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DEEP-SEA CORALLIGENOUS BEDS OBSERVED WITH ROV ON FOUR SEAMOUNTS IN THE WESTERN MEDITERRANEAN

ABSTRACT
*In 2006 and 2007, Oceana carried out several investigations on four Western Mediterranean seamounts, finding red algae bio-concretions down to 150-160 meters depth. The areas surveyed were the Ausias March seamount and the Emile Baudot seamount in the Mallorca Channel (Balearic Islands), the Chella Bank (Andalusia-Alboran Sea) and the Palos seamount (in front of Palos Cap, in Murcia). More than 40 hours of video material was collected with an ROV. Species known only to be in shallow waters, like carnivorous sponges (*Asbestopluma hypogea*), were found on small seamounts with peaks between 80 and 170 meters depth. Sponge aggregations were filmed on coralligenous beds and new data on the distribution of anthozoans (e.g.,* Paramuricea macrospina*) was recorded. Nearly 300 species living on these bottoms were identified, giving new perspectives on their range and habitat dependence and preferences.*

KEY WORDS: seamounts, coralligenous, bio-concretions, maërl, carnivorous sponge.

INTRODUCTION

Red calcareous algae have been widely studied in the shallow waters of the Western Mediterranean (Ballesteros, 2006), but there is very little information about their distribution and function in deep areas. Two main infralittoral and circalittoral ecosystems created by calcareous red algae have been mentioned: maërl and coralligenous beds (Pérès & Picard, 1964; Picard, 1965). These have been described as areas of high diversity and ecological importance (Bosence, 1983; Barberá *et al*., 2003), being two of the most productive ecosystems in temperate regions (Martin *et al*., 2007). Seamounts and smaller marine elevations are considered hotspots, “stepping stones” and zones with high biodiversity (Matthiessen *et al*. 2003; Butler *et al*. 2001; Morato & Pauly, 2004). Those with shallow peaks are often found to be areas of high biological productivity (Rogers 1994), as in the four seamounts researched, with tops between 80 and 100 m. depth, where red algae can grow and develop.

MATERIALS AND METHODS

The research was carried out during from June to September of 2006 and 2007 on board the Oceana “Ranger" catamaran, equipped with a HSB2-plus Raymarine digital sonar with a high-powered transducer, linked to software to create bathymetric maps. Nineteen dives were carried out on four marine seamounts (Tab.1). Transects were filmed by a camera with 750 lines of resolution, a F1.2 lens and a 1:12 zoom, attached to an ROV Phantom H2+2. The ROV provided real time data on its position, depth, course, day and time. All of the identifications were made visually.

Tab.1 Summary of dives, time and areas observed with the ROV on the four seamounts

	Ausias March 38º44’N-001º48’E	Emile Baudot 38º42’N-002º20’E	Palos seamount 37º53’N-000º01’W	Chella Bank 36º31’N-002º51’W
Dives	3	4	6	6
Nautical miles	1.85	3.7	1,77	1.96
Area observed m²	5,140	10,278	4,917	5,445
Filming time	5h29m	9h40m	8h24m	14h57m

RESULTS

Two main red algae formations were registered: (i) maërl or rhodolith beds and (ii) coralligenous formations. Most of the rhodolith beds found on these mounds and seamounts reached down to 140-150 meters depth, although the most important ones were between 80 and 120 meters. The formations were especially common over the top of Ausias March, but could also be found on Emile Baudot and the Chella Bank; they were absent from the Palos seamount. Three forms of coralligenous beds were detected: (i) large bio-concretions, (ii) “cobbled” bio-concretions and (iii) thin sheets and small patches. Although some smaller patches were found at 160-170 meters depth, large concretions were more common between 80 and 120 meters depth. Flat areas on the top of the seamounts showed the largest bio-concretions, normally formed by red calcareous algae of the genera Lithophyllum, Mesophyllum and Neogoniolithon, usually with other red algae, like *Peyssonnelia sp*. and the green algae *Palmophyllum crassum*. The most important ones were found on Ausias March and Chella Bank. Large bio-concretions forming round circles of around two meters in diameter and ten to 20 centimetres high were found on top of the Ausias March mound. These kinds of geometrical concretions were not found over the other seamounts. Coralligenous beds did not always form large bio-concretions but instead small, spotted blocks of some 10 to 30 centimetres in diameter fixed in the substratum. It was very often found as a transitory substratum between maërl and large coralligenous beds. They were very common on Ausias March and Emile Baudot. Patches of red algae were found on all of the seamounts. They were very common on the Palos mount, but were also the most common bio-concretion over the 120-130 meter range.

Some 300 species were identified. 150 of them were most commonly found in red algae bio-concretions, but none of them were exclusive from these beds. Two biological communities were widely distributed on bio-concretion beds: sponge aggregation (genera Haliclona, Aplysina, Tedania, Axinella, etc.) and fields of dead man´s fingers (*Alcyonium palmatum* and *Paralcyonium spinulosum*). Species like *Paramuricea clavata, P. macrospina, Anthias anthias, Muraena helena, Lappanella fasciata* and *Phycis phycis* were recorded mainly on coralligenous beds. The carnivorous sponge *Asbestopluma hypogea* was first found in deep areas, but not always connected to bio-concretions. The specimen found on Ausias March was on a coralligenous bio-concretion at 100 meters depth, but the one found in Chella Bank was at 167 meters in a rocky area on a small pinnacle beside the main summit (Fig. 1). Some other protected species included in the annexes of BARCOM-SPAM were also found. For example, the elephant ear sponge (*Spongia agaricina*) was found on Emile Baudot and the triton snail (*Charonia lampas*) on Ausias March (Fig. 1).

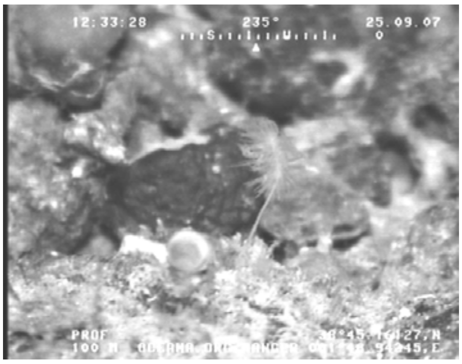

Fig.1:
1 *Asbestopluma hypogea*, & 2 *Charonia lampas* on the Ausias March seamount’s bio-concretions

DISCUSSION AND CONCLUSIONS

Maërl was mainly formed by rounded rodoliths, instead of the branched forms more common in shallower areas. Hydrodynamism and bathymetric distribution can determine morphology and maërl ramification (Bosence, 1983, Steller & Foster, 1995, Yabur-Pacheco & Riosmena-Rodríguez, 2007). Coralligenous concretions went from thin patches to large concretions -including circular geometric formations not yet described - many times looking like steps or visible different stages as it builds up.

As Laborel (1961) affirms, morphology and interim structure could depend on depth, topography and algae species. Some concretions give an aspect of a cobbled seabed, likely due to the lack of fusion or coalescence between several patches of algae, as in the large bio-concretions. Although red algae bio-concretions were found in all of the areas researched, from the surface down to 160-170 meters depth, distribution of the communities had a spatial segregation.

Most of the species found associated with the coralligenous beds were also found in surrounding areas without red algae, including *Anthias anthias*, *Lappanella fasciata*, *Muraena helena* and *Phycis phycis*, although they were apparently less abundant, showing their preferences for irregular bottoms. Only a few species, like *Paramuricea clavata,* seem to be strongly related to these bio-concretions, although depth distribution is probably a more important factor. Sponge aggregations were more common on maërl and “cobbled” coralligenous beds, while dead man’s finger colonies were more often found on “cobbled” coralligenous, large coralligenous and rocky areas. *Asbestopluma hypogea*, since it was discovered in 1995 (Vacelet & Boury-Esnault, 1996), was so far only recorded in shallow caves in France and Croatia. Although Bakran-Petricioli *et al*. (2007), mentioned the possibility, this is the first time this species has been found in deep areas, both in coralligenous beds and rocky bottoms.

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REFERENCES

BALLESTEROS E. (2006) - Mediterranean Coralligenous assemblages: a synthesis of present knowledge. *Oceanogr. and Mar. Biol.: an Annual Review* 44: 123-195.

BAKRAN-PETRICIOLI T., VACELET J., ZIBROWIUS H., PETRICIOLI D., CHEVALDONNÉ P. & RAĐA T. (2007) - New data on the distribution of the `deep-sea' sponges *Asbestopluma hypogea* and *Oopsacas minuta* in the Mediterranean Sea *Marine Ecology* 28 (1): 10-23.

BARBERÁ C., BORDEHORE C., BORG J.A., GLÉMAREC M., GRALL J., HALL-SPENCER J.M., DE LA HOZ C.H., LANFRANCO E., LASTRA M., MOORE P.G., MORA J., PITA M.E., RAMOS-ESPLÁ A.A., RIZZO M., SÁNCHEZ-MATA A., SEVA A., SCHEMBRI P.J. & VALLE C., (2003) - Conservation and management of northeast Atlantic and Mediterranean maërl beds. Aquatic Conservation: *Marine and Freshwater Ecosystems* 13: 65-76.

BOSENCE D.W. (1983) - Coralline algal reef framework. *J. Geol. Soc. London* 140: 365- 376.

BUTLER A.J., KOSLOW J.A., SNELGROVE P.V.R. & JUNIPER S.K. (2001) - A review of the biodiversity of the Deep Sea. Environment Australia, Canberra, 2001. Available from website: http://www.ea.gov.au/marine

LABOREL J. (1961) - Le concretionnement algal "coralligène" et son importance géomorphologique en Méditerranée. *Recueil Travaux Station Marine d'Endoume* 23: 37-60.

MARTIN S., CLAVIER J., CHAUVAUD L. & THOUZEAU G. (2007) - Community metabolism in temperate maerl beds. II. Nutrient fluxes. *Marine Ecology Progress Series* 335: 31-41.

MATTHIESSEN B., FOCK H.O. & VON WESTERNHAGEN H. (2003) - Seamounts, hotspots for high speciation rates in bentho-pelagic fishes? A case study on *Macrorhamphosus* sp. (Syngnathidae) from the Great Meteor seamount, *Helgoland Marine Research* 57: 63-72.

MORATO T. & PAULY D. (eds). (2004) - Seamounts: Biodiversity and fisheries. *Fisheries Centre Research Reports* 12 (5): 78pp.

PÉRÈS J. & PICARD J.M. (1964) - Nouveau manuel de bionomie benthique de la mer Méditerranée. *Recueil Travaux Station Marine d’Endoume* 31 (47): 1-131.

PICARD J. (1965) - Recherches qualitatives sur les biocenoses marines des substrats meubles dragables de la région marseillaise. *Recueil del Travaux de la Station Marine d’Endourme* 52 (36): 1-160.

STELLER D. L. & FOSTER M. S. (1995) - Environmental factors influencing distribution and morphology of rhodoliths in Bahía Concepción, B. C. S., México, *J. Exp. Mar. Biol. Ecol.* 194: 201-212.

VACELET J. & OURY-ESNAULT N. (1996) - A new species of carnivorous sponge (Demospongiae: Cladorhizidae) from a Mediterranean cave. In: Willenz P, editor. Recent advances in sponge biodiversity inventory and documentation. *Bull Institut Roy Sci Natur Belg Sci Terre*, *Biologie*. 66: 109-115.

YABUR-PACHECO R. & RIOSMENA-RODRÍGUEZ R. (2007) - Rhodoliths beds composition in the southwertern Gulf of California, Mexico. *Publications of the Seto Marine Biological Laboratory* Special Publication Series. Selected Papers of the NaGISA World Congress 2006, 8: 37-47.