Dear editors,

Thank you for posting the statements. Here is our response to your comments.

Public justification:
"I appreciated that the authors openly admitted the “apples and oranges” issue. However, in the conclusion, they strongly advocate for choosing steel slag over Olivine, citing its efficiency in CO2 removal and limited environmental impact. I find this statement too assertive, and some rephrasing seems necessary for the following reasons. The reasons are: 1. the authors themselves noted that different steel slags may contain varying trace metals with different impacts on biota. Hence, the final statements seem overly general; 2. the authors themselves highlighted the limited duration of the experiments. It could be possible that Olivine released less TA in this short time and/or that the set-up of the experiments - distinct from a coastal environment with turbulence and strong waves - was not ideal for testing the effective release of alkalinity from an Olivine rock."

As indicated previously, we recommend that a minor revision to L33-35 and L759-763 (of the most recent uploaded version) would be sufficient to address this concern.

Comments to the author:
I am recommending the authors make a minor revision of the two statements (or add an additional sentence) to avoid any generalized prescriptions for the use of different alkaline material in OAE projects. There are many considerations that will come into play when choosing what type of material to use for OAE, some (e.g., logistical, LCA related, etc) that are not assessed in this study.

Response to the public justification:

Thank you for your careful consideration of this conclusion and constructive comments. We agree with your first point and have emphasized that minerals differ in composure and care must be taken when transplanting our observations to other slags or olivine. We already mentioned that in the conclusion (line 761) but now also added this statement in the first section of the discussion (lines 551-553).

With regard to your second point, we are not agreeing entirely with your argument. It is true that abrasion, potentially induced by wave action, increases olivine dissolution rate (Flipkens et al., 2023). However, such increased dissolution would not only increase alkalinity but also release of other (potentially detrimental) substances such

as specific trace metals. Thus, the higher amount of added material is not the most crucial metric for the comparison with slag but more important appears to be how much material got dissolved.

Our argument is that while increased duration/stirring may have increased alkalinity release, it would also have increased other substances that cause environmental effects. The stoichiometry of release seems to be what matters the most (and not how much material is lying at the bottom of the microcosm). We needed to add substantially more olivine to achieve only a fraction of CDR potential as steel slag and still observed more pronounced environmental effects. As such our argumentation throughout the text has consistently been to relate the environmental impact to the alkalinity generation. With this concept in mind, we think that our conclusions are fully backed by the data.

Nevertheless, we did the following changes to account for the reviewer's comment on the specificity of the material's impacts:

1) The text in the abstract where we compare slag and olivine CDR potentials and associated environmental effects is now much less general but specified for the specific types of materials used here (line 33-37).
2) We deleted the following statement in the conclusion: "Based on our findings, it can be concluded that steel slag powder exhibited fewer environmental impacts on plankton communities compared to olivine powder relative to its capacity for alkalinity enhancement" (line 766-767).

We hope these adjustments resolve the remaining controversy.

Kind regards,

Jiaying Guo

Flipkens, G., Dujardin, V., Salden, J., T'Jollyn, K., Town, R. M., and Blust, R.: Olivine avoidance behaviour by marine gastropods (*Littorina littorea* L.) and amphipods (*Gammarus locusta* L.) within the context of ocean alkalinity enhancement, Ecotoxicol Environ Saf, 270, 115840, 10.1016/j.ecoenv.2023.115840, 2023.