EGU2020-19481, updated on 10 Jan 2024
https://doi.org/10.5194/egusphere-egu2020-19481
EGU General Assembly 2020

Deciphering the Signal of Arctic Climate Change

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Whether or not Arctic regions remain(ed) a carbon sink or source to the atmosphere during rapidly warming climates (in the past) is a fundamental question with regards to future global warming and ocean acidification. The boron isotopic composition of planktonic foraminiferal shell calcite ($\delta^{11}B_{Cc}$) can potentially provide valuable information of past seawater pH if information on a second carbonate system parameter, temperature, and salinity is available. However, most applications of palaeoceanographic proxies to the cold polar oceans are limited due to a paucity of calibration data, limited information on the calcification habitat, and secondary effects of the carbonate system on the temperature recorded by Mg/Ca values measured in the dominant Arctic species Neogloboquadrina pachyderma sinistral (NPS). Here we present a new Multi-Collector Inductively Coupled Mass Spectrometry (MC-ICPMS) $\delta^{11}B$ dataset measured on live NPS collected via plankton tows from the Labrador Sea and Baffin Bay. We compare our results with $\delta^{11}B_{borate}$ derived from pH measurements, $\delta^{13}C$ DIC seawater values, temperature and salinity collected at the time and depth the foraminifera calcified. To quantify the control of low carbonate ion concentration on Mg/Ca derived temperatures we measured B/Ca alongside Mg/Ca in the calibration dataset. We are thus able to present a new geochemical correction scheme that can isolate non-thermal controls on the Mg/Ca-temperature relationship for NPS, allowing us for the first time the reconstruction of carbonate system parameters in the Arctic Ocean.

How to cite: Morley, A., Raitzsch, M., Bijma, J., Karancz, S., and Kucera, M.: Deciphering the Signal of Arctic Climate Change , EGU General Assembly 2020, Online, 4–8 May 2020, EGU2020-19481, https://doi.org/10.5194/egusphere-egu2020-19481, 2020.