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# *Interactive comment on* "The B/Ca proxy for past seawater carbonate chemistry reconstructions-laser ablation based calibrations for *C. mundulus*, *C. wuellerstorfi* and its morphotype *C. cf. wuellerstorfi*" *by* F. Kersten et al.

**Anonymous Referee #2**

Received and published: 30 September 2013

This paper presents some new data for B/Ca in benthic foraminifera from multi-corer tops from the South Pacific and suggests a morphotype specific relationship between foraminiferal B/Ca and calcite saturation exists. These are good quality and interesting data from an undersampled part of the ocean and worthy of publication. Without any time series or application of this calibration I'm not sure how appropriate this paper is for Climate of the Past but that is an editorial decision. With that caveat, I recommend this for publication following substantial revision, including acquiring some additional

data if at all possible.

Major points that need to be addressed:

The linear regressions are missing uncertainties and some interpretations may change if these standard errors overlap. There are places were linear regression has not been carried out and the significance (or not) seems to be purely speculative (e.g. p4430 line 24).

The “B/Ca-DCO32- range “ is referred to throughout the manuscript but this should just be the DCO32- range as B/Ca is measured as a proxy for DCO32-. If the manuscript discussed changes in seawater B/Ca this would make sense but this is not the case.

The discussion of ontogenetic variability (NOT profiles through shells) is based on two individual shells and no C. cf. wuellerstorfi specimens had many different chambers analysed because of technical problems. I do hope that these technical problems can be resolved and perhaps the ontogenetic variability of the different morphotypes compared? This would be exciting to see.

The different morphotypes need to be better defined and distinguished. The Hayward reference is not freely available and I was unable to see if the morphotypes are more clearly defined there. I was therefore not able to see the reasoning for calling the morphotype simply “cf.” when in planktonic taxonomy the consensus seems to be distinguish different morphotpes with different species names (e.g. Aurahs et al., 2011, Mar. Micropal. 79, 1). Has anyone looked at the genetics of these benthic foraminifera yet?

The calibration obtained here is compared to the extensive dataset of Yu & Elderfield (2007) but why are the data from Raitzsch et al. (2011) and Rae et al. (2011) also not plotted and included in the compiled calibration?

Detailed points:

Introduction. I do not see the need to have separate sections 1.1 and 1.2. In fact



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section 1.1 fits nicely after page 4427 line 6. Section 1.2 fits nicely after page 4427 line 15. Also at that point some more references concerning different shell chemistry and morphotypes could be cited, perhaps expanding to the planktonic literature also.

P4427 line 27. Can you cite a reference suggesting HCO3- incorporation into calcite?

P4428 line 16. Element names should not be capitalised unless at the start of a sentence.

P4428 line 18. Replace “Seeing that” with “As”.

P4428 line 21-23. This sentence would fit better in the methods sections.

P4429 line 5. Replace “marine expeditions” with “research cruises”

P4429 line22. SEM is the English term, which should also be defined.

Was there any pre-cleaning of the shells performed, for example the first clay removal step?

P4430 line 1. Was the instrument used in high resolution mode for the B/Ca measurements? It would probably be more helpful to readers who do not know the AttoM instrument to refer to it as a magnetic sector or sector field ICP-MS.

P4430 line 3. So there are 12 to 24 data points for each sample? I assume it is the standard deviation of these 12 to 24 data that are providing the sample standard deviation? Please clarify this here and delete the unclear sentence on line 5 to 6.

P4430 line 3. The NIST 614 and 615 glasses are the same apart from the wafer thickness. It is therefore more common to see NIST 614 used in the literature, including Jochum et al. (2011). What is the B/Ca of the NIST 614 glass?

P4430 line 5. You should mention that accurate non-matrix matched calibration of B/Ca in carbonate samples has been demonstrated for 193nm laser ablation and cite a reference like Raitzsch et al. (2011) or one of the references in that paper.



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P4430 line 8. Delete "...begun, and...". Start a new sentence with "Samples with..."

P4430 line 9-10. Where were these values for discarding data as being contaminated taken from? Ni et al. (2007) used a cut-off value of 100 umol/mol Al/Ca to eliminate clay contaminants high in B. What is the basis of the 4 times higher value here?

P4430 line 16. What parameters were taken from the GLODAP sites and how nearby were they to the multi-core locations?

P4431 line 8-9. What is the p value if regression analysis was performed?

P4431 line 23. Replace "Analogue..." with "Similar..."

P4432 line 11. Delete "Analogue to C. wuellerstorfi..." and start the next sentence with "A linear...".

P4433 line 20. I'm not sure if citing yourself in this way is part of the Harvard method and probably should be avoided.

P4433 line 21. Replace "constrained" with "understood".

P4434 line 9. Should read "The two specimens chosen for ontogenetic analysis come from water depths...". Profiles could be confused with time resolved depth profiles through chamber walls that are not presented here.

P4434 line 15. Replace "...analogue to..." with "...as found by previous studies." What about the intra-shell Mg/Ca variability and references dealing with how many laser ablation analyses of benthic foram Mg/Ca are required to be representative, for example the work of de Nooijer and colleagues?

P4435 line 9-25. This should be rephrased to highlight these samples extend the range of DCO32- sampled in the same oceanographic region.

P4436 line 1. Surely such statements should be examined with water data and not proxy calibrations?



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Section 4.3 is mostly redundant. As the other reviewer mentioned small samples can be analysed by solution ICP-MS. The point of a micro-sampling technique like laser ablation is to provided additional spatial information, such as looking at ontogenetic patterns or lack of. This study could be greatly improved by incorporating some additional data for many chambers of more individual shells than the 2 specimens analysed.

P4437 line 12. The intra-sample variability is not presented or discussed previously in the paper so why should this suddenly appear in the conclusions?

If not already there please include a data table in the supplementary material.

Fig 4. Why are there different symbols in (d)?

Fig 5. Which samples are which? Do the downcore samples have the higher B/Ca?

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Interactive comment on Clim. Past Discuss., 9, 4425, 2013.