SENSITIVITY OF PLANKTONIC FORAMINIFER SHELL MASS TO AMBIENT SEA WATER DENSITY: ATLANTIC AND MEDITERRANEAN PERSPECTIVES

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Abstract

Foraminifera shell thinning due to the ongoing surface ocean acidification is a topic of increasing interest in paleoceanographic research. As CO_2 invades the surface ocean, carbonate ion concentrations $[CO_3^{=}]$ and pH are lowered. Since it was first shown that the calcification capability of foraminifera is related to changes in ambient seawater $[CO_3^{=}]$ [1] their shell weight has been used in paleoceanographic reconstructions as a $[CO_3^{=}]$ proxy [2]. Although glacial-interglacial shell weight variations are well correlated with the atmospheric pCO_2 record [3] this is not always the case [4]. Based on new investigations carried out in selected foraminifera species, shell weight measurements suggest that glacial – interglacial ocean density oscillations may also account for the observed shell weight variations.

Keywords: Density, Foraminifera, Paleoceanography, Pelagic, Mediterranean Sea

Downcore results from the North East Atlantic, core NEAP 8K , revealed a good correlation between the shell mass of *G. bulloides* tests and density values reconstructed from combined Mg/Ca and $\delta^{18}O$ measurements on the same weighed tests (Fig.1). Mg/Ca in the same carrier were used to subtract the temperature effect on $\delta^{18}O$ in order to gain information on past sea water $\delta^{18}O$, which is directly related to variables like salinity and continental ice volume [5].

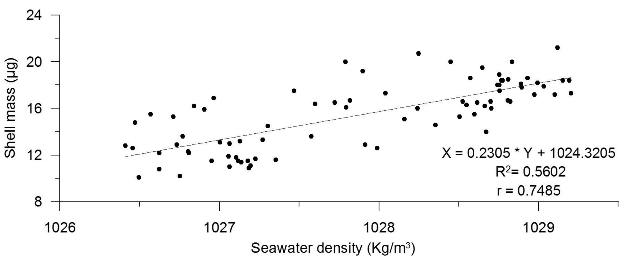

Fig. 1. *G. bulloides* shell mass relation to water paleodensities estimates from core NEAP 8K from the North East Atlantic. Heavier tests are found to precipitate in denser waters.

We further tested the link by investigating modern foraminifera and in-situ T-S data from core top samples from different Mediterranean localities. The Mediterranean Sea is a particularly sensitive area to global environmental change and it has been suggested that its rate of acidification has been higher than in the open oceans [6].

In order to assess the effect of dissolution on shell weight variations the preservation of the samples was checked using the fragmentation index [7]. Weight measurements were performed on different abundant surface and deep-dwelling planktonic foraminifera species such as *O. universa*, *G. ruber* s.s., s.l both white (*G. ruber alba*) and (*G. ruber rosea*) pink variety, *G. inflata*, *G. trilobus* etc. The different *G. ruber* alba morphotypes were measured as they have been found to calcify in different depths [8]. Furthermore, benthic foraminifera species such as *Cibicidoides kullenbergi* and *Planulina ariminensis* are also examined in order to investigate the role of shell mass to exceed buoyancy and sink to the sea floor.

The tests were picked from the 300 – 355 μm size fraction and a mean sieve based weight [9] was calculated for each species. SEM examination of test ultrastructure [10] was performed on the weighed *G. ruber* pink tests to crosscheck their dissolution and exclude any increase in fragmentation due to extremely delicate and thin test secretions.

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