Response Letter

Dear reviewer,

Thank you for your comments on our manuscript. Here are our point-by-point responses to these comments.

General comments:

I enjoyed reading the revised version of the MS by Guo and co-authors and the replies to the comments. I think it's a nice paper that has nicely improved.
I still have a few comments that I will list down here.

Response: We thank the review's general comment.

Major comment 1. Abstract: I would appreciate if the abstract could be more concise and condensed. The current version lack of appeal while reading it. While I understand it could be challenging, I strongly suggest that the authors make an effort to shorten thinking about the main information they want to convey. Still in the abstract: lines 18-19 can you rephrase it? For example: "Olivine and steel slag powders were of similar grain size. Olivine was added in a higher amount than the steel slag since previous tests evidenced that it would have released less alkalinity over the 3-week experiment".

Response: Thanks for your suggestion. We have revised the line 18-19 using your example and shortened the abstract.

Major comment 2. Line 356: can you make explicit which day instead of writing "final pH"?

Response: We have added the description "the pHT on the day 23" (line 356).

Major comment 3. Line 409: "was 50-fold greater than in steel slag (100 g vs 2 g)"

Response: We have revised as suggested (now line 403).

Major comment 4. Line 461: "treatment"

Response: We have added the word accordingly (line 461).

Major comment 5. Chapter 4.2: I appreciated the open discussion in chapter 4.2 about the "apples and oranges" issue. Generally speaking, I don't completely get your explanation: you state that you knew already from a previous test that the slag would have elevated alkalinity faster. Since you aimed at reaching a similar TA level through the duration of the experiment for both treatments, why did you add this big mass of olivine from the very beginning, considering all the information achieved in a pre-test?

Response: Thank you for your comment. We added the large mass of olivine because the total alkalinity (TA) released by the olivine was not very high (29 µmol kg^{-1} by 100g of olivine), and this TA elevation is achievable and maybe lower than the real application in the field in the future. We could

have reduced the amount of slag powder added in the slag treatment to achieve a similar TA level as the olivine addition, but since the OAE application may elevate more than 29 µmol kg^{-1} in real application to achieve carbon removal, we decided to use slag powder to assess its environmental impacts on a relatively high TA scenario (around 300 µmol kg^{-1}). We agree that the final different TA levels caused some challenges with the comparison of these two materials in our discussion. Thus, our discussion mainly relates the observed environmental effects with the alkalinity enhancement achieved over the course of the study.

Major comment 6. Line 570: I would change the word "argue" that is too strong and a bit provocative and I would just say that your study is still relevant since it's consistent with a real-world application of OAE using different materials.

Response: We have changed the word “argue” to “note”.

Major comment 7. Line 585: please change it to “within the alkalinity ranges tested in this study.”

Response: We have rephased according to your suggestion (now line 578).

Major comment 8. Line 594-595: “As such, diatoms are likely to benefit from olivine and slag 594 applications.” Can you condense this sentence with the previous one to avoid repetition?

Response: Thank you for pointing this out. We have deleted this sentence since it was discussed in the previous one (now line 587-588).

Major comment 9. 651-655: These sentences are too speculative…you should dig more into species level to say so. I would be more cautious here if you don’t have information at the taxa level or TM cellular requirements of coastal species in the area.

Response: We rephased these sentences to make it more precise. “It is possible that these coastal phytoplankton species have higher Fe requirements than those from the open ocean where Fe is limiting (Strzepek and Harrison, 2004). Our findings suggest that Fe perturbations may not only be relevant for low Fe open ocean regions but could also be relevant for coastal ocean locations.” (now line 642-645)

Major comment 10. Line 690-693: I appreciated that you tried to explain the second bloom of cyanobacteria but your interpretation is not consistent with your data analyses as you mentioned in the text (“The section second bloom of cyanobacteria in olivine is likely to be the results of decreased predators, like Penilia sp. and Oikopleura sp., although the changes in their abundance were not statistically significant between treatments and the control”).
Response: We apologize for this confusion. The bloom of cyanobacteria was statistically significant but the abundance of Penilia sp. and Oikopleura sp. was not statistically significant possibly due to the limited data points we got and the limitation of GLM on the zooplankton dataset. We have deleted the unprecise description (now line 683).

Major comment 11. Due to the “apples and oranges” issue, the sentence in lines 800-801 (from Based to enhancement) should be deleted. Otherwise, you make the same mistake as the previous

version where you compared two different things.
I hope to see this MS published asap! Good luck!!!!

Response: Thank you for your comment. We think the sentence as formulated currently is precise and correct because we compare the environmental impact to the alkalinity enhancement potential observed in our study. The slag was >10 more efficient and considering that it would have to have >10 stronger environmental side-effects to have a relatively similar impact than olivine. This was not the case, so that the sentence is correct in our opinion, and we would like to keep it.