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δ^{44}Ca-Temperature Calibration on Fossil and Cultured G. Sacculifer: A new Proxy for the Reconstruction of Palaeo Sea Surface Temperature (SST) Fluctuations

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SST is an important factor for the reconstruction of global climate change because at the ocean-atmosphere interface SST influences physical parameters like ocean-atmosphere gas exchange and global precipitation patterns. Application of stable oxygen isotopes ($\delta^{18}O$) and chemical SST-proxies (Sr/Ca, Mg/Ca, alkenones, etc.) for glacial/interglacial reconstructions of SST change is limited by uncertainties introduced by various factors, e.g. salinity, dissolution, continental ice volume and post-depositional chemical alteration. We here report on direct δ^{44}Ca-temperature calibrations ($\delta^{44}Ca = (^{44}Ca/^{40}Ca_{sample} / ^{44}Ca/^{40}Ca_{normal}^{-1}) \times 1000$) on calcite foraminifera demonstrating the high potential of Ca-isotopes as new SST-proxy. Biogenic Ca-precipitation is a kinetic process in which ^{40}Ca precipitates more rapidly than ^{44}Ca. In order to avoid species dependent isotope fractionation we focused our investigations on a single foraminifera species (*Globigerinoides sacculifer*) which is known to inhabit shallow euphotic waters in tropical and subtropical oceans.

Ca-isotope determinations involved the use of a ^{43}Ca-^{48}Ca double spike. Procedural blanks are less than 1 ng. Ca isotopic compositions were measured on a single cup AVCO mass-spectrometer. Ca isotopic fractionation was calculated based on an exponential fractionation law. Application of this new method to *Globigerinoides sacculifer* of an equatorial east Atlantic sediment core indicates that the SST difference between Holocene and Last Glacial Maximum (LGM) amounts to 3.1±0.7 C.

We analysed cultured *Globigerinoides sacculifer* that grew in sea water kept at temperatures of 19.5, 26.5 and 29.5ºC, to serve as absolute temperature calibration. It was found that the temperature range of about 10 C corresponds to a total δ^{44}Ca-variation of about 2.5 with a δ^{44}Ca-change of 0.24±0.02 per 1ºC defined by the weighted linear regression (95% confidence level).

The difference between mean Holocene and mean LGM δ^{44}Ca in the analysed drill core is about 0.74±0.18. Because of the use of one species only any vital effects can be ruled out to have influenced our δ^{44}Ca record. In addition, variations of the initial seawater δ^{44}Ca-ratio can be neglected for Holocene/LGM variations because this time interval is short when compared to the Ca-residence time in the ocean. Thus we interpret δ^{44}Ca-variations in the core as to reflect glacial/interglacial SST variations corresponding to about 3.1 ±0.7 C according to our δ^{44}Ca-temperature calibration.