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Unravelling the paleoenvironmental archive of coralline algae (calcareous Rhodophyta): which scale for which resolution?

D. Basso (1), B. Grobety (2), C. Neururer (2), **S. Spezzaferri** (2)

(1) University of Milano-Bicocca, Dept of Geological Sciences and Geotechnologies, Piazza della Scienza 4, 20126 Milano – Italy (daniela.basso@unimib.it) (2) University of Fribourg, Dept. of Geosciences, Geology and Paleontology, Ch. du Musée 6, 1700 Fribourg – Switzerland (bernard.grobety@unifr.ch)

Since the pioneer investigation on the biogeochemistry of calcareous marine organisms of the fifties, coralline red algae appeared to be very promising as natural biogenic archive of paleotemperatures. Their thallus is composed of high-Mg calcite deposited in the cell walls and a considerable body of evidence is now available on the direct relationship between $MgCO_3$ content of the thallus (whole plant) and mean water temperature of the life environment. Corallinales occur from the tropics to Antarctica, down to the depth limits of distribution of marine plants. As a rule the same plant grows for several years. Ages of several decades are also common.

Some genera, such as *Lithothamnion*, can produce protuberances ("branches"), several mm in length, showing a very characteristic zonation when sectioned longitudinally. After electron microprobe analyses, this zonation also show cyclic oscillations of the $MgCO_3$ content, that has been related to seasonal variations of sea water temperature.

Very recent SEM and TEM-EDS investigations went to further detail, detecting variations in $MgCO_3$ content at the scale of a single cell, together with a previously unknown heterogeneity in cell wall microstructure. These results have been obtained with different equipments, with resolution increasing as the scale of the analysis decreases (from the whole plant/mean water temperature correlation to the cell layers/seasonal (?) water temperature correlation). The problem of the spatial/technical resolution in the geochemical analysis of coralline cells is here addressed.