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Influence of planktic foraminiferal morphotypes, shell size, and water depth on Mg/Ca ratios

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To understand past changes in climate and oceanography, it is essential to determine temperature and salinity of ocean surface and deep waters. Mg/Ca ratios in foraminiferal calcite have been of increasing use in the past decade as proxy for seawater paleotemperature. To use the Mg/Ca-paleothermometer effectively calibration is needed in order to assess the accuracy and precision of the technique. One striking feature of recent investigations has been the existence of differences in resulting calibrations between different species. Thus, the use of species-specific calibrations provides the most desirable way to employ the Mg/Ca paleotemperature technique. However, we do not know the extent to which calibrations are applicable across foraminiferal morphotypes and little is known about the effect of shell size and weight on Mg/Ca ratios as well as intraspecies-differences through the water column.

To increase our understanding of how these factors influence planktic foraminiferal Mg/Ca ratios, we analyzed eight different species in core-top samples from the North Atlantic Ocean Azores-Front Current-System and four different species along plankton tow depth transects of the North Atlantic and Arabian Sea.

Core top planktic foraminiferal tests were picked from the 100 to 750 µm size interval in 50 μm steps and subsequently weighed, photographed and analysed for their morphometry using automatic microscopy and image analysis software. Plankton tow samples were picked from the 200-250 µm size interval in water depths between 10 and 2500 m. After weighing and photographing Mg/Ca ratios of al samples were measured by inductively coupled plasma-optical emission spectrometry. Our results allow clarification of the relationship between Mg/Ca and shell size, morphotypes, and water depth, helping to increase the accuracy and precision of the Mg/Ca-paleothermometer.