Biogeosciences Discuss.,
https://doi.org/10.5194/bg-2018-164-RC1, 2018

Biogeosciences
Discussions

Interactive comment on "Salinity control on Na incorporation into calcite tests of the planktonic foraminifera *Trilobatus sacculifer* – Evidence from culture experiments and surface sediments" *by* Jacqueline Bertlich et al.

Anonymous Referee #1

Received and published: 15 May 2018

Bertlich et al., make use of earlier studies that introduced Na/Ca ratios from foraminifera as a proxy for surface seawater salinity, and they assess the reliability of Na/Ca derived from T. sacculifer as a salinity proxy. They conclude that Na/Ca can be applied as a reliable proxy for reconstructing sea surface salinity and furthermore that species-specific calibrations are necessary. General comments: This study is one step closer towards establishing Na/Ca as a proxy for SSS. It is a well-designed study making use of culture experiments, wherein they vary salinity keeping temperature constant or vice versa and measure the Na/Ca to understand the salinity and temperature

effects on Na/Ca. They further corroborate the culture studies with surface sediments from two different locations, Caribbean and Gulf of Guinea. This study has the potential to highlight the efficiency of Na/Ca as a salinity proxy which may soon be followed by other studies that may target different foraminiferal species and oceanic locations so as to develop this proxy further into a robust one. This proxy can then be utilized in unison with δ18O and in some cases, Ba/Ca, to get a better handle on absolute salinity values, as each proxy has its own limitations. Here, the authors have touched a few important environmental variables that may affect and are needed in proxy validation. However I urge the authors to consider the following issues that I have raised and incorporate them in the manuscript. Specific comments: âĂć The authors mention that in order to avoid dissolution they have chosen sampling sites where Δ[CO32–] is >30 μmol/kg. But, if samples from water depths deeper than 2.7 km (see Table 1) are plotted against Na/Ca a clear depth dependency is noticed, Na/Ca decreasing with increasing depth. The authors should make this explicit to the reader by providing the Δ[CO32–] for each sample/depth and a separate paragraph discussing the depth dependency/dissolution effect on Na/Ca. âĂć The range in spatial salinity distribution at the surface sediment locations is $\sim$1 to 1.5 salinity units. However the vertical distribution in salinity which may be encountered by T. sacculifer at its habitat, especially at the Gulf of Guinea is large, reaching $\sim$ 4 salinity units. Planktic foraminifera live for few weeks and so may encounter ambient conditions which are seasonal during their life cycle (eg: Honisch et al., 2013 GCA). So when applying the Na/Ca proxy to down core samples to environments such as the Gulf of Guinea, how one does take into account such large vertical variations. This signal will also be mixed with the seasonal signal. Ideally surface samples should have covered a larger range in surface salinity.

Technical corrections: Line 74: Do you mean G. sacculifer? Line 89: 'related' should rather be 'correlated'? Line 92: SCUBA is written in upper case, is it an acronym? Line 95: Salinity experiments were done at salinities of 23, 26, 41, 44 and 45, which do not encompass the entire salinity range of 23 to 45. Why are the mid ranges not included? Line 100: '26.5°C to 29.5°C' OR '26.5°C and 29.5°C'? Line

114 and 133: any reason for using the two different size fractions? 315 to 400μ and 300 to 400μ? Line 138: 'The annual SSS varies from east to……..'. The variation of SSS from 32 to 35.9 is spatial or with depth? Line 140 to 141: ΔCO3= should be calculated for respective depths and included in tabular form. Line 221: Na/Ca increases by 0.12 mmol/mol per salinity unit. However the error on Na/Ca measurements at many instances is beyond this value (see table 1). Line 273: 'Nevertheless, it is still a ….noticeable'. Should it read as……..' …..which is noticeable?'

Figure1b: As seen from the figure, the GIK samples seem to fall within 35 and 36 salinity units. However the figure 1c shows a larger range in salinity, from $\sim$ 31.7 to 34.7 units. Figure 3a: Why is the 5th box, at salinity value of 44, grey in color? The text describes the salinity values for culture experiments of 23, 26, 41, 44 and 45 salinity units. The figure however shows 26, 33, 36, 41, 44 and 45 salinity units.

References: Line 33, 35 and 36: Rohling and Bigg, 1989 is listed as Rohling and Bigg, 1998 in the reference list. Line 78: The reference Lin et al., 2004 is Lin et al., 2014 in reference list. Line 193: Barker et al., 2003 is not listed in the references. Lines 297, 300 and 487: Dueñas-Bohórquez et al 2011 mentioned in text is Dueñas-Bohórquez et al 2011b in the reference list. Line 469: Busenberg and Plummer, 1989 is not included in the reference list. Lines 538 and 540: Bijma et al., 1990 are two different papers and should be labelled as 1990a and 1990b, in text and reference list. Line 682: The reference Spero, 1988 is not found in the text.

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