UvA-DARE (Digital Academic Repository)

New bioeroding sponges from Mingulay coldwater reefs, north-west Scotland

van Soest, R.W.M.; Beglinger, E.J.

DOI

[10.1017/S0025315408002725](https://doi.org/10.1017/S0025315408002725)

Publication date

2009

Published in

Journal of the Marine Biological Association of the United Kingdom

[Link to publication](#)

Citation for published version (APA):

van Soest, R. W. M., & Beglinger, E. J. (2009). New bioeroding sponges from Mingulay coldwater reefs, north-west Scotland. *Journal of the Marine Biological Association of the United Kingdom*, 89(2), 329-335. <https://doi.org/10.1017/S0025315408002725>

General rights

It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

Disclaimer/Complaints regulations

If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: <https://uba.uva.nl/en/contact>, or a letter to: Library of the University of Amsterdam, Secretariat, Singel 425, 1012 WP Amsterdam, The Netherlands. You will be contacted as soon as possible.

New bioeroding sponges from Mingulay coldwater reefs, north-west Scotland

ROB W.M. VAN SOEST AND ELLY J. BEGLINGER

Zoological Museum of the University of Amsterdam, PO Box 94766, 1090GT Amsterdam, The Netherlands

The relatively shallow coldwater coral reefs growing off the eastern coast of Mingulay, north-west Scotland, are excavated by five sponge species, three of which, Alectona millari, Pione vastifica and Cliona lobata, were known previously from Scottish waters. The other two species are new to Scotland and Great Britain. One species is here described as new to science: Cliona caledoniae sp. nov. The species shows a superficial resemblance in colour (orange) and spiculation (possession of tylostyles and knobby microscleres) to Cliothosa hancocki described disjunctly from the Pacific Ocean and the Mediterranean Sea, but it differs clearly in lacking the characteristic Cliothosa amphiasters with branching rays. The Scottish species only possesses peculiar thick-rayed streptasters, which at first glance appear rather similar to the second microsclere type reported for Cliothosa hancocki, knobby-rayed amphiasters. However, the majority of the microscleres in the Mingulay species appear to be genuine spirasters (not amphiasters), and exhaustive search for true amphiasters, branching or otherwise, was in vain. The new species is extensively illustrated. Furthermore, we also report the first occurrence in British waters of Spiroxya levispira, originally described from Azorean deep waters, and subsequently reported from Madeira and several Mediterranean localities. It was found to occur not uncommonly in the Mingulay reefs, and additionally also in reefs of the Rockall Bank, west of Ireland. The spicular characters generally match those of the southern locations. The newly recorded species is described and amply illustrated.

Keywords: new bioeroding sponges, Mingulay cold water reefs, north-west Scotland

Submitted 13 May 2008; accepted 30 June 2008; first published online 17 November 2008

INTRODUCTION

Coldwater reefs off the east coast of Mingulay Island, southern Hebrides, north-west Scotland (Figure 1), were investigated in July 2006 during a joint multidisciplinary effort of the Royal Netherlands Institute of Sea Research (NIOZ) and the Scottish Association of Marine Sciences (SAMS). Bottom samples were obtained by video-grabbing, boxcoring, and dredging, while side-scan and multibeam transects were made over the reefs (Maier, 2006). One of the projects concerned the species composition of sponges occurring in and near the reefs, as a continuation of a series of investigations made in coldwater reefs elsewhere in the north-east Atlantic (see e.g. Van Soest & Lavaleye, 2005; Van Soest *et al.*, 2007), forming a part of the Dutch funded BIOSYS 2005–2007 programme.

Excavating or ‘boring’ sponges play a distinct role in coldwater reef systems as major bioeroders (Beuck & Freiwald, 2005; Beuck *et al.*, 2007). Not unexpectedly they were found to be frequent dwellers in the Mingulay reefs, typically occupying recently dead coral branches, but they were not found in the living parts of the corals. However, recent sophisticated techniques applied by Beuck *et al.* (2007) demonstrated the cryptic presence of sponge borings infesting living parts of *Lophelia* in reefs on the Porcupine Seabight. Five species were encountered: *Alectona millari* Carter, 1879, *Pione*

vastifica (Hancock, 1849), both quite common, *Cliona lobata* Hancock, 1849, which occurred only rarely, and two species not previously known from Scottish waters, a *Cliona* species that appeared to be undescribed, and a southern deepwater species *Spiroxya levispira* (Topsent, 1898). The former species was at first assigned to alpha forms of *Cliona* aff. *celata* Grant, 1826, because it seemed as if no microscleres were present, its colour is a distinct yellow or orange, and the papilla-size appears similar to that of *C. celata*. However, upon closer examination, not very numerous, thick spirasters were detected in some individuals. Subsequent studies demonstrated that the microscleres were confined to the papillar skeleton of all the alleged ‘*celata*’ specimens. Below, the new species of *Cliona* and the newly recorded *Spiroxya levispira* are described and extensively illustrated.

MATERIALS AND METHODS

Bottom samples containing dead and living reef corals, mostly *Lophelia pertusa* but occasionally also *Madrepora oculata*, were obtained by three sampling methods (Maier, 2006): video-grabbing (cf. Mortensen *et al.*, 2000 for an extensive description of this method), boxcoring using a 50 cm diameter cylinder, and trawling (10 minutes bottom time). Table 1 lists all the samples from which bioeroding sponges were obtained. Sponges were usually obtained from subsamples of coral branches assigned for sponge research. Occasionally the entire sample was made available for sponge studies. Sponges detected on board were pre-identified using crude

Corresponding author:

R.W.M. van Soest

Email: R.W.M.vanSoest@uva.nl

Fig. 1. Map of the Hebrides off the Scottish west coast showing the approximate location of the Mingulay reefs and the sampling stations (map obtained through Wikipedia from the internet source: www.aquarius.ifm-geomar.de, and was slightly modified).

slide preparations (cf. Van Soest & Lavaleye, 2005) and preserved in 96% ethanol. Unsorted trawl subsamples and boxcore subsamples were directly preserved in larger containers and analysed onshore in Amsterdam. Dead coral branches were examined using a low power microscope and opened up using hammer and chisel. Sponge identification was done

from teased tissue preparations. Spicules were dissociated by boiling in concentrated nitric acid and the residue was washed five times in distilled water and mounted on slides and SEM stubs for examination at high magnification.

SYSTEMATIC DESCRIPTIONS

The classification used here follows the *Systema Porifera* (Hooper & van Soest, 2002):

Class DEMOSPONGIAE
Order HADROMERIDA
Family CLIONAIDAE
Genus *Cliona* Grant, 1826
Cliona caledoniae sp. nov.
Figure 2A–B, Figure 4A–D

TYPE MATERIAL

Holotype: ZMA Por. 20174, Mingulay, Station BX48/06, 56.8054°N 7.4419°W, 127 m, in *Lophelia pertusa*, 14/7/06.
Paratypes: ZMA Por. 20171C, same data as the holotype; ZMA Por. 20270 & 20271, Mingulay, Station BX127, 82 m, in *Lophelia pertusa*, 56.8033°N 7.4471°W, 20/7/06; ZMA Por. 20320, Station VG28/05, 131 m, in *Lophelia pertusa*, 56.8219°N 7.3964°W, 12/7/06.

DESCRIPTION

Excavating sponge, with exclusively alpha-habit (distinctly separate non-confluent papillae protruding from the corals). Papillae yellow, or orange-yellow, rather conspicuous, flush with the surface, often slightly elevated beyond the coral surface (Figure 4D), but in preserved material the papillae tend to be contracted below the substratum level (Figure 4C). The papillae turn brown in alcohol. Both optically ‘closed’ papillae, presumably exhalant, and optically perforated papillae, presumably oscular, occur. The holotype has only a single papilla (Figure 4A) hidden in the calyx of a dead coral polyp and sponge tissue has permeated and

Table 1. Locality data of studied samples.

ZMA registration number	Species	Reef site	Sample number	Depth (m)	Latitude	Longitude	Date
20174	<i>Cliona caledoniae</i> sp. nov.	Mingulay	BX48/06	127	56.8054	−7.4419	14/7/06
20171C	<i>Cliona caledoniae</i> sp. nov.	Mingulay	BX48/05	127	56.8054	−7.4419	14/7/06
20270	<i>Cliona caledoniae</i> sp. nov.	Mingulay	BX127	82	56.8033	−7.4471	20/7/06
20271	<i>Cliona caledoniae</i> sp. nov.	Mingulay	BX127	82	56.8033	−7.4471	20/7/06
20320	<i>Cliona caledoniae</i> sp. nov.	Mingulay	VG28/05	131	56.8219	−7.3964	12/7/06
20210A	<i>Spiroxya levispira</i>	Mingulay	BX123	162	56.8059	−7.429	19/7/06
20255A	<i>Spiroxya levispira</i>	Mingulay	BX180	144	56.8034	−7.4467	22/7/06
20269A	<i>Spiroxya levispira</i>	Mingulay	BX127	82	56.8033	−7.4471	20/7/06
20274	<i>Spiroxya levispira</i>	Mingulay	BX127	82	56.8033	−7.4471	20/7/06
20280B	<i>Spiroxya levispira</i>	Mingulay	BX127	82	56.8033	−7.4471	20/7/06
20350A	<i>Spiroxya levispira</i>	Mingulay	VG49	168	56.8071	−7.4303	14/7/06
20418A	<i>Spiroxya levispira</i>	Mingulay	DR182	128	56.8243	−7.3686	22/7/06
20611	<i>Spiroxya levispira</i>	Rockall Bank	BX72	762	55.44437	−16.07597	4/7/05
20612	<i>Spiroxya levispira</i>	Rockall Bank	BX168	691	55.44432	−16.07457	12/7/05

replaced most of the limestone skeleton (Figure 4B), leaving only a thin-walled coral. Papilla size variable, 1–4 mm diameter. Papillae unevenly distributed over the coral surface (Figure 4C–D). Excavations are extensive chambers, up to 5 mm or more in diameter, filled with soft tissue of a pale brown or off-white colour. The branching corals and coral polyps are hollowed out to leave only a thin limestone wall.

SKELETON

The papillae are provided with the usual dense palisade of tylostyles, points outward, with intermingled microscleres in a moderate density. The intra-coral tissue contains scattered loose tylostyles, and microscleres are absent.

SPICULES

Tylostyle megascleres and spiraster microscleres. Tylostyles (Figure 2A), robust, with usually slightly subterminal tyle, $246\text{--}360.9\text{--}426 \times 8\text{--}9.8\text{--}12 \mu\text{m}$ ($N = 25$); tyles $11\text{--}12.3\text{--}15 \mu\text{m}$ diameter.

Spirasters (Figure 2B), thick, blunt-rayed, with short axis, occasionally almost straight and with the rays concentrated at the extremities. Length: $19\text{--}24.3\text{--}31 \times 5\text{--}6.8\text{--}9 \mu\text{m}$ ($N = 25$), excluding rays which are $3\text{--}5.1\text{--}7 \mu\text{m}$; number of rays $10\text{--}11.8\text{--}17$.

ECOLOGY

Excavating dead *Lophelia* and *Madrepora* corals at 82–131 m depth.

ETYMOLOGY

Named after Caledonia, the Roman name for Scotland.

REMARKS

The new species is distinguished from the known north-east Atlantic Clionidae species by its combination of common-place tylostyles and a single category of thick-rayed amphiaster-like spirasters. *Cliona lobata* is the only species in the area with similar overall spiculation of tylostyles and spirasters, but it has two categories of spirasters the larger of which are longer and thinner (up to $65 \mu\text{m}$), with up to 9 spiral curves (Topsent, 1900) and its papillae are usually not larger than 0.5 mm in diameter. *Cliona celata* has similar papilla size as the new species but these are usually much closer together, and the species lacks microscleres entirely (Rützler, 2002a). Excavations in the alpha-form of this species usually are thin, branching corridors and small galleries, not large chambers entirely filled with tissues as described above. No specimens of *Cliona celata* were encountered in the Mingulay reefs, although initially the present species was mistaken for it. *Pione vastifica*, very common in the Mingulay reefs, possesses next to tylostyles and thin microrhabds also rugose microxeas, usually in two size-classes. Macroscopically, *Pione vastifica* and *Cliona caledoniae*

Fig. 2. *Cliona caledoniae* sp. nov., scanning electron microscopy images of spicules. (A) Tylostyle and variations of tyles; (B) spirasters, showing from upper left to lower right spicules with spiral turns and conical rays spread randomly to amphiaster-like forms with straight rhabd and apically concentrated rays.

sp. nov. are similar and microscopic examination is necessary to identify either with certainty.

Other excavating sponges in the Mingulay reefs (*Spiroxya levispira*, cf. below, and *Alectona millari*) belong to a different family, Alectonidae, and are clearly distinct in spiculation from the Clionidae. Further excavating species, e.g. *Aka infesta* (Johnson, 1899), *A. nodosa* (Johnson, 1899) and *A. insidiosa* (Johnson, 1899), found in North Atlantic cold-water reefs (see e.g. Van Soest & Lavaleye, 2005 and Schönberg & Beuck, 2007), but so far not found in the Mingulay reefs, differ in lacking microscleres and having only oxeas as spicules.

Elsewhere in European waters, several additional *Cliona* species are reported (Topsent, 1888, 1900; Rützler, 1973; Rosell & Uriz, 2002). *Cliona janitrix* Topsent, 1932 and *C. ampicavata* Rützler, 1974 do not have spirasters. *Cliona viridis* (Schmidt, 1862) has two categories of spirasters, long thin ones with 2–5 bends, $10\text{--}53 \mu\text{m}$ and short straight ones with long spines, $13\text{--}30 \mu\text{m}$. The short spirasters have the spines much sharper and subdivided compared with those of *C. caledoniae* sp. nov. It occurs predominantly in shallow waters in the Mediterranean–Atlantic area. *Cliona schmidtii* (Ridley, 1881) likewise has two categories of spirasters, longer/thinner ($25\text{--}90 \mu\text{m}$) and shorter/thicker ($35\text{--}62 \mu\text{m}$). The shorter/thicker spirasters are not unlike those of *C. caledoniae* sp. nov. in shape but are longer and thicker, neatly separated in size. The colour of *C. schmidtii* is characteristically dark purple, which is retained in alcohol-preserved specimens. Similar spiculation is found in *Cliona carteri sensu* Rützler, 1973 (probably not Ridley, 1881) and *C. rhodensis* Rützler & Bromley, 1981 from Tunisia, with

small spirasters resembling those of *C. caledoniae* sp. nov. but possessing an additional long type with several bends.

Thick knobby spirasters occur in *Cliona thoosina* Topsent, 1888 described from several localities in the Mediterranean, and this species shares the yellow colour and tylostyle size with the new species, but the spirasters occur in three size-categories, up to 65 μm in length. Additional similar species are the Mediterranean *Cliona cretensis* Pulitzer-Finali (1983), but this has the typical thin spirasters of the majority of *Cliona* species, and *C. trematensis* Sarà, 1961, which has a complement of oxea megascleres (which may mean it is not a *Cliona* but a *Volzia*) and microscleres longer and slimmer than but not unlike those of *C. caledoniae* sp. nov.

Interestingly, the microscleres of *C. caledoniae* sp. nov. are reminiscent of the knobby amphistars described for several *Cliothosa hancocki* (Topsent, 1888) individuals from widely disparate areas (Rützler, 2002a). Like the thick spirasters of *C. caledoniae* sp. nov., these knobby amphistars of *C. hancocki* are concentrated in the papillae. Also the excavations of the new species are similar to those of *C. hancocki* (cf. also Calcinai *et al.*, 2005). The resemblance is superficial, but needs further comment. *Cliothosa hancocki* was originally described from various Pacific and Indian Ocean localities (Topsent, 1888, 1905; Lindgren, 1898; Annandale, 1915; Schönberg, 2000; Calcinai *et al.*, 2005) but subsequently from the Mediterranean (Adriatic, Tunisia) (Lendenfeld, 1897 (as *Vioa ramosa*); Topsent, 1928; Rützler, 1973). The closest locality to Mingulay from which this species was recorded is the Adriatic (Lendenfeld, 1897; see also Topsent, 1932), so occurrence in Mingulay is not unimaginable. The nodulous amphistars of *Cliothosa hancocki* are characterized by blunt cone-shaped rays and a very short axis, making them similar to thick spirasters. The difference between *Cliona* and *Cliothosa* is that the latter has only amphistars, while the former has spirasters sometimes combined with amphistar-like microscleres. *Cliothosa* typically has thin-rayed amphistars with branched rays as the major synapomorphy for the genus, while the nodulous amphistars are apparently rare or absent. In theory, the thin-rayed amphistars of *Cliothosa* could also be rare in some individuals (cf. Topsent, 1932), and then such *Cliothosa* individuals would resemble *Cliona* species with thick, blunt-rayed spirasters such as the present new species. Further similarities with *Cliothosa hancocki* are the exclusively alpha-stage, the colour and the size of papillae and galleries. However, we do not think the specimens of our new species are deficient *Cliothosa* specimens, because: (1) exhaustive search did not reveal the presence of thin-rayed amphistars with branching rays; (2) the axis of most microscleres is curved; (3) the rays are distributed all over the axis and do not appear to be concentrated at both ends so technically they are not amphistars; and (4) length of the microscleres (19–31 μm) is clearly greater than that of reported nodulous amphistar sizes in *Cliothosa hancocki* (10.5–25 μm)

Family ALECTONIDAE

Genus *Spiroxya* Topsent, 1896

Spiroxya levispira (Topsent, 1898)

Figures 3A–D, 4E

Cliona levispira Topsent, 1898: 235, figure 2; Topsent, 1904: 105, pl. XII figure 1; Pouliquen, 1972: 751, pl. 9 figure 4; Boury-Esnault, 1994: 61, figure 37.

Scantilla spiralis Johnson, 1899: 462, figure 5.

Fig. 3. *Spiroxya levispira* (Topsent, 1898), scanning electron microscopy images of spicules. (A) Large oxea; (B) smaller anisoxeas with magnified bluntly rounded end; (C) various sizes and forms of spiral strongyles; (D) spined microrhabds.

Scantilletta levispira; Rosell & Uriz, 1997: 361; Rosell & Uriz, 2002: 60, figure 3.

Spiroxya levispira; Rützler, 2002b: 289, figure 10D–E; Longo *et al.*, 2005: Table 2; Van Soest *et al.*, 2007: Table 2.

MATERIAL EXAMINED

ZMA Por. 20210A, Mingulay, Station BX123, 162 m, 56.8059°N 7.429°W, 19/7/06; ZMA Por. 20255A, Mingulay, Station BX180, 144 m, 56.8034°N 7.4467°W, 22/7/06; ZMA Por. 20269A & 20274 & 20280B, Mingulay, Station BX127, 82 m, 56.8033°N 7.4471°W, 20/7/06; ZMA Por. 20350A, Mingulay, Station VG49, 168 m, 56.8071°N 7.4303°W, 14/7/06; ZMA Por. 20418A, Mingulay, Station DR182, 128 m, 56.8243°N 7.3686°W, 22/7/06; ZMA Por. 20611, Rockall Bank, Station BX72, 762 m, 55.44437°N 16.07597°W, 4/7/05; ZMA Por. 20612, Rockall Bank, Station BX168, 691 m, 55.44432°N 16.07457°W, 12/7/05.

DESCRIPTION

Excavating sponge, with exclusively alpha-habit, papillae inconspicuous, flush with the surface, 2–4 mm in diameter, giving access to relatively large ellipsoid cavities (Figure 4E), up to approximately 10 mm diameter, filled with pale-coloured, off-white or beige, soft tissue.

Table 2. Spicule measurements and characteristics of all European *Spiroxya levispira* records.

Spicule type	Rockall	Mingulay	Azores	Madeira	Morocco	Mediterranean
Source	Present paper	Present paper	Topsent, 1898, 1904	Johnson, 1899	Boury-Esnault <i>et al.</i> , 1994	Poulliquen, 1972; Rosell & Uriz, 2002
Oxeas	360–450 10–15	186–330 9–12	350–410 15	Unknown Unknown	355–461 8–13	180–450 8–27
Anisoxeas	129–232 3–5	126–198 4	200 3–4	180 5	106–265 2.5–5	70–215 1–8
Microstrongyles	24–156 3–6	15–138 6	15–150 4–8	60 3	26–120 2.5–5	15–82 1–7
Acanthomicrohabds	Spined 8–12 Microspined	Spined 9–15 Microspined	Smooth? 7–10 Microspined	Smooth? Unknown Unknown	Smooth? Present Microspined	Smooth and spined 5–12 Long-spined

SKELETON

Radiate arrangement of megascleres at the surface of papillae, with tracts of oxeas lining the cavities and with confused arrangement of spicules in the soft interior mass. Smaller oxeas are concentrated in the surface, larger oxeas in the cavities.

SPICULES

Two size-classes of oxeas, spiral microstrongyles and acanthomicrohabds. Oxeas I: fusiform, sharply pointed, $186–280.3–330 \times 9–12 \mu\text{m}$ ($N = 25$); oxeas II, anisoxeote, with one end usually rounded or blunt, the other end sharply pointed, $126–169.0–198 \times 4–5 \mu\text{m}$ ($N = 25$); spiral microstrongyles, large size variation, $15–138 \times 5–6 \mu\text{m}$ ($N = 50$); acanthomicrohabds, straight, amphiaster-like, usually centrotylote or

spined most prominently in the middle, $9–11.9–15 \times 1–1.2–2 \mu\text{m}$ ($N = 25$).

ECOLOGY

Excavating dead *Lophelia* and *Madrepora* corals at 82–762 m depth (present study); elsewhere 5–2165 m. The shallow record is from Mediterranean cave habitats (Poulliquen, 1972), which are known to contain a deepwater fauna.

REMARKS

The present record is the most northern location known for the species and the first report of it from the waters of the British Isles. The species is predominantly reported from southern European localities, Azores, Madeira, Morocco and the western Mediterranean (Topsent, 1898, 1904; Johnson, 1899; Boury-Esnault *et al.*, 1994; Poulliquen, 1972; Rosell & Uriz, 2002; Longo *et al.*, 2005). The species was recently reported from Rockall Bank deepwater coral reefs, in the ocean west of Ireland (Van Soest *et al.*, 2007). Together with the Mingulay specimens these recent records comprise a considerable range extension. Most of the reported specimens show closely similar spicular characters (see Table 2). Compared to the description of the holotype from deep water off the Azores, the oxeas I of the Mingulay specimens are notably shorter and do not appear to overlap in length. The Madeira specimen of Johnson (1899 as *Scantilla spiralis*) was not fully described, but the figures provided by this author make it likely that they concern the same species.

A second species of *Spiroxya*, *S. heteroclita* Topsent, 1896 is recorded from *Lophelia* reefs west and south of Ireland (Stephens, 1915; Beuck *et al.*, 2007). This species differs clearly from *S. levispira* in possessing spirally spined straight strongyles, lacking acanthomicrohabds, and having oxeas up to $900 \mu\text{m}$ (Rützler, 2002b).

The acanthomicrohabds are named amphiasters by most past authors (e.g. Rosell & Uriz, 2002), but microstructure of the Mingulay and Rockall microscleres does not justify the name amphiaster as there are no proper rays, merely spines and clusters of spines (cf. Figure 3D). Calcinai *et al.* (2002) called the microscleres of their species *Scantiletta* (= *Spiroxya*) *corallophila* spiny microrhabds and we fully agree with that and recommend naming them

Fig. 4. Habitus images of *Cliona caledoniae* sp. nov. (A–D) and *Spiroxya levispira* (Topsent, 1898) (E). (A–B) Holotype of *C. caledoniae* sp. nov. infesting dead *Lophelia* corallite; (C–D) papillae (arrows) of paratypes of *C. caledoniae* sp. nov.; (C: ZMA 20271, D: 20270); (E) *S. levispira* excavations (arrows) (ZMA Por. 20418A).

acanthomicrohabds in the definition of the genus *Spiroxya*. These microhabds appear to be the only spicule type with some morphological diversification over the range of *Spiroxya levispira*, as the microhabds shown by Rosell & Uriz, 2002 have a different appearance with fewer much more prominent spines and less microspination. Further studies along the lines of Picton & Goodwin (2007), who looked at differences of local sponge populations in a restricted area, are needed to establish whether such subtle but apparently consistent differences in microstructures of spicules and relatively small size differences are of taxonomic importance.

ACKNOWLEDGEMENTS

Connie Maier and Fleur van Duyl (NIOZ, Texel) are thanked for inviting the first author to participate in the cruise to Mingulay Reefs as part of the BIOSYS programme financed by the Netherlands Organization for Science (NWO). Andy Davies (Scottish Association for Marine Sciences, SAMS, Oban) manipulated the video-grab which brought up coral material with a minimum of damage. Colleagues of the NIOZ secured the boxcore and dredge samples. The captain and crew of RV 'Pelagia' are acknowledged for their skills at operating the sampling gear and for their seamanship.

REFERENCES

- Annandale N. (1915) Indian boring sponges of the family Clionidae. *Records of the Indian Museum* 11, 1–24.
- Beuck L. and Freiwald A. (2005) Bioerosion patterns in a deep-water *Lophelia pertusa* (Scleractinia) thicket (Propeller Mound, northern Porcupine Sea Bight). In Freiwald A. and Roberts J.M. (eds) *Cold-water corals and ecosystems*. Berlin, Heidelberg and New York: Springer, pp. 915–936.
- Beuck L., Vertino A., Stepina E., Karolczak M. and Pfannkuche O. (2007) Skeletal response of *Lophelia pertusa* (Scleractinia) to bioeroding sponge infestation visualized with micro-computed tomography. *Facies* 53, 157–176.
- Boury-Esnault N., Pansini M. and Uriz M.J. (1994) Spongiaires bathyaux de la mer d'Alboran et du golfe ibéro-marocain. *Mémoires du Muséum National d'Histoire Naturelle* 160, 1–174.
- Calcinai B., Cerrano C. and Bavestrello G. (2002) A new species of *Scantiletta* (Demospongiae, Clionidae) from the Mediterranean precious red coral with some remarks on the genus. *Bulletin of Marine Science* 70, 919–926.
- Calcinai B., Bavestrello G. and Cerrano C. (2005) Excavating sponge species from the Indo-Pacific Ocean. *Zoological Studies* 44, 5–18.
- Carter H.J. (1879) On a new species of excavating sponge (*Alectona millari*); and on a new species of *Rhaphidotheca* (*R. affinis*). *Journal of the Royal Microscopical Society* 2, 493–499.
- Grant R.E. (1826) Notice of a new zoophyte (*Cliona celata* Gr.) from the Firth of Forth. *Edinburgh New Philosophical Journal* 1, 78–81.
- Hancock A. (1849) On the excavating powers of certain sponges belonging to the genus *Cliona* with descriptions of several new species, and an allied generic form. *Annals and Magazine of Natural History* 3, 321–348.
- Hooper J.N.A. and van Soest R.W.M. (eds) (2002) *Systema Porifera: a guide to the classification of sponges*. 2 volumes. New York: Kluwer Academic/Plenum Publishers.
- Johnson J.Y. (1899) Notes on some sponges belonging to the Clionidae obtained at Madeira. *Journal of the Royal Microscopical Society* 1899, 461–463.
- von Lendenfeld R. (1897) Die Clavulina der Adria. *Nova Acta Academiae Caesareae Leopoldino Carolinae Germanicae Naturae Curiosorum* 69, 1–251.
- Lindgren N.G. (1898) Beitrag zur Kenntniss der Spongienfauna des Malayischen Archipels und der chinesischen Meere. *Zoologische Jahrbücher. Abteilung für Systematik, Geographie und Biologie der Tiere* 11, 283–378.
- Longo C., Mastrototaro F. and Corriero G. (2005) Sponge fauna associated with a Mediterranean deep-sea coral bank. *Journal of the Marine Biological Association of the United Kingdom* 85, 1341–1352.
- Maier C. (2006) *Biology and ecosystem functioning of coldwater coral biherms at Mingulay (Hebrides), NE Atlantic. Cruise Report, BIOSYS 2006, Cruise 64PE250 on R/V Pelagia, Oban-Oban, 7–23 July 2006*. Royal Netherlands Institute for Sea Research, pp. 1–63.
- Mortensen P.B., Roberts J.M. and Sundt R.C. (2000) Video-assisted grabbing: a minimally destructive method of sampling azooxanthellate coral banks. *Journal of the Marine Biological Association of the United Kingdom* 80, 365–366.
- Picton B.E. and Goodwin C.E. (2007) Sponge biodiversity of Rathlin Island, Northern Ireland. *Journal of the Marine Biological Association of the United Kingdom* 87, 1441–1458.
- Pouliquen L. (1972) Les spongiaires des grottes sous-marines de la région de Marseille: ecologie et systématique. *Téthys* 3, 717–758.
- Pulitzer-Finali G. (1983) A collection of Mediterranean Demospongiae (Porifera) with, in appendix, a list of the Demospongiae hitherto recorded from the Mediterranean Sea. *Annali del Museo Civico di Storia Naturale Giacomo Doria* 84, 445–621.
- Ridley S.O. (1881) XI Spongida. Horny and siliceous sponges of Magellan Straits, S.W. Chili, and Atlantic off S.W. Brazil. In Gunther A. (ed.) *Account of the zoological collections made during the survey of H.M.S. 'Alert' in the Straits of Magellan and on the coast of Patagonia. Proceedings of the Zoological Society of London* 1881, 107–137, 140–141.
- Rosell D. and Uriz M.J. (1997) Phylogenetic relationships within the excavating Hadromerida (Porifera), with a systematic revision. *Cladistics* 13, 349–366.
- Rosell D. and Uriz M.J. (2002) Excavating and endolithic sponge species (Porifera) from the Mediterranean: species descriptions and identification key. *Organisms Diversity and Evolution* 2, 55–86.
- Rützler K. (1973) Clionid sponges from the coast of Tunisia. *Bulletin de l'Institut National Scientifique et Technique d'Océanographie et de Pêche, Salammbö* 2, 623–636.
- Rützler K. (1974) The burrowing sponges of Bermuda. *Smithsonian Contributions to Zoology* 165, 1–32.
- Rützler K. (2002a) Family Clionidae D'Orbigny, 1851. In Hooper J.N.A. and van Soest R.W.M. (eds) *Systema Porifera: a guide to the classification of sponges*. 2 volumes. New York: Kluwer Academic/Plenum Publishers, pp. 173–185.
- Rützler K. (2002b) Family Alectonidae Rosell, 1996. In Hooper J.N.A. and van Soest R.W.M. (eds) *Systema Porifera: a guide to the classification of sponges*. 2 volumes. New York: Kluwer Academic/Plenum Publishers, pp. 281–290.

- Rützler K. and Bromley R.G.** (1981) *Cliona rhodensis*, new species (Porifera: Hadromerida) from the Mediterranean. *Proceedings of the Biological Society of Washington* 94, 1219–1225.
- Sarà M.** (1961) La fauna di Poriferi delle grotte delle isole Tremiti. Studio ecologico e sistematico. *Archivio Zoologico Italiano* 46, 1–59.
- Schmidt O.** (1862) *Die Spongien des Adriatischen Meeres*. Leipzig: Wilhelm Engelmann, pp. i–viii, 1–88.
- Schönberg C.H.L.** (2000) Bioeroding sponges common to the Central Australian Great Barrier Reef: descriptions of three new species, two new records, and additions to two previously described species. *Senckenbergiana Maritima* 30, 161–221.
- Schönberg C.H.L. and Beuck L.** (2007) Where Topsent went wrong: *Aka infesta* a.k.a. *Aka labyrinthica* (Demospongiae: Phloeodictyidae) and implications for other *Aka* spp. *Journal of the Marine Biological Association of the United Kingdom* 87, 1459–1476.
- van Soest R.W.M. and Lavaleye M.S.S.** (2005) Diversity and abundance of sponges in bathyal coral reefs of Rockall Bank, NE Atlantic, from boxcore samples. *Marine Biology Research* 1, 338–349.
- van Soest R.W.M., Cleary D.F.R., de Kluijver M.J., Lavaleye M.S.S., Maier C. and van Duyl F.C.** (2007) Sponge diversity and community composition in Irish bathyal coral reefs. *Contributions to Zoology* 76, 121–142.
- Stephens J.** (1915) Sponges of the coasts of Ireland. I. The Triaxonia and part of the Tetraxonia. *Fisheries Ireland Scientific Investigations* 1914, 1–43.
- Topsent E.** (1888) Contribution à l'étude des Clionides. *Archives de Zoologie Expérimentale et Générale* 5, 1–166.
- Topsent E.** (1896) Matériaux pour servir à l'étude de la faune des spongiaires de France. *Mémoires de la Société Zoologique de France* 9, 113–133.
- Topsent E.** (1898) Éponges nouvelles des Açores. *Mémoires de la Société Zoologique de France* 11, 225–255.
- Topsent E.** (1900) Étude monographique des spongiaires de France, III. Monaxonida (Hadromerida). *Archives de Zoologie Expérimentale et Générale* 8, 1–331.
- Topsent E.** (1904) Spongiaires des Açores. *Résultats des Campagnes Scientifiques Accomplies par le Prince Albert I. Monaco* 25, 1–279.
- Topsent E.** (1905) *Cliothosa Seurati*, Clionide nouvelle des Îles Gambier. *Bulletin du Muséum National d'Histoire Naturelle* 11, 94–96.
- Topsent E.** (1928) Spongiaires de l'Atlantique et de la Méditerranée provenant des croisières du Prince Albert I^{er} de Monaco. *Résultats des Campagnes Scientifiques Accomplies par le Prince Albert I. Monaco* 74, 1–376.
- and
- Topsent E.** (1932) Notes sur des Clionides. *Archives de Zoologie Expérimentale et Générale* 74, 549–579.

Correspondence should be addressed to:

Rob W.M. van Soest
 Zoological Museum of the University of Amsterdam
 PO Box 94766, 1090GT Amsterdam, The Netherlands
 email: R.W.M.vanSoest@uva.nl