Biogeosciences Discuss.,
https://doi.org/10.5194/bg-2020-269-RC2, 2020


Biogeosciences Discussions
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# *Interactive comment on* "Technical note: Single-shell $\delta^{11}$B analysis of *Cibicidoides wuellerstorfi* using femtosecond laser ablation MC-ICPMS and secondary ion mass spectrometry" *by* Markus Raitzsch et al.

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Received and published: 5 August 2020

Raitzsch et al. provide a detailed comparison between SIMS and LA-MC-ICPMS measurements of delta-11B in individual shells of benthic foraminifera. They show that intra-shell and inter-shell variability is significantly lower for the LA-based technique compared with SIMS, which they attribute to the larger volume sampled by the LA-based technique. Importantly, they show that both techniques yield very similar "average" values to those obtained by the traditional bulk measurements based on dissolved specimens. They conclude that the traditional bulk-based analysis is still the preferred



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approach for paleo applications, but demonstrate clearly the advantages and limits of the microanalytical techniques.

The manuscript is well written and clearly organized. Also the figures are clear and of excellent quality.

I only have a few minor comments and questions. I recommend the manuscript for publication after these minor issues have been resolved by the authors.

Technical comments/questions/suggestions:

l.69: Please formulate more clearly the *aim* of the study. 'What' do you want to achieve, and especially 'why'?

l.154-155: Please clarify how this variability was calculated. Since 2*sigma is used, it may be confused with 2*sigma of the individual measurement's precision. And since per-mil units are used, it may be confused with the coefficient of variation (which is in per-cent). To avoid confusion, best would be to clarify in one sentence that 2*sigma here actually corresponds to 2*SD of n individual measurements (if I understand it correctly). Or is it 2*SE (standard error)?

l.157: unclear why such inistinguishability should affect variation in measured data. Please explain, or provide an alternative explanation.

l.168-169: Please clarify how this was derived/deduced. Intuitively it is expected that variability in measurements is lower if larger volume is sampled. But it is unclear how you arrived to those values (e.g. $\sim$0.3 permil).

l.176/fig.4: Please clarify representation of the data in polar plots in Fig. 4. I understand that the "phi" coordinate corresponds to the chamber, but it took me a while to figure out that the r-coordinate (scale -7 to 3) corresponds to Delta-delta11B.

Also I am wondering whether it would be more beneficial/transparent to show each Delta-delta-11B datapoint rather than average Delta-delta-11B deviations derived from





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measurements of multiple specimens. Averages may be misleading, as we know. Did you test whether the decreasing trend between f and f-5 is significant, or you can only state "the deviation tends to decrease"?

l.200: I am wondering why the authors report median instead of, for example, the mean? If it leads to a different mean in comparison to the bulk-based analysis, it should be discussed why such a difference exists. In any case, I think it needs to be clarified why median was used. Similar on l.254.

l.211: yes, I agree, but it would be useful to expand this argument towards the *source* of this variability (e.g., shell-to-shell differences in the intra-shell heterogeneity?).

Figure 1: It is rather confusing to see signals for 10B and 11B centred on the same mass (10.25). Is it really so? And why? I am not familiar with the Daly detector principle.

Figure 3: Please verify the expression for 2*sigma in the graph (in red). First, the factor 1000 does not make sense if cps is in counts per second (perhaps it does if it is in kilo-counts per second). Second, if I substitute 300,000 and 300,000/4.9 for 11B and 10B, I get a factor 8.8, not 8.2. In my opinion, the formula should read as 2*sqrt(1/counts(11B)+1/counts(10B)), where counts(11B)=cps(11B)*1s*n and similarly for 10B. This is a formula for the Poisson error of 11B/10B based on counting statistics. In this formula the factor is then 0.00887 at B11=300,000. Please verify cps vs. kcps.

Editorial suggestions:

l.24: unclear why the word "presumably" is used in the abstract. It would help if the sentence is reworded to clarify what is certain and what is not (i.e., what is estimated).

l.39: would be useful to cite few examples of such studies.

l.104: perhaps it should read "45 cm4 *and* ablated"?

l.126: remove "and" before "that"





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In caption to Fig. 4, it should read "inset", not "inlet". Similar on l.195.

l.184: remove "large-scale"

l.279: "French" - uppercase F.

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