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New cores-top Mg/Ca calibration of multiple benthic foraminiferal species: Thermometry of the thermocline water in Tropical western Atlantic

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A cruise with the research vessel G.O. SARS was carried out from 07 to 20 December 2007 within the framework of the European Science Foundation (EuroMARC) project RETRO, which aims to reconstruct changes within the thermocline in the tropics during periods of reduced Meridional Overturning Circulation (MOC). As part of this strategy we need a best possible calibration of methods to reproduce water mass properties, and part of the goal of this cruise was to get a good representation of the thermocline area present at the Brazilian Atlantic margin. The method used to map the thermocline gradient in the western tropical Atlantic is to use the concept of Magnesium/Calcium (Mg/Ca) on bottom water living foraminifera as a representation of temperature at site. The Mg/Ca thermometry on deep-dwelling foraminifera calibrated vs. δ^{18}O measurements provides an estimate of depth of thermocline penetration in modern climate. Knowing the function of modern representation of the thermocline defined by Mg/Ca, we can use this concept to map thermocline deepening/shallowing in the past.
The Mg/Ca ratios in benthic foraminiferal calcite are considered as the most commonly used and a reliable paleo-proxy for reconstructing bottom-water temperatures. Mg/Ca ratios of thermocline and deep-dwelling benthic foraminiferal species were determined on cores-top samples from a depth transect from the western tropical Atlantic, spanning a depth range of 600 to 1000 m representing a temperature range of 6 to 4°C. Mg/Ca are obtained from samples cleaned using oxidative steps and measured on a ICP-AES. Moreover here we show the inter-species, inter-individual and intra-individual variability in shell Mg/Ca ratios.
Although temperature seems to be the most important parameter controlling the incorporation of Mg, the carbonate chemistry of ambient water could exert an important control on the incorporation of Mg during shell growth. Consequently the elemental trace metal in the shell composition of benthic foraminiferal species potentially can reflect the bottom water composition. In that respect we examined the sensitivity of benthic foraminiferal species in response to the seawater CO^{32-} concentration.