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Using a Flow Through device to reconstruct the thermal gradient in the water column based on G. inflata Mg/Ca

Jeroen Groeneveld (1), Ed C. Hathorne (2), and Martin Kölling (3)

(1) Marum Excellence Cluster, Alfred Wegener Institute, Bremenhaven, Germany (jeroen.groeneveld@awi.de), (2) IFM-Geomar, Kiel, Germany, (3) Institute of Marine Environmental Sciences (Marum), University Bremen, Bremen, Germany

We present Mg/Ca analyses performed via a Flow Through sequential dissolution device connected to an ICP-OES on the planktonic foraminifer *Globorotalia inflata*. The aim of the study is to explore the possibility to reconstruct the thermal gradient in the water column by separating non-crusted and crusted calcite phases in the tests of *G. inflata* using the difference between their Mg/Ca ratios as a measure of the thermal gradient. An important assumption is that the non-crusted part of the tests is calcified in shallow, warmer water than the crusted part. For analyses a range of different preparation steps were used to determine the ideal way of separating the phases. Foraminifer tests were (not) cleaned, (not) crushed, and (not) pulverized before online analysis with the FT device.

To analyze samples with a FT device the foraminifer tests are placed on a filter with a mesh of 0.45 μm preventing clay minerals to wash through. A sequential dissolution protocol first rinses the samples with buffered Seralpur water before QD HNO_3 is added in small steps to create a ramp of increasing acid strength. As acid is kept constant at each concentration for several minutes, dissolution of a specific calcite phase can take place. Initial results show that it is most effective to slightly crush the tests without applying standard cleaning procedures, but rather analyze them without cleaning.

Samples were selected from the South Atlantic (core tops and specific downcore samples) and the Mediterranean (plankton tows). All samples were chosen based on previous work on them to provide comparison with routinely analysed Mg/Ca ratios. The South Atlantic samples have been analyzed extensively as bulk samples separated in difference size fractions and crusted vs. non-crusted (Groeneveld and Chiessi). The Mediterranean samples were not only analyzed as bulk samples but also by Laser Ablation ICP-MS (von Raden et al.).

Results show that bulk analyses are reliably reproduced by the FT method, especially for samples which are dominated by crusted calcite. Samples which were uncrusted often gave much higher Mg/Ca ratios than the bulk analyses. These higher Mg/Ca ratios mainly occur in the plankton tow samples and were also identified with Laser Ablation ICP-MS. A possible reason for this could be the presence of a high Mg amorphous calcite layer on the outside of foraminifer tests which have not completed their calcification yet as was recently also pointed out in several other studies. Identification of the crusted and uncrusted phases, and therewith a thermal gradient, seems to give the expected differences but a more rigorous statistical treatment is needed to pinpoint singular dissolution phases.