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Foraminiferal single chamber trace element records by LA-ICP-MS

G.J. Reichart (1,2), F. Jorissen (3), C. Fontanier (3) and P. Mason (1)

(1) Dept. of Earth Sciences, Faculty of Geoscience, Utrecht University, Utrecht, The Netherlands, (2) Alfred Wegener Institute for marine and polar research, Bremerhaven, Germany, (3) Laboratory of Recent and Fossil Bio-Indicators, Angers University, Angers, France (reichart@geo.uu.nl)

The actual level in or on the sediment where benthic foraminifera calcify is essential for the correct interpretation of the trace metal and stabile isotope composition of their tests. Traditionally benthic foraminifera are classified as in or epi-faunal based on the distribution of living specimen in the sediment. The distribution of living foraminifera, however, is not necessarily an accurate reflection of their actual calcification depth. Foraminifera calcify, add chambers, as a consequence of growth. Most carbonate will, therefore, be added at the level where most growth is taking place. Since traditional isotopic and trace metal analyses always consider the test as a whole it was not possible to distinguish different levels of carbonate addition.

Following the direction of growth series of craters of 80 micron were ablated in spiral benthic foraminifera using an Excimer 193nm deep ultra violet laser. Energy density at the sample surface was kept at 2 mJ/cm2, shot repetition rate at 8Hz. Laser ablation of calcite, especially the fragile tests of foraminifera, requires ablation at ultra violet wave lengths since higher wave lengths result in uncontrolled cleavage. The ablated material was transported by a continuous He flow and mixed with an Ar make up gas before injection into the Ar plasma of the quadrupole ICP-MS instrument. A collision and reaction cell was used to give improved results by reducing spectral interferences on the minor isotopes of Ca (42Ca, 43Ca, and 44Ca).

Individual chambers of benthic foraminifera collected alive were analysed for their test carbonate Ba, Mg, Mn and Sr concentrations. The chemistry of the individual chambers will reflect ambient sea or pore water conditions. Profiles of trace metal concen-

trations indicate some internal variability within the test wall. Changes in carbonate chemistry between chambers, however, are considerable. At sites with a shallow oxygen penetration depth it can be expected that pore water Mn increases steeply close to the sediment water interface. The incorporation of Mn in foraminiferal chambers will, therefore, reflect depth of calcification. Higher Mn concentrations are indicative for calcification deeper in the sediment, changes along the growth spiral indicate vertical migration and calcification at different depths.