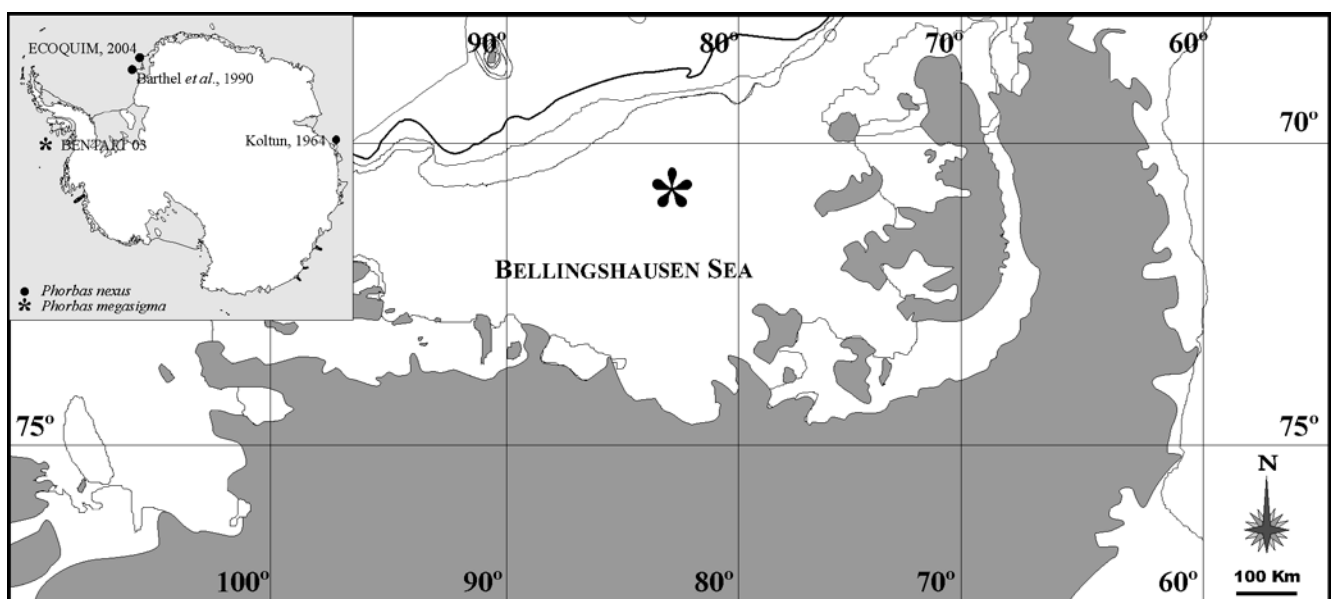


Figure 1. Map of the Antarctic continent and the Bellingshausen Sea. Location of *Phorbas megasigma* is indicated by * and location of *Phorbas nexus* is indicated by •.

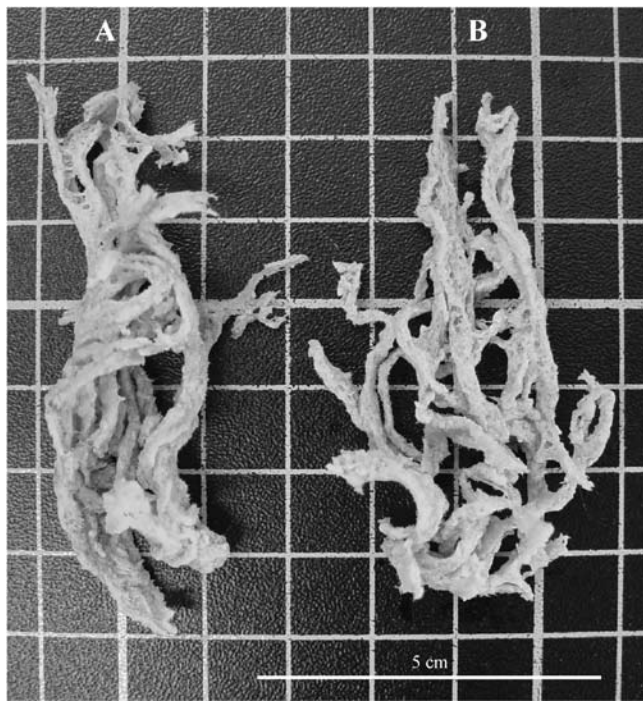


Figure 2. *Phorbas megasigma* sp. nov. Habitus. (A) Paratype; (B) holotype.

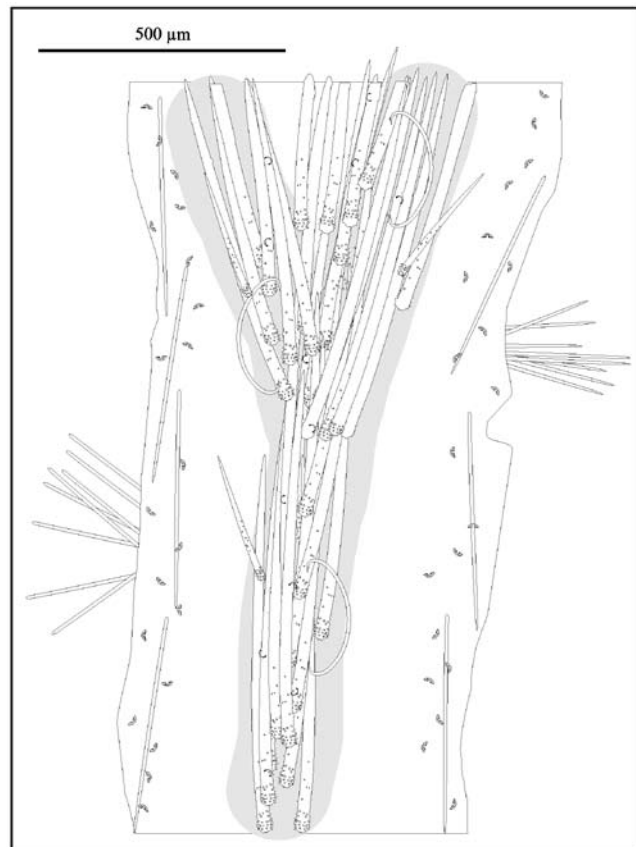


Figure 3. *Phorbas megasigma* sp. nov. skeleton.

system adopted in this work is that proposed by van Soest (2002) in the *Systema Porifera* (Hooper & van Soest, 2002).

The type material was deposited at the Museo Nacional de Ciencias Naturales, Madrid, Spain (MNCN) and Muséum National d'Histoire Naturelle, Paris, France (MNHN).

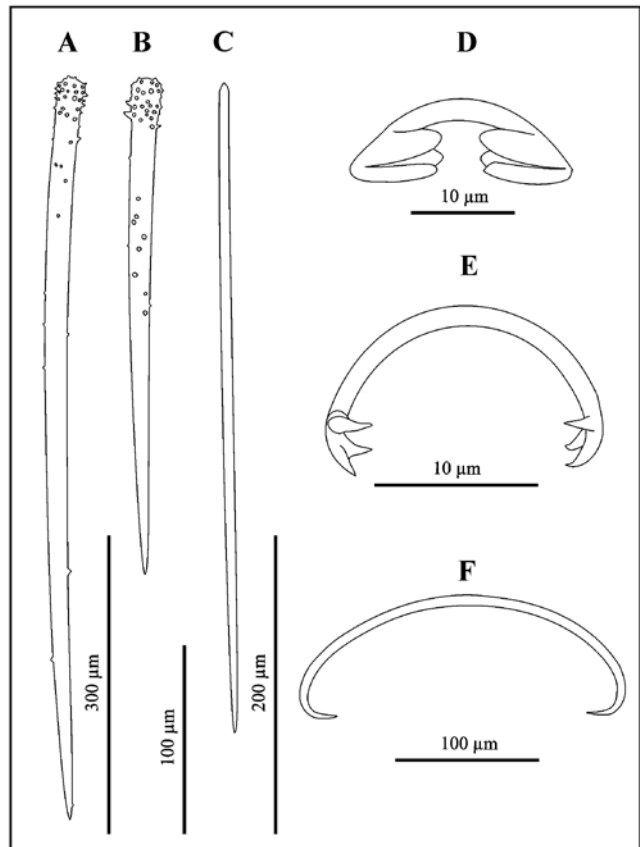


Figure 4. *Phorbas megasigma* sp. nov. (A) Principal acanthostyle; (B) secondary acanthostyle; (C) tornote; (D) arcuate chela; (E) unguiferate chela; (F) sigma.

SYSTEMATICS

Class DEMOSPONGIAE Sollas, 1885
 Order POECILOSCLERIDA Topsent, 1928
 Suborder MYXILLINA Hajdu, van Soest & Hooper, 1994
 Family HYMEDESMIIDAE Topsent, 1928
 Genus *Phorbas* Duchassaing & Michelotti, 1864
Phorbas megasigma sp. nov.

Type material

Holotype: Museo Nacional de Ciencias Naturales de Madrid. MNCN 1.01/372.

Paratype: Muséum National d'Histoire Naturelle, Paris. MNHN DCL 4016.

Type locality: Bellingshausen Sea (Antarctic); 70° 44'28"S 81° 28'37"W; 494 m depth; coll. RV 'Hespérides', 11 February 2003. Two specimens. Muddy substrate with sand and not many gravels.

Other material examined. Specimens of *Phorbas nexus* from ECOQUIM Project (Chemical ecology of Antarctic invertebrates), Weddel Sea (Antarctic): 72° 48'00"S 19° 30'46"W and 72° 54'00"S 19° 46'26"W; 668–693.6 m depth; coll. RV 'Polarstern' 1–3 January 2004. Two specimens.

External morphology (Figure 2)

Erect arborescent growth form. Cylindrical, anastomosed and levelled branches with irregular surface. Size: 7×1×0.15 cm. Elliptical oscules less than 1 mm in diameter, scattered

Table 1. Comparison of some ecological data and spicule sizes of Antarctic species of the genus Phorbas Duchassaing & Michelotti, 1864 including *P. megasigma* sp. nov.

Reference	Locality	Depth (m)	Acanthostyli	Megascleres (µm)					
				Tornote (To)	Oxea (O)	Strongyle (St)	Subtylostyles (Su)	Isochela	Microscleres (µm)
<i>P. areolata</i> (Thiele, 1905)	Calbuco	40	I. 240×16 II. 120×7	(O) 225×8				25	
<i>P. glaberrima</i> (Topsent, 1916)	Alexander I Land	297	260×13–14	(To) 530–600×20–22				25–27.5	
<i>P. affinis</i> (Brøndsted, 1924)	New Zealand	9–14	90–180×13–14	350×5–6				26	
<i>P. longurivoides</i> (Burton, 1932)	Shag Rocks	177	I. 350×16 II. 105×8	(To) 320×7					
<i>P. antarctica</i> (Hentschel, 1914)	Gauss Station (Wilhelm II Land)	385	I. 352–480×25 II. 128–144×9–10	(St) 296–328×5					
<i>P. acanthochela</i> (Koltun, 1964)	Mac Robertson Coast	1340	130–250×10–12 (Style) 360–430×6–8					30–35	
<i>P. nexis</i> (Koltun, 1964)	Wilkes Land; Wilhelm II Coast; Queen Mary Coast	310–400	520–720×15–25	(To) 370–480×5–7				(Bipocillum) 16–20	
<i>P. nexis</i> (Koltun, 1964) as <i>Clathria (Clathria) nexis</i> (Hooper, 1996)	Claire Coast or Wilhelm Land	310–400	I. 518–620×18–25 II. 214–278×9–17	(Su) 366–415×3–7				14–19	
<i>P. nexis</i> (Koltun, 1964) from ECOQUIM Project	Weddell Sea	668–694	I. 440–700×10–35 II. 217.5–300×10–30	(To) 300–400×2.5–6.25				15–20	
<i>P. domini</i> (Boury-Esnault & Van Beveren, 1982)	Kerguelen	155	I. 294–377×19–22 II. 179–211×9–12	(To) 242–350×6–12				25–32	
<i>P. roemeri</i> (Hentschel, 1929) (Koltun, 1959)	Arctic	66–300	I. 266–364×12–13 II. 126–182×9–10	(To) 196–238×3–6				I. 15–20 II. 32–56	40–54
<i>P. megasigma</i> sp. nov.	Bellingshausen Sea	494	I. 580–780×10–20 II. 200–295×10–25	(To) 300–445×2.5–5				I. 15–20 II. 20–25×5–10	25–230

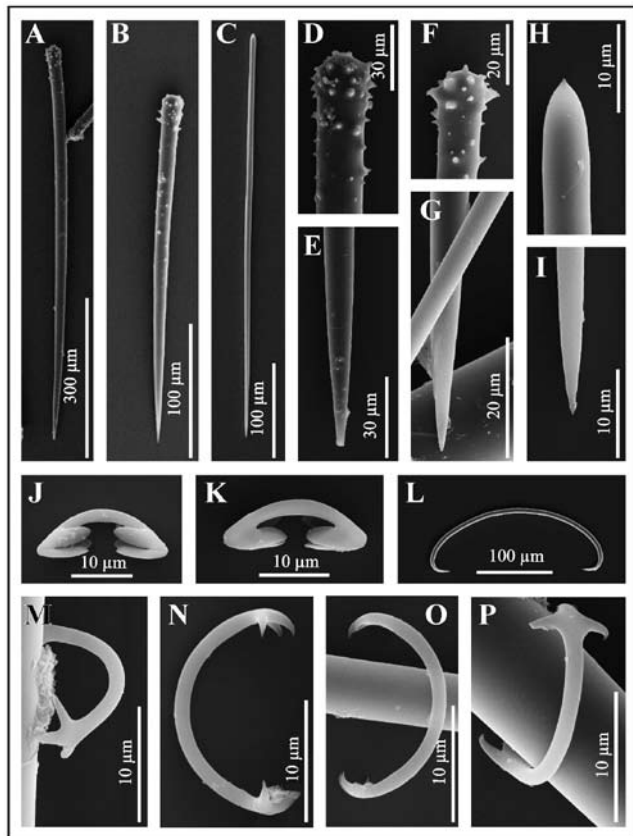


Figure 5. *Phorbas megasigma* sp. nov. (A) Principal acanthostyle; (B) secondary acanthostyle; (C) tornote; (D,E) detail of extremities of principal acanthostyle; (F,G) detail of extremities of secondary acanthostyle; (H,I) detail of extremities of tornote; (J,K) arcuate chelae; (L) sigma; (M–P) unguiferate chelae.

and irregularly distributed. With pore sieves. Soft and flexible consistency. Smooth and velvety texture. Ivory colour *in vivo* and in ethanol.

Skeleton (Figure 3)

Choanosomal skeleton with bundles of acanthostyles connected by spongine and echinating secondary acanthostyles. Microscleres are sigmas and isochelae. Ectosomal skeleton with tornotes in bundles of 8–10 spicules protruding from the surface half of their length and free spicules paratangential to surface. Arcuate isochelae are not very abundant.

Spicules (Figures 4 & 5)

Megascleres. Principal acanthostyles long, straight or slightly curved towards the basal end. Short and sharp basal spines which are scarce on the shaft and point. Size: 580–780 (687) × 10–20 (18) μm .

Secondary acanthostyles similar in form to principal acanthostyles, but shorter. Spines concentrated on the base; pointed end. Size: 200–295 (263.25) × 10–25 (17.5) μm .

Straight and thin tornotes. Different ends, one with sharp and the other swollen ending in a short mucron. Size: 300–445 (383.92) × 2.5–5 (4.75) μm .

Microscleres. Unguiferate chelae with sigma appearance; both ends divided in to three curved teeth. (One frontal and two lateral). Size: 15–20 (17.58) μm .

Arcuate chelae with three teeth with rounded ends. Shaft strongly curved. Size: 20–25 (21.33) × 5–10 (7.35) μm .

Big sigmata with short and pointed opposite ends curved at 90° angles. They have a wide dimensional range. Size: 25–230 (116.1) μm long.

Etymology

The specific name is given for the presence of very big sigmata as microscleres.

DISCUSSION

Eight species of the genus *Phorbas* Duchassaing & Micheloti, 1864, have been reported to date in Antarctic waters: *P. areolata* (Thiele, 1905), *P. glaberrima* (Topsent, 1916), *P. affinis* (Brøndsted, 1924), *P. longurioides* (Burton, 1932), *P. antarctica* (Burton, 1940), *P. acanthochela* (Koltun, 1964), *P. nexus* (Koltun, 1964) and *P. domini* (Boury-Esnault & Van Beveren, 1982) (Table 1).

Phorbas areolata described by Thiele (1905) from Calbuco (Chile) has two size-classes of acanthostyli, oxea and isochelae. The skeleton consists of abundant acanthostyli placed in the inner part of the sponge and oxeas at the surface in a paratangential ectosomal disposition. Isochelae are abundant on the surface. Pore areas lack megascleres and isochelae appear isolated. No sigmata.

In the description of *P. glaberrima*, Topsent (1916) characterized this species on the presence of acanthostyli, tornotes and isochelae. No sigmata.

Phorbas affinis was collected for the first time in Wellington Harbour and New Plymouth (New Zealand) and after that was recorded by Burton (1938) in Antarctic waters. In the original description, Brøndsted (1924) defined it as an encrusting or oblong roundish species, with smooth diactines variously ended (strongyla, tylota or tornota), acanthostyli and curved isochelae. No sigmata.

Burton (1932) in the original description of *P. longurioides* characterized it on the presence of two size-classes of acanthostyli and tornota. He included it in the genus *Hymedesmia* because it was an encrusting sponge with dermal skeleton an irregular tangential layer of tornota and the main skeleton composed of acanthostyli of two sizes. Subsequently, Koltun (1976) assigned it to the genus *Anchinöe* Gray, 1867 because the studied specimen was massive, with a skeleton typical for this genus, but with spicules like *H. longurioides*; for this reason, he considered the specimen as an adult or a more developed form of that described by Burton. No sigmata have been reported.

Phorbas antarctica was described by Hentschel (1914) as an antarctic variety of *Hymedesmia dermatata* (Lundbeck, 1910), characterized by the presence of two categories of acanthostyles in the choanosomal skeleton and strongyles (amphistrongyle *sensu* Hentschel, 1914) which form irregular horizontal fibres among the ends of the big acanthostyles. Burton (1940) believed that it was a valid species and he included it in the genus *Anchinöe*.

In the original description of *P. acanthochela* Koltun (1964), this species is characterized by the presence of polytylote styles, acanthostyles and arcuate chelae sometimes with a few spinules along the shaft. The ectosomal skeleton is a mass of microscleres and styles. The choanosomal skeleton

is formed of bundles and fibres of styles. Acanthostyles are present in both skeletons. No sigmata.

Phorbas domini was originally described in the genus *Pronax* Gray, 1867 by Boury-Esnault & Van Beveren (1982) and characterized by the presence of two acanthostyle categories which form choanosomal skeleton and tornotes and isochelae in a layer that form the ectosomal skeleton tangentially grouped or in bouquets. No sigmata were reported.

Koltun (1964) in the original description placed *P. nexus* in his genus *Bipocillopsis* Koltun, 1964 characterized by its reticulated or fibrous skeleton composed of monactinal spicules (spined or smooth styles) and supplementary acanthostyles. Dermal skeleton is composed by smooth monactines or anisodiactines and bipocilli as microscleres.

From all Antarctic species of the genus *Phorbas* the closest species to the new species collected during the Bentart 03 expedition is *P. nexus* (Koltun, 1964). Habitus and spicular composition is similar but we found significant differences which are constant in specimens found in the Bellingshaussen Sea. The main difference is a second class of acanthostyles (Koltun, 1964, figure 19-3 did not describe it but he made a drawing of it) and the presence of arcuate chelae and sigmata which are neither described nor drawn by Koltun.

Hooper & Wiedenmayer (1994) and Hooper (1996) considered that *Bipocillopsis* Koltun, 1964 was a synonym of *Clathria* Schmidt, 1862 by its skeletal architecture. Also Hooper studied the paratype of *Bipocillopsis nexus* (BMNH_1963.7.29.56) and he confirmed the presence of a second size of acanthostyle not described by Koltun (1964). Van Soest (2002) considered the genus *Bipocillopsis* a junior synonym of the genus *Phorbas* Duchassaing & Michelotti, 1864 because the only difference with this is the peculiar reduced chelae in *Bipocillopsis*. In the same book Hooper (2002) maintained that *Bipocillopsis* is a synonym of *Clathria* characterized by the presence of a single category only of auxiliary style forming a sparse paratangential ectosomal skeleton and choanosome without marked difference between axial and extra-axial regions.

The taxonomic position of this species thus seems controversial. In the particular case of the specimen collected during the Bentart 03 expedition (holotype and paratype of *P. megasigma* sp. nov.), the skeleton does not correspond with the family Microcionidae. Because of the presence of sigmas we must include this specimen in the genus *Pronax* (M.J. Uriz, personal communication, 2004), which was recently synonymized with *Phorbas*.

In our specimens other spicular classes are present which were not described in the original description of *P. nexus* nor in the study of the paratype by Hooper.

The only further record of the species was made by Barthel et al. (1990) from the expedition ANTARKTIS VII/4 (Epos leg 3) of RV 'Polarstern' in 1989, where in the list of preliminary results they report the presence of *P. nexus* in the eastern Weddell Sea.

We had the opportunity to study two samples collected in the Weddell Sea during the Antarctic cruise ANTXXI/2 on board the RV 'Polarstern' with the participation of scientists of the ECOQUIM Project. The habitus, the skeleton, the spiculation and the size of spicules of these specimens make it close to the type and paratype of *P. nexus* (Koltun, 1964).

One species, *Phorbas roemeri* (Hentschel, 1929), collected in Arctic waters, presents the same spicular types as *P. megasigma*, but the size of them are very different (Table 1).

Consequently we consider that the presence of truly arcuate chelae and sigmata constitute sufficient differences to conclude that our specimen belongs to a species different from that described by Koltun and that it is a new species. Moreover, because of the presence of this chela category we included it in the genus *Phorbas*.

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REFERENCES

- Barthel, D., Tendal, O. & Panzer, K., 1990. Ecology and taxonomy of sponges in the eastern Weddell Sea shelf and slope communities. In *Reports on polar research, Bremerhaven, Germany* (ed. W. Arntz et al.). *Alfred Wegener Institute for Polar and Marine Research*, **68**, 120–131.
- Boury-Esnault, N. & Van Beveren, M., 1982. Les démosponges du plateau continental de Kerguelen-Heard. *Comité National Français des Recherches Antarctiques*, **52**, 1–175.
- Brøndsted, H.V., 1924. Sponges from New Zealand. Part I. Papers from Dr. Th. Mortensen's Pacific Expedition, 1914–16. XXIII. *Videnskabelige Meddelelser fra Dansk Naturhistorisk Forening i Kjobenhavn*, **77**, 435–483.
- Burton, M., 1932. Sponges. *Discovery Reports*, **6**, 237–392.
- Burton, M., 1938. Non calcareous sponges. *Scientific Reports of the Australasian Antarctic Expedition, Series C (Zoology and Botany)*, **9**, 5–22.
- Burton, M., 1940. Las esponjas marinas del Museo Argentino de Ciencias Naturales. *Anales del Museo Argentino de Ciencias Naturales*, **XL**, 95–121.
- Cristobo, F.J., Urgorri, V., Solorzano M.R. & Ríos, P., 1993. Métodos de recogida, estudio y conservación de las colecciones de poríferos. In *International Symposium & First World Congress on Preservation and Conservation of Natural History Collections*, (ed. F. Palacios et al.). Madrid: Dirección General de Bellas Artes y Archivos. Ministerio de Cultura, 2, 277–287.
- Hentschel, E., 1914. Monaxone Kieselschwämme und Hornschwämme der deutschen Südpolar Expedition 1901–1903. *Deutschen Südpolar Expedition Zoology*, **7**, 37–141.
- Hooper, J., 1996. Revision of Microcionidae (Porifera: Poecilosclerida: Demospongiae) with description of Australian species. *Memoirs of the Queensland Museum*, **40**, 1–626.
- Hooper, J., 2002. Family Microcionidae Carter, 1875. In *Systema Porifera: a guide to the classification of sponges* (ed. J.N.A. Hooper and R.W.M. van Soest), pp. 432–468. New York: Kluwer Academic/Plenum Publishers.
- Hooper, J. & Soest, R.W.M. van eds., 2002. *Systema Porifera: a guide to the classification of sponges*. New York: Kluwer Academic/Plenum Publishers.
- Hooper, J. & Wiedenmayer, F., 1994. Porifera, (ed. A. Wells). *Zoological Catalogue of Australia, Melbourne*, **12**, 1–620.
- Koltun, V.M., 1959. Corneosiliceous sponges of the northern and far eastern seas of the USSR. In *Keys for the identification of the fauna of the USSR* (ed. Zoological Institute of the Academy of Sciences of the USSR). Moscow-Leningrad. 236 pp.

- Koltun, V.M., 1964. Sponges of the Antarctic. I. Tetraxonida and Cornacuspongidae. Academy of Sciences of USSR Zoological Institute. Explorations of the Fauna of the Seas. *Biological Results of the Soviet Antarctic Expedition (1955–1958)*, **2**, 1–116.
- Koltun, V.M., 1976. Porifera. Part I. Antarctic sponges. *British Australian New Zealand Antarctic Research Expedition 1929–1931 Reports Series B (Zoology and Botany)*, **9**(4), 147–198.
- Rützler, K., 1978. Sponges on coral reef. In *Coral reefs: research methods* (ed. D.R. Stoddart and R.E. Johannes), pp. 81–120. Paris: Unesco.
- Soest, R.W.M. van, 2002. Family Hymedesmiidae Topsent, 1928. In *Systema Porifera: a guide to the classification of sponges* (ed. J.N.A. Hooper and R.W.M. van Soest), pp. 575–593. New York: Kluwer Academic/Plenum Publishers.
- Thiele, J., 1905. Die Kiesel und Hornschwämme der Sammlung Plate. *Zoologische Jahrbücher*, **6**, 407–495.
- Topsent, E., 1916. Diagnoses d'éponges recueillies dans l'Antarctique par le "Pourquoi-pas?". *Bulletin du Muséum d'Histoire Naturelle Paris*, **3**, 163–172.

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