General comments:

This study assesses the long-term alkalinity generation and CO_2 ingassing following the addition of $Ca(OH)_2$, $Mg(OH)_2$, and liquid NaOH to seawater under slow advective and stagnant conditions. The experimental design and findings are novel and provide a valuable contribution to the growing body of literature on ocean alkalinity enhancement (OAE), particularly regarding the role of hydrodynamic conditions in determining alkalinity realization and CO_2 uptake. The results are relevant for informing implementation strategies and parameterization in larger-scale models. However, the manuscript contains numerous minor grammatical errors and some unclear sentence constructions, which make parts of the text, especially outside the Discussion, difficult to read fluently. In addition, the Materials and Methods section lacks a clear and logical structure, making it challenging to easily understand the experimental setup and workflow. I believe that moderate revisions are therefore required before the manuscript can be considered for publication in Biogeosciences.

Specific Comments

Abstract & Introduction

Line 4:
"Long term modelling studies have focused on this strategy, but most laboratory experiments focus on shorter term with strong advection…"
This sentence is strangely formulated. Shorter-term what? Experiments? Timescales? Please clarify and reformulate.

Line 10:
Replace "have been" with "were" to be grammatically correct, since the six-month experiment has presumably been terminated.

The abbreviation TA is not introduced in the abstract. Please introduce total alkalinity before using TA.

Line 14:
What is the critical alkalinity period (CAP)? This is not a commonly used term in OAE research and should therefore be explained in more detail.

Line 18:
"Using NaOH revealed buffering by $Mg(OH)_2$ precipitation, which ultimately redissolved in the bottles exposed to advection."
The meaning of this sentence is unclear. Please rephrase for clarity.

Line 19:
"Finally, the bottles exposed to advection represented open ocean conditions with wind speeds of ~3 m s^{-1}…"
This is a somewhat unusual concluding sentence. I suggest mentioning earlier in the abstract (around line 11) that slow advection represents open ocean conditions (~3 m s^{-1} wind speeds). You can then conclude that advection is important to consider and that these data may serve as lower thresholds for inclusion in global models.

Line 21:
Either "carbon dioxide" is missing before (CO_2), or the brackets should be removed.

Line 22:
This sentence does not read fluently and is missing a verb before “the” and after “atmosphere.” I suggest:
“While strong efforts to reduce CO_2 emissions are required, current projections report that these efforts are insufficient to slow global warming, with active CO_2 removal from the atmosphere being the only solution.”

Line 26:
Insert “seawater” before “total alkalinity” so it is clear to non-experts where alkalinity is added.

Line 36:
Does precipitation always lead to a runaway pattern? For example, if dilution occurs (leading to a decrease in Ω_a) after precipitation has started, would precipitation continue or stop? Please rephrase this statement more cautiously if necessary.

Line 43:
Since CAP is not a commonly used term in OAE research, I miss a clear definition of its meaning here.

Line 48:
Is the word “rates” missing after “dissolution”? The sentence reads awkwardly.

Line 49:
“More important” is not the right word here. I believe “stronger” would be more appropriate.

Lines 50–54:
The research aim is not explicitly mentioned. Please clearly state the objective of the study. The rationale for selecting a specific rotation speed would likely fit better in the Materials and Methods section.

Materials and Methods

The Materials and Methods section starts in a very unconventional way, with the duration of the experiment mentioned in the first sentence and the actual setup described only later. Please rewrite this section in a more logical, chronological order reflecting how the experiments were conducted. This will make it easier for readers to understand the experimental setup, sampling, and analyses.

Furthermore, adding a figure of the experimental setup would improve clarity.

Line 58:
Define “room temperature.” I see it is mentioned again in line 132. I suggest combining this information so that all relevant details are presented together.

Line 59:
Why was circular motion used? Does this represent seawater movement under natural hydrodynamic conditions? Please clarify.

Line 68:
A small schematic of the experimental setup would be useful for clarity.

Line 72:
There should be a space between “90” and “L.” Please ensure consistent spacing throughout the manuscript.

Lines 85–86:
This sentence is unclear. Was MilliQ only added if the difference in weight was between 5 and 10% (and not if higher or lower)? Please clarify.

Line 88:
What were the light conditions? Was the experiment conducted in the dark or under normal laboratory light? Please specify.

Line 90:
Change “organisms’” to “microorganism.”

Line 100:
“Powders were sieved to allow for direct comparison.”
Even after sieving, the powders can still differ significantly in grain size distribution and reactive surface area. Please elaborate on this limitation.

Line 108:
Write dissolved inorganic carbon (DIC) in full before using the abbreviation.

Line 109:
Does “3.3” refer to the type of TOC vials? The manufacturer name is typically mentioned in brackets. Please apply this consistently throughout the manuscript.

Line 138:
This is already a result and should not be included in the Materials and Methods section.

Line 144:
How does Ca and Mg analysis of the water help determine whether undissolved $Mg(OH)_2$ (solid phase) could have acted as a substrate for $CaCO_3$ precipitation? Please clarify.

Line 145:
Why was the remaining water volume weighed and dried in a 50-mL Falcon tube? I assume this was to estimate the precipitated $CaCO_3$ amount, but please explicitly state this. Were filters rinsed with MilliQ before drying? Please elaborate.

Line 151:
Quality control for what? To compare measured and calculated carbonate system parameters? Please clarify.

Results

Figure 1:
Instead of showing only average values, also display variation (standard deviations).
Was one day expected to be sufficient to dissolve $Ca(OH)_2$ and $Mg(OH)_2$ under stagnant or rotation conditions? Perhaps the percentage is higher after several days?

Line 160:
Space missing between “125” and “RPM.” Please check spacing throughout.

Line 168:
After “%TArealised,” “which was” is missing.

Line 173:
The statement comparing $Mg(OH)_2$ and $Ca(OH)_2$ TA generation without advection needs reformulation. $Mg(OH)_2$ values (3–18%) appear mostly lower than $Ca(OH)_2$ (3–30%) relative to expected TA increase. $Mg(OH)_2$ seems only significantly higher than $CaCO_3$ in at most half of the treatments (100, 200, 400 µmol kg^{-1}). Please revise accordingly.

Line 187:
“Overtime” should be “over time.”

Line 188:
Add standard deviations to the 100 and 180 µmol kg^{-1} averages and to other averages throughout the text.

Line 197:
Provide actual numbers instead of “slightly negative ΔTA.”

Line 199:
Add “values” after “positive.”

Line 202:
The “l” is missing in “slight.”

Line 203:
Provide exact values instead of “about 100 µmol kg^{-1}.” Also, error bars are large after one month in the 600 µmol kg^{-1} treatment. Is there actually a statistically significant decrease compared to day 6? Statistical analysis would strengthen this section.

Line 2015:
“In most cases…” — this sentence needs improvement; it does not read fluently and contains errors.

Line 220:
The trend in pCO_2 values for 0 RPM $Mg(OH)_2$ treatments appears very similar to 0 RPM $Ca(OH)_2$ treatments. I do not agree with the current interpretation. Statistical analysis would help reduce subjectivity.

Line 223:
There is no day 2 data point; 24 h should likely be 48 h (day 3).

Line 224:
For low alkalinity treatments, $Mg(OH)_2$ pCO_2 values were already similar to the control at day 3. Please rephrase.

Lines 236 and 337:
The first two sentences of this paragraph appear contradictory. Please rephrase.

Section: Effects of advection on pCO_2 changes:
Statistical analysis would be useful to identify when pCO_2 values are not significantly different from the control.

Figure 2 caption:
Replace “range” with “error bars.”

Lines 256–258:
Move this calculation to Materials and Methods and explain how it was calculated.

Line 259:
Add “more” after “about 194 µmol kg^{-1}.”

Table 1:
Consider whether this could be presented as a figure for improved clarity.

Table 1 caption:
Specify that it refers to the 600 µmol kg^{-1} treatment.

Line 261:
Add the formula for estimated Ca^{2+} in Materials and Methods.

Lines 264–266:
Improve fluency.

Figure 5 caption:
Mention exact treatment (e.g., 600 µmol kg^{-1}), not “higher addition.”

Discussion

Line 293:
Specify $Ca(OH)_2$ and $Mg(OH)_2$ instead of “such materials.”

Line 295:
Explain why this incubation is more realistic and which coastal conditions are being mimicked. The impact of advection on CO_2 ingassing rates is not sufficiently discussed despite being in the section title.

Line 298:
Flipkens et al. (2023, GCA, 359, 84–99) reached similar conclusions in an olivine incubation under different advective regimes and could therefore be cited.

Line 313:
Provide percentage of total expected TA increase rather than absolute concentration.

Line 338:
Change “loss of alkalinity to $CaCO_3$” to “loss of alkalinity through $CaCO_3$ precipitation.”

Line 349:
Improve sentence fluency.

Line 353:
Change “figure 2, Figure3” to “Figure 2 and 3.”

Line 358:
Specify which figure is being referenced.

Line 405:
Should this be “upper limit of effects” rather than “lower limit”?

Line 406:
The statement that real-world OAE applications may only have small effects, if any, on living organisms is too bold. Results from a 1-L bottle cannot necessarily be extrapolated to a 50-m water column. CAP duration and impacts could differ. Also specify which OAE applications are meant. This conclusion cannot yet be drawn for all OAE approaches, especially those involving trace-metal-releasing materials such as olivine or steel slags. Please nuance this statement.

Line 413:
Add “drastically” after “decreased.” CCS/CCU of calcination associated CO2 emissions will be essential for ocean liming (see Foteinis et al., 2022).

Line 429:
Export to deeper ocean is not the only possibility; settling onto coastal sediments is also possible.

Line 431:
“Buried in sediments without further dissolution” is incorrect. The cited studies show $CaCO_3$ dissolution in surface sediments under undersaturated conditions. Dissolution would only stop if buried below the reactive layer. Please correct.

Line 443:
It is unclear why slower $Mg(OH)_2$ dissolution would allow a higher CAP in the diffusive boundary layer. Wouldn’t slower dissolution instead prolong but reduce oversaturation intensity?

Line 461:
Add “seawater” before “the bottle.”

Line 470:
Add typical open-ocean gas transfer velocities in brackets for comparison.

Line 483:
This is not purely hypothetical. Your data and other studies (England & Bach, 2025; Flipkens et al., 2023) support this claim. Please cite accordingly.

Line 492:
Other long-term OAE experiments exist (e.g., Fuhr et al., 2025), but not with fast-dissolving minerals like $Ca(OH)_2$ or $Mg(OH)_2$. Please rephrase.

Lines 497–499:
Rephrase this sentence; it is currently too complex.