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A new species of *Halcampella* (Actiniaria: Halcampoididae) from the eastern Weddell Sea and the Antarctic Peninsula*

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SUMMARY: A new species of soft-bottom-dwelling sea anemone of the genus *Halcampella* is described and illustrated based on 47 specimens collected during the *Polarstern* cruises ANT XV/3 and ANT XVII/3 to the Antarctic Peninsula and the eastern Weddell Sea. The new *Halcampella* species is easily distinguishable from its congeners by the number of cycles of mesenteries and tentacles, the cnidae and the geographic distribution. The new species is described and compared to the available type material of the other species of the genus and new cnidae data are given for *H. maxima* Hertwig, 1888 and *H. robusta* Carlgren, 1931. According to other authors *H. endromitata* (Andres, 1881) is considered a *nomen dubium* and *H. maxima* is here proposed as the types species of the genus.

Key words: *Halcampella*, Halcampoididae, Actiniaria, Antarctic Peninsula, Weddell Sea.

INTRODUCTION

For many years the order Actiniaria Hertwig, 1882 has been divided into three suborders, with Nynantheae Carlgren, 1899 being the most speciose (Carlgren, 1949; Manuel, 1988). Depending on the presence or absence of basilar musculature, ectodermal longitudinal musculature and the shape of the base, three tribes have been traditionally distinguished in the suborder Nynantheae: Boloceroidaria, Thenaria and Athenaria (see Stephenson, 1935; Carlgren, 1949; Manuel, 1988).

The tribe Athenaria Carlgren, 1899 forms a very distinct group of soft-bottom-dwelling sea anemones, characterised by an often elongated column, a pedal disc usually rounded without basilar musculature (see Carlgren, 1949: 21) and a burrowing mode of life (sometimes attached to small gravel, sand and fragments of shells), with only the most distal part of the column with the expanded oral disc and tentacles protruding above the substratum (Manuel, 1988: 180).

In spite of this apparent structural homogeneity, some authors have claimed a possible polyphyletic origin of the Athenaria (Hand, 1966; Schmidt, 1972, 1974; Riemann-Zürneck, 1979; Shick, 1991). Hence the colonisation of the soft-bottom could have taken place in different steps from Nynanthean forms. Thus, the elongated appearance could be considered as an adaptive convergence to a burrowing way of life. For this reason we prefer not to use the category of tribe in the present work, awaiting a more comprehensive study of the natural classifica-

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tion of the order Actiniaria, an aspect beyond the scope of this contribution.

The family Halcampoididae Appellöf, 1896 includes eight genera inhabiting the soft-bottoms with a world wide distribution, and its current differentiation from the Haloclavidae Verrill, 1899 is unsatisfactory (see Carlgren, 1949: 21; Manuel, 1988: 182). *Halcampella* Andres, 1884 is a small genus of the Halcampoididae with three described species: *Halcampella endromitata* (Andres, 1881), *H. maxima* Hertwig, 1888 and *H. robusta* Carlgren, 1931 (see Carlgren, 1949: 26).

During the recent EASIZ II and EASIZ III (Ecology of Antarctic Sea Ice Zone) *Polarstern* cruises to the Weddell Sea and the Antarctic Peninsula, 47 specimens of an undescribed species of the genus *Halcampella* were collected. This material is described here and compared with extant type material of its congeners.

MATERIAL AND METHODS

The material studied was collected on the *Polarstern* cruises ANT XV/3 (EASIZ II) and ANT XVII/3 (EASIZ III) to the eastern Weddell Sea and Antarctic Peninsula, sponsored by the Alfred-Wegener-Institut für Polar-und Meeresforschung, Bremerhaven, during the austral summer of 1998 and the austral autumn of 2000.

Sea anemones were relaxed on board using menthol crystals and subsequently fixed in 10% formalin in seawater. Fragments of selected specimens were dehydrated in buthanol (Johansen, 1940) and embedded in paraffin. Histological sections 7-8 μm thick were stained with Ramón y Cajal's Triple Stain (Gabe, 1968).

Cnidae measurements were taken from capsules in squash preparations at 1000X magnification with Nomarski differential interference contrast optics. Frequencies given are subjective impressions based on squash preparations. All cnidae were photographed and illustrated at the same magnification for comparative purposes.

The material was collected from 3 sampling stations, two along the Antarctic Peninsula and one in the eastern Weddell Sea. Table 1 shows the sampling data of the stations where the new species of *Halcampella* described here was collected.

The material of the new species studied here has been deposited in the Zoologisches Institut und Zoologisches Museum in Hamburg (ZMH), the Natural History Museum in London (NHM), the Nationaal Natuurhistorisch Museum, formerly the Rijksmuseum van Natuurlijke Historie, in Leiden (RMNH), the Swedish Museum of Natural History in Stockholm (SMNH), and the Section of Zoology of the Faculty of Biology at the University of Seville in Spain (SZ).

For purposes of comparison, the following type material deposited in the SMNH was also examined:

Halcampella maxima Hertwig, 1888. 1 lectotype (SMNH-type-1160) and 5 paralectotypes (SMNH-type-5367) here designated. Philippines, Zebu. Leg. Challenger Expedition. 22 January 1875, stn. 209, 95 fathoms.

Remarks: A specimen from the syntype original collection is here designated as lectotype to become the unique bearer of the name for the nominal species *Halcampella maxima* and the standard for its application. The syntype specimens are not well preserved and the proposed lectotype is the best preserved of all the specimens showing the characteristics of the species. Cnidae measurements, histological sections and SEM photographs of the surface of the scapus were obtained from the lectotype and paralectotypes.

Halcampella robusta Carlgren, 1931. (SMNH-type-4029). Holotype. 37ºS, 10ºW. Depth unknown. This specimen is labelled "Antarctic", but the sampling coordinates do not correspond to this biogeographical region.

Remarks: The holotype is reduced to three small fragments of the scapus without any trace of usable tissues of mesenteries or stomodaeum. From these fragments only a few cnidae measurements were obtained.

TABLE 1. – Sampling data of the stations where *Halcampella fasciata* sp. nov was collected. N: number of specimens collected at each station; S/VK: South of Vestkapp (eastern Weddell Sea); KG: King George Island (Antarctic Peninsula); BT: Bottom trawl; AGT: Agassiz trawl.

Cruise	Station	Area	Coordinates	Depth (m)	Date	Gear	N
ANT XV/3	48/100	S/VK	73°36.4'S 22°07.0'W	440-444	05/02/1998	BT	1
ANT XV/3	48/307	KG	62º22.4'S 58º44.6'W	817-864	15/03/1998	AGT	10
ANT XVII/3	193.1	KG	62º18.6'S 58º33.6'W	353-378	05/05/2000	AGT	36

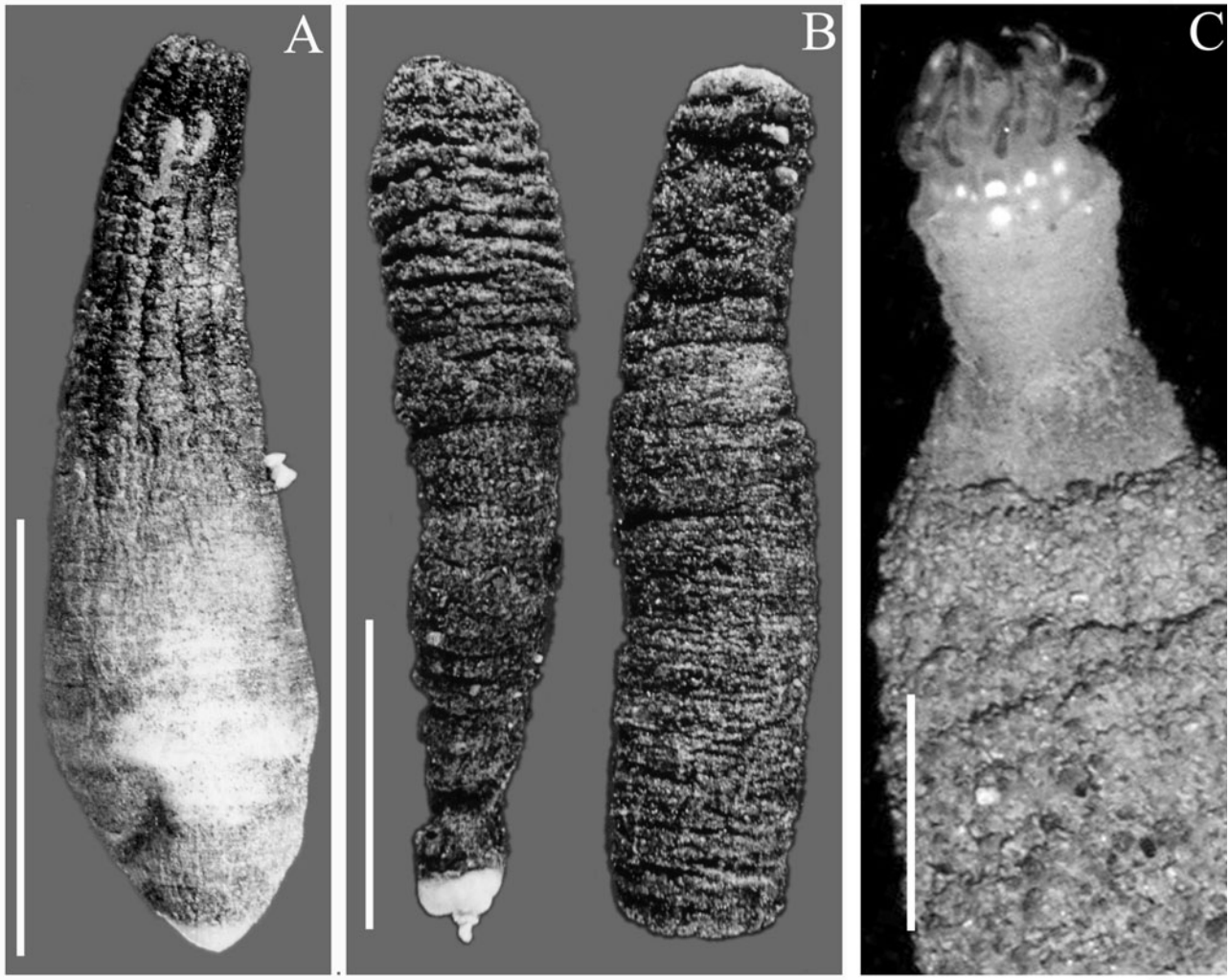

FIG. 1. – *Halcampella fasciata* sp. nov. (A) lateral view of the holotype ZMH (C 11661); (B) retracted specimens, RMNH Coel. 24969 (left) and SMNH-39157 (right); (C) detail of a living specimen after menthol anaesthesia; notice the whitish annular bands on the tentacles and the whitish marks along the scapulus. Scale bars: A, 40 mm; B, 25 mm; C, 5 mm.

RESULTS

Order ACTINIARIA Hertwig, 1882
Suborder NYNANTHEAE Carlgren, 1899
Family HALCAMPOIDIDAE Appellöf, 1896
Genus *Halcampella* Andres, 1884

Halcampella fasciata sp. nov.
(Figs. 1-4, Table 2)

Type Material: Holotype, ZMH (C 11661), 1 specimen, *Polarstern* ANT XV/3, stn. 48/307. Paratypes, ZMH (C 11662), 2 specimens, *Polarstern* ANT XV/3, stn. 48/307; NHM (2001.6711), 1 specimen, *Polarstern* ANT XV/3, stn. 48/307; RMNH (Coel. 24968), 1 specimen, *Polarstern* ANT XV/3, stn. 48/307; SMNH (Type-5368), 1 specimen, *Polarstern* ANT XV/3, stn. 48/307; SZ (ANT-440), 1 specimen, *Polarstern* ANT XV/3, stn. 48/307.
Additional material: ZMH (C 11663), 1 specimen, *Polarstern* ANT XVII/3, stn. 193.1; NHM (2001.6712-6713), 2 specimens, *Polarstern* ANT XVII/3, stn. 193.1; RNHM (Coel. 24969), 2 specimens, *Polarstern* ANT XVII/3, stn. 193.1; SMNH (General coll. 39157), 2 specimens, *Polarstern* ANT XVII/3, stn. 193.1; SZ (ANT-441), 1 specimen, *Polarstern* ANT XV/3, stn 48/100; SZ (ANT-442), 3 specimens, *Polarstern* ANT XV/3, stn. 48/307; SZ (ANT-443), 1 specimen, *Polarstern* ANT XVII/3, stn. 193.1; SZ (ANT-444), 1 specimen, *Polarstern* ANT XVII/3, stn. 193.1; SZ (ANT-445), 27 specimens, *Polarstern* ANT XVII/3, stn. 193.1.

Etymology: The specific name *fasciata* (*fascia*: strip or band in Latin) is chosen because of the colour pattern of the tentacles in living specimens.

External anatomy (Figs. 1 and 2): Body elongated, to 23 mm diameter and 82 mm height in preserved and retracted specimens. Body divided into three regions: physa, scapus, and scapulus. Physa rounded, sometimes invaginated, smooth, with mesenteric insertions visible. Scapus elongated with thin cuticle, covered with tenaculi, except in its most distal zone (to 13 mm height), rough and rigid due to the abundant foreign particles adhering to cuticle and tenaculi. In preserved specimens, surface of most of scapus slightly reticulated by longitudinal

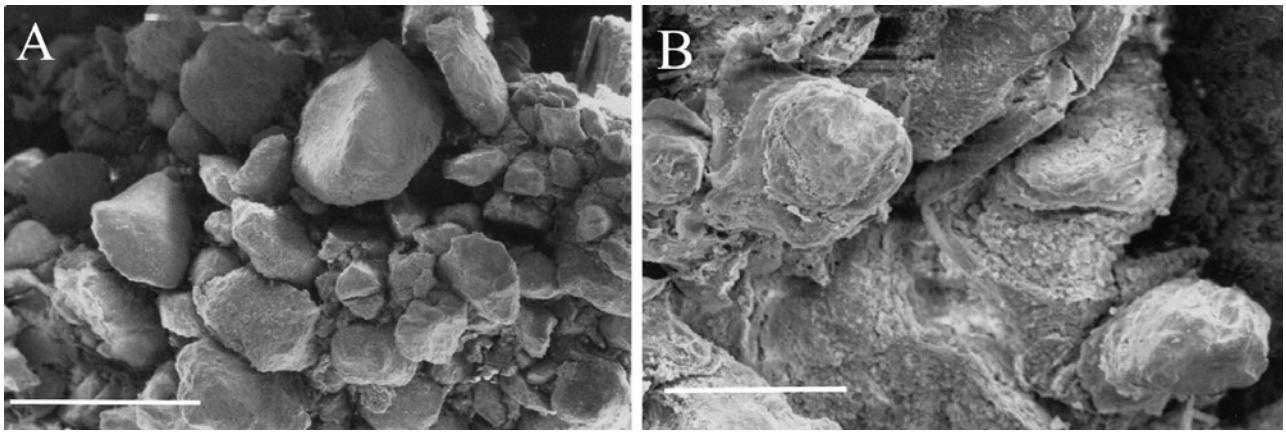

FIG. 2. – *Halcampella fasciata* sp. nov. (A) SEM photograph of the surface of the scapus showing grains of sand adhering to it; (B) detail of the tenaculi after hydrofluoric acid dissolution of the grains of sand adhering to them. Scale bars: A, 1 mm; B, 0.1 mm.

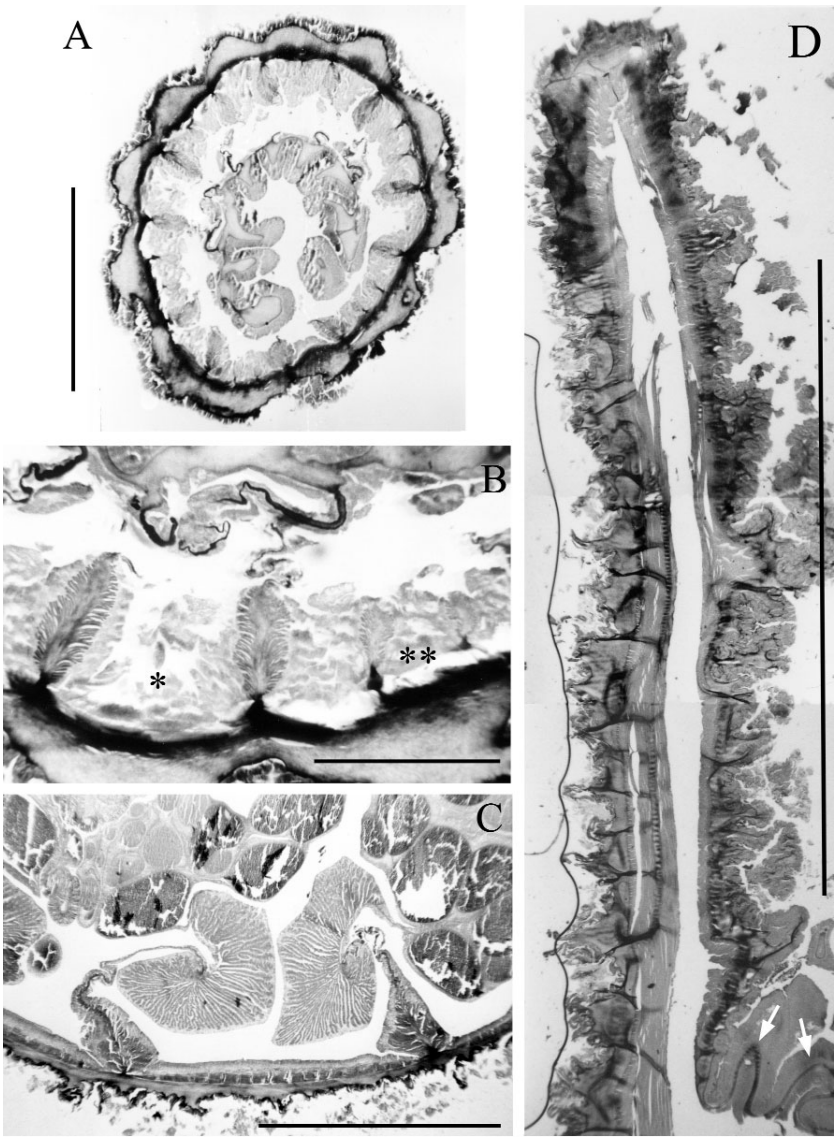

FIG. 3. – *Halcampella fasciata* sp. nov. Internal anatomy. (A) cross section of the entire column at stomodaeum level; (B) detail from A showing the two cycles of mesenteries; (*) indicates endocoel between mesenteries of the first cycle, (**) indicates endocoel between mesenteries of the second cycle; (C) detail of the restricted retractor musculature at mid-column level; (D) longitudinal section through distal end of a retracted specimen showing no traces of sphincter; white arrows at the bottom indicate the location of the tentacles. Scale bars: A, 2 mm; B, 0.5 mm; C, 2 mm; D, 5 mm.

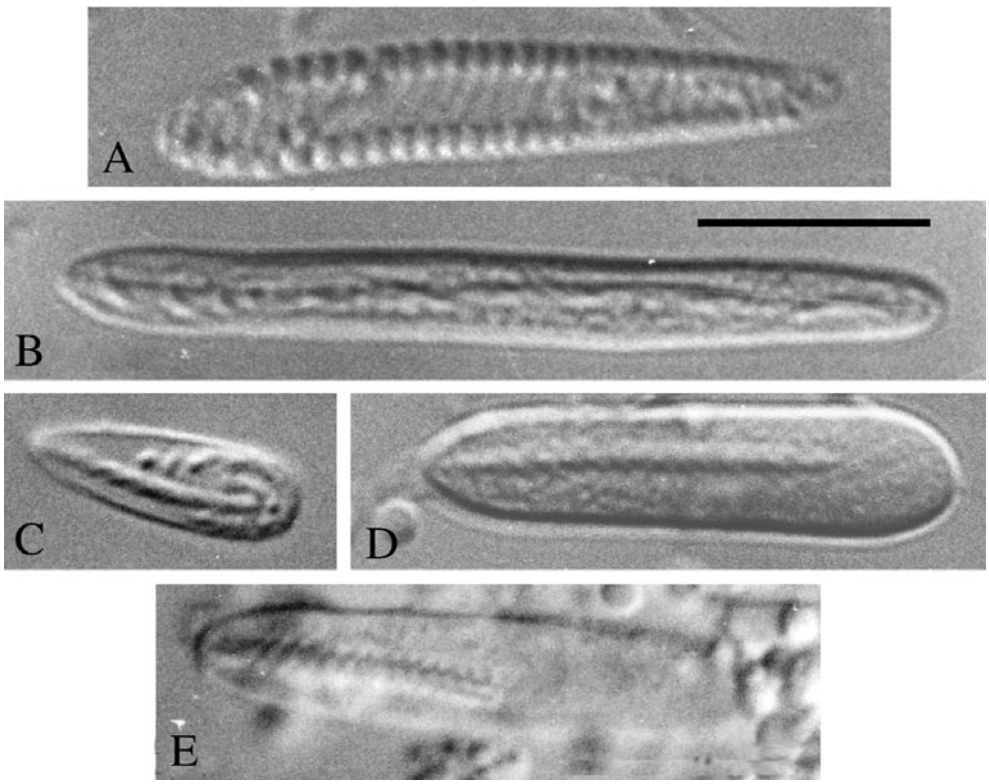

FIG. 4. – *Halcampella fasciata* sp. nov. Cnidae. (A) spirocyst; (B) basitrich 1; (C) microbasic b-mastigophore 1; (D) microbasic b-mastigophore 3; (E) microbasic p-mastigophore 2. See text and Table 2 for explanation. Scale bar: 10 µm.

TABLE 2. – Size ranges of the cnidae (in µm) of *Halcampella fasciata* sp. nov., *H. maxima* and *H. robusta*.(*) data from Carlgren 1931. (#) those two categories appear to be mutually exclusive in *H. fasciata* sp. nov. Different size categories of each type of nematocyst have been named only attending to the appearance order in this table; this nomenclature has been followed in Figs. 4, 8 and 9, where microphotos of the capsules are shown. Samples (S): the ratio indicates the number of specimens in which each cnidae was found compared to the number of specimens of each species examined; the second value indicates the total number of capsules measured. M: microbasic. Frequency (F): +++ = very common, ++ = common, + = rather common, —- = sporadic, nf: no found, nd: no data.

	Halcampella fasciata			*Halcampella maxima*			*Halcampella robusta*		
Categories	Range of length and width of cnidocyst capsules in µm	S	F	Range of length and width of cnidocyst capsules in µm	S	F	Range of length and width of cnidocyst capsules in µm	S	F
Physa									
Basitrichs 1 #	(19.7-28.7) x (3.3-4.1)	6/8: 118	++	(24.6-32.0) x (4.1-4.9)	3/3: 21	+	nd		
M. b-mastigophores 1 #	(13.8-18.0) x (4.1-5.7)	2/8: 26	+	nf			nd		
Scapus									
Basitrichs 1	(17.9-31.2) x (3.3-4.9)	6/6: 102	+/++	(21.4-41) x (4.1-4.9)	3/3: 39	+/++	(14.8-18) x (3.3-4.1)	1/1: 5	+
M. b-mastigophores 2	nf			nf			(24.6-29.4) x (4.9-6.6)	1/1: 8	+
Scapulus									
Basitrichs 1	(12.3-23.8) x (2.5-4.1)	6/6: 120	++	(16.4-22.0) x (2.5-4.1)	3/3: 60	++	(14-17)*		
Tentacles									
Spirocysts	(16.4-36.9) x (2.5-4.9)	6/6: 120	+++	(20.5-48.4) x (2.5-5.7)	3/3: 60	+++	40 x 5*		
Basitrichs 1	(26.1-41.0) x (2.5-4.1)	6/6: 120	++/+++	(26.1-35.3) x (2.5-3.3)	3/3: 59	++	(19-22)*		
Stomodaeum									
Basitrichs 1	(29.4-44.3) x (2.5-4.1)	6/6: 120	++	(28.7-45.1) x (3.3-4.1)	3/3: 60	++	nd		
M. p-mastigophores 1	nf			(38.5-48.4) x (7.4-10.7)	3/3: 48	++	nd		
M. b-mastigophores 1	(12.3-18.9) x (4.1-5.7)	4/6: 15	—-	nf			nd		
Filaments									
Basitrichs 1	(35.3-46.6) x (3.3-4.1)	4/4: 80	++/+++	(20.5-35.8) x (3.3-4.1)	3/3: 49	++	nd		
Basitrichs 2	nf			(62.2-77.9) x (4.1-5.7)	2/3: 9	—-/+	nd		
M. p-mastigophores 1	nf			(33.5-43.5) x (6.6-7.4)	3/3: 18	+/++	nd		
M. p-mastigophores 2	(21.2-30.2) x (4.1-5.7)	5/6: 41	+	nf			nd		
M. b-mastigophores 1	(15.6-16.4) x (4.1-4.9)	2/6: 11	—-	nf			nd		
M. b-mastigophores 3	(20.5-27.9) x (4.1-6.6)	5/6: 31	+/—-	nf			nd		

furrows related to mesenteric insertions and transversal folds. Scapulus short, to 6 mm length, smooth with visible mesenteric insertions. Tenaculi-free distal zone of scapus and scapulus often retracted in preserved specimens.

Oral disc flat, slightly narrower in diameter than the column in retracted specimens. Mouth on a cone. Tentacles smooth, slightly longer than the diameter of the oral disc in preserved specimens. Inner tentacles longer than outer ones, to 24 in number, arranged in three cycles (6+6+12).

Internal anatomy (Fig. 3): More distal than proximal mesenteries. Mesenteries hexamerously arranged in two cycles: first cycle, 6 pairs of macronemes, perfect and fertile; second cycle, incomplete, 9-10 microcnemes observed, only present in scapulus and at distal part of scapus. Macronemes with retractor musculature restricted, reniform and very strong. Parietobasilar musculature strong, well developed. Gonads well developed in specimens collected in March and May; dioecious; oocytes up to 770 µm in diameter. Sphincter absent. Tentacles with ectodermal longitudinal musculature. Stomodaeum relatively short compared to total animal length (5-15 %), its internal surface with 12 folds corresponding to the insertion of macronemes. Single siphonoglyph weak.

Column wall of similar thickness entire length. Mesogloea 100-350 µm thick; epidermis 50-140 µm thick, and gastrodermis 80-230 µm thick. Cuticle 4-12 µm thick.

Cnidom: Spirocysts, basitrichs, microbasic p-mastigophores and microbasic b-mastigophores. A survey of the cnidae is presented in Table 2 and Figure 4.

Colour: Living specimens show tentacles brownish in colour, first cycle with two annular whitish bands, second cycle with only one, and third cycle without annular bands. Scapulus delicate, with whitish and brownish marks along endocoele and exocoele areas, wider in the former (Fig. 1C). Scapus dirty brown because of cuticle and foreign particles adherent to tenaculi. Physa brownish in colour.

Preserved material with physa, scapulus and oral disc light brown in colour, scapus with similar aspect to living material.

Geographic and depth distribution: Currently, *Halcampella fasciata* sp. nov. has been found in the Antarctic Peninsula and in the eastern Weddell Sea, between 353 and 864 m.

Habitat and associated fauna: The nature of the bottom where the new species was found was mainly muddy. The fauna of one of the stations, ANT XVII/3 stn. 193.1 (see Table 1 for additional data), was kindly characterized by Drs. Boris Sirenko and Igor Smirnov (unpublished data). In that station about 76 species were collected, mainly dominated by polychaetes , ophiurids and echinoids. However, respect to the number of species per phylum, the best represented phylum was Mollusca (18 species), followed by Echinodermata (12 species), Arthropoda (6 pantopod species plus 6 crustacean species), and Annelida (11 polychaete species); other phyla such as Cnidaria, Bryozoa, and Porifera were also present.

DISCUSSION

Halcampella fasciata sp. nov. is compared here with the other species of the genus, *H. endromitata*, *H. maxima* and *H. robusta.* These comparisons are based upon the type material deposited in the SMNH (see Figs. 5, 6, 7 and 8 for *H. maxima* and Fig. 9 for *H. robusta*).

Halcampella endromitata is known only from the original description of Andres (see Andres, 1881) and in the absence of good characters and pending the collection of new material from the Mediterranean that fits the description, it must be considered a *nomen dubium* (Chintiroglou *et al*., 1997). Paradoxically, *Halcampella endromitata* is the type species of the genus although the ICZN has already been informed (Rodríguez and López-González, in press: case 3206) and the case is awaiting resolution. In this communication to the ICZN, *Halcampella maxima* has been proposed to be nominated as the new type species of the genus.

Halcampella fasciata sp. nov. is easily distinguishable from the two other recognisable species in the genus, *H. maxima* and *H. robusta*, by the number of mesenteries and tentacles. Both, *H. maxima* and *H. robusta* have three cycles of mesenteries (the third cycle partially developed) (see Fig. 7A for *H. maxima* and Carlgren, 1931: 30 for *H. robusta*) and tentacles to 48 in number. However, in *H. fasciata* sp. nov. only two cycles of mesenteries (Figs. 3A and B) and tentacles to 24 have been observed in specimens from 40 mm to 82 mm long.

Halcampella maxima has a strong but diffuse retractor musculature (see Carlgren, 1931: fig. 25). The retractor musculature is similar in *H. robusta* and *H. fasciata* sp. nov.: strong, restricted and reniform, with numerous high folds, although the base of mesogloea of the retractor musculature is thicker in *H. robusta* than in *H. fasciata* sp. nov. (see Carlgren, 1931: fig. 28; Fig. 3C of the present paper).

Table 2 shows comparatively the size and distribution of cnidae of *Halcampella fasciata* sp. nov., *H. maxima* and *H. robusta*. Only a few measurements of the cnidae of *H. robusta* were reported in Carlgren's original description and, due to its scarce and fragmentary state, although the holotype has been examined, only a few new data can be added. Thus, type and size-classes of the cnidae of *H. robusta* can currently be compared only for the scapus, scapulus and tentacles; indeed, the data from the latter two zones should be taken with care due to the unknown number of capsules measured by Carlgren. Despite these limitations, the cnidae of *H. fasciata* sp. nov. differ clearly from the cnidae of *H.*

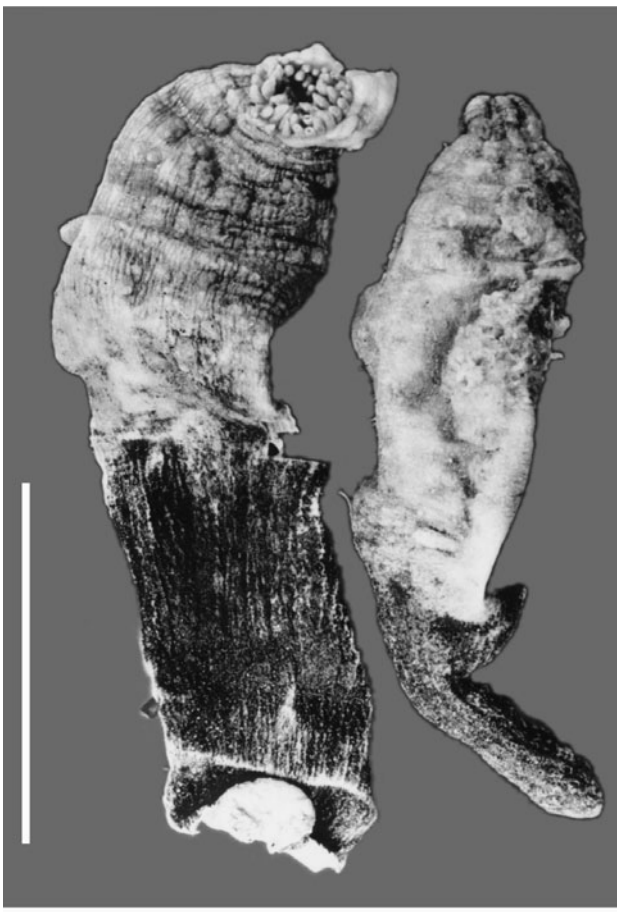

FIG. 5. – *Halcampella maxima*. Lateral view of the lectotype (SMNH-Type-1160, at left) and one of the paralectotypes (SMNH-Type-5367, at right). Scale bar: 50 mm.

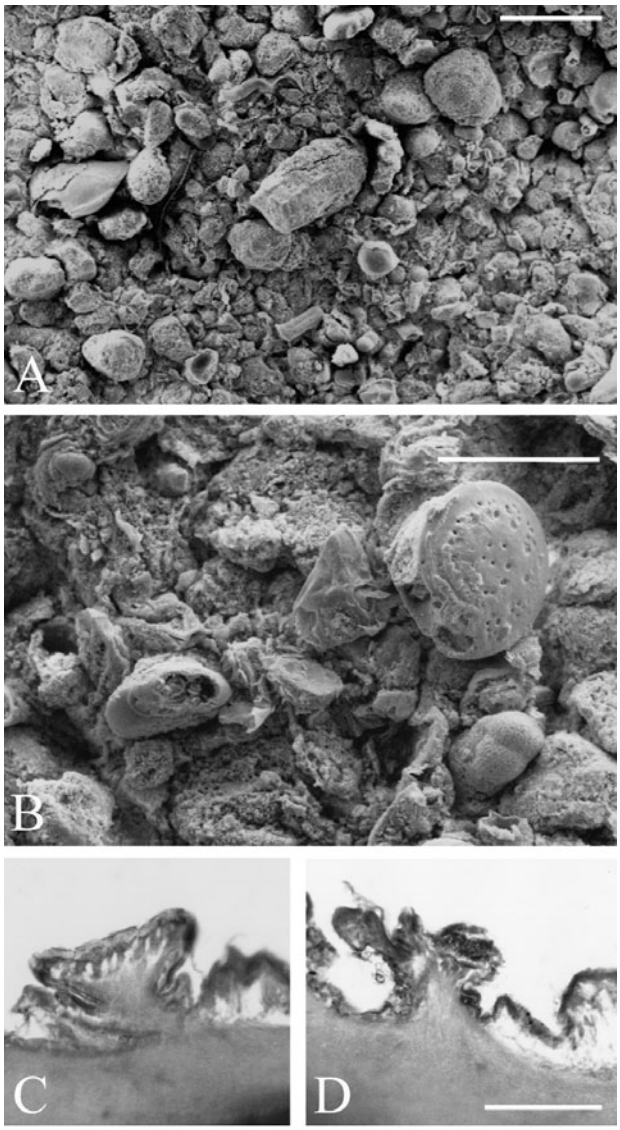

FIG. 6. – *Halcampella maxima*.(A) and (B) SEM photograph of the surface of the scapus showing the tenaculi and grains of sand and foreign particles (mainly foraminifers) adhering to it; (C) and (D) cross sections through the scapus wall illustrating the tenaculi. Scale bars: A, 0.5 mm; B, 0.2 mm; C and D, 10 µm.

robusta in the scapus: the microbasic b-mastigophores 2 (Fig 9B) in *H. robusta* are absent in *H. fasciata* sp. nov. and also in *H. maxima*. There are also differences in the size range and distribution of the cnidae of *H. fasciata* sp. nov. that clearly distinguish it from *H. maxima*; the main differences are in the stomodaeum and filaments. In the stomodaeum, *H. fasciata* sp. nov. has short microbasic b-mastigophores (microbasic b-mastigophores 1, Fig. 4C) that are absent in *H. maxima*, while the large microbasic p-mastigophores (microbasic p-mastigophores 1, Fig. 8B) in *H. maxima* are absent in *H. fasciata* sp. nov. In the filaments, *H. maxima* has longer basitrichs (basitrichs

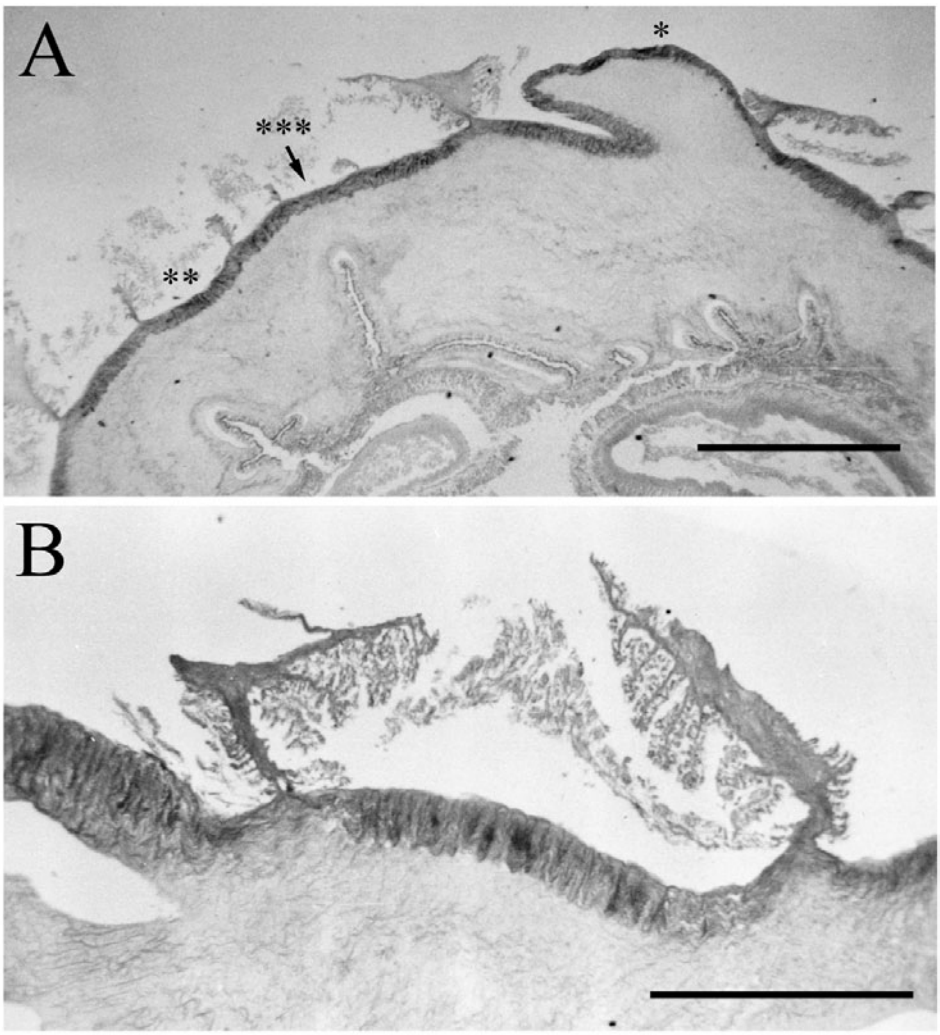

FIG. 7. – *Halcampella maxima*. Internal anatomy. (A) transverse section through the scapulus wall from a retracted specimen showing the three cycles of mesenteries; it should be noted that in retracted specimens the scapulus and distal part of the scapus is inverted in comparison with the non-retracted scapus wall; this explain the placement of the perfect and imperfect mesenteries on the convex side of the section; (*) indicates endocoel between mesenteries of the first cycle, (**) indicates endocoel between mesenteries of the second cycle and (***) indicates endocoel between mesenteries of the third cycle; (B) detail of the musculature of mesenteries of the first cycle at scapulus level. Scale bars: A, 1 mm; B, 0.4 mm.

2, Fig. 8D) and larger microbasic p-mastigophores (microbasic p-mastigophores 1, Fig. 8B) than *H. fasciata* sp. nov. (basitrichs 1, Fig. 4B and microbasic p-mastigophores 2, Fig. 4E, respectively); furthermore, there are two categories of microbasic b-mastigophores (microbasic b-mastigophores 1 and 3, Figs. 4C and D respectively) in *H. fasciata* sp. nov. that *H. maxima* does not have.

With regard to the maximum size of the three species, *Halcampella maxima* reaches 150 mm in length (with three cycles of mesenteries and four cycles of tentacles), *H. robusta* reaches 53 mm (for a specimen lacking the physa with three cycles of mesenteries and four cycles of tentacles) and *H. fasciata* sp. nov. reaches 82 mm (retracted specimens, with two cycles of mesenteries and three cycles of tentacles).

The known geographic distribution of the three species is also different. *Halcampella maxima* was collected in the Philippines (Hertwig, 1888); the report of *H. maxima* from Japan (Wassilieff, 1908) is considered doubtful by Carlgren (1931: 28) who investigated Hertwig's type material. *H. robusta* and *H. fasciata* sp. nov. are from the southern hemisphere, but widely separated. *H. robusta* is known only from the mid-Atlantic, near Tristan da Cunha (37ºS, 10ºW), while *H. fasciata* sp. nov. is known from the Antarctic region, where it has been found in the Antarctic Peninsula and in the eastern Weddell Sea.

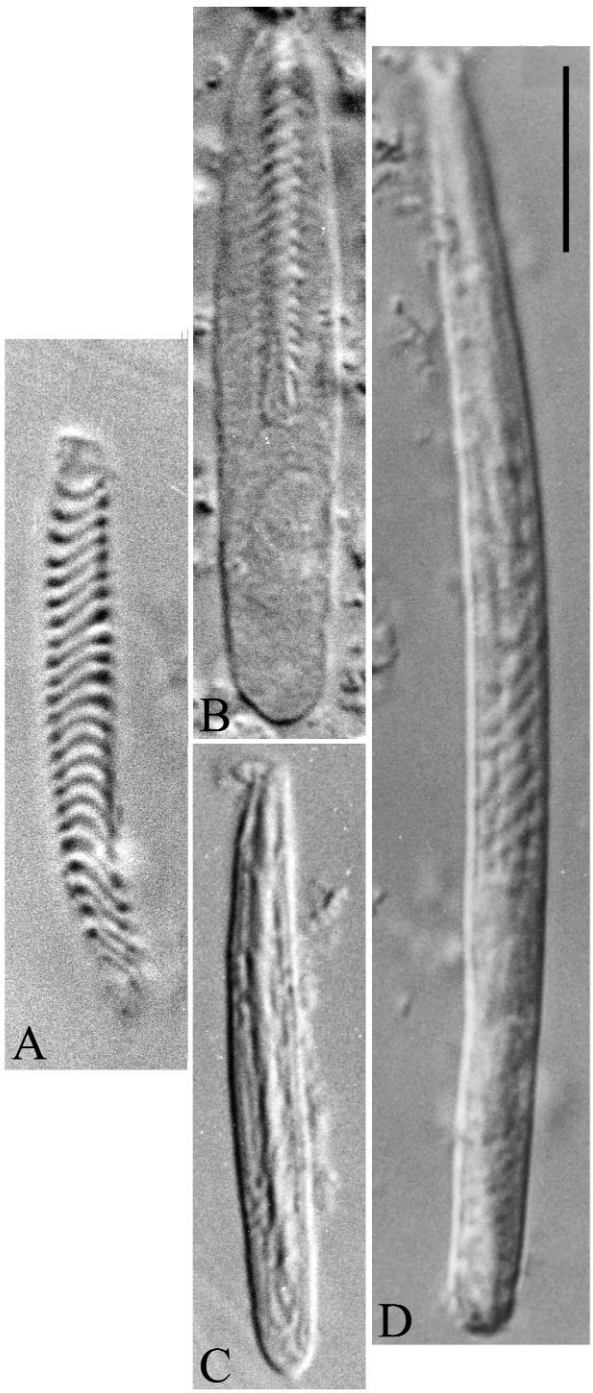

FIG. 8. – *Halcampella maxima*. Cnidae. (A) spirocyst; (B) microbasic p-mastigophore 1; (C) basitrich 1; (D) basitrich 2. See text and Table 2 for explanation. Scale bar: 10 μm.

FIG. 9. – *Halcampella robusta*. Cnidae. (A) basitrich 1; (B) microbasic b-mastigophore 2. See text and Table 2 for explanation. Scale bar: 10 μm.

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