Compilations of Palaeogene deep-sea diatom-bearing sediments and associated data

C. Figus et al., Biogeosciences

General Comments

This paper offers a paleo-oceanographic insight into the importance of nutrient availability and ocean circulations versus climate on the abundance of diatoms in water columns. This study's wide spatial and temporal scope broadens its implication, encompassing four of the five oceans from the late Mesozoic to the Cenozoic periods. Despite this strength, I am not convinced about the novelty of this paper. Rather, I see it in terms of a summary review rather than an original research article. This is because most of the key data in this paper is pulled from previous literature. Most newly displayed datasets in this paper are analytically rudimentary based on enumeration (mostly the number or frequency of diatom-bearing sediments). This means that insufficient evidence has been presented to support new findings as it stands. Section 3.2. in the Results and Interpretation section is the core part of this paper, however, it has been augmented with a summary of the previous findings. The author's tone fails to convincingly convey the proposed new ideas (e.g., words such as "probably", "might", or "may" are used when stating new insights). The writing style of this paper is better suited to a technical report rather than a journal paper, focusing on the description of data or findings instead of the critical assessment or the logical connection between them. Therefore, I recommend the authors position this manuscript as being a foundation for another original study, instead of being an independent journal publication. Alternatively, this paper can be condensed into a one-page "Perspective" article, assuming that the main premise behind this study is critical and timely for the current paleo-sciencific readership.

Specific Comments

1. L9-10: Please clarify if the diatomite gap was observed in shallow marine or deep-sea sediments. The diatomite gap typically refers to the deposition in shallow marine sediments. This is essential to follow your logical reasoning that the tectonic reorganizations led to the diatomite gap, despite the deep-sea diatom deposition.

2. L14-28: This part lacks any plausible explanation about how tectonics could have affected the deep-sea diatom deposition, although it does describe a potential impact of the other two factors, climate and ocean circulations.

3. I cannot see any sign that the sampling bias correction method in this study has been significantly advanced, nor that it is novel when compared to the existing statistical methodology.

    a. Section 3.1 Impact of Biases on the Observed Pattern in the Results and Interpretation section may not merit its own independent subsection.

    b. Figure 3 could be included as supplementary information, not as a main figure.

4. This paper fails to (i) succinctly introduce a scientific principle or known facts and (ii) connect it to support the original dataset. The latter part (ii) is much more important than the former (i) for a research article. Also, I note that some sentences are logically incomplete. For example, in L145-149:

    a. In general, N_2-fixing microbes and diatoms occupy distinctive spatial or temporal niches, oligotrophic and warm waters vs. nutrient-rich cold waters. The statement in L145-149 reads as if N_2 fixers and diatoms dwell close to each other and exchange nutrients. This issue can be partially solved by elaborating on "then nitrite (NO2-) and nitrate (NO3-) by nitrification" in a new separate sentence. Were the study areas unaffected by other N sources such as terrestrial input and nitrate upwelling? You may want to add more references about known and potential N sources of the time span and specific sites, in addition to Kast et al. (2019).

    b. Please clarify whether you are referring to benthic diatoms or planktonic diatoms. Their morphology, species, and the δ^{15}N values all differ.

    c. The sentence in L147-149 can be made clearer by stating what phytoplankton vs. bacterial decomposers do in N cycling, rather than distinguishing phytoplankton vs. diatoms and other organisms. "Used" and "recycled" does not sound mutually exclusive, and "other organisms" is ambiguous.

    d. Please add a sentence about what proxies you analyzed or cited for N cycling, as you did for the Sr and Li isotopes. You can inform (i) how the analysis is related to diatom accumulation (e.g., lower/higher δ^{15}N of sediments suggests more/less diatom deposition) and (ii) if you expected N dynamics to be related to pCO_2, as Sr, Li, silicate, and P all are.

5. The authors state the aim of this study is to identify the factors determining the vertical flux of diatom deposition. In my opinion, the actual goal should be to advance learning in paleoenvironmental conditions, such as nutrient distribution, ocean circulations, plate tectonics, or climate, based on the diatomite data. Thus, I would expect a revised manuscript to discuss the broader implications of the paleoenvironment.

Technical Corrections

1. Please be more direct and specific at the individual sentence level. For example:

    a. The Abstract section overuses vague expressions such as “response to”, “is mainly controlled by”, “an indirect correlation”, “linked to”, and “a comparison of”. Clearer, on-point wording, such as increase/enhance/elevate/intensify or decrease/suppress/prevent/weaken, can be substituted for some of these ambiguous expressions. Adding an adverb or an adjective would help inform the scale of change, such as largely, slightly, or x-fold.

    b. L33-34: The summary of Figus et al. (2024a) should be more direct. How did climatic and tectonic factors and ocean circulations change diatomite accumulation? Please specify the factors and the changing direction (e.g., increase or decrease).

    c. The writing from Section 3.2.1 onwards is clearer than the earlier part.

2. L26: “more” seems unnecessary.

3. L25-47: Please break this paragraph up into two or three paragraphs.

4. L28-31: The second sentence is redundant in terms of the point made in the preceding one. You can combine these two sentences together and add Brylka et al. (2024) to support the limitation of the datasets.

5. L28-30: Did the “several studies” investigate different parts of the oceans or the same location? Please specify which it was in this sentence.

6. L34-35: “the presence of a gap” can be just “a gap”.

7. L140: The opening sentence can be more generic, summarizing your approach rather than describing a figure. You can amend this sentence accordingly: “We analyzed x (e.g., four) geochemical proxies to reconstruct the distribution of diatoms (Fig. 4).” You cannot use this sentence if those proxies were analyzed for other papers, rather than for this one.

8. Please make sure that the y-axis of Figure 2(b) covers the entire range of the line graph. The current axis does not encompass a range of higher values greater than 2 ‰.

9. Please add the unit of the y-axes in the following figures: The first two y-axes in Fig. 1; Fig. 2b; Fig. 4a.

10. You can add a map of sampling sites with sampling frequency if you want to include some graphic information about the geographic coverage of the sampling sites.