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New Record of *Oceanactis diomedeae* (Cnidaria: Actiniaria: Oractiidae) and Systematic Position of the Genera *Oceanactis* and *Oractis*

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The small, deep-water sea anemone *Oceanactis diomedeae* (McMurrich, 1893) is recorded for the first time since it was first described, living in muddy habitats of the Sea of Okhotsk. The genus *Oceanactis* Moseley, 1877 is considered synonymous with *Oractis* McMurrich, 1893 and is the only genus belonging to the family Oractiidae Riemann-Zurneck, 2000. The invaginations of the oral disc or "glandular sacs", unique to the Oractiidae, are described and their possible function is discussed.
Key Words: Actiniaria, Oractiidae, sea anemones, Sea of Okhotsk, taxonomy.

Introduction

Several specimens of *Oceanactis diomedeae* (McMurrich, 1893) were found among other sea anemones collected in the Sea of Okhotsk. This species was described as *Oractis diomedeae* McMurrich, 1893 from several specimens collected in California (McMurrich 1893). The taxonomic status of *Oractis* McMurrich, 1893 was not clear for a long time: initially described as a form related to *Gonactinia* Sars, 1851 (Gonactiniidae), it was referred to the Andresiidae by Carlgren (1931) and later to the Haloclavidae by Carlgren (1949). Stephenson (1935: 30) pointed out that *Oractis* is an unusual form, not fitting readily into any family. He considered it to be related to the Halcampoididae or it "may be an immature or aberrant Ilyanthid." Recently Riemann-Zurneck (2000) established a new family Oractiidae and described a second species belonging to this genus, *Oractis bursifera* Riemann-Zurneck, 2000, based on a single specimen from the central Arctic deep sea (Amundsen Basin, 3000 m). She was the first to describe the unusual sac-like invaginations of the oral disc in *O. bursifera*, a structure not known in other Actiniaria. These invaginations are well-developed in specimens from the Sea of Okhotsk and are described in the present paper. Although their function is not clear, a possible role in nutrition is suggested.

Material and Methods

Material examined (see Fig. 1). Vessel "Pogranichnik Petrov", Sea of

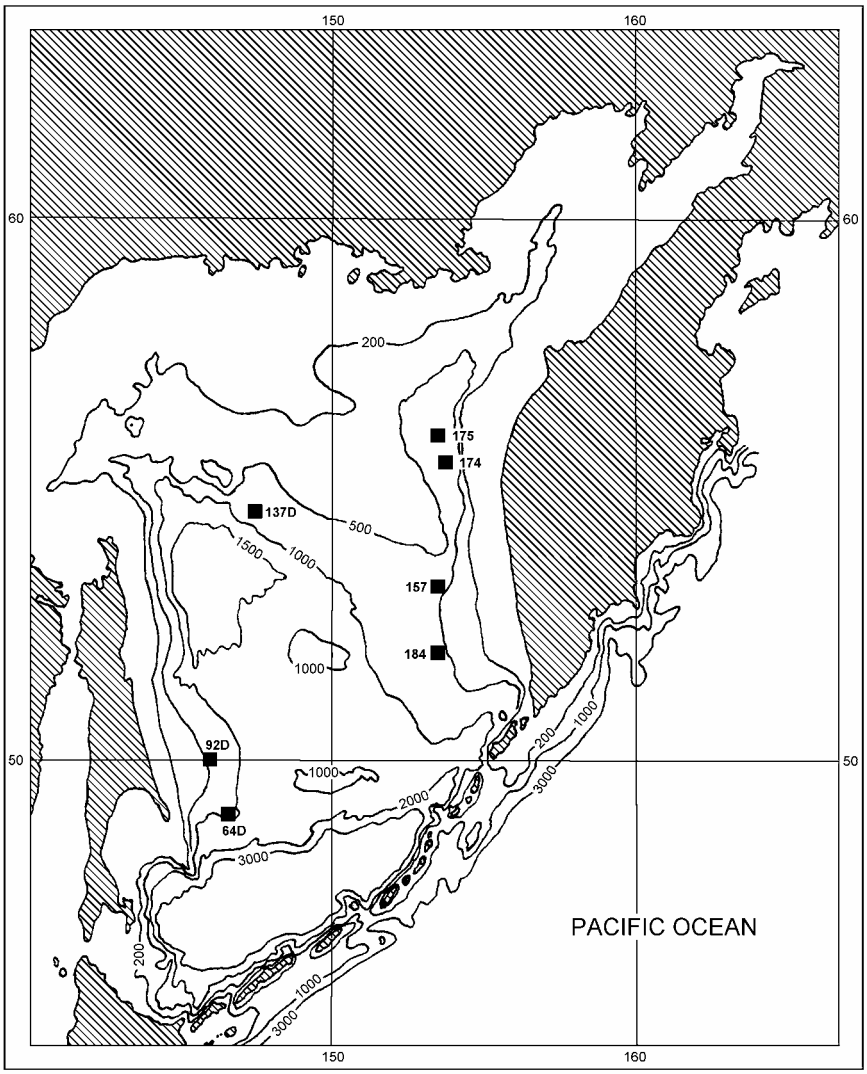

Fig. 1. Map of the stations in the Sea of Okhotsk where *Oceanactis diomedeae was* collected.

Okhotsk, Western Kamchatka, collector A. V. Chetvergov: trawl 157, 53°12'N, 153°36.1'E, 558m, 28 Aug. 2000, 1 specimen; trawl 174, 55°39'N, 153°48'E, 750m, 01 Sept. 2000, 1 specimen; trawl 175, 56°01'N, 153°37'E, 815m, 02 Sept. 2000, 1 specimen; trawl 184, 52°01'N, 153°34'E, 645m, 07 Sept. 2000, 5 specimens. Vessel "Novoulyanovsk", Sea of Okhotsk, collector S. D. Grebelny: trawl 64D, 48°59.6'N, 146°37.8'E, 840m, mud and small stones, 01 Oct. 1984, 1 specimen; trawl 92D, 50°N, 146'E, 600m, mud, 08 Oct. 1984, 2 specimens; trawl 137D, 54°40'N, 147°30'E, 900m, mud, 21 Oct. 1984, 4 specimens.

Nematocysts were examined in squash preparations and in histological sections.

Results

Family ***Oractiidae*** Riemann-Zürneck, 2000
Oceanactis diomedeae (McMurrich, 1893), comb. nov.
(Figs 2-5)

Oractis diomedeae McMurrich, 1893: 138; Carlgren 1931: 43.

Description. The body shape of the 15 studied specimens varies from regularly spherical to spindle-, pear-, or vase-shaped, depending on the state of contraction of the column (Fig. 2). The largest specimen is 28 mm in height and 29 mm in diameter; the smallest is 13 mm in height and 8 mm in diameter. The column is not divided into regions. Although in some specimens the aboral part is flattened or resembles a physa (Fig. 2A), there is no limbus and true base or physa. The ectoderm on the column is almost entirely abraded in all specimens, being present only near the margin. The body wall is smooth, transparent, and very thin, especially in larger, swollen specimens, which resemble small ballons with internal organs visible through the body wall. Mesenterial insertions appear as 20 light meridional lines. The margin has a ring of ten small, solid tubercles corresponding to the endocoels. Twenty simple, elongated tentacles are arranged in two cycles; the outer tentacles correspond to the exocoels and are about two or three times longer and thicker than the inner endocoelic tentacles. In some specimens the tentacles are covered by the upper part of the column and are not visible externally.

The oral disc has ten peculiar invaginations into the exocoels, with one situated near the base of each outer tentacle [termed "glandular sacs" by Riemann-Ziirneck (2000)]. Each of these invaginations is a complex organ composed of three parts: sac, ductus, and valve. The sac is an elongated, sometimes three-lobed struc-

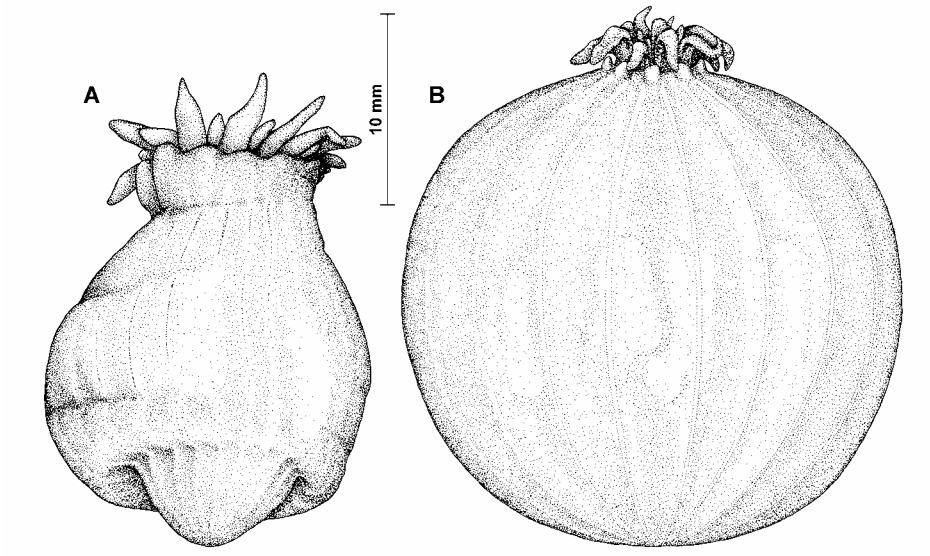

Fig. 2. *Oceanactis diomedeae.* A, B, external appearance of two specimens.

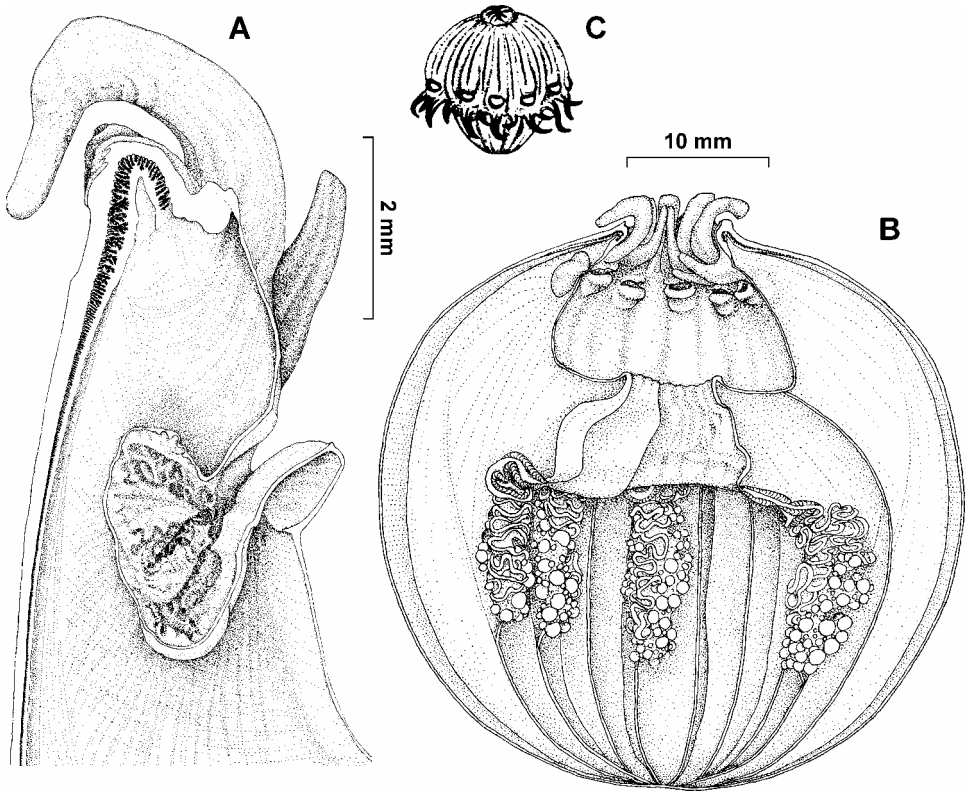

Fig. 3. *Oceanactis* spp. A, *Oceanactis diomedeae,* longitudinal section through upper part of column, endodermal sphincter, and glandular sac; B, *Oceanactis diomedeae,* longitudinal section through whole specimen; C, *Oceanactis rhodactylus,* external appearance of one specimen from type lot (after Moseley 1877, pl. 45, fig. 4).

ture about 1 mm in diameter and 2 mm in length with the longer axis lying along the radius of the oral disc. The epithelium lining its inner surface forms anastomosing ridges of various height. Usually two transverse ridges are higher than the rest and they divide the cavity of the sac into three pockets (Fig. 3A). Some sacs contain foreign matter, usually in the form of undefinable debris, mud particles, minute sand grains, and remains of articulate legs of small crustaceans and shells of ostracods. The ductus is a tube flattened in the radial direction that connects the sac to the oral disc and opens onto it as a slit continuing transversely from one mesentery to another. On the inner rim of the slit the oral disc forms a hollow evagination, a "valve", closing the orifice of the ductus. The outer edge of this slit has a valve-like elevation of ectoderm. The mouth is a C-shaped slit.

The diffuse endodermal sphincter is fairly long and has numerous long, branched mesogloeal lamellae. They are noticeably shorter on the top, where the sphincter is curved at a sharp angle, and the distal end of the sphincter appears to be slightly separated from the rest. The mesogloea of the mesenteries in the sphincter region is significantly thickened, and the sphincter appears mesogloeal where it crosses mesenteries (Fig. 4C). The mesogloea of the body wall below the

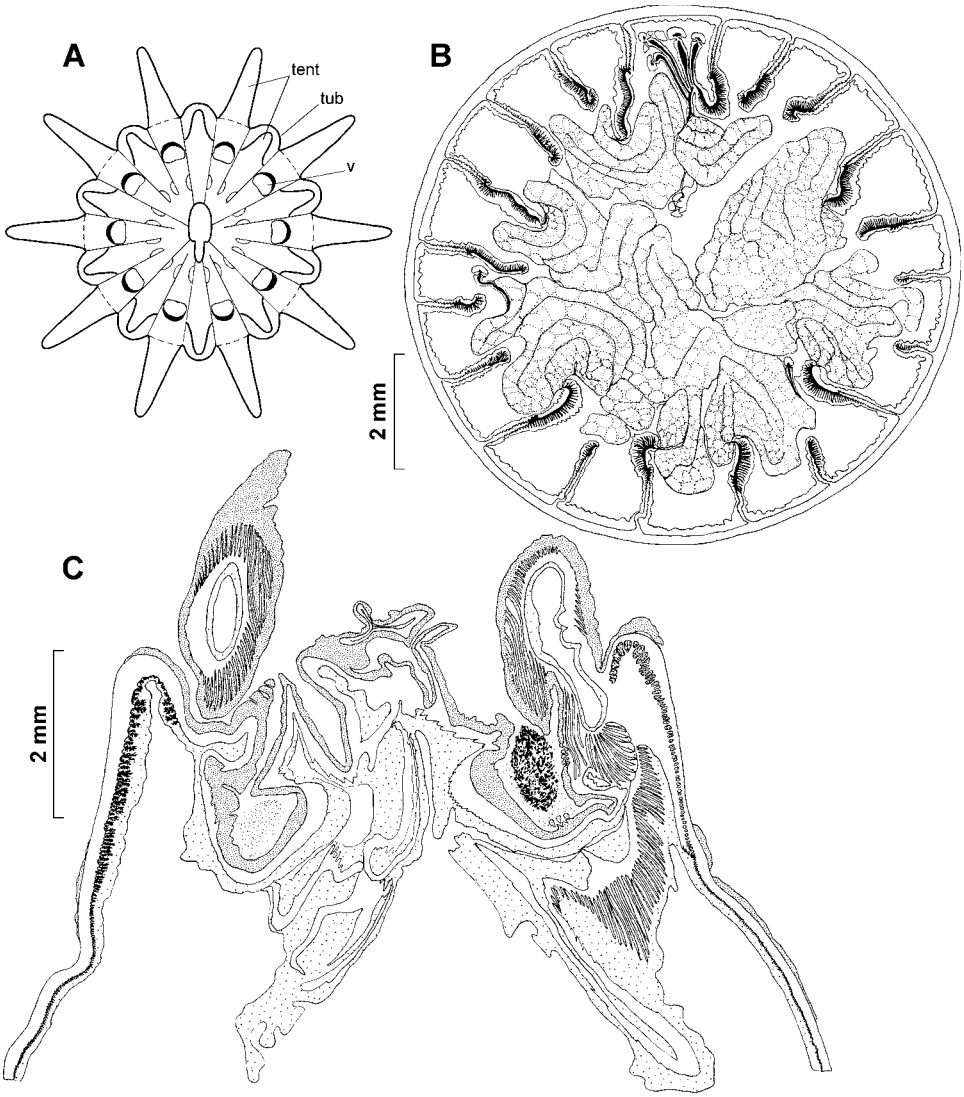

Fig. 4. *Oceanactis diomedeae. A*, scheme illustrating relative positions of large and small tentacles (tent), mesogloeal marginal tubercles (tub), valves closing entrances of glandular sacs (v), and arrangement of mesenteries and siphonoglyph; B, transverse section of column below actinopharynx; C, longitudinal section of upper part of column showing sphincter, two glandular sacs, and tentacles.

sphincter region has a fibrillar structure. The longitudinal muscles of the tentacles and radial muscles of the oral disc are ectodermal; in large tentacles they form strong ribbons bifurcated near the base of the tentacle. Mesogloea on the aboral sides of the tentacles is thicker than on the oral sides, while the longitudinal muscles are better developed on their oral sides.

The short actinopharynx has six longitudinal mesogloeal ridges correspon-

ding to the mesenterial insertions, as figured by Carlgren (1931, Fig. 43). There is a single deep (up to 4.5 mm in large specimens), thick-walled, ventral siphonoglyph. Ten pairs of mesenteries are arranged in two cycles (6+4; the ventrolateral mesenteries of the second cycle are absent); two pairs are directives. Only eight mesenteries, including directives, are perfect, fertile, and have filaments. They are arranged like the macrocnemes in *Edwardsia*; the other mesenteries are microcnemes. Retractors of all mesenteries are diffuse and rather weak, although slightly better developed on the macrocnemes (Fig. 4B). Weak parietal muscles are present. On the macrocnemes they form a low fold on the side opposite the retractor. Basilar muscles are absent. Short trilobate filaments are situated just below the actinopharynx and are similar to those described by Riemann-Zürneck (2000) for *O. bursifera.* Acontia are absent. The sexes are separate.

Cnidome (letters in brackets refer to Fig. 5, all measurements in (m): column, basitrichs (a) 15-22x2.5-3.5; tentacles and oral disk, spirocysts (a) 18-80x2-6, basitrichs (b) 15-35x2-3.5; actinopharynx, basitrichs (a) 17-28x2.5-3, p-mastigophores (b) 24-41x4-6; filaments, basitrichs (a) 13-18x2-3, p-mastigophores (b) 20-30x4-6.

Spirocysts and basitrichs are very numerous in the oral disc ectoderm. The epithelium lining the inner surface of the glandular sac ducts also has numerous spirocysts and basitrichs of the same size ranges as in the oral disc. Similar sparse cnidae are in the epithelium at the bottom of the glandular sacs. They were also found in the contents of the glandular sacs, sometimes in large quantities.

The preserved specimens are colorless or beige; the living specimens were reddish.

Ecology. All the specimens were collected from soft muddy bottoms. According to Zenkevich (1963), the places where the present specimens were collected belong to zones where detritophagous forms predominate. The average benthic biomass here is 1-10 g/m^2 (St. 92D, 64D), 10-50 g/m^2 (St. 137D, 174, 175), and 50-100 g/m^2 (St. 157, 184). The summer temperature at depths of 500-1000 m is 1.88-2.32°C (Zenkevich 1963). Along with the specimens described above, several large Actinostolidae (St. 184), Actiniidae (St. 157, *Isotealia* sp.), and Hormathiidae (St. 64D, *Stephanauge* sp.) were collected.

Discussion

The present species was previously known only from several specimens described as *Oractis diomedeae* by McMurrich (1893) from California (33°08'N, 118°40'W), from 775 m. Two of these specimens were reexamined and redescribed by Carlgren (1931). The specimens were small, 5-8 mm in height and 10-13 mm in diameter, and contracted (see McMurrich 1893, pl. XIX, figs 5, 6). This explains why such small and unusual structures as the glandular sacs, the most peculiar character of the genus, were overlooked by both authors. Probably for the same reason McMurrich in his original description erroneously reported only 10 tentacles. Carlgren (1931) discovered that McMurrich (1893) had counted only the outer tentacles and overlooked the shorter inner tentacles; thus the specimens actually have 20 tentacles. McMurrich's specimens, as well as the present ones, have distinctive longitudinal muscles of the larger tentacles. Bifurcation of the strong muscle ribbon near the base of the outer tentacles apparently is related to the glandular sacs

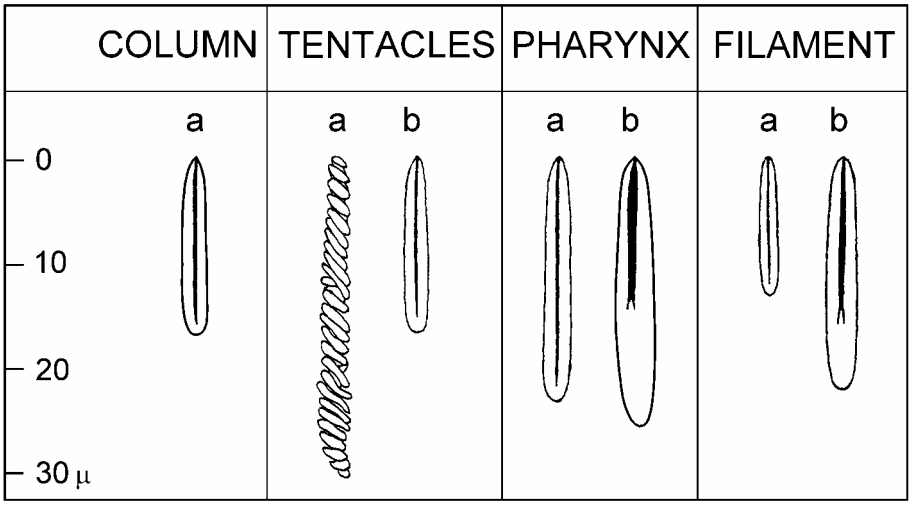

Fig. 5. Cnidome of *Oceanactis diomedeae.*

located near the bases of these tentacles; this provides indirect evidence of the presence of glandular sacs in McMurrich's specimens. McMurrich (1893) and Carlgren (1931) were uncertain of the existence of trilobate mesenteric filaments, while our specimens have trilobate filaments, but they are short and can be easily overlooked in small specimens. In other respects the specimens collected from the Sea of Okhotsk, far from the type locality, are in good agreement with both of the existing and rather detailed descriptions, and can be safely assigned to this species.

Oractis diomedeae, the type species of *Oractis,* is very similar to *Oceanactis rhodactylus* Moseley, 1877, the type species of the genus *Oceanactis* Moseley, 1877. *Oceanactis rhodactylus* is known only from two specimens described from east of the North Island of New Zealand, from 1260 m (Moseley 1877). The basal aperture described in the original description of this species is an artifact. It was not present in freshly collected specimens and appeared only after they had been placed in fresh water for the night. Although Moseley reported that this aperture is in direct communication with the "body cavity" and that there is no separate chamber for the float as in *Minyas,* he placed *Oceanactis* in the Minyadidae. Andres (1884) did not consider Moseley's (1877) arguments strictly logical; nevertheless, he also placed this species in the Minyadidae (as *Dactylominyas rhododactyla,* a junior objective synonym of *Oceanactis rhodactylus).* Carlgren (1924: 465) considered that this species could not be assigned to Minyadidae because of the absence of a float, and he doubted that it was a free-swimming form, as Moseley (1877) had thought. The systematic position of the genus *Oceanactis* remained unclear, and the genus was not even mentioned in Carlgren's (1949) monograph.

Although Moseley's (1877) description of *Oceanactis rhodactylus* contains no description of the sphincter muscle and arrangement of mesenteries, all mentioned features are in good agreement with *Oractis diomedeae. Oceanactis rhodactylus* has 20 mesenteries and 20 tentacles in two circles, of which the outer are larger. Moseley (1877: 297) described ten "rounded prominent tubercles" situated "just above the origin of the tentacles" (i.e. on the oral disc), and these tubercles corre-

spond to the larger tentacles of the outer series. In his figure (see Fig. 3C in the present work) the oral disc is protruding and the "tubercles" on the oral disc look exactly like the valves of the glandular sacs of the specimens described above (compare Fig. 3C and 3B). Such "tubercles" are not known in other genera of Actiniaria. In conclusion, *Oractis* is considered here to be a junior synonym of *Oceanactis.*

The glandular sacs were first described in *Oceanactis bursifera.* Although Riemann-Zurneck (2000: 607) wrote that glandular sacs "are the most significant diagnostic character" of her species *O. bursifera,* the presence of such an unusual feature is a character of generic or family level importance. The function of the glandular sacs is not clear. It is very unlikely that they "are destined to take up and brood the probably low number of eggs that are produced during the lifetime of this ... anemone" (Riemann-Zurneck 2000: 607). We have male and female specimens with well developed gonads, and the females have numerous eggs. Both male and female specimens have glandular sacs, and the presence of mud particles and remains of small crustaceans inside them accompanied by numerous nematocysts in the epithelial lining of the interior of the glandular sacs suggests their role in nutrition, as was also tentatively supposed by Riemann-Zurneck (2000). Villous epithelium lining the interior of the sacs, and the ridges that increase their surface area (see Fig. 3A) also support this suggestion. Riemann-Zurneck (2000) reported that the epithelium lining the ductus of the glandular sacs contains no cnidae, while in our specimens cnidae are numerous there. It should also be noted that she did not see basitrichs or p-mastigophores in her slides. *Oceanactis bursifera* differs from *O. diomedeae* in the number of mesogloeal tubercles on the margin: 20 tubercles were reported in the former, while the latter has 10.

The diagnosis given below for the genus *Oceanactis* corresponds to the diagnosis of *Oractis* as given by Carlgren (1949), with an added sentence about the oral disc invaginations.

Oractiidae with smooth body, not divisible into regions and with round proximal end. Endodermal diffuse sphincter. Tentacles 20 (10+10), inner ones (endocoelic) considerably smaller than outer (exocoelic) ones. Oral disc with 10 sac-like invaginations into exocoels near bases of outer tentacles. Longitudinal muscles of tentacles and radial muscles of oral disc ectodermal. Single deep, ventral siphonoglyph. Ten pairs of mesenteries, with eight pairs perfect and fertile and arranged as are macrocnemes in *Edwardsia;* ventrolateral mesenteries of second cycle absent. Retractors of mesenteries diffuse, fairly weak. Cnidom: spirocysts, basitrichs, and microbasic p-mastigophores.

The genus *Oceanactis* contains three species: *O. rhodactylus, O. diomedeae,* and *O. bursifera.* The first two may be synonyms, although a definite conclusion cannot be made because *O. rhodactylus* was incompletely described and the present author was not able to locate and examine the type specimens.

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