

Suessle et al., 2026 – ‘Ocean alkalinity enhancement reduces silica ballasting during export due to amplified dissolution’

This is my second review of this manuscript, and as previously concluded, this study presents a very timely and relevant aspect of OAE research. I appreciate the time and effort the authors have put into revising the manuscript thoroughly and am pleased with edits made. Particularly, I appreciate the tightening and cleaner presentation of the statistical analysis and results.

I believe that this manuscript warrants publication, however, I would suggest three minor points to consider:

We sincerely thank the reviewer for their careful evaluation of the revised manuscript and for their positive assessment of the revisions undertaken. We are pleased that the reviewer found the manuscript substantially improved. We also appreciate the constructive suggestions provided in this second review. We have carefully considered all comments and have revised the manuscript accordingly. Below, we provide a detailed point-by-point response and indicate the corresponding changes made to the manuscript.

- (1) Lines 95-98: Although this is true, it would be good if the authors could elaborate on this a little further to give a more complete picture. What does trigger precipitation, and how could that alter carbon export pathways? I am missing some mechanistic links here, which are especially relevant in coastal OAE applications, where naturally high fluctuations of carbonate parameters are occurring. Right now, this statement seems a bit out-of-place, but its significance gets lost a bit. This line of argumentation should then also be picked up again in the discussion. How are biotic (established in this study) vs abiotic (alkalinity loss due to precipitation) factors acting on export efficiency, and how are the results of this study are situated in this context?

We thank the reviewer for this helpful suggestion. We agree that the original text provided insufficient context on the mechanisms and relevance of OAE-driven carbonate precipitation. We have therefore expanded the Introduction to briefly explain the conditions under which precipitation may occur, how it can reduce OAE efficiency through alkalinity loss, and how it may alter carbon export pathways via the formation of sinking carbonate ballast.

*We note, however, that the effect of carbonate precipitation on organic matter export was already briefly evaluated in the Results section (**now lines 400 - 409**). As these effects were not found to explain the export responses observed here, we chose to keep the Discussion focused on the primary mechanism identified in this study, namely reduced silica ballasting and enhanced dissolution during export. We therefore limited the revision to providing additional mechanistic context in the Introduction and note that the broader implications of OAE-driven carbonate precipitation are discussed in detail in Suessle et al. (2025), which is cited in the Results section.*

Now lines 95 - 100: *Elevated alkalinity may also trigger unintended calcium carbonate precipitation when local carbonate saturation states become sufficiently high, particularly under concentrated or poorly diluted OAE additions (Hartmann et al., 2023; Hashim et al., 2025; Moras et al., 2022; Schulz et al., 2023). Such precipitation consumes alkalinity and can reduce the effective CO₂ uptake potential of OAE (Bach et al., 2019a; Hashim et al., 2025), while simultaneously altering carbon export pathways through the formation of ballast material associated with sinking particles (Suessle et al., 2025).*

- (2) Line 107: (BSi:POC) POC was not yet defined. I suggest to introduce it earlier in the introduction rather than here to maintain the current read flow. Lines 63-65 might be a good place for this.

We thank the reviewer for noting this oversight. We agree that particulate organic carbon (POC) should be introduced before the first use of the abbreviation in the context of silica ballasting ratios (BSi:POC). We have therefore added a definition of POC earlier in the Introduction, where export production and silica ballasting are first discussed.

Now lines 65 – 68: *In many productive systems, diatom blooms dominate this export flux production, and diatom-derived particulate biogenic silica (BSi) provides ballast for aggregates that increases sinking velocities and shifts particulate organic carbon (POC) remineralization to greater depths (Armstrong et al., 2001; Honjo et al., 2008).*

- (3) How confident are the authors that the filling and four days confinement have not altered the baseline measurements and subsequently might potentially have impacted biology? This would be rather important to consider when comparing observed post-OAE patterns to pre-treatment conditions. Please elaborate on this here and also shortly in the discussion.

We thank the reviewer for raising this important consideration. We agree that enclosure and the four-day pre-manipulation confinement period may have altered biological conditions relative to the surrounding environment, as is inherent to mesocosm experiments. However, the present study does not infer OAE effects from comparisons between pre-treatment baseline conditions and post-treatment responses. Rather, conclusions are based on treatment differences among mesocosms after alkalinity manipulation. As all mesocosms were filled from the same source at the same time, and experienced the same filling procedure and pre-manipulation confinement period, any enclosure effects should have affected treatments similarly and are therefore unlikely to explain the clear OAE responses observed here.

Nevertheless, to clarify this point for readers, we have now added a statement to the Methods section acknowledging that enclosure and pre-manipulation confinement may have influenced community development relative to ambient field conditions, while noting that such effects are unlikely to confound the treatment comparisons presented here.

Now lines 138 – 141: *We note that enclosure and the four-day pre-manipulation confinement period may have influenced community development relative to ambient field conditions. However, because all mesocosms experienced the same filling and confinement history prior to OAE manipulation, such effects are unlikely to confound the post-manipulation treatment comparisons presented here.*