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Biogeosciences Discussions

Interactive comment on "Reviews and syntheses: Revisiting the boron systematics of aragonite and their application to coral calcification" *by* Thomas M. DeCarlo et al.

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I really enjoyed reading the manuscript. The authors summarized issues on the selection of Kd value (and its formula) and its potential influence on the calculation of full carbonate chemistry in the calcifying medium. The logic is concise, and I strongly recommend a publication of the manuscript.

The followings are my minor comments that may be helpful for the authors to improve the manuscript.

(pp. 2 Line 20–) I think almost nobody use stable carbon and oxygen isotopes as a

proxy of carbonate chemistry, so you can delete the related sentences.

We agree with the reviewer that carbon and oxygen isotope ratios are not commonly applied as carbonate system proxies in corals. This phrasing will be revised to indicate that they are not typically applied in this way, but they are theoretically sensitive to carbonate chemistry. We prefer to still mention carbon and oxygen isotopes because they are examples of geochemical proxies that are sensitive to the carbonate system, yet are not very useful proxies in corals due to a variety of vital effects.

(pp. 7 Figure 2 and pp. 14 Figure 8) About pH and [H+]. I think [H+] presented in the Figure 2 is that of solution used in the precipitation experiment. In Figure 8, on the other hand, they are calcifying fluid pH for coral data as well as solution pH for precipitation experiment. I would be better to clarify what each pH stand for in somewhere in the manuscript (in each figure caption?).

We will make clear the distinction between coral calcifying fluid pH (or H+) and the abiogenic experimental fluid pH, both in the captions and axis labels.

(pp. 10 Figure 4) Why do you use Kd value of 0.002 as an example of constant Kd?

The value of 0.002 was selected simply as an example that intersects the abiogenic data near the range of [CO_3^{2-}] found in corals. We could choose any other value, which would be a similar line but further from the abiogenic dataset. The main message is that the constant Kd underestimates the sensitivity of [CO_3^{2-}] to borate/(B/Ca), which is made clear by the best-case example with Kd of 0.002.

(pp. 12 Figure 6) Is there any better way to plot these data? The difference between New Eq. (12) line and Allison (2017) line are very ambiguous.

We agree that the lines are very close together. We will revise this figure to show a narrower y-axis that will enable better visualization of the different lines.

(pp. 14 Line 17- pp. 15 Line 2) It is just a question. Is this the reason why you don't

show a cross-plot of âĎęar against the other parameters? (such as âĎęar versus pH)

Yes, we prefer to plot only boron-derived [CO_3^{2-}], rather than saturation state, because boron systematics really only provide information regarding pH and [CO_3^{2-}], not [Ca^{2+}].

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