Response to Reviewer #2

The authors aim to synthetize current understanding in biosilification across diverse organisms and its influence on the global marine Si cycle.

In this manuscript, without a doubt, the authors have achieved their goal, delivering to a large audience existing knowledge on the different processes that control silicification in various organisms, exploring the taxonomic diversity of marine silicifiers, and assesing their role in Si cycling across geological timescales and in the modern ocean.

The four figures are helpful to illustrate silicification processes in unicellular and multicellular organisms, the size range of silicifiers, the processs that control the Si cycle in the modern global ocean, and the schematic of the silicon cycle and isotopic fractionation during various processes, using diatoms as a model for the biogenic silica component (included in box 4).

Four boxes detail the use of molecular tools and radioactive tracers for studying biosilificication processes and silicon uptake, that of siliceous microfossils as markers of past and present oceanic environments, trait-based approaches to understand the function of silicification in diatoms and plants, and the use of silicon natural stable isotopes to trace the marine silica cycle. Interstingly, this manuscript also shed light on silicification processes in terrestrial organisms and compare them to those occuring in marine organisms.

AUTHORS' RESPONSE:

We would like to warmly thank Reviewer 2 for their thorough and encouraging evaluation of our manuscript *"Silicification in the ocean: from molecular pathways to silicifiers' ecology and biogeochemical cycles"*. We greatly appreciate your recognition of our efforts to synthesize the current understanding of biosilicification across diverse organisms and its influence on the marine silicon cycle.

We are pleased that you found the manuscript comprehensive and valuable. Your positive assessment of the figures and boxes, and the way they illustrate processes and tools relevant to silicification, is particularly encouraging. We are also grateful that you highlighted our inclusion of comparisons between marine and terrestrial silicification processes, as this was an aspect we aimed to emphasize in order to broaden the perspective for readers.

In the following, we provide detailed responses to your specific comments and suggestions for improvement, and we explain the changes made in the revised manuscript.

General comment :

Page 62 line 1991 : It seems that Maria Lopez-Acosta and Antonia U. Thielecke are acting as the coordinators of the writing group. If this is correct their names should come first.

AUTHORS' RESPONSE:

We thank the reviewer for their thoughtfulness. However, responsibilities were distributed equally and corresponding author is not an indicator of a higher contribution.

-Line 2000: The writing and coordination of this manuscript was very much a group effort and responsibilities were distributed equally among the participants. Hence, neither the order of authors nor the role of corresponding authors is a reflection of their contribution to the work.

Minor comments :

Page 2 line 4 : what is the meaning of « regulators » ?

AUTHORS' RESPONSE:

We have now rephrased this sentence for clarity.

Page 4 line 103: regarding this topic Jacques Livage's works should be mentioned, for instance his publication on « Bioinspired nanostructured materials », published in September 2018 in Comptes Rendus Chimie 21(10) DOI:10.1016/j.crci.2018.08.001

AUTHORS' RESPONSE:

Thank you for suggesting this reference. It has been added to this section at the end of this sentence: "This stark difference highlights the efficiency of biological silicification, which occurs under ambient environmental conditions without the need for high temperatures or external catalysts (Livage, 2018)."

Page 6 line 157, EGXQ and GRQ : meaning ?

AUTHORS' RESPONSE:

This sentence has been rearranged to clarify that these are amino acid motifs. The letters are commonly used abbreviations for amino acids (E: glutamic acid, G: glycine, Q: glutamine, R: arginine), while X usually denotes an unknown amino acid or nonconsensus between different protein sequences.

Page 13 line 391 : how many species of diatoms ?

AUTHORS' RESPONSE:

Thank you. We added the current number of described species and the total estimate to the text.

Page 16 line 465 : Which recent studies ?

AUTHORS' RESPONSE:

We added the appropriate reference to this study (Laget et al., 2024).

Page 16 line 492 : could contribute up to 20% of the bSi production of the global ocean.

AUTHORS' RESPONSE:

Thank you. We adjusted the sentence accordingly.

Page 20 Figure 3 should be improved. Aeolian inputs and reverse weathering are missing processes (see Tréguer et al. 2021). At a first look the reader gets the feeling that sponges and glaciers/Ice sheets play a major role in the Si global marine cycle, which is not true.

AUTHORS' RESPONSE:

Thank you for the feedback. We adjusted the figure to include weathering and aeolian input as processes and reduced the size of the ice and the number of the sponges to more accurately reflect their contribution to the Si cycle. We also note that the figure does emphasize the specific processes and interfaces that we focus on in our manuscript, and is not meant to be a proportional depiction of their global importance. Regarding "reverse weathering", it is in fact included under the processes of "Alteration" and "Precipitation" in the figure, since it is a specific type of diagenetic alteration/precipitation, as discussed on L838-852.

Page 23 line 685. Figure 3 of Tréguer and De La Rocha 2013 or Figure 1 of this manuscript ?

AUTHORS' RESPONSE:

Thank you for the comment. We revised the sentence as "Silicon, which is ultimately derived from the weathering of the Earth's crust, is transported to the ocean via various pathways (Fig. 3 and Table 1)".

Page 24 Table 1. Move Marine Si sinks on page 25

AUTHORS' RESPONSE:

-Table 1:

We moved "Marine Si sinks" on page 25 of Table 1, but after adjusting the content of Table 1, it is then moved to page 24. We thank you for the comment.

Page 25 Table 1 (continuation) : Marine geological residence time

AUTHORS' RESPONSE:

-Table 1:

We changed "Marine Si residence Time (yrs)" as "Marine geological residence time of Si (yrs)"

Page 25 line 715. …this task is challenging. Impossible is too much.

AUTHORS' RESPONSE:

-Line 715:

We deleted the phrase "if not impossible,"

Page 26 line 730 submarine groundwater (Cho et al. 2018; Rahman et al., 2019 ;…)

AUTHORS' RESPONSE:

-Line 728:

Thank you for this suggestion. We added the "Cho et al., 2018" which is a very supportive reference.

Page 27 line 750 and followings. The authors should say a few words about the impacts of the Yangtze huge dam on the dowstream ecosystems as regards the Si cycle.

AUTHORS' RESPONSE:

Thank you for the suggestion, however to maintain the focus of the manuscript, we only discuss global riverine inputs only broadly as a whole, and we feel discussing specific rivers or indeed the continental Si cycle in more detail is unfortunately outside of the scope of this manuscript.

Page 28 line 797 and following. The authors should mention Luo et al. (2022)'s work on in the deepest hadal trench (Marianna) sediments, where alkalinity profiles are generated by organic matter mineralization that represents the dominant early diagenetic process in marine sediments, despite the occurrence of reserve weathering.

AUTHORS' RESPONSE:

Thank you for the suggestion, we have now included references to Luo et al. 2022, as well as 2025 in the sentences discussing authigenic precipitation and the coupling to organic matter, respectively. (Paragraph 2 of section 4.3.2)

Page 29 line 825 : aSi definition.

AUTHORS' RESPONSE:

-Line 825:

Thank you for the comment. The definition of aSi was given in Line 819: amorphous silica (aSi).

Page 29 line 834 : « CNSi » as an abreviation of colloidal-nanoparticulate size Si is not pertinent (CNSi = carbon, nitrogen, silicon.

AUTHORS' RESPONSE:

-Line 832:

We deleted the abbreviation "CNSi" as it was only used once in the manuscript.

Page 35 line 1031: lower case letters.

AUTHORS' RESPONSE:

-Line 1028-1029:

We changed the upper-case letters into lower-case.

Page 64 Box 2 last line: « only about 10% of surface-dwelling diatoms are preserved in sediments ». This seems too high. What are the references supporting this statement ?

AUTHORS' RESPONSE:

We modified this to “in about 1-10% reach the seafloor and are preserved in the sediment (Crosta and Koc, 2007)”.

Page 67 Box 4 line 12 « isotopic fractionation in sponges' spicules correlates closely with ambient dSi concentrations »… is this statement in agreement with Maldonado and Hendry (L&O, July 2025) ?

AUTHORS' RESPONSE:

Thank you for this comment. A sentence has been added after this statement that incorporates the results from Maldonado and Hendry, 2025, into this section