

## ***Interactive comment on “A novel salinity proxy based on Na incorporation into foraminiferal calcite” by J. C. Wit et al.***

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Wit and colleagues present Na/Ca and Mg/Ca data from experiments with *Ammonia tepida* cultured at different salinities while other parameters were carefully controlled. The data are of high quality and the paper explores some very interesting ideas. We have some suggestions and points we would like to see clarified in the final manuscript.

Some import details are missing from the methods section, e.g. how alkalinity and DIC have been measured and that an Excimer laser system was coupled to an Element 2? Also were the foraminifera cleaned at all before LA-ICP-MS analysis? Using NaOH buffered H<sub>2</sub>O<sub>2</sub>?

Figure 1 describes a correlation between test size and salinity and it seems possible

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the correlation between the Na/Ca ratio and salinity simply reflects the correlation of Na/Ca with test size. Therefore, it would be useful to demonstrate a correlation of Na/Ca ratio with salinity for specimens with similar test size to fully exclude any size effects.

Page 6044 line 9 “. . .test size significantly increased with salinity. . .” but both Figure 1 and Table 3 clearly indicate a decrease in test size with increasing salinity.

Page 6044 line 11-14 “. . .and of the same order in single chamber ablation profiles.” This is confusing especially when the methods state “Elemental ratios. . .were based on the average of each ablation profile” and no ablation profiles, time (chamber wall depth) resolved data, are presented. It would be nice to see an additional figure showing the intra-shell wall variability observed for Na/Ca and the relationship to Mg/Ca.

Page 6044 line 25 “Both Mg and Na show distinct banding. . .” But this is not shown here. Is this just a reference to the Erez (2003) paper or a finding of the current work?

Page 6045 line 21 “. . .lack of so-called hotspots in the Na profiles.” What profiles? Please add a figure or do not discuss the time resolved data.

Page 6045 line 25: Heterovalent substitution into CaCO<sub>3</sub> has been suggested in the literature although Okumura and Kitano (1986) *Geochim. Cosmochim. Acta* 50, 49-58 suggests alkali metals are incorporated interstitially into calcite but by substitution into aragonite. This paper should be cited and the implications of the current work for other alkali metals like Li in biogenic CaCO<sub>3</sub> should be discussed more.

Page 6046 line 4: How is the book by Zeebe and Wolf-Gladrow an appropriate reference here? What Na species is incorporated, Na<sup>+</sup>?

Page 6046 line 9: Full stop missing.

Section 4.2: The salinity effect on foraminiferal Mg/Ca, at least in culturing studies, is relatively small for the approximate 1 psu differences that occur on glacial-interglacial timescales. What is the fidelity or precision of the new Na/Ca salinity proxy? Is it

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really worth correcting benthic Mg/Ca using Na/Ca or would the propagated errors become larger than the uncertainty of the salinity effect? IF the Na/Ca proxy can be demonstrated for planktonic foraminifera what magnitude of salinity changes could you reconstruct with confidence using the current relationship?

Page 6047 line 25: This is certainly an interesting idea but does the solution activity ratio and the Mg/Ca of foraminiferal calcite vary by a similar magnitude over the studied salinity range?

Page 6048 line 3-5: This sentence is confusing. Is there a clear ontogenetic effect in both Mg and Na/Ca?

Page 6048 line 13-23: This section is not needed as no corrections have actually been applied and, as mentioned above, are probably not needed for benthic foraminifera from most settings. The space would be better used to further discuss the implications of the data for alkali metal incorporation in biogenic calcite.

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