

Clathria (*Cornulotrocha*) *rosetafiordica* sp. nov. from a south-east Pacific fjord (Chilean Patagonia) (Microcionidae: Poecilosclerida: Demospongiae: Porifera)

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This article reports on a new species originating from the northern Chilean fjord region, which argued for the resurrection of *Cornulotrocha*, here classified as a new subgenus of *Clathria*, for sponges with choanosomal acanthostyles, ectosomal quasideactinal monactines and rosettes of palmate (an)isochelae. *Clathria* (*Cornulotrocha*) *rosetafiordica* sp. nov. was collected at 23 m depth at Quintupeu fjord (~42°S), and is unique within this very large genus, in possessing rosettes of palmate anisochelae. The new species is compared to the only other known *Clathria* (*Cornulotrocha*), viz. *C. (Cornulotrocha) cheliradians* n. comb.; to the single other *Clathria* known with anisochelae, viz. *C. (Thalysias) dubia*; to other crustose *Clathria* from southern South America, the subantarctic and Antarctic areas; and also to other sponges bearing rosettes; and is considered clearly distinct from all. The phylogenetic significance of rosettes is discussed, a likely adaptive value being discarded in view of the variable location of such structures in the distinct poecilosclerid taxa in which they occur.

INTRODUCTION

The south-east Pacific has one of the least studied sponge faunas in the world. Only about 140 species are known from the entire Chilean coast (Desqueyroux, 1972, 1976; Desqueyroux & Moyano, 1987), in spite of its > 5000 km stretch of coastline (spanning 38 degrees of latitude), and the intricate system of islands, fjords and canals unmatched elsewhere on the planet (Försterra et al., 2005). As part of an international effort to acquire new knowledge on Chilean marine sponges, a systematic collecting plan was implemented under the auspices of Belgian, Brazilian, Chilean and Swiss institutions, visiting 18 localities since 2003 (between ~23 and 48°S), and undertaking > 50 dives for sponge collection. Among the specimens collected, several are new records of genera and/or families for the south-east Pacific and will be reported elsewhere. The results presented here report on a new species of *Clathria* collected at Quintupeu fjord (XII Region, Chile), the first within a genus containing more than 400 species, to possess rosettes of anisochelae. The new species is considered to be closest to *Cornulotrocha cheliradians* Topsent, 1927 which is transferred here from synonymy with *Cornulum* (Acanthidae) to the Microcionidae, as a new subgenus of *Clathria*, viz. *C. (Cornulotrocha)*.

MATERIALS AND METHODS

Figure 1 illustrates the study area. The single specimen studied has been collected by SCUBA diving using hammer and chisel and photographed *in situ*. It belongs to a collection of Chilean sponges, which has been deposited

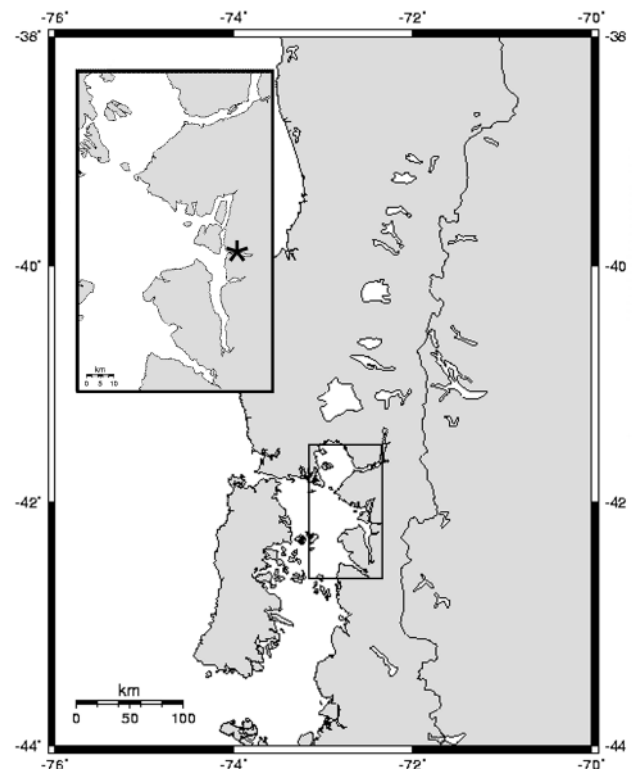


Figure 1. Map of the central-southern Chilean coast (38–44°S). The type locality, Quintupeu fjord, is indicated by an asterisk on the insert.



Figure 2. *Clathria (Cornulotrocha) rosetafiordica* sp. nov. The specimen from which the holotype was sampled, photographed *in situ* at Quintupeu fjord, Chile. Scale bar: 2 cm.



Figure 3. *Clathria (Cornulotrocha) rosetafiordica* sp. nov. Skeletal architecture photographed under light-microscopy. Arrows point to rosettes of anisochelae. Scale bar: 50 μ m.

at the Muséum d'Histoire Naturelle, Geneva (MHNG—Switzerland) and Museu Nacional (MNRJ—Brazil), with type material sent also to the Instituto de Zoología de la Universidad Austral de Chile (IZUA—POR—Chile) and the Royal Belgian Institute of Natural Sciences (RBINSc—Belgium).

Dissociated spicules slides and thick section mounts were made according to the usual procedures (Rützler, 1978), including boiling with nitric acid, and both direct sectioning followed by drying under a warm lamp, and paraffin embedding. For scanning electron microscopy (SEM), spicules were cleaned from organic matter in boiling nitric acid, washed five times in MilliQ water, rinsed five times in absolute ethanol and dried, prior to being sputter-coated with gold. The SEM used was a

FEI/Philips XL30 ESEM TMP Microscope at 20 and 30 kv at the RBINSc (Department of Invertebrates).

Abbreviations used throughout the text are RBINSc, Royal Belgian Institute of Natural Sciences, Brussels (Belgium); MHNG, Muséum d'Histoire Naturelle, Geneva (Switzerland), IZUA—POR, Instituto de Zoología, Universidad Austral de Chile, Valdivia (Chile); MNRJ, Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro (Brazil).

SYSTEMATICS

Class DEMOSPONGIAE Sollas, 1885

Order POECILOSCLERIDA Topsent, 1928

Suborder MICROCIONINA Hajdu, van Soest & Hooper, 1994

Family MICROCIONIDAE Carter, 1875

Subfamily MICROCIONINAE Carter, 1875

Genus *Clathria* Schmidt, 1862

Diagnosis

Microcioninae with auxiliary styles in one or two categories forming various ectosomal structures ranging from membranous paratangential to a dense erect palisade of brushes; choanosomal skeleton well structured, hymedesmiod to reticulate, with mostly smooth styles enclosed within spongin fibres and fibres echinated by mostly acanthose smaller styles (Hooper, 2002b).

Subgenus *Cornulotrocha* Topsent, 1927

Diagnosis

Clathria with skeletal architecture consisting of a basal layer of spongin with embedded acanthostyles, from which ascending, paucispicular tracts of mucronated

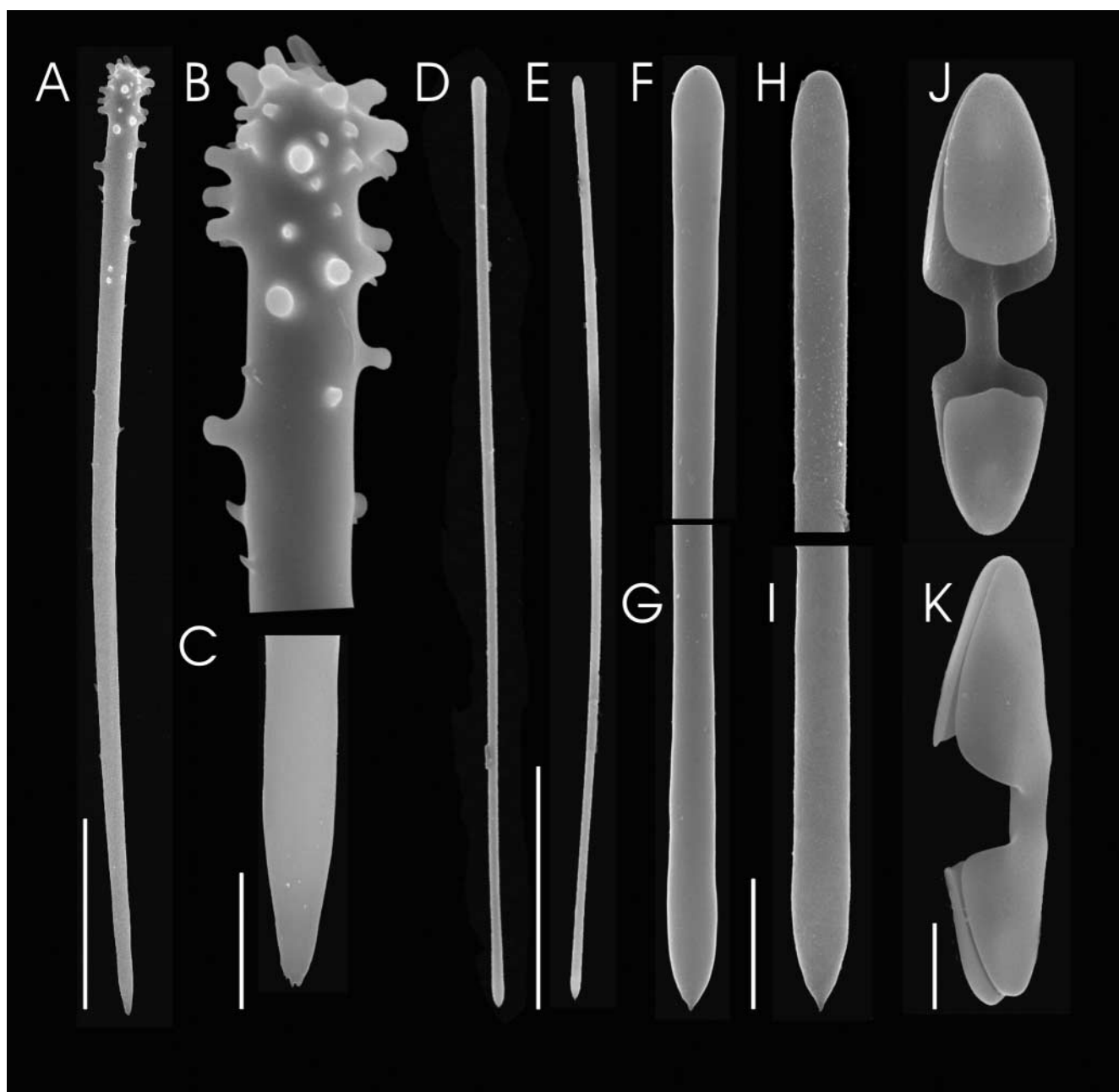


Figure 4. *Clathria* (*Cornulotrocha*) *rosetafiordica* sp. nov. Scanning electron microscopy micrographs of the spicules: (A–C) choanosomal acanthostyles; (D–I), ectosomal tylote-like subtylostyles; and (J,K) palmate anisochelae. Scale bars: A,D,E, 50 μ m; B,C, 10 μ m; F–I, 5 μ m; J,K, 2 μ m.

(subtylo)styles arise. A conspicuous feature is the presence of rosettes of palmate (an)isochelae. Type species: *Cornulotrocha cheliradians* Topsent, 1927.

Remarks

Cornulotrocha has been the subject of some conflicting classification assignments in the recent past. Van Soest et al. (1994) suggested its likely microcionid affinity, while Hooper (2002) preferred to argue for acarnid (*Cornulum*) affinity, in view of the fistular habit in its type species, *C. cheliradians*. The finding of a second species, described here, and which is best assigned to the close vicinity of *C. cheliradians*, but which is non-fistular, corroborated the interpretation advocated by van Soest et al. (1994).

Cornulotrocha is here transferred to the Microcionidae as the most parsimonious solution for the character distribution observed in *Clathria* (*Cornulotrocha*) *cheliradians* nov. comb. and the new species described here. Further support for this decision is given in the Discussion below.

Clathria (*Cornulotrocha*) *rosetafiordica* sp. nov.
(Figures 2–4)

Type material

Holotype: northern side of the entrance of Quintupeu fjord (field number Ch2004Por 71, 42°09'49.67"S–72°26'33.62"W, Chilean Patagonia), 23 m depth [MHNG 37493]. Collected by E. Hajdu, G. Lôbo-Hajdu &

Ph. Willenz, 21 April 2004. Schizoholotypes: IZUA-POR 104, MNRJ 8224 and RBINSc-IG 30509-POR.084.

Diagnosis

Clathria (*Cornulotrocha*) *rosetafiordica* sp. nov. is the only *Clathria* with smooth subtylote-like subtylostyles, acanthostyles and rosettes of anisochelae, but no toxas.

Description

The only specimen available for study is a thin crust (~1 mm thick) which was spread over some 400 cm² in area (20×20 cm). In the preserved state it is soft and fragile, easily torn, with a slightly transparent smooth surface membrane, where no openings of the aquiferous system are visible. Abundant subdermal spaces are visible through the surface peel, or where it is damaged, and the overall appearance of the choanosome is quite cavernous. Live-colour was yellow (Figure 2), turning brown after preservation in ethanol. The holotype consists of several barnacle fragments encrusted by the new species, the largest of which is 25×25 mm.

Skeleton

Ectosomal skeleton indistinguishable from choanosome. Choanosomal skeleton composed of ascending, sinuous, paucispicular tracts of subtylostyles arising from a basal region where both infrequent erect acanthostyles, as well as criss-crossed subtylostyles are seen. Subtylostyles are still seen spread at random, as are the rosettes of anisochelae (Figure 3, ~30 µm across, up to 10 rosettes in 1 mm²). The overall appearance of the skeleton is not very dense, and abundant canals of the aquiferous system are conspicuous.

Spicules

Megascleres, ectosomal subtylostyles ('subtylotes') in a single size category, smooth, mostly straight; base slightly spurred, only slightly inflated, as is the apex, thus conferring a subtylote aspect; 176–223.6–240 µm long and 4.0 µm thick (Figure 4D–I). Choanosomal acanthostyles more heavily spined on the basal half, and much more heavily spined close to the base, stouter at base, gradually tapering to the sharp apex; spines more frequently lobate than sharp; 115–238.8–525 µm long and 11–14 µm thick (Figure 4A–C). Microscleres, palmate anisochelae, with larger and smaller claws only slightly distinct; 10–13 µm long (Figure 4J,K).

Distribution and ecology

The species is so far known only from its type locality at the northern side of the entrance of Quintupeu fjord, 23 m deep (low tide). Water temperature was about 11°C when the sponge was collected. The entrance of Quintupeu fjord is characterized by strong currents due to its very narrow width (~300 m vs 12 km of fjord length) and the prevailing large tidal variation in the area. The specimen was associated with a few cnidarian polyps, to barnacles and bryozoans.

Etymology

The name *rosetafiordica* is derived from the juxtaposition of 'roseta', for the species' possession of rosettes, and 'fiordica', for the type locality.

DISCUSSION

The new species differs from the only other known *Clathria* (*Cornulotrocha*), viz *C. (C.) cheliradians*, by the latter's possession of fistular habit, main megascleres without an inflated apex, toxas and isochelae. Both species are clearly distinct. The presence of rosettes of anisochelae also differentiates the new species from every other known *Clathria*. To our knowledge, only one species of *Clathria* reported so far has palmate anisochelae, *C. (Thalysias) dubia* (Kirkpatrick, 1900), from Christmas Island (Indian Ocean). The chelae in that species are reduced and aberrant, and distinct from those found in the new species. Furthermore, *C. (T.) dubia* has megascleres which frequently bear basal spination, and toxas in two distinct categories, thus rendering Kirkpatrick's species only distantly related to the new species described above.

Following is a comparison between other flat, crustose species of *Clathria* inhabiting the Antarctic, the subantarctic, and southern South America, viz *C. (Microcionia) antarctica* (Topsent, 1917) (cf. Hooper, 1996), *C. (Thalysias) amabilis* (Thiele, 1905), *Clathria (T.) koltuni* Hooper, in Hooper & Wiedenmayer, 1994, and *C. (T.) membranacea* (Thiele, 1905).

Clathria (Cornulotrocha) rosetafiordica sp. nov. differs from *C. (M.) antarctica* by the latter's much larger megascleres of distinct morphology (ectosomal styles up to 899 µm, choanosomal styles up to 676 µm), toxas and lack of isochelae. It differs from *C. (T.) amabilis*, from Punta Arenas (Chile), by the latter's pink-red colour and complete lack of microscleres. *Clathria (T.) koltuni*, from the Antarctic, is blackish-grey and also has no microscleres. *Clathria (T.) membranacea*, from the Juan Fernandez Archipelago, has no acanthostyles and has toxas. Additionally, the species assigned to *Clathria (Thalysias)* all possess two categories of auxiliary megascleres (Hooper, 2002), which is not matched by the new species described here. The new species is thus considered clearly distinct from all possibly more closely related species of *Clathria*.

The occurrence of rosettes, whether composed of anisochelae, isochelae, or even diancistras, is difficult to explain on a phylogenetic prisma, unless we postulate that the ability to build such structures is a basic poecilosclerid achievement, an underlying synapomorphy for the entire order. Rosettes are known from two suborders, viz Mycalina and Microcionina, which according to the current scheme are not sister groups within the Poecilosclerida (Hajdu et al., 1994). Within Mycalina, rosettes occur in four families, viz Cladorhizidae (e.g. *Asbestopluma*), Esperlopsidae (e.g. *Esperiopsis*), Hamacanthidae (e.g. *Hamacantha*) and Mycalidae (e.g. *Mycale*). Within the Microcionina, only Acarnidae was known to have a species with rosettes, viz *Iophon radiatus* Topsent, 1901, with the first record of rosettes for the Microcionidae recorded here. In view of their rare occurrence and diverse location within the skeleton (see below), the more likely interpretation for their phylogenetic signal appears to be as multiple synapomorphies at higher ranks on the phylogenetic tree of the Poecilosclerida, such as subgenera and species groups.

The adaptive value of rosettes is an open matter of debate, especially if one takes into consideration that

some rosettes appear to be attached to spiculofibres, ectosomal or choanosomal [*Hamacantha*, *Mycale* (*Mycale*), *M. (Zygomycale)*], some others appear to project slightly from the sponge surface (*Asbestopluma*), and still some others are restricted to the basal portions of the sponge [*Clathria* (*Cornulotrocha*) *rosetafiordica* sp. nov., *M. (Arenochalina)*]. It is curious to note that rosettes are really only widespread within the Mycalidae, where probably over 100 species are known with this character.

At first glance, the combination of rosettes of anisochelae and smooth ectosomal subtylote–subtylostyles suggested to us the new species may be related to *Cornulotrocha cheliradians*, from the Azores. Topsent's (1928) full description of *C. cheliradians* illustrates an ectosomal subtylostrogonyle (his plate vii, figures 21–22) which is easily interpreted as monactinal, thus suggesting a better placement of *Cornulotrocha* not in the synonymy with *Cornulum*, as suggested by Hooper (2002), but within *Clathria* (van Soest et al., 1994). Our interpretation considers it more parsimonious to assign the fistular *C. cheliradians* to the Microcionidae, recognizing the likely synapomorphic value of both the quasi-diactinal nature of the main megascleres in these species, as well as their shared possession of rosettes. Additionally, it appears to us that the cavernous structure of the new species may be related to the fistular habit of *C. cheliradians*. Following current practice in sponge taxonomy, it is preferable to revalidate *Cornulotrocha* as a valid subgenus within *Clathria*, rather than to expand the morphological limits of *Clathria* (*Microcionia*) where both would otherwise fit.

As noted, there is no clear diagnostic value at higher levels of the classification for the rosettes, and the same is applicable to the anisochelate condition. Chelae which are only slightly anisochelate as in the new species described here are known from *Amphilectus lobata* (Gray, 1867), the single anisochelae-bearing species within the Esperopsidae. Palmate anisochelae are also known from *Acanthorhabdus* and *Iophon* (Acarinidae), and from *Asbestopluma* (Cladorhizidae). All these occurrences are most likely not homologous, also because small, variably consistent, morphological differences are visible in several anisochelae. It is thus likely that the anisochelate condition arose independently on several occasions within the evolution of the Poecilosclerida, including potentially the Microcionidae.

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