Geophysical Research Abstracts, Vol. 9, 02273, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-02273
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Differential crystallization of high-magnesian calcites in the cortical spicules and axes of the red coral (Corallium rubrum) correlated to the biochemical compositions of their mineralizing matrices.

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The Mediterranean Red Coral is an octocoral of which skeleton possesses two distinct calcium carbonate structures, both Mg calcites: a massive axial skeleton, surrounded by a porous envelope composed of numerous scattered spicules. We separately analysed the skeleton axis and spicules using several approaches: (1) Scanning Electron Microscopy and Atomic Force Microscopy (AFM) were used to explore the morphology, as well as micro- and ultra-structures. (2) Chemical contents were established with an EDS microprobe. (3) Mg content and organic compounds presence were traced out with Infrared Spectroscopy (Dauphin 2006). (4) With powder X-ray diffraction, we investigated the lattice level, and statistically determined the mean inter-reticular distances as well as the quality of the crystal lattices (estimated by the mean size of crystallites). These data show that the skeleton axis is better crystallized and less magnesian than the spicules; the smaller inter-reticuar distances found in spicules also indicate that at least a part of the Mg excess is localized within the lattice, substituted to calcium in its site.

The organic matrices extracted from the two components were analysed by using an amino acid analyser, high pressure liquid chromatography and gel electrophoresis: the difference appears both quantitative, as spicules seem richer in organic macromolecules, and qualitative, as the amino acids content also varies between the axis and spicules (Allemand et al. 1994). The difference in elemental compositions and crystallographic parameters between the spicules and the skeleton can therefore correspond to a difference in secretory activities of the respective ectodermal areas that control their crystallization. Indeed, the organic compounds that take part in the miner-

alization of the skeleton axis result from the activity of a continuous epithelium, which differs from the fragmented epithelium that produces the compounds participating in the mineralization of the spicules (Grillo et al. 1993).

We now aim to investigate the relation between the organic compounds and the crystalline domains at the nanoscale by using AFM. This approach provides information regarding the structure, which evidenced the existence of nano scaled grains embedded in an organic matrix (Dauphin 2006), as well as the interaction forces between grafted organic compounds and the sample surface (contact mode). Moreover, the use of TEM (Baronnet oral comm.) could improve our understanding of this relation at a scale close to the atomic-scale. This example so far illustrates the impact of the variation in organic matrix composition on mineralized biocrystal characteristics at various scales (lattice parameters, trace element signatures), and therefore on the overall skeleton properties and behaviour.

GRILLO and al, Marine Biology, 117 : 119-128. ALLEMAND and al, Bull. Inst. océanogr., Monaco, 14, 1 : 129-139. DAUPHIN and al, Comp. Biochem. Physiol., A145 : 54-64

This poster is made possible thanks to the support from the European Science Foundation (ESF) under the EUROCORES Programme EuroMinSci through contract No. ERAS-CT-2003-980409 of the European Commission, DG Research, FP6.