

## *Gorgonactis marisalbi*, a new genus and species of burrowing sea anemones (Anthozoa: Actiniaria: Halcampidae) from the White Sea

## *Gorgonactis marisalbi*, новый род и вид зарывающихся актиний (Anthozoa: Actiniaria: Halcampidae) из Белого моря

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**Abstract.** New genus and species of burrowing sea anemones of the family Halcampidae, *Gorgonactis marisalbi* gen. et sp. nov., are described from the White Sea (Chupa Bay). The new taxa are characterised by unique characters not found in other members of this family: a simple, strong marginal sphincter, very long tentacles and their large spirocysts.

**Резюме.** Описаны новый род и вид зарывающихся актиний семейства Halcampidae, *Gorgonactis marisalbi* gen. et sp. nov., из Белого моря (губа Чупа). Новый род характеризуется уникальными признаками, которые не отмечены у других представителей этого семейства: простым сильным маргинальным сфинктером, очень длинными щупальцами и их крупными спироцистами.

**Key words:** White Sea, burrowing sea anemones, Halcampidae, new genus, new species

**Ключевые слова:** Белое море, зарывающиеся актинии, Halcampidae, новый род, новый вид

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### Introduction

The fauna of burrowing sea anemones of the White Sea is rather poor. According to the literature data and collection of the Zoological Institute of the Russian Academy of Sciences, St Petersburg, Russia (ZIN), it includes four species from three families: *Halcampa arctica* Carlgren, 1893 and *H. duodecimcirrata* (Sars, 1851), which are representatives of Halcampidae Andres, 1883; *Haliactis arctica* Carlgren, 1921 belonging to Halcampactinidae Carlgren, 1921; and *Nematostella polaris* (Carlgren, 1921), a member of Edwardsiidae Andres, 1881 (Bocharova et al., 2010; Grebelnyi, 2012; Ivanova & Grebelnyi, 2021).

During processing of the collection of ZIN, I found one specimen of an undescribed species belonging to the family Halcampidae. Members of Halcampidae are characterised by having a simple or double mesogloal sphincter, a relatively low number of tentacles and mesenteries, from which 8–12 are perfect, and the absence of basilar muscles. Moreover, the column of some halcampids is subdivided into scapus, scapulus and physa. The scapus can be provided with a cuticle and tenaculi or papillae, or it can be bare (Carlgren, 1921, 1949; Sanamyan et al., 2016). Halcampidae currently comprises eight genera and 23 species distributed worldwide, from intertidal to deep waters (Carlgren, 1949; Fautin, 2016).

In this paper, I describe this species, *Gorgonactis marisalbi* **gen. et sp. nov.**, from a single specimen collected in the sublittoral zone (62 m depth) of the White Sea.

## Material and methods

The specimen was collected in the White Sea in 1967 during a cruise of the RV *Professor Mesyatshev*, using a bottom grab “Ocean”, was stored in formalin and then transferred to 70% ethanol for long-term storage. The ethanol-preserved specimen was examined as a whole and then dissected. It was embedded in paraffin and sliced into histological serial sections. These latter, having a thickness of 3–7 µm, were prepared by the isopropanol-mineral oil method (see Sanamyan et al., 2013). Nematocysts located in the tentacles, column, actinopharynx and filaments were examined. The general terminology of the cnidae follows Weill (1934a, b) and Carlgren (1940).

The holotype of the new species is deposited in the Zoological Institute of the Russian Academy of Sciences, St Petersburg, Russia (ZIN).

## Results

Order **Actiniaria** Hertwig, 1882

Suborder **Nynantheae** Carlgren, 1899

Infraorder **Athenaria** Carlgren, 1899

Family **Halcampidae** Andres, 1883

*Diagnosis* (modified from Carlgren, 1949; changes are given in italics and explained below). *Athenaria*, commonly with an elongate, cylindrical body, usually divisible into three regions: physa, scapus and *scapulus*. Scapus often provided with tenaculi or papillae containing numerous nematocysts. Sphincter mesogloea, simple or double. Mesenteries represented by macro- and microcnemes. Usually six pairs of macrocnemes; rarely only eight macrocnemes present arranged likewise perfect mesenteries in *Edwardsia* Quatrefages, 1842.

*Note*. In the diagnosis of the family Halcampidae, Carlgren (1949: 33) pointed out that the body is subdivided into three regions, physa, scapus and capitulum. Sanamyan et al. (2016: 2) revised the terminology used for halcamps, and proposed to

use “scapus”, but not “capitulum” for *Halcampa arctica* and *Cactosoma abyssorum* Danielssen, 1890. In the course of studying the new species, as well as comparing it with another member of halcamps, the opinion of Sanamyan et al. (op. cit.) is supported and extended by me to all other representatives of this family. Therefore, it is proposed here to make appropriate changes in the diagnosis of the family.

*Included genera*. *Cactosoma* Danielssen, 1890, *Halcampa* Gosse, 1858, *Halcampaster* Carlgren, 1938, *Halianthella* Kwietniewski, 1896, *Kodioides* Danielssen, 1890, *Mena* Stephenson, 1920, *Neohalcampa* Sanamyan, 2001, *Parahalcampa* Carlgren, 1927, and *Gorgonactis* **gen. nov.**

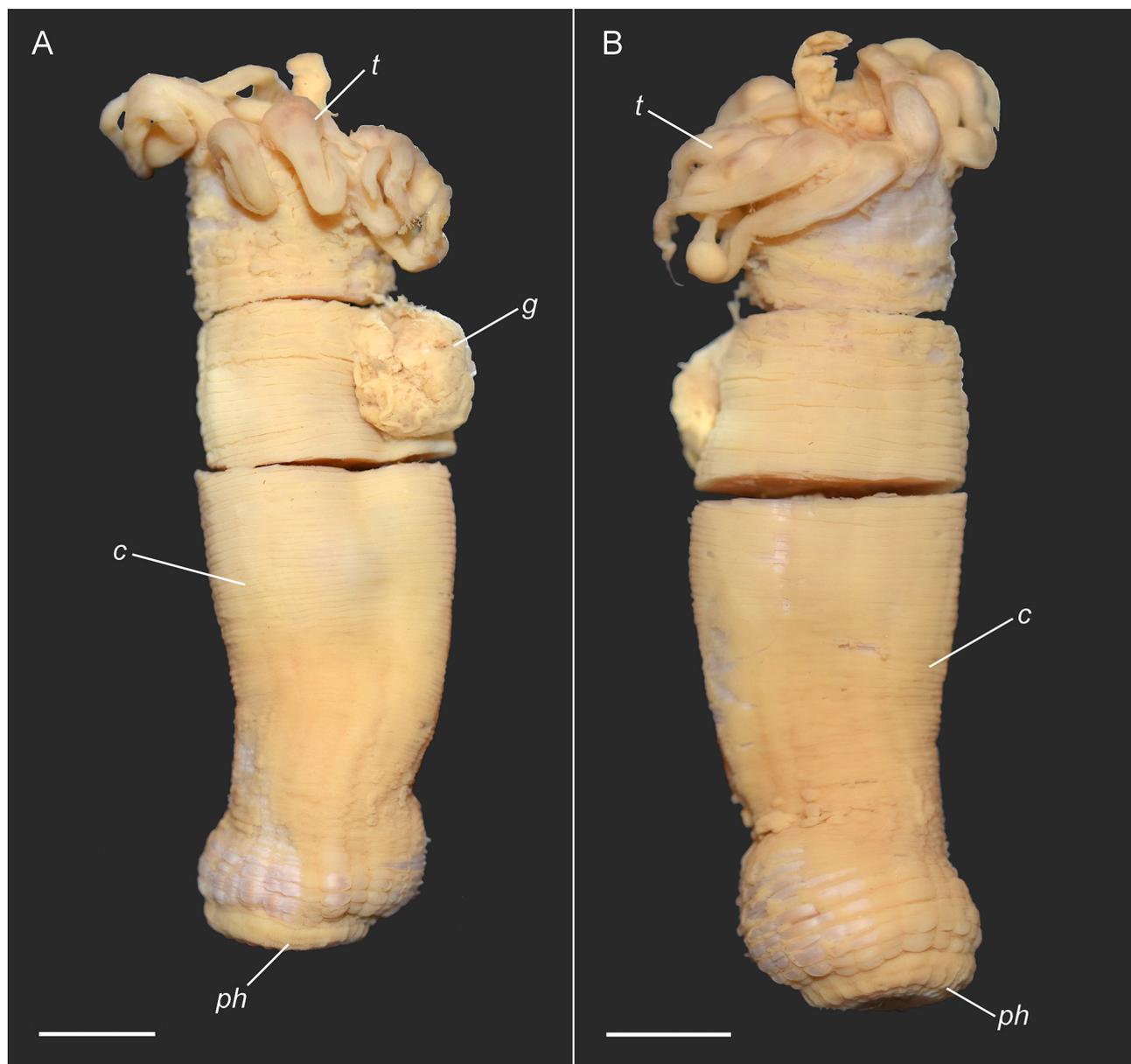
Genus ***Gorgonactis* gen. nov.**

Type species *Gorgonactis marisalbi* **sp. nov.**

*Diagnosis*. Body cylindrical, divisible into physa and scapus. Physa small. Scapus long, smooth, with thick mesogloea, forming folds and outgrowths. Distal part of column with numerous spirocysts. Strong marginal mesogloea sphincter extending into bases of tentacles. Twelve long tentacles with wide bases. Siphonoglyphs absent. Twelve perfect mesenteries, two pairs of directives. Second complete cycle presented by imperfect mesenteries. Perfect mesenteries fertile, with filaments and strong, restricted retractors. Parietal muscles elongated. Cnidom: spirocysts, basitrichs, (?) mastigophores.

*Included species*. Type species only.

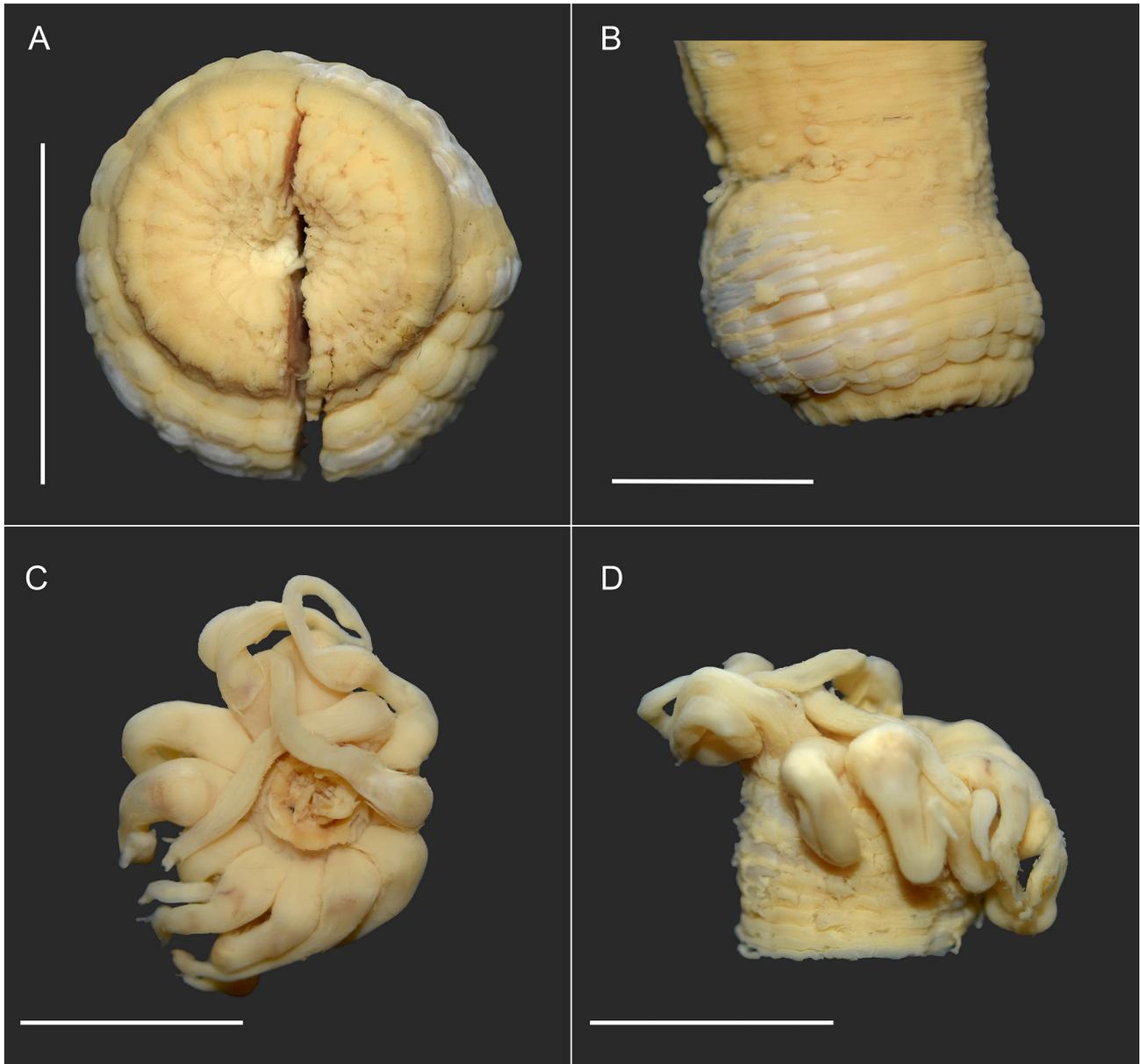
*Differential diagnosis*. *Gorgonactis* **gen. nov.** is characterised by a combination of characters of different halcamps genera. Like *Halcampa*, this genus has two cycles of the hexamerously arranged mesenteries and a simple marginal mesogloea sphincter, but it is devoid of a cuticle and tenaculi; its twelve tentacles are very long and smooth (*vs.* from eight to twelve short tentacles in *Halcampa*), and the marginal sphincter is very strong. *Cactosoma* differs from *Gorgonactis* **gen. nov.** in that its scapus is always with a cuticle and tenaculi, the sphincter is weak, and there are always more than twelve short tentacles (see Carlgren, 1949). The new genus shares with *Parahalcampa* and *Halcampaster* the division of the column into only two regions and the absence of a cuticle and tenaculi. It differs from these two genera in the



**Fig. 1.** *Gorgonactis marisalbi* gen. et sp. nov. **A**, habitus, lateral view; **B**, habitus, lateral view from other side. c, column; g, gonads; ph, physa; t, tentacles. Scale bars: 5 mm.

presence of twelve tentacles (*vs.* 20–30 tentacles in *Halcampaster* and ten tentacles in *Parachalcampa*), the twelve hexamerously arranged pairs of mesenteries (*vs.* 18 pairs of the mesenteries with a tendency toward pentamerous arrangement in *Halcampaster* and ten macrocnemes [eight mesenteries like in *Edwardsia* + fifth couple] in *Parachalcampa*), the absence of siphonoglyphs (*vs.* two distinct siphonoglyphs in *Halcampaster* and one siphonoglyph in *Parachalcampa*), and a strong marginal mesogloea sphincter (*vs.* a very

weak sphincter in both the genera) (see Carlgren, 1927, 1938). The new genus differs from *Mena* and *Halianthella* in a simple mesogloea sphincter (*vs.* double sphincter). Unlike *Neochalcampa*, it does not have the third additional cycle of mesenteries, a thin and easily deciduous cuticle, but shares with this genus a thick mesogloea of the body wall and the absence of tenaculi (see Sanamyan, 2001). *Gorgonactis* gen. nov. is similar to *Kodioides* in the absence of siphonoglyphs but differs from it in the bare column (see Danielssen, 1890).



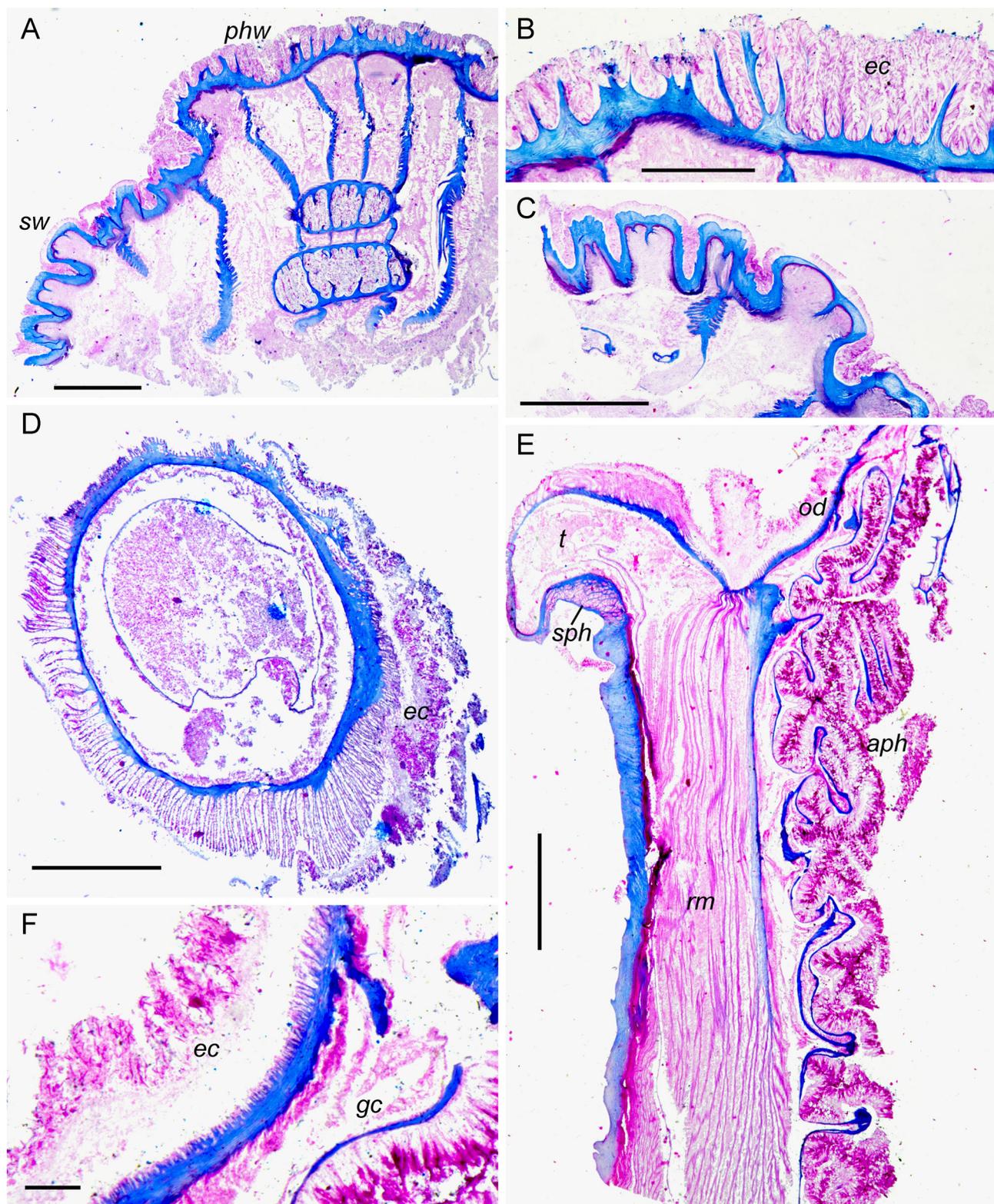
**Fig. 2.** *Gorgonactis marisalbi* gen. et sp. nov. **A**, physa, aboral view; **B**, proximal column, lateral view; **C**, oral disc; **D**, distal column, lateral view. Scale bars: 7 mm (A, B); 8 mm (C, D).

*Etymology.* The genus is named after the long, curving tentacles that resemble snakes on the heads of the Gorgons, creatures from Ancient Greek mythology, and derives from Ancient Greek Γοργών and ἄκτις, “ray”. The gender is feminine.

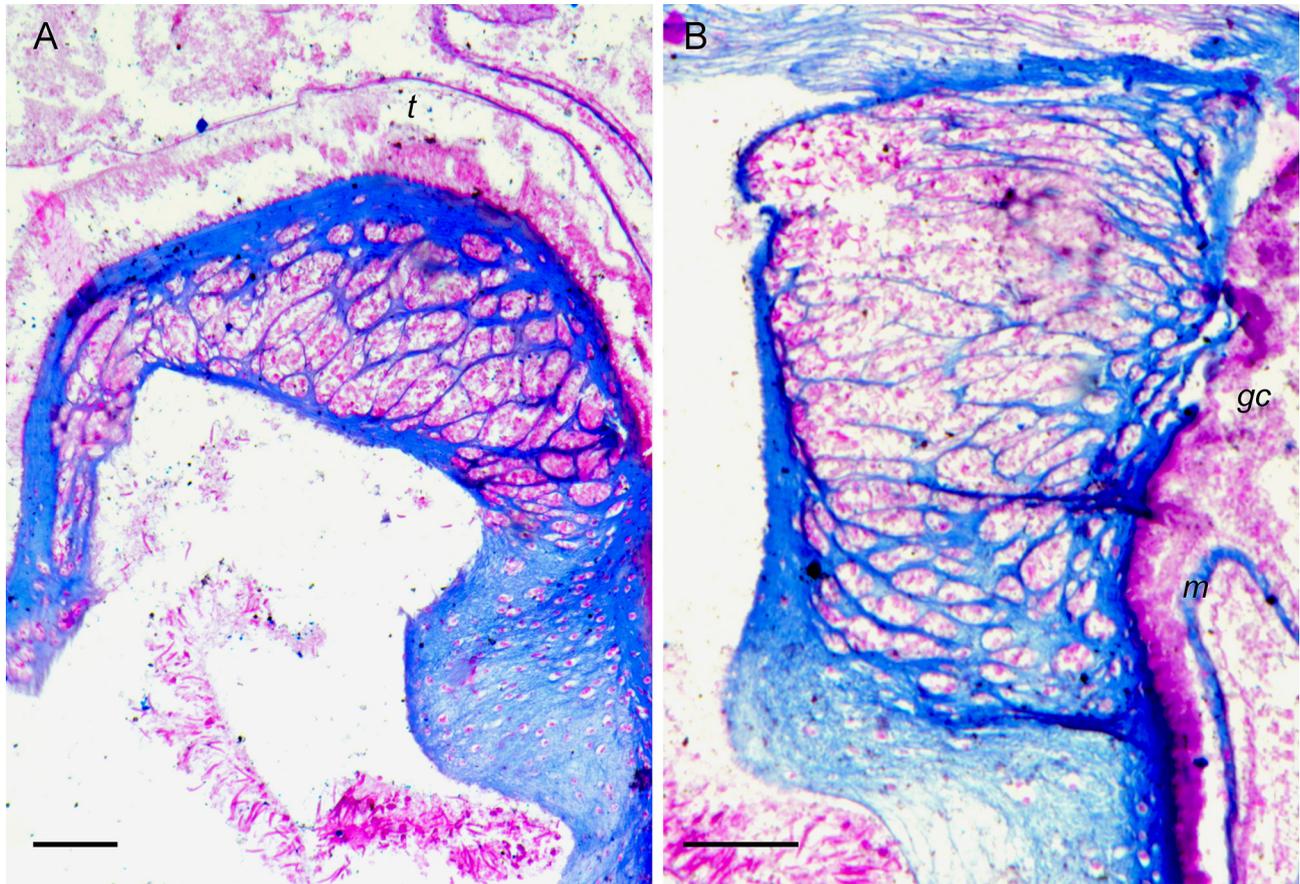
***Gorgonactis marisalbi* sp. nov.**  
(Figs 1–8)

*Holotype.* Female, **Russia**, *White Sea*, Chupa Bay, 62 m, 24 July 1967, research vessel *Professor Mesyatssev*, bottom grab “Ocean” (ZIN 12372).

*Description.* Body length 35 mm; largest body diameter in middle 11 mm; diameter of aboral end 7 mm. Column elongated, cylindrical, divided into scapus and physa (Fig. 1). In distal and proximal parts, column surface covered with distinct transverse and longitudinal furrows forming a clear reticular structure (Figs 1 and 2A, B, D). Numerous spirocysts in ectoderm of distal part of column. In middle part, column surface covered with small transverse folds (Fig. 1). Mesogloea of body wall thick. Physa small, its central part slightly



**Fig. 3.** *Gorgonactis marisalbi* gen. et sp. nov. **A**, longitudinal section of proximal part of column, showing difference in structure of the walls of physa and scapus; **B**, details of physa wall; **C**, details of scapus wall; **D**, transverse section of tentacle; **E**, longitudinal section of distal part of column, showing position of sphincter muscle; **F**, radial musculature of oral disc. *aph*, actinopharynx; *ec*, ectoderm; *gc*, gastral cavity; *od*, oral disc; *phw*, physa wall; *rm*, retractor muscle; *sph*, marginal sphincter; *sw*, scapus wall; *t*, tentacle. Scale bars: 100  $\mu$ m (F); 500  $\mu$ m (B, D); 1000  $\mu$ m (A, C, E).

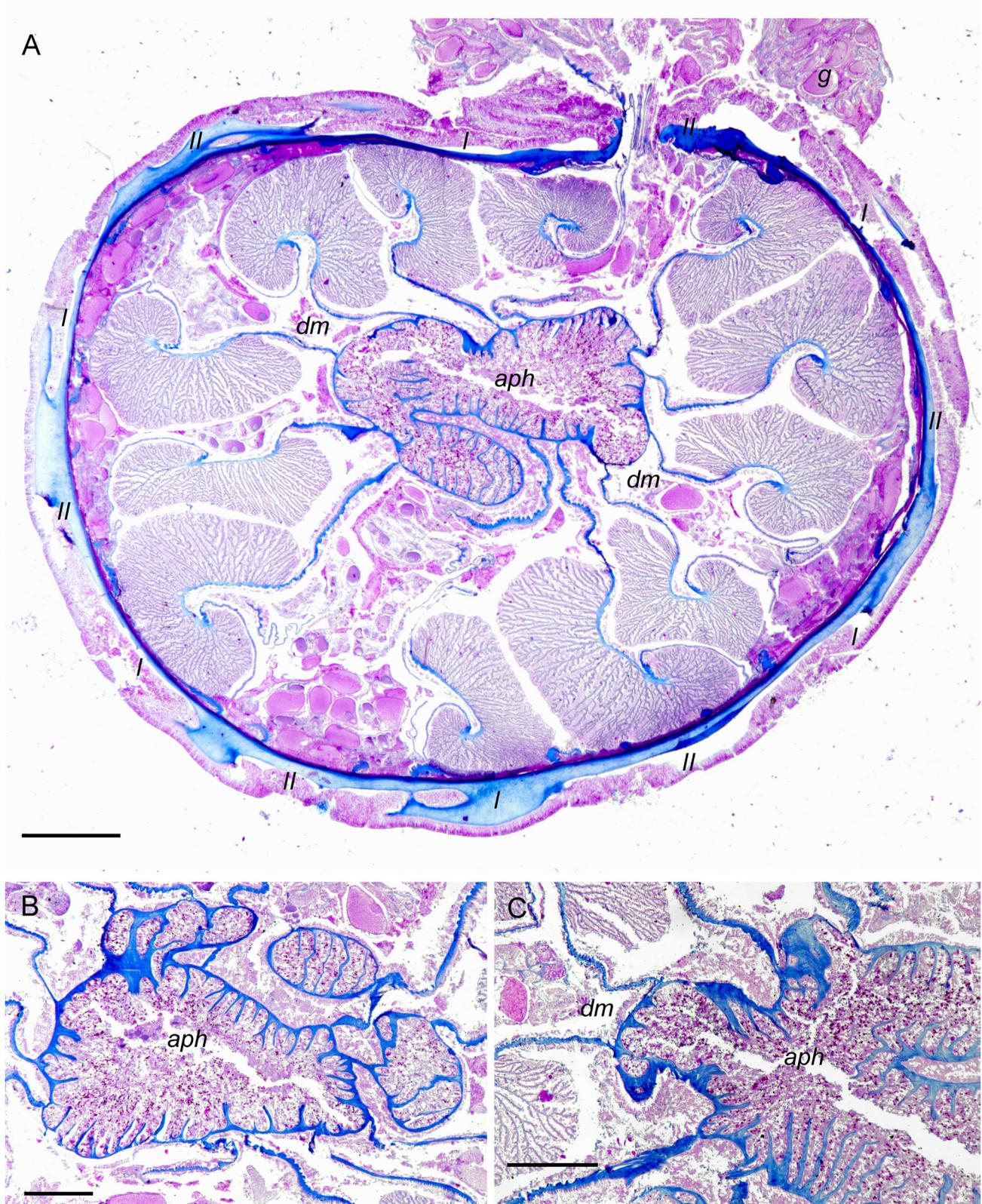


**Fig. 4.** *Gorgonactis marisalbi* gen. et sp. nov. **A**, sphincter muscle at base of tentacle; **B**, sphincter muscle in area between tentacles. *gc*, gastral cavity; *m*, mesentery; *t*, tentacle. Scale bars: 100  $\mu$ m.

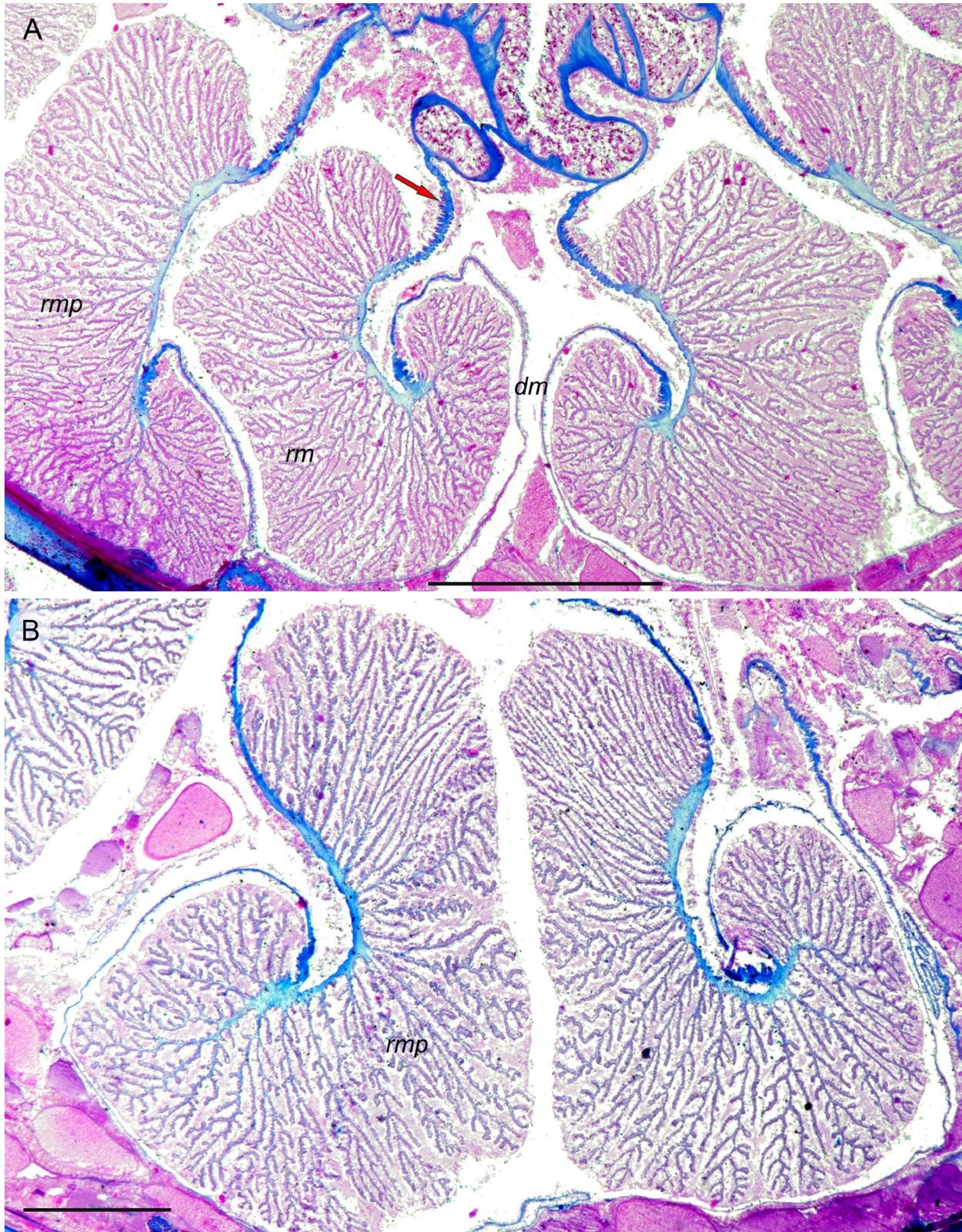
retracted (Figs 1 and 2A, B). It separated from scapus by a clear furrow and well distinguished from it by structure of wall. Surface of physa covered with radial ridges and annular grooves (Fig. 2A, B). On a series of longitudinal sections, numerous long and short projections of thick mesogloea visible; adjacent proximal part of column, in contrast, devoid of such mesogloea and equipped with only large folds formed by body wall (Fig. 3A–C). Oral disc small, its central part occupied by a wide mouth opening, at a small distance from it surrounded by twelve tentacles lying tightly to each other. Tentacles long (more than 10 mm), widened at base and with narrow tips, curved, smooth, with barely noticeable longitudinal striation (Fig. 2C, D).

Actinopharynx short, provided with numerous large longitudinal and transverse folds, as a result of which separate cavities often visible on a series of sections. Numerous long and short

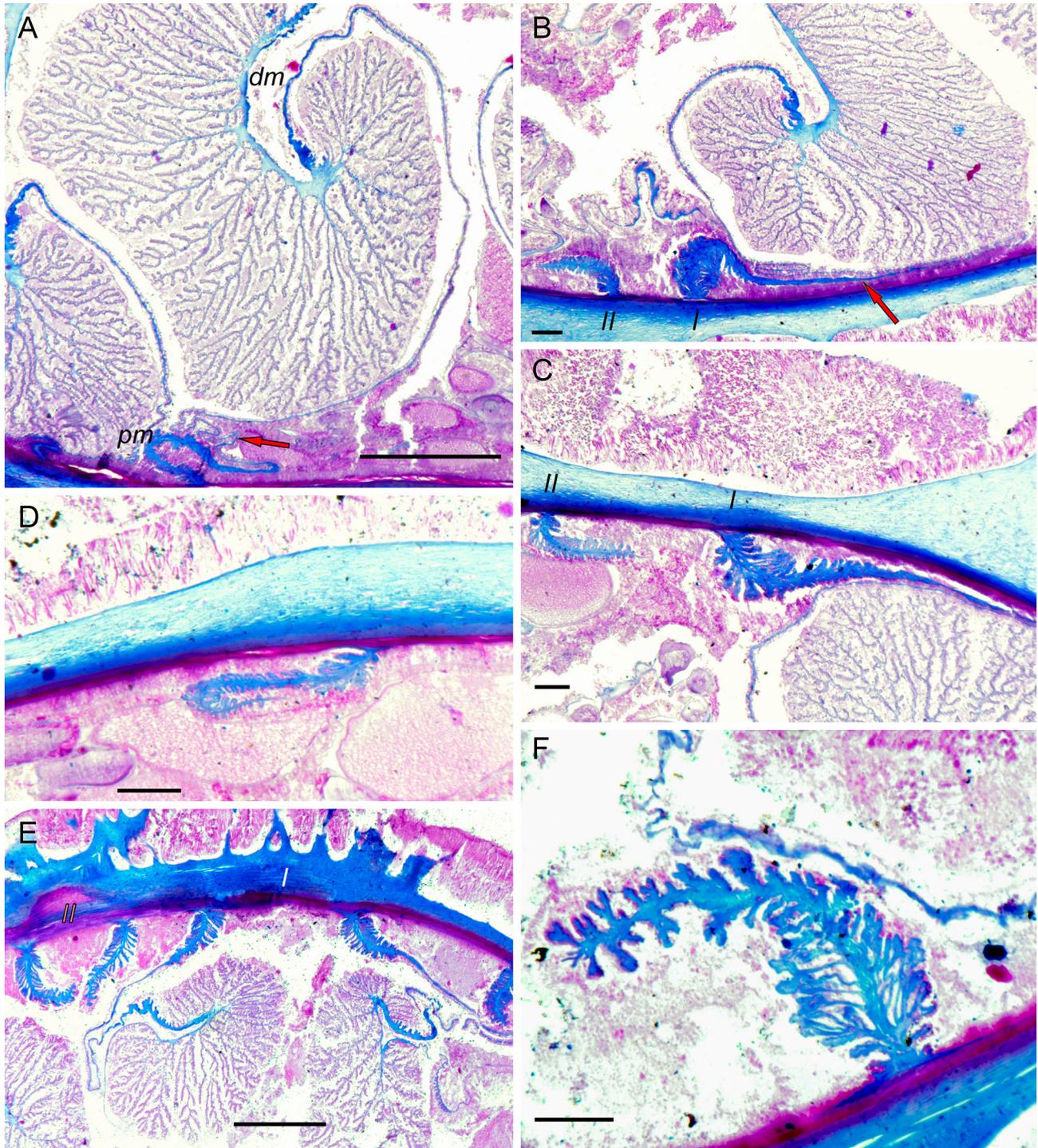
projections formed by mesogloea of actinopharynx wall (Figs 3E and 5A–C). Siphonoglyphs absent (Fig. 5A, C). Marginal sphincter muscle mesogloea, strong and significantly extending into bases of tentacles (Fig. 3E). Structure and shape of sphincter different at base of tentacles and in area between them. At base of tentacles, sphincter elongated and mostly reticular, but alveolar at its proximal end. In main part of sphincter, muscle meshes large; mesogloea strands forming them thick, especially in area of endoderm (Figs 3E and 4A). In area between tentacles, sphincter wide, rectangular, almost completely reticular, with only a few muscle alveoli in its proximal part (Fig. 4B). Longitudinal muscles of tentacles ectodermal, distinct (Fig. 3D). At base, muscle processes sometimes very high; towards tip of tentacle, their height decreases. Radial musculature of disc also ectodermal, well developed (Fig. 3E, F). Mesenteries organised in two



**Fig. 5.** *Gorgonactis marisalbi* gen. et sp. nov. **A**, transverse section through column at level of actinopharynx; **B**, transverse section showing folds and ridges of actinopharynx; **C**, transverse section showing folds and ridges of actinopharynx and absence of a siphonoglyph. *aph*, actinopharynx; *dm*, a pair of directive mesenteries; *g*, gonads; *I, II*, cycles of mesenteries. Scale bars: 1000  $\mu\text{m}$  (A); 500  $\mu\text{m}$  (B, C).



**Fig. 6.** *Gorgonactis marisalbi* gen. et sp. nov. **A**, a pair of directive mesenteries, transverse section; **B**, a pair of perfect mesenteries of first cycle, transverse section. *dm*, a pair of directive mesenteries; *rm*, retractor muscles; *rmp*, retractor muscles of perfect mesenteries. Red arrow indicates short muscular processes between the actinopharynx and the retractor muscle. Scale bars: 1000 µm (A); 500 µm (B).



**Fig. 7.** *Gorgonactis marisalbi* gen. et sp. nov. **A**, directive mesenteries: retractor muscle, parietal muscle and wide mesenteric plate, transverse section at level of actinopharynx; **B**, mesenteries of first and second cycles, retractor muscle, parietal muscles and wide mesenteric plate, transverse section at level of actinopharynx; **C**, parietal muscles of mesenteries of first and second cycles, transverse section at level of actinopharynx; **D**, mesentery of second cycles, transverse section at level of actinopharynx; **E**, mesenteries of first and second cycles, transverse section in proximal part of column; **F**, mesentery of second cycles, transverse section in proximal part of column. *dm*, directive mesentery; *pm*, parietal muscle; *I*, *II*, cycles of mesenteries. Red arrows indicate a wide and thin plate of mesentery. Scale bars: 500  $\mu$ m (**A**, **E**); 100  $\mu$ m (**B**-**D**, **F**).

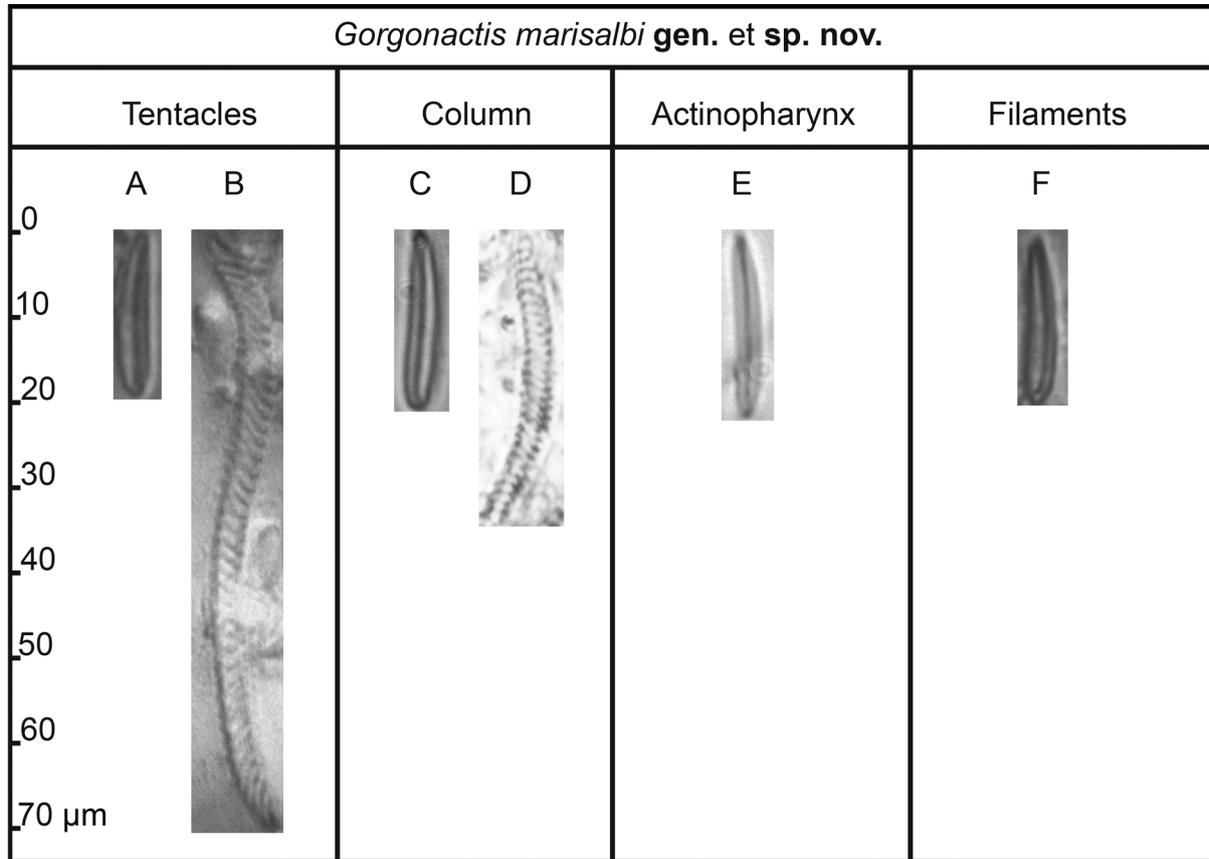


Fig. 8. *Gorgonactis marisalbi* gen. et sp. nov., distribution of cnidae (see Table 1 for size ranges).

cycles (6 + 6). First cycle represented by macrocnemes; second, by microcnemes. Only mesenteries of first cycle perfect, supplied with longitudinal retractor muscles, parietal muscles, gonads and filaments. Mesenteries of second cycle supplied only with parietal muscles (Fig. 5A). Retractors strong, large, restricted, forming more than 20 high and highly branched folds. Mesenteric plate between actinopharynx and retractor muscles thicker and supplied with short, small, unbranched muscular processes, those sometimes being not connected with retractors at all (Fig. 6A); thin and very wide mesenteric plate extending from outer edge of retractor muscle to body wall (Fig. 7A, B). In proximal part, structure of retractor muscles the same, but they somewhat smaller in size (Fig. 7E). Size of retractor muscles of one pair of mesenteries changeable. Parietal muscles of perfect mesenteries distinct, elongated, forming mostly short, thick and often branched folds (Fig. 7A–C). In proximal part, they supplied with longer and thinner muscle

processes (Fig. 7E). Parietal muscles of imperfect mesenteries similar in appearance (Figs 5A and 7B–F). Basilar muscles absent. Oocytes up to 500  $\mu\text{m}$  in diameter (Fig. 5A).

Cnidom (Fig. 8, Table 1) [is not fully examined since only one specimen was available, and possibly also due to its unsatisfactory condition]. Tissues of actinopharynx and filaments filled only with numerous immature nematocysts (up to 36  $\mu\text{m}$ ) of an undetermined type, possessing unformed membrane and irregularly lying tube. In some of them, however, differentiation of tube into shaft and thread barely perceptible, therefore, they are most likely most likely a kind of mastigophores. Nevertheless, basitrichs very common and easily detectable on temporary preparations. Ectoderm of tentacles supplied with rather not numerous basitrichs and large (up to 70  $\mu\text{m}$ , usually 40–55  $\mu\text{m}$ ), numerous, often curved spirocysts. Ectoderm of oral disc and distal column also filled with numerous spirocysts.

**Table 1.** Size ranges (length × width, in microns) and distribution of cnidae of *Gorgonactis marisalbi* gen. et sp. nov. Letters in brackets correspond to letters in Fig. 8.

Body region	Cnidae	Size ranges
Tentacles	(A) basitrichs (few)	17–20 × 3–4
	(B) spirocysts (very numerous)	30–70 × 3–5
Column	(C) basitrichs (very numerous)	15–21 × 3–4
	(D) spirocysts (very numerous)	27–35 × 3–4
Actinopharynx	(E) basitrichs (common)	19–22 × 2–3
Filaments	(F) basitrichs (common)	16–20 × 3–4

*Etymology.* The name of this species is a noun in the genitive case and means “of the White Sea”.

*Comparison.* *Gorgonactis marisalbi* sp. nov. is the third species of the family Halcampidae found in the White Sea. Earlier, *Halcampa arctica* and *H. duodecimcirrata* were recorded in this region (Bocharova et al., 2010; Grebelny, 2012; Ivanova & Grebelny, 2021). They also have twelve tentacles, two cycles of the mesenteries, and a simple, marginal mesogloal sphincter. However, unlike the new species, their column is divided into three regions, and the scapus is provided with a cuticle and tenaculi. *Halcampa duodecimcirrata* has smaller retractors with less numerous mesogloal processes (compare the present Fig. 6 with Fig. 3 in Carlgren, 1893, Taf. V). Retractors of *H. arctica*, like those of the new species, have numerous, highly branched muscle processes, but they are smaller, restricted to circumscribed and reniform while in *Gorgonactis marisalbi* sp. nov., they are large and elongated (compare the present Figs 5A and 6 with Fig. 6B in Sanamyan et al., 2016). In addition, the parietal muscles of *H. arctica* and *H. duodecimcirrata* are small, oval or triangular on transverse sections and have several thick, weakly branched processes, while the parietal muscles of the new species are elongate (compare the present Fig. 7 with Figs 2 and 7 in Carlgren, 1893, Taf. V, and with Fig. 6E in Sanamyan et al., 2016). Another northern representative of the family Halcampidae, *Cactosoma abyssorum*, has even greater differences. In addition to the column divided into the scapus, scapulus and physa, and provided

with tenaculi, this species has 24 short tentacles, two shallow siphonoglyphs, reniform retractor muscles and a distinct flap in the parietal region of the macrocnemes (see Sanamyan et al., 2016, Figs. 1 and 2C, F); it is similar to the new species in the structure of the longitudinal muscles of tentacles (compare the present Fig. 3D with Fig. 2G in Sanamyan et al., 2016). The new species is well distinguished from *Kodioides pedunculata* Danielssen, 1890, which has a pear-shaped body with a long stem, the column provided with suckers, and a cuticle that is heavily incrustated by sand (see Danielssen, 1890, Pl. VI, Fig. 3).

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