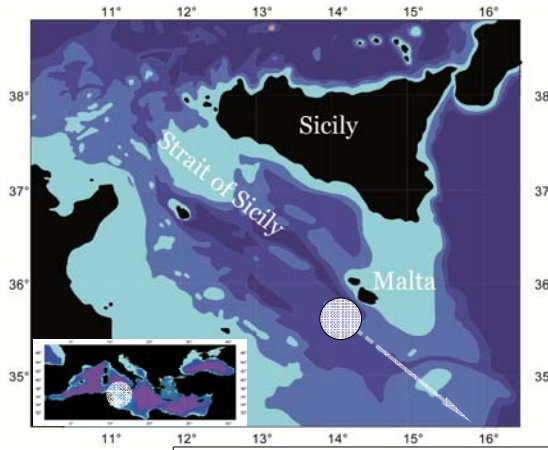


Giant sessile barnacles contribute to the construction of cold-water coral habitats south of Malta (Mediterranean Sea)

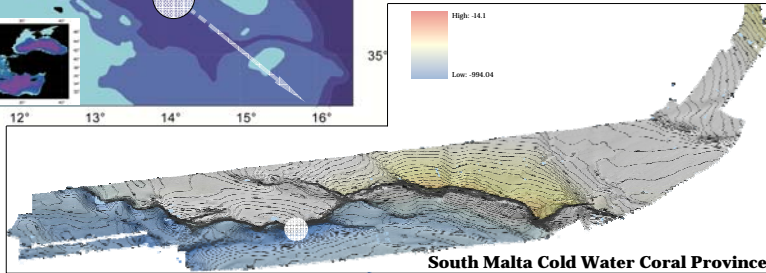


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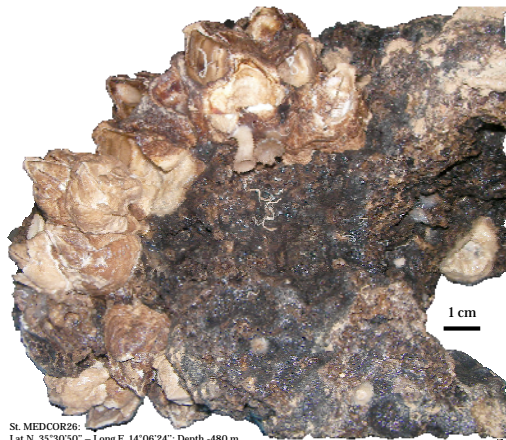


Location site of *Pachylasma* "reef"



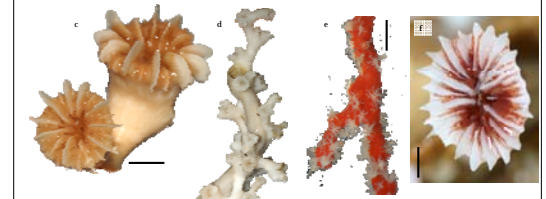
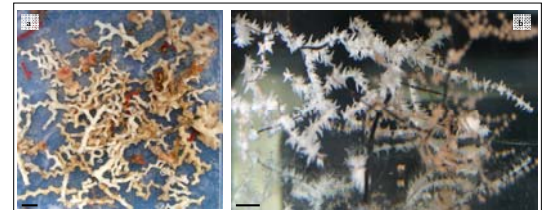
South Malta Cold Water Coral Province

Sessile barnacles may be important contributors to benthic communities worldwide from warm temperate to polar latitudes. Although barnacles are more often found in shallow settings, they equally occur below wave base down to bathyal depths. A case in point is represented by the presence of live populations of the thoracican cirripede *Pachylasma giganteum* (Philippi, 1836) associated with the lush and highly diverse deep sea cold-water coral communities (cwc) south of Malta. *P. giganteum* is a large cirripede (> 40 mm in height and > 30 mm in basal diameter) that is uncommon recorded in the Mediterranean Sea and the Azores region. It is relatively frequent in the Strait of Messina on circalittoral hard substrates between 80-200 m to bathyal depths (435-640 m) in the NE Atlantic where it has been found attached to scleractinians and sponges. The species is recorded as epibiont on turtles in the Aegean Sea. Finally, *P. giganteum* is also known as a fossil from Pleistocene palaeo-strait deposits in the Messina area (Sicily), a record which is consistent with the association of this suspension feeder with submarine topographies under the influence of strong currents.



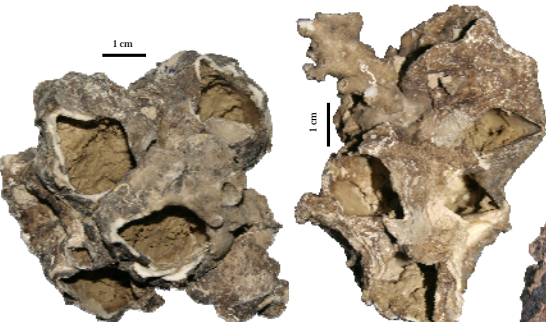
St. MEDCOR26:
Lat N. 35°30'50" – Long E. 14°06'24"; Depth -480 m

As documented during the 2009 Hermione cruise MEDCOR of R/V *Urania*, in the cwc province south of Malta clusters of *P. giganteum* colonize oxide-patinated biomicritic *Lophelia* hardgrounds that plaster the escarpment at depth of 460-480 m. In these settings, the barnacles seem to form distinct populations with little intermingling with scleractinians and other cnidarians. Their contribution to the overall architecture of such coral habitats, however, is far from negligible. In fact, *P. giganteum* may locally cover ca. 25 % of the available space attaining a density up of 40 individuals/m² and dominating the macrobenthos.



The South Malta Cold Water Coral Province: a biodiversity hotspot

This cwc site holds a remarkably high diversity, probably representing the richest hotspot of its keen in the Mediterranean basin. Some remarkable examples are: a) *Madrepora oculata* and *Lophelia pertusa* dominated coral assemblage; b) the black coral *Leiopathes glaberrima*; c) *Desmophyllum dianthus*; d) *Lophelia pertusa*; e) *Corallium rubrum*; f) *Javanina calletii*; g) *Emarginula* sp.; h) *Babelomurex sentix*; i) *Corallioophila richardi*. Scale bars = 1 cm.



St. MEDCOR25:
Lat N. 35°30'47" – Long E. 14°11'04"; Depth -690 m

St. MEDCOR25



St. MEDCOR26

Pachylasma barnacle as a reliable paleoceanographic archive: Neodymium isotopic composition

Neodymium isotopes (¹⁴³Nd/¹⁴⁴Nd) are increasingly employed to trace provenance and water mass mixing in the past, not being fractionated by biological processes in the water column and having a residence time in the order of 500-1000 years. So far, this geochemical tracer has been successfully applied to the dispersed authigenic ferromanganese oxide fraction in marine sediments, ferromanganese crusts, foraminifer shells, fossil fish teeth and to scleractinian deep-water coral skeletons but it has never been investigated on barnacle shells. The low-Mg calcite shell of a living specimen of *P. giganteum* (MEDCOR 26) was analysed for its neodymium isotopic composition on a VG Sector 54-30 thermal ionization mass spectrometer by dynamic multicollection at the Lamont-Doherty Earth Observatory (Columbia University). Before the analysis the sample underwent a sequence of cleaning steps to ensure the complete removal of contaminant phases: the sample was physically pre-cleaned using a dental drill-bit and crushed into powder for a rigorous oxidative cleaning protocol. The cleaned carbonate material was dissolved in nitric acid and neodymium was isolated from the other major and trace elements using column chemistry. The neodymium isotopes were analyzed as oxides and the mass fractionation was corrected using a ¹⁴⁸Nd/¹⁴⁴Nd value of 0.7219. The external error, calculated as the standard deviation of five replicates of the JNdi-1 standard performed during the analytical session, was 0.37 (2σ ε_{Nd}). The ε_{Nd} was calculated using the present-day ¹⁴⁸Nd/¹⁴⁴Nd CHUR value of 0.512638. The corrected ε_{Nd} value for the sample is -6.61, which is similar within error to the isotopic value of the closest seawater station (-6.78 ± 0.33), located about 18 nautical mile from the sample location. This proves the ability of this organism to record the neodymium isotopic composition of the ambient seawater, opening new perspectives to reconstruct seawater mass circulation in different environmental settings, from the warm temperature to polar latitudes.

References

- Freiwald, A., Beuck, L., Rüggeberg, A., Taviani, M., Hebbeln, D., R.V Meteor Cruise M70-1 participants, 2009. The white coral community in the central Mediterranean Sea revealed by ROV surveys. *Oceanography* 22/1, 58-74.
 Schembri, P.J., Dimech, M., Camilleri, M., Page, R., 2007. Living deep-water *Lophelia* and *Madrepora* corals in Maltese waters (Strait of Sicily, Mediterranean Sea). *Cahiers de Biologie Marine* 48, 77-83.
 Taviani, M., Angeletti, L., Dimech, M., Mifsud, C., Freiwald, A., Harasewych, M.G., Oliverio, M., 2009. Coralliofiliinae (mollusca: Gastropoda) associated with deep-water coral banks in the Mediterranean. *The Nautilus* 123, 106-112.
 Taviani, M., Freiwald, A., Beuck, L., Angeletti, L., Remia, A., Vertino, A., Dimech, M., Schembri, P.J., 2010. The deepest known occurrence of the precious red coral (*Corallium rubrum* L. 1758) in the Mediterranean Sea. In: Bussoletti, E., D. Cottingham, A. Bruckner, G. Roberts, and R. Sandulli (editors). 2010. Proceedings of the International Workshop on Red Coral Science, Management, and Trade: Lessons from the Mediterranean. NOAA Technical Memorandum TRCP-13, Silver Spring, MD 233 pp.

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