

We appreciate the suggestions provided which helped us make our manuscript better. Please find our responses below each suggestion (in italics).

Suggestions for revision or reasons for rejection

Biçe et al's revised manuscript is a significantly improved interpretation of their data. The authors have made substantial changes which have improved the readability and interpretation of the MS, in particular with the reframing around organic matter and sediment carbonate chemistry. The authors improved manuscript addresses most of the original feedback, and I accept the authors defence where they have not made changes, in particular around using their field data and keeping their model simple. I appreciate the additional literature that is engaged with and the additions to the discussion to address these limitations.

This is a useful contribution to the field of sediment carbonate chemistry and I have no further major comments. In particular, I can see this work being of high value to future modelling projects. This MS is suitable for publication in Biogeosciences following a small number of *very* minor technical edits.

Suggestion 1: I accept the justification for using linear kinetics based on the lab measurements, but it is not clear to me that aragonite and calcite actually have different dissolution rates as a function of omega. I suspect that statistical analysis of the data in Figure 1 will indicate this to be the case. Please provide all appropriate statistical analyses. I had a (very rough) go at this and it certainly suggests that these are not significantly different (relative to their own omega), though I accept that this might change if accurate data are used.

We appreciate for pointing out this important aspect. We ran a t-test between the dissolution data for each mineral and found out that the difference between means were not significant therefore, we changed the paragraph describing rate constants accordingly.

Suggestion 2: If this is the case, please re-run the simulations with appropriate rate constants (i.e. the same rate constant for calcite and aragonite). As the authors point out in their response, their preference is to use their observations from Yaquina Bay, and it seems that this experiment suggests that these rates are not different. The authors do not state how the model is implemented, but I assume from the use of marelac and AquaEnv and the figures included that it is in R. It should be fairly straightforward to update this one parameter, re-run the code then update the figures (which need to be done anyway; see below) and in-text values as appropriate. I suspect that this will make very small changes to actual values, but not affect the high-level interpretation or conclusions.

Building on the findings with the guidance of the previous suggestion, we repeated our analyses and calculated a rate constant for both minerals which was very close our original calcite value. Considering this change, we updated our figure about rate constant (Figure 1). Using this value, we ran simulations again and updated other figures, however, differences were not noticeable. We still appreciate the suggestion.

On the implementation, we added a sentence reflecting that we performed our simulations in R using the package called 'ReacTran'.

Suggestion 3: Please use consistent symbology, units and terminology throughout. There are a number of examples where these are interchanged (e.g. TA is at various points in mol, mmol and umol depending on context; saturation is sometimes "omega" and sometime the symbol, "per" is sometimes negative indices and sometimes "/"). Each individual instance is correct, but I found it distracting and often had to jump around to compare numbers.

We updated symbology in the light of this suggestion.

Suggestion 4: Please slightly tidy the figures for notation, symbology etc. For instance, the scales in Figure 2 are not all readable (i.e. panel f). This is taste only, but I would prefer if the concentration scales in 2h-j went to zero (given they go close). Please amend the axis label in Figure 3 to "production or consumption rate" to clarify that this is not a ratio. As earlier, none of this is critical, but it is distracting and unnecessarily risks misinterpretation of what is some lovely modelling.

We improved the readability of the figures as suggested above.