

First records of Parazoanthidae and Microzoanthidae (Anthozoa: Hexacorallia: Zoantharia) from the Red Sea

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Here we report on the first records of the families Parazoanthidae and Microzoanthidae and by extension for the suborder Macrocnemina (Cnidaria: Anthozoa: Hexacorallia: Zoantharia) from the Red Sea. Despite a long history of zoantharian research in the region, previous records only reported species of the suborder Brachycnemina, from the genera Zoanthus and Palythoa. Both Parazoanthus sp. and Microzoanthus sp. specimens were first found from the same small coral cave at a reef at Jaz'air Sila, Saudi Arabia, and subsequently observed at another location in the northern Red Sea. Numerous Antipathozoanthus sp. colonies were observed at Marker 9 north of Yanbu, Saudi Arabia in association with antipatharians inside small caves. The Parazoanthus sp. was in association with numerous encrusting sponge species on the roof of the cave, similar to previously reported undescribed species in the Pacific Ocean. Microzoanthus sp. was found on hard rubble on the cave floor. These records represent large range extensions (e.g. thousands of kilometres) for each genus, demonstrating the overall lack of research on the order Zoantharia, especially within the Red Sea.

Keywords: zoantharian, *Parazoanthus*, *Antipathozoanthus*, sponge, *Microzoanthus*, Saudi Arabia

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INTRODUCTION

Zoantharia (=Zoanthidea) are an order of Hexacorallia currently divided into two suborders, the Macrocnemina and the Brachycnemina. Brachycnemine zoantharians such as the genera *Palythoa* and *Zoanthus* are often in symbioses with zooxanthellae, and are commonly found in shallow subtropical and tropical waters. Macrocnemine zoantharians are more widely distributed; from tropical to polar waters, and from shallow waters to the deep sea. Although a few species in Macrocnemina are zooxanthellate, most species are epibiotic planktivores, and can be associated with a variety of benthos including but not limited to hydrozoans, octocorals, hermit crabs, gastropods and sponges (e.g. Sinniger *et al.*, 2010).

Within the Macrocnemina, the most well studied genus is likely *Parazoanthus* Haddon & Shackleton, 1891 (family Parazoanthidae Delage & Hérouard, 1901). Although recently revised and limited to species associating with sponges, *Parazoanthus sensu stricto* is still polyphyletic (Sinniger *et al.*, 2010). *Parazoanthus* species have been reported from the Mediterranean, the Atlantic and Caribbean, and the Indo-Pacific Ocean.

Antipathozoanthus Sinniger, Reimer & Pawlowski, 2010 was recently erected for former *Parazoanthus* sp. zoantharians

epizoitic on antipatharians, and species have been reported from the Atlantic, the eastern Pacific, and Japan.

The genus *Microzoanthus* Fujii & Reimer, 2011 (family Microzoanthidae) that has also only been recently described contains two species, and has been reported widely across the Pacific, including from Japan to Australia, and the Galapagos to Singapore and Thailand (Fujii & Reimer, 2011; Reimer & Fujii, 2013).

In the Red Sea, zoantharian research dates from Savigny (1811), with species reported from *Palythoa* and *Zoanthus* (e.g. Audouin, 1826; Klunzinger, 1877). However, since Pax & Muller (1956, 1957) there has been little research into the diversity of zoantharians in this region, and no Macrocnemina have been reported from this region. In general, invertebrate research in the Red Sea has lagged far behind that of other, better studied coral reef regions (Berumen *et al.*, 2013).

As part of a research project investigating the biodiversity of marine invertebrates in the Red Sea, surveys were conducted to assess the biodiversity on zoantharians on the coast of Saudi Arabia. Here, we report on findings of *Parazoanthus* sp., *Antipathozoanthus* sp. and *Microzoanthus* sp. from these surveys.

MATERIALS, METHODS AND RESULTS

In SCUBA surveys of zoantharian diversity in the northern Red Sea on 26 September 2013, colonies of small polyps

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were noticed on various encrusting sponges on the roof of a shallow coral reef cave (depth = 3 m) at Jaz'air Sila, Saudi Arabia (N27°38.302' E35°18.369') (Figure 1A). Detailed images, collection, and examination identified these to belong to the genus *Parazoanthus*, as polyps were clearly zoantharians with two rows of tentacles and sand encrustation, and were in association with sponges (Sinniger *et al.*, 2010). Expanded polyps were very small, with oral disc diameters of <3 mm (Figure 1A).

During a subsequent night dive on the same day, additional colonies of polyps were noticed covering rubble half-buried in fine sand sediment at the back of the cave. The small size (expanded oral disc diameter <5 mm), long extended polyps covered with large sand particles, long clear tentacles, and zigzagged pattern and the outer edge of the oral disc identified these as azooxanthellate *Microzoanthus* sp. (Figure 1B, C) (Fujii & Reimer, 2011). Subsequent *Parazoanthus* sp. and *Microzoanthus* sp. colonies were also observed and/or collected at Jazirat Burcan (N27°54.593' E35°03.925') at similarly shallow depths (<5 m).

Finally, on 4 October 2013, at Marker 9 (N24°26.561' E37°14.860'), numerous azooxanthellate *Antipathozoanthus* sp. were observed in small caves on the sides of coral reefs at depths of 11–13 m, exclusively on association with antipatharians as seen in this genus (Figure 1D) (Sinniger *et al.*, 2010).

Specimens are currently housed at the King Abdullah University of Science and Technology (KAUST)'s marine biodiversity collection, in Thuwal, Saudi Arabia, under specimen numbers SAZ-RS46 (*Parazoanthus* sp. from Jaz'air Sila), SAZ-RS51 to SAZ-RS54 (*Microzoanthus* sp. from Jaz'air Sila), SAZ-RS78 (*Microzoanthus* sp. from Jazirat Burcan) and SAZ-RS190 to SAZ-RS192 (*Antipathozoanthus* sp. from Marker 9).

DISCUSSION

This is the first record of the genera *Parazoanthus*, *Antipathozoanthus* (family Parazoanthidae) and *Microzoanthus* (Microzoanthidae), and, by extension, of the suborder Macrocnemina from the Red Sea. The genus *Parazoanthus* is widespread, and has previously been reported in the Atlantic Ocean, and in the Indo-Pacific species have been described from the Galapagos and South Africa, with numerous undescribed species from Japan and the central Indo-Pacific (Reimer, unpublished data). Thus, the finding of *Parazoanthus* in the Red Sea is not entirely unexpected. On the other hand, *Antipathozoanthus* and *Microzoanthus* have only recently been described, and although they have been reported from other regions (*Antipathozoanthus* from the eastern Atlantic and Pacific, *Microzoanthus* from the Indo-Pacific), less is known about their global distribution.

There are some potential causes for the lack of previous Macrocnemina records from the Red Sea. Although the Red Sea has a long history of zoantharian research dating from Savigny (1811), very little taxonomic work has been performed since Pax & Muller (1957). Thus, research on species diversity of not only zoantharians but also of many invertebrate taxa, particularly outside of the Gulf of Aqaba (Berumen *et al.*, 2013) and at depths below the intertidal zone (e.g. depths accessible by SCUBA), is lacking. Furthermore, the species reported here are quite small compared to many *Palythoa* and *Zoanthus* spp., which also often have colourful oral discs and can dominate intertidal areas.

Zoantharian research in the Red Sea would benefit from continued examination of less well-studied habitats such as caves (e.g. Hoeksema, 2012), rubble areas (e.g. Obuchi *et al.*, 2009; Fujii & Reimer, 2011), and all habitats at mesophotic

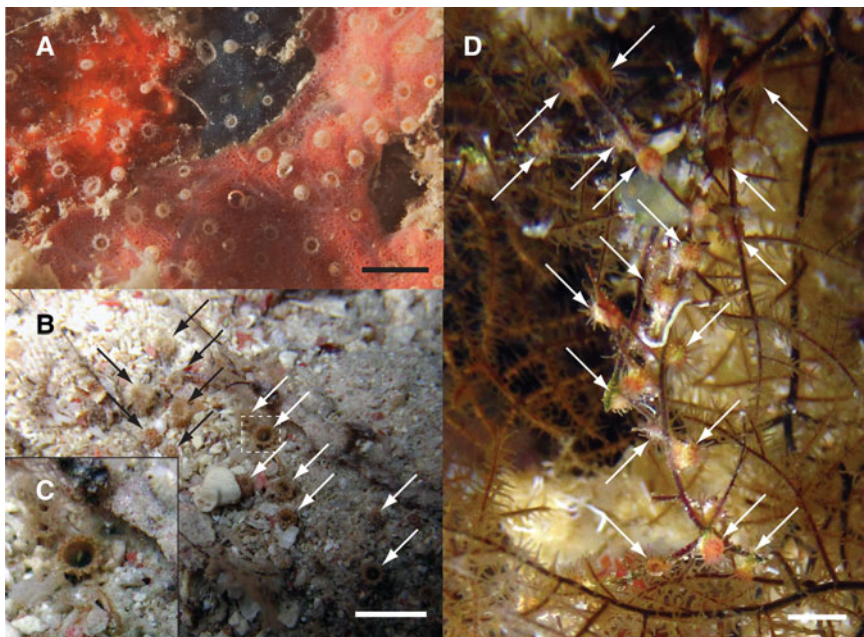


Fig. 1. *In situ* images of macrocnemic zoantharians of the Red Sea: (A) *Parazoanthus* sp. colony (pale whitish-yellow polyps) associated with three different sponges; (B) *Microzoanthus* sp. colony on coral rubble partially buried in fine coral sand sediment, with inset (C) of an individual polyp shown by dashed box in (B); (C) *Antipathozoanthus* sp. on antipatharian colony. Arrows in (B) and (D) indicate individual polyps. Scale bars = approximately 1 cm. (A), (B), and (C) from Jaz'air Sila, Saudi Arabia, depth = 3 m, on 26 September 2013 and (D) from Marker 9, Saudi Arabia, depth = 12 m, on 4 October 2013.

depths (e.g. Luck *et al.*, 2013). At least two of the species of zoantharians (*Antipathozoanthus* and *Parazoanthus*) observed in this study are likely to be undescribed species, as the nearest described congeners for each species are thousands of kilometres away, and acquired DNA sequences (unpublished) show they are unique from known species. Future work will formally describe these specimens.

Like many taxa, the zoantharians are very poorly known from the Red Sea due to a general lack of modern work done in the region. These findings, even without a comprehensive spatial assessment, show the potential for greatly expanding our understanding of Red Sea biogeography and thus allow us to better address the role of the Red Sea in a broader Indo-Pacific context (e.g. Bowen *et al.*, 2013).

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