

The manuscript egusphere-2026-982 assesses the impact of varying alkalisers on the broader carbon pool. It focuses on three main alkaline feedstocks, NaOH, CaO and a mix of NaHCO₃ and CaCl₂, which are used to increase alkalinity between 500 and 1000 μmol kg⁻¹. It then explores the evolution of the various carbon pools, both dissolved and particulate, as well as dissolved O₂ and chlorophyll a. A last interesting aspect is the use of heavy carbon (¹³C) to enhance the analysis of the carbon budget. The paper requires some revisions with emphasis on consistency before being ready for publication, but I strongly believe that once my general comments and suggestions, as well as the specific ones, have been addressed, the manuscript will be more ready for publication.

General comments:

The experimental setup is rather straight forward and should be easily replicated, though some more information would be beneficial. First and foremost, I am questioning the surprisingly consistent salinity measurements in Table 1? Considering the study area and the inputs from both seawater (which one could assume to have a salinity of 35) and the Southern California Bight (which based on quick reading seems to have slightly lower salinity), I am doubtful the water collected at different points I time will have a salinity of exactly 35. This may need further research/analysis/discussion. Some more work is also needed in the “2.2 Alkalinity Types” and “2.3 Experimental Set Up” sections. First and foremost, the choice of alkaline source to simulate AWL is questionable, given that limestone, CaCO₃, would dissociate into Ca²⁺ and CO₃²⁻. I am therefore wondering why using NaHCO₃ (which need to be added twice as much to match the TA increase from CaCO₃ dissolution) instead of Na₂CO₃, which would have provided CO₃²⁻ ions as when CaCO₃ dissolves. Furthermore, I fully agree with the statement made in lines 142-143 about deciding against introducing particles. However, some information on the stock solution preparation is missing, most importantly the targeted molarity of said solution. This leads to a rather abrupt end to the paragraph stating that somewhere between 100 and 160mL were added. While I agree that this only represent between 2 and 3.2% of the final volume (assuming 5L bottles, if I am not wrong?), the additions are significantly different. The handling of carbonate chemistry samples would also benefit from further details. For example, it is stated that a portion of the filtrate is used for DIC (lines 207-208) but without any further information. DIC sampling is very sensitive to exchanges with the atmosphere, particularly with alkaline samples. Some standard operating procedures SOPs (e.g., Dickson 2007) have been published to assist scientists with such issues. I recommend adding more information on the sampling procedures and, if different from such SOPs, argue the limitations and potential changes in samples concentrations.

The results section is significantly large and clearly shows the efforts and work put into this research. Overall, it is well written and there are no major gaps, though there are some points that require further justification. A very first comment is regarding the section “3.1.1 Observing Short Term Impacts at Extremely Low Alkalinity Additions”. I believe that some information presented here would fit better in the Materials and Methods section (here named “Study Area & Methods” which may need to be edited, though this is to the discretion of the editor). Furthermore, I am also questioning the measured alkalinity. Following the description, one part of 5,000 μmol kg⁻¹ water was mixed to 600, 300 and 150 parts for each dilution. Assuming the TA of the water used to dilute was the same as the control, a quick calculation reveals that expected final TAs should have been 2227.6, 2232.3 and 2241.5, respectively. Similarly, since the alkalinity addition was performed with bicarbonate (if I am correct, line 282), the changes in DIC should have been very close to the changes in TA which is not the case here. This needs to be verified and discussed. The remaining part of the Results section are good and mostly fine in my opinion. A small suggestion would be to report ΔTA and ΔDIC instead of the values. This would make

the reading of the graphs and especially small changes more easily visible. This would also help the reader see whether the targeted changes in TA in all experiments were reached. Another important point on the graphs is the mislabelling of the calcium ions, it should read Ca^{2+} rather than Ca^{+2} .

Finally, the discussion section is a little short but interesting as it combines several key OAE studies and puts the results of this research into context. Some edits may be suggested into this section, and a deeper interpretation of the data and implications for the OAE field should be done. In the paragraph “4.1 Secondary Precipitation of CaCO_3 ”, the observed patterns are compared with other studies, but the section lacks discussion about time. While I agree that the risk for CaCO_3 precipitation is directly linked to surface area and Ω_A , a third important factor is time. One could have expected that if the experiments had run for longer, CaCO_3 precipitation may have eventually occurred. This should be added to the paragraph and can be done by comparing the duration of the experiments presented with the literature mentioned. One other point which could help the reader follow better is referring to the experiments in a consistent manner. For example, the experiments are identified by the TA additions performed earlier on, i.e., +500 and +1000. In the discussion, the experiments are referred to as “pH<8.55” (line 542 for example). It would be easier to follow if each experiment's labelling was constant throughout. Finally, the section would benefit from a paragraph discussing the limitations of this research (see comments above). This will reinforce the research outreach and will give interesting guidelines for other researchers that may be interested in running similar experiments.

Specific comments:

Line 1: calcium ions should be written (conventionally) as Ca^{2+} instead of Ca^{+2} . Please edit throughout the text and graphs.

Lines 17-19: I believe as per Biogeosciences guidelines that one should limit the use of acronyms in the abstract.

Line 21: shouldn't this read “selected experiments”?

Line 26: the acronym C for carbon is not introduced before

Line 29: I believe the concluding section of the abstract is repeating lines 23-24. The abstract may need to be rephrased to enhance flow.

Line 32: consider “atmospheric carbon dioxide”

Line 33: the acronym IPCC needs to be introduced

Line 48: here the use of the acronym OAE would be suitable, please edit throughout

Line 49-51: this sentence is somewhat too broad? Maybe consider “understanding the impact of different alkaline feedstocks and concentrations on the ocean chemistry and ecosystems is still limited.”

Line 55: here the use of the acronym CaCO_3 would be suited as well, please edit throughout the text

Line 69: I believe “when” should be “whether” instead

Line 73: here, Ω could be introduced, and also Ω_A with a quick explanation why choosing aragonite over calcite (aragonite is the morphotype that precipitates in seawater rather than calcite, see Morse 2007 for example)

Line 79: here, the acronym DIC is used without introduction before. Consider “showing the loss of total alkalinity (TA) and dissolved inorganic carbon (DIC)...”, this way both are introduced together and can be substituted later in the text

Line 82: I am not fully sure, but I believe that the agreed upon/conventional labelling is Ω_A instead of $\Omega_{\text{aragonite}}$, though this may need to be double checked. If so, consider changing

Line 83: I believe the sentences need to be reformulated. It is not “NaHCO₃/Na₂CO₃ addition” that is “stable up to $\Omega_{\text{aragonite}} \sim 20$ ” but rather the seawater alkalinity after addition of said alkaline feedstock. Please rephrase

Line 89: I believe it was both CaO and Ca(OH)₂ though this may need to be double-checked

Line 92: you could consider mentioning and discussing quickly Suitner et al., 2025 (<https://doi.org/10.5194/egusphere-2025-381>) that provides a first attempt at characterising the precipitation pattern as a function of ΔTA

Line 93: one could argue that the research has grown exponentially rather than steadily

Line 95: consider mentioning the acronym LA Harbour used later in the text

Line 100: here I would argue that both TA and DIC are increased, not only DIC

Line 134: here, “Sodium Hydroxide” is introduced while earlier, the acronym NaOH is already used (e.g., lines 81, 86, ...). Please review for consistency.

Line 135: CaO is commonly referred to as “quicklime”, please edit. Also, is there any information on the purity and potential traces of CaCO₃?

Line 136: I am not sure about the formulation “purposeful weathering” please elaborate

Line 138: this is not correct, when this occur, the water is enriched with Ca²⁺ and CO₃²⁻. Though the latter reacts with CO₂ to give 2 HCO₃⁻, the dissolution of CaCO₃ lead to Ca²⁺ and CO₃²⁻ additions. Please edit

Line 145: here the reader needs information on the targeted molarity for reproducibility

Lines 184-186: here it would be interesting to know how the addition was performed. Was it with a pipette? Where the bottles mixed?

Line 187-189: how was this tracer added? Was it prepared as a stock solution? And though I understand the idea of increasing ¹³C for detection, the statement “a couple hundred per mil” is not sufficient for publication, this should be precise. One should report the targeted enrichment to enable proper carbon budget analysis.

Lines 207-209: as mentioned above, the handling of carbonate chemistry samples may significantly alter the measurement of parameters. This section needs more details.

Line 213: if I understood correctly, 5L bottles were used. About 250mL was removed for filtration and another litre for genomic analysis. It stated that 4.5L were remaining, shouldn't it be 3.5L instead?

Lines 231-232: was it a single point standard curve?

Line 285: I believe the “and” should be removed

Line 294: as mentioned above, the results rise some questions. Assuming starting TA is 2223 $\mu\text{mol kg}^{-1}$, adding 1:600 of 5000 $\mu\text{mol kg}^{-1}$ would lead to 599 parts of 2223 and 1 part of 5000. Hence, $2223/600*595 + 5000/600*1 = 8.3 + 2219.3 = 2227.6 \mu\text{mol kg}^{-1}$. Though here it is reported to be 2232. This also true for the other dilution where I would have expected 2232.3 $\mu\text{mol kg}^{-1}$ for 1:300 and 2241.5 $\mu\text{mol kg}^{-1}$ for 1:150.

Line 323: as mentioned above, presenting the data as ΔTA and ΔDIC might make it easier for the reader to identify changes overtime

Line 328: the pH reported as pH^{STP} is not a standard pH scale. Consider introducing the meaning or to use a more traditional scale, e.g., total, free or seawater scale

Line 340: why writing “the Omega value” instead of “the Ω value” when the latter is used in the graphs?

Line 342: I believe this should read “ μmol ”

Line 356: the opening sentence is a bit awkward, consider rephrasing

Lines 449-450: the formulation may be misleading. While the graph does show that DIC decrease is compensated by either POC or DOC, the graphs represent only proportions, i.e., %. Hence, a DIC decrease may not lead to an increase in POC or DOC, but rather in their contribution to the carbon pool. Please review

Line 464: here again, for consistency, use CaCO_3 . This applies all throughout the text and needs to be addressed

Lines 471-474: the experiments are once referred to as “calcium + bicarbonate experiments” and then as “ $\text{Ca}^{+2} + \text{HCO}_3^-$ experiments”. Please keep it consistent

Lines 516-522: this is a heavy paragraph, consider rephrasing in 2-3 sentences

Line 551: consider rephrasing as “addition, which they attributed to a possible...”

Lines 556-562: this is a very interesting point and is sadly way too short. These hypotheses should be expanded to explain that naturally ecosystems are subject to such alkalinity changes and may therefore be able to handle to some extent OAE