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THE DEEPEST KNOWN OCCURRENCE OF THE PRECIOUS RED CORAL *CORALLIUM RUBRUM* (L. 1758) IN THE MEDITERRANEAN SEA

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Introduction

An initiative for the worldwide conservation of gorgonian corals of the family Coralliidae (Anthozoa, Gorgonacea) was attempted at the 14th Meeting of the Conference of the Parties of CITES at The Hague (CoP14) through a proposal to place members of this family on Appendix-II of the Convention (Anonymous 2007; Pala 2007; WWF 2007). Ultimately the proposal was defeated in a secret ballot, although the decision was taken to organize topical workshops devoted to upgrading knowledge of precious corals, which are all grouped in the two extant genera *Corallium* and *Paracorallium.* This call resulted in two workshops focusing on Pacific and Mediterranean precious corals, held in 2009 in Hong Kong and Naples, respectively (IAPPCS 2009; Anonymous 2009). In the meantime the request for inclusion of the Coralliidae in Appendix-II of CITES is in all likelihood going to be proposed for consideration at the forthcoming CoP15 in Qatar, scheduled for the year 2010.

Corallium rubrum colonizes a variety of sublittoral habitats generally between a few meters depth down to 120 m in the Mediterranean Sea and Eastern Atlantic Ocean (e.g. Bayer 1964; Carpine and Grasshof 1975; Zibrowius et al. 1984; Chintiroglou et al. 1989; Cattaneo-Vietti and Cicogna 1993; Abbiati et al. 1993; Garrabou and Harmelin 2002; Torrens et al. 2008; Rossi et al. 2008; Tsounis et al. 2006). The bright red calcitic axis of this species has been prized in the jewelry trade from antiquity to the present day (Cattaneo-Vietti and Cicogna 1993; Tsounis et al. 2007). Although far from being close to extinction, a decline in shallow-water populations of this widespread taxon has nevertheless been observed, giving rise to some concerns about its management (Santangelo and Abbiati 2001; Santangelo et al. 2003; Tsounis et al. 2007).

The present paper is a contribution on novel aspects of the ecology, biology and biogeography of *Corallium rubrum* based on the recent discovery of previously uncharted deep-water populations in the bathyal zone of the Mediterranean Sea (Fig. 1).

Distribution of *Corallium rubrum* at Bathyal Depths

Living red coral colonies were observed in 2006 during the Marum-Quest 4000 ROV survey of the R/V Meteor in the Strait of Sicily in water depths down to at least 684 m (Freiwald et al. 2009: Fig. 4). Before this discovery, the deepest confirmed lower bathymetric limit of this species was 230 m at Cap Creus in the Western Mediterranean (Rossi et al. 2008). In the Strait of Sicily deep water, *Corallium rubrum* is now documented to occur at three disjunct sites, namely (1) Linosa Island, dive 673; (2) Nameless-Urania Bank, dive 677; (3) South of Malta, dive 657 (see Freiwald et al. 2009 for details of the ROV dive stations). The first two sites refer to submarine volcanic edifices where the species fringes overhangs and 'caves' often in close association with living colonial and solitary scleractinians (e.g. Lophelia pertusa, Madrepora oculata, and Desmophyllum dianthus), antipatharians and gorgonians (Fig. 2). The site South of Malta site refers to a sedimentary escarpment and is located in the South Malta Deep-Water Coral Province first described by Schembri et al. (2007). Here *Corallium rubrum* is also found in intimate association with white stony corals, primarily Madrepora and Lophelia. In addition, red coral branches, some possibly still alive, were also spotted in recent coral taluses accumulated at the foot of coral-covered walls, again in association with 'white corals' (Fig. 2).

Colonies of red coral were collected alive for the first time from such deep-sea sites off Linosa and South of Malta in 2007 during the scientific cruise MARCOS of R/V Urania (Fig. 3). Some of these samples were provided to investigators for genetic characterization to investigate the genetic connectivity between geographically and/or bathymetrically disjunct coral sites (Costantini et al. in press). Samples have been used for the geochemically-based evaluation of climatic signals incorporated into the calcitic skeleton (Montagna et al. 2008, in progress).

Conclusions and Recommendations

The discovery of deep-sea populations of *C. rubrum* is important for the overall characterization of its ecological requirements (substratum and physicochemical factors), connectivity (interrelationship between disjunct coral populations), and sustainable management. It is also relevant for the evaluation of the present status of this species in the Mediterranean Sea and the adjacent Atlantic Ocean.

The existence of previously uncharted deep-water populations is opening new perspectives in characterizing the distribution and the role that this habitat forming species plays in ecosystem processes of the deep Mediterranean Sea. This discovery increases significantly the known depth range of this cnidarian, suggesting its potential presence at many other still-uncharted deep-water sites in the Mediterranean basin.

The *in situ* observation of its intimate association with other ecologically valuable sessile organisms (white corals, antipatharians etc.) is a strong argument against any commercial exploitation of these deep-water colonies, and no exploitation whatsoever should ever be considered. On the contrary, such fragile red coral bearing deep-water habitats are in strong need of proper management to ensure their protection. The relative inaccessibility of such remote habitats at present serves to protect them; however, the continuous implementation of wide scale operations in the deep ocean (including industry) could in principle put in jeopardy some unique systems. Action should therefore be taken to ensure the inclusion of known deep-sea *Corallium* habitats within marine protected areas.

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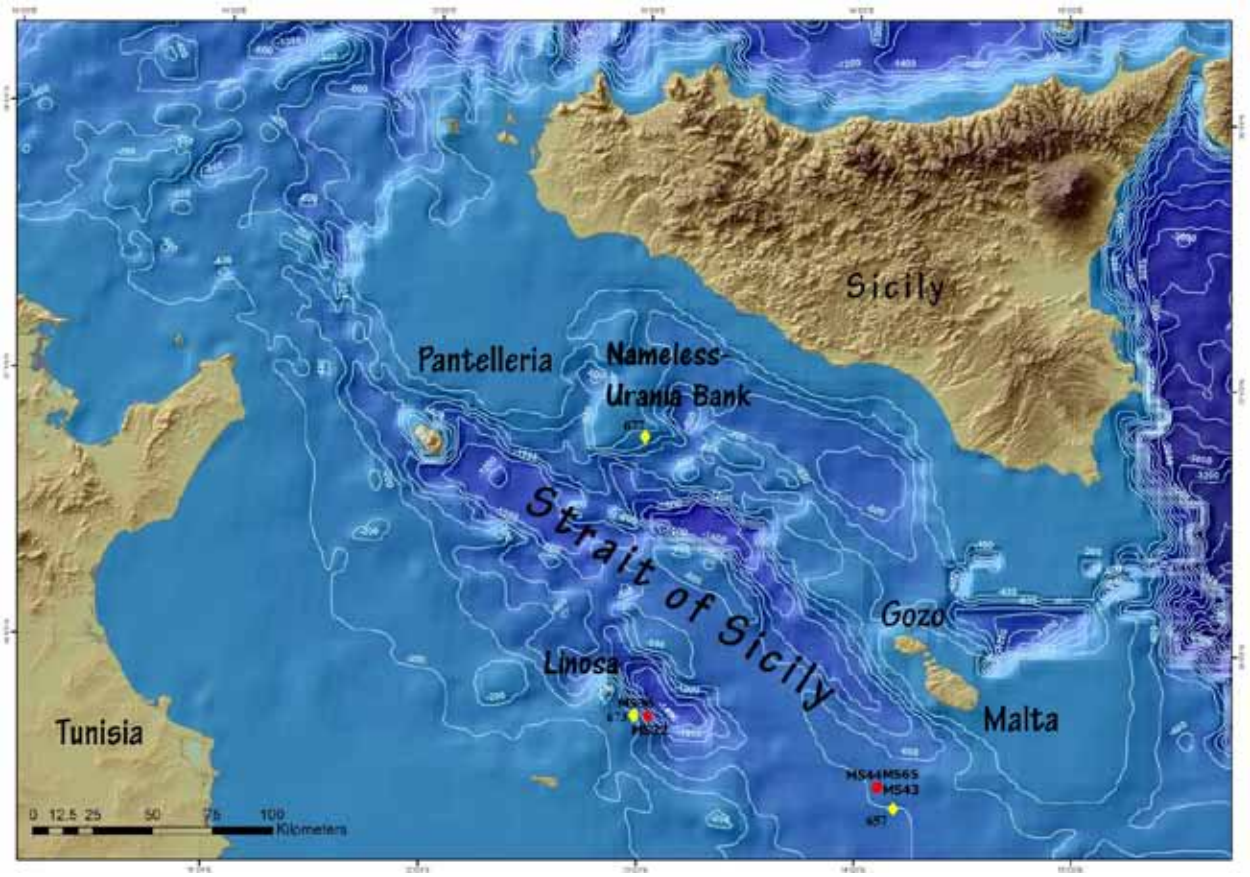

Fig. 1. Map of the Strait of Sicily showing the location of the MARCOS stations that provided live *C. rubrum* from bathyal depths. Red dots are samples from MARCOS Cruise; yellow diamonds are ROV dives from Meteor M70/1 Cruise (see Freiwald et al. 2009 for details).

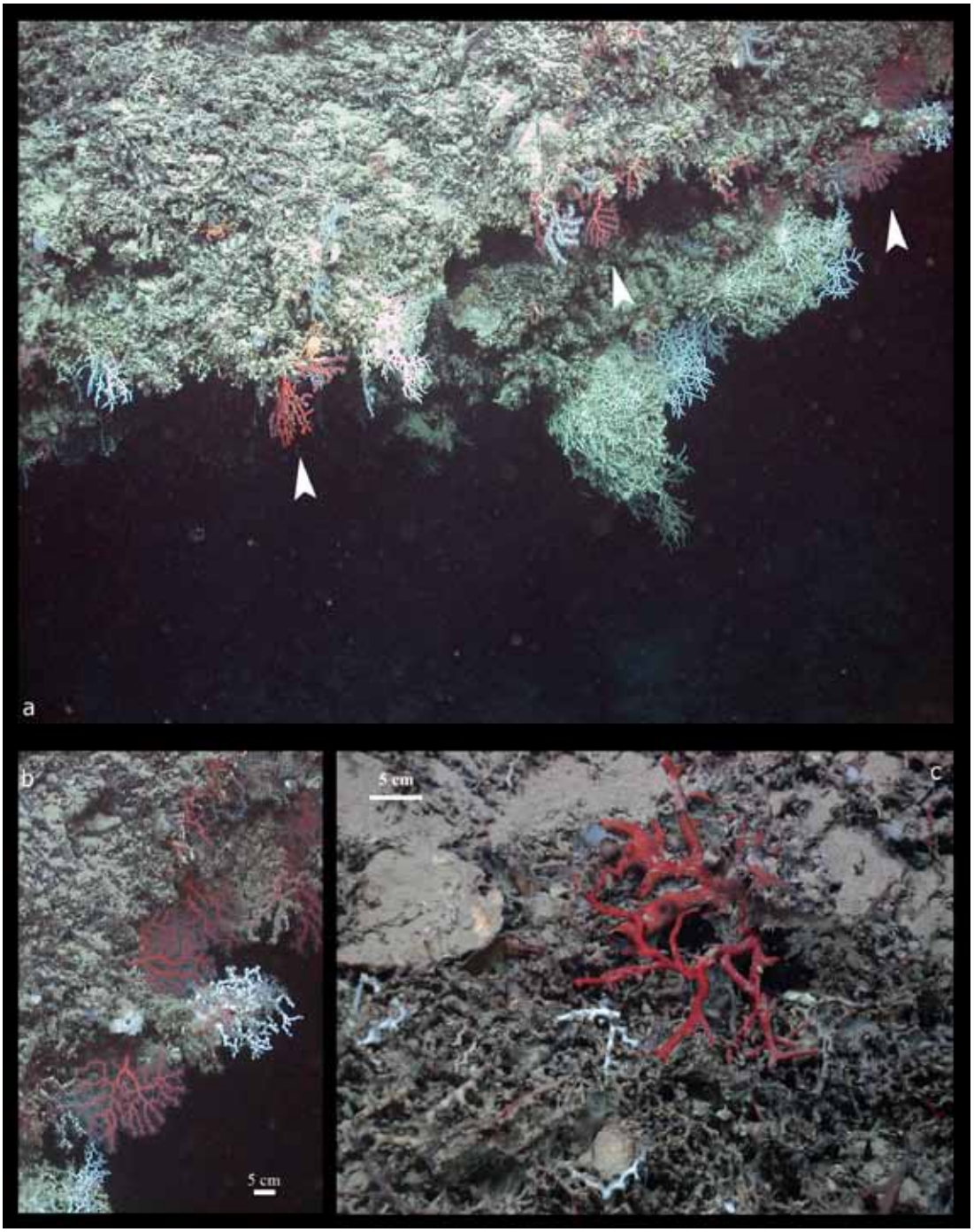

Fig. 2. MARUM ROV 'Quest 4000' *in situ* documentation of *Corallium rubrum* occurrences at Linosa Island site, Dive 673, Linosa Trough: (a) panoramic view of the complex coral-bearing community fringing overhangs at the edge of volcanic caves at 673 m water depth: note clumps of live *C. rubrum* (arrows) intimately associated with other cnidarians, including *Madrepora oculata*; (b) close-up of living *C. rubrum* from the same site showing fully expanded polyps (-673 m); (c) biostromal coral accumulation at the foot of the Linosa volcanic edifice; note fresh-looking *C. rubrum* and *Madrepora* together with degraded and partly silted white and red coral debris (-737 m). All pictures courtesy of MARUM, Bremen University.

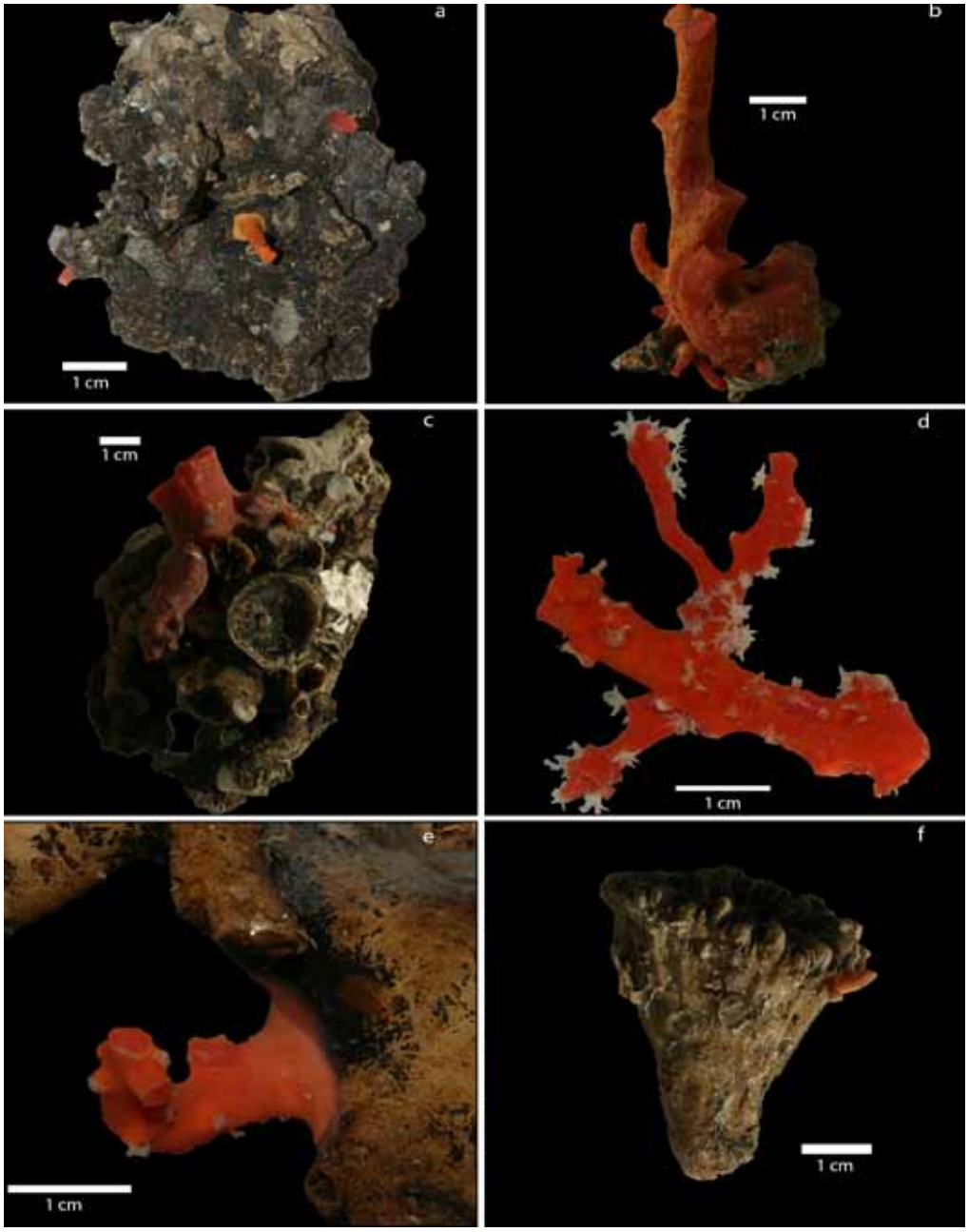

Fig. 3. Examples of deep-water red coral samples from the Strait of Sicily, MARCOS Cruise: (a) Coral-hardground with modern *C. rubrum* colonies St. MS43; (b) Large live *C. rubrum* colony st. MS43, ca. 650 m; (c) Degraded patinated hardground with red coral growth St. MS32; (d) Living colony of *C. rubrum* with expanded polyps, st. MS43; (e) Living colony of *C. rubrum* growing on degraded coral hardground st. MS43; (f) *Desmophullym dianthus* fouled by recent *C. rubrum*.