

Review for Harning et al. “High-resolution Holocene record based on detailed tephrochronology from Torfdalsvatn, north Iceland, reveals natural and anthropogenic impacts on terrestrial and aquatic environments”

Structure of review: A. Summary, B. Minor comments

A. Summary

Harning et al. have effectively incorporated most of the reviewers' feedback, thoroughly addressing and responding to all suggestions. Notably, the title, abstract, and introduction now appropriately incorporate tephrostratigraphy, enhancing the manuscript's thematic coherence. The methods section has also been reorganized, presenting a clearer and more structured approach than in the initial version.

Despite the density of the manuscript, which still presents extensive datasets that could constitute two independent papers, I found it engaging and insightful.

I am pleased to recommend it for publication, pending the authors' addressing of some minor comments.

B. Minor Comments

1 Introduction

L34: “...have analyzed physical...” Have the empirical records analyzed the properties?

L57: “Icelandic lake sediment studies provide optimal archives...” do the studies provide archive, or the sediments?

2 Methods

From an organizational perspective, the manuscript is now concisely structured.

3 Results

L237: As your Fig. 3b shows, the SAR is not linear, but you have variations from 0.001-0.25, which is >20-fold of variation. This substantial variability could influence the interpretation of sedimentary fluxes and patterns.

My question about MAR from the first round has been replied to as follows: “Due to the linear sediment rate, calculating fluxes does not alter the structure of the proxy curves and therefore does not provide any difference in plots than those shown in the figures presented. This point was already made in the original manuscript. See L300.” While this explanation is understandable, it overlooks the considerable variability in SAR noted in Fig. 3b. MAR (mass accumulation rate, expressed as mass per area and year, e.g., $\text{g cm}^{-2} \text{yr}^{-1}$) differs from SAR (sediment accumulation rate, e.g., cm yr^{-1}). Typically, substance fluxes are calculated using MARs. Given the changes in the sedimentary matrix (minerogenic versus biogenic, as you have nicely detailed in your manuscript) and the variations in C_{org} , alongside changes in SAR, it is reasonable to anticipate a different flux pattern compared to the concentrations. I suggest calculating these fluxes and presenting the results in the supplementary information. If they are substantially different (in terms of trends), it would be interesting to see whether they would change the interpretation of the dataset.

4 Discussion

The first paragraph (L316–327) primarily describes and quantifies the tephra layers in a descriptive manner. To enhance the flow and logical structure of the manuscript, I recommend moving this section to the results section. Consequently, the first paragraph of the discussion (starting at L328) should be adjusted to reflect this change and maintain coherence.

L323: I couldn't find the Veidivötn-B in Table 2 (also comment later) → make sure to be consistent with IDs

L370: “have low C/N (7 to 26) and high d13C values...” → add “relatively” → “relatively low” and “relatively high” values

L379: “...as they reflect all taxonomic groups...” remove “all” → ...as they reflect taxonomic groups...

L392: in front of 10,000 is there a double spacing? Use search&find function in word processor to find and remove double spacing.

L479: are there other confounding factors influencing the abundance of cyanos, e.g. anoxic periods?

L568: “the contaminant rise...” is this speculative? Rephrase it to anthropogenic landuse, or pressure or similar.

5 Conclusions

L573: “high-resolution age model” is overselling here. Varves would be high resolution, or age control every 100 years, here it is every 550 years.

BTW. In Figure 2 I only count 18 age markers, but you claim that there are 22 in the conclusion, and in the figure legend you describe 20, what is correct? → be consistent

Supplementary data

The supplementary material provides a comprehensive and well-structured tephrography, which is clear and informative. I also appreciate that the data tables are now accessible. However, I noticed that the cluster coordinates for the tephra layers (e.g., 'Hekla') are not provided in a tabular format. Including these coordinates in a spreadsheet would enhance the utility of the supplementary data for future users.

Aside from this, the collection of biplots is exhaustive and very well done—great work!

Minor comments - Figures

Figure 3

- How many control points? I count 18 in the figure, see 20 in the figure caption, and 22 in the conclusion section...

Figure 4

- The PCoA Axis 1 curve (plot f) seems to be cut-off in the Early Holocene, is this on purpose?
- Suggestion: Add vertical lines, such as dashed lines, at regular intervals (e.g., every millennium) to facilitate readability of the years.

Figure 8

- Increase scale bar (on the left of the figure), it is not readable as is

Minor comments - Tables

Table 2

- Action: Add a column containing the core-ID to facilitate finding the tephra layers in Figure 2. This hasn't been implemented yet.
- In the footer of the table you describe “V-B, Veidivötn...”, however, there is no Tephra ID visible in the table, either remove this, or add the tephra layer.