

General Responses:

We thank the three reviewers for their comments, and those who provided community comments too. We will respond to all comments individually but there are some general points mentioned in multiple comments that we would like to address, here labelled as General Responses 1 to 3 (GR-1 - GR-3).

GR-1: There is some confusion as to the purpose of this work; this work is an addition to the Varved Sediments Database (VARDA) as opposed to a data compilation exercise using the database. This was not made clear within the text and in the revised manuscript we now explicitly state that this data is a new addition to VARDA (Lines 15, 18, 60, 74).

GR-2: The Kernel Density Estimate plots are not meant to be a comprehensive overview of all known findings of the tephra layers, instead they are intended for use as a statistical and schematic diagram to highlight the future potential to better synchronise varve chronologies using tephra layers. We hope that further clarification in the caption of Figure 4 addresses this issue.

GR-3: The inclusion of tephra data into VARDA is not intended to be used as a new database for tephrochronologists; we aim that the inclusion of tephra data enables varve chronologists to better synchronise varve chronologies to an absolute timescale using tephra as an isochronous marker horizon.

Reply to Reviewer #1 ([://doi.org/10.5194/essd-2023-154-CC1](https://doi.org/10.5194/essd-2023-154-CC1))

We would like to thank Carl Regnéll for the constructive feedback. We copied all comments below, numbered them in order of appearance (CC1-1 to CC1-4) and provided a response accordingly. We hope to have addressed all concerns and improved the manuscript according to the suggestions.

General comments:

CC1 - 1: It is important not to consider databases like RESET and VARDA as complete and not critically review the data one uses from them, as it might lead to the propagation of misinformation.

Also, when referring to specific sites and studies included in these databases I would consider it only fair to cite the original references for these studies and not only the databases.

More specific:

P.7, Lines 152-154: “Furthermore, the location of seven additional sites with robust varve chronologies, which have high potential for cryptotephra investigations are identified (Figure 4).”

Authors' response: We appreciate these comments and have adjusted our maps and figures accordingly to remove Lake Aspevatnet from them (CC1-2). In addition we agree that original studies should be referenced in the text for these sites, and regarding the origin of the tephra data for each site we believe we have done this; original site studies and references are all cited on the VARDA database. Where applicable, we have added additional citations (Lines 163 - 166) when referring to sites to reflect this suggestion.

CC1 - 2: Comments: Potential tephra site “a” (Aspevatnet) is included in the VARDA-database but is not varved, or at least no varves are reported in the reference given in VARDA (Bakke et al. 2005).

Authors' response: We appreciate this comment as there are a number of sites on VARDA that are not varved; their inclusion into the database is justified in the original VARDA paper (Ramisch et al., 2020) within which we conducted this additional data collection phase for tephra data. The non-varved sites were included originally as they have good chronological control through radiocarbon dating and tephra layers. We have further clarified in diagrams and text where sites are not varved.

CC1 - 3: Potential tephra site “b” (Storsjom) is misspelt and slightly misplaced on the map. It should be “Storsjön” and as it only has a c. 250 varves long floating chronology (Labuhn et al. 2018) it might not qualify as a “robust varve chronology” with “high potential for cryptotephra

investigations"? In addition, Storsjön was covered by the Scandinavian ice sheet during all of the four eruptions shown in Fig. 4 (e.g. Hughes et al. 2016; Stroeven et al. 2016).

Authors' response: *We thank you for this insight, we have updated Figure 4 accordingly to reflect this.*

CC1 - 4: Fig. 4, p.9: Comment: The known distribution of the Vedde ash is vastly underestimated as it is also found across Arctic Russia and into the Polar Ural Mountains (Haflidasson et al. 2019) and on Svalbard (Farnsworth et al. 2022).

Authors' response: *We appreciate the insight provided here and we acknowledge that the KDE does underestimate the distribution of the Vedde Ash; this is however as a result of the statistical approach used in a KDE that uses 95% confidence. The sites Bolshchoye Shchuchye and Yamozero (Haflidason et al. 2018) were included in the KDE (which has now been acknowledged in the paper) but are at the extreme end of the known extent of the VA and statistically will have been excluded from the 95% interval as a result. The KDE is used here as a schematic representation of the ash dispersal using statistical analysis and is not meant to highlight every location where the VA is found. We have made it clear in the text that additional sites, if not on the RESET Database, have been included in the creation of the KDE maps with citations (Line 159) and further clarified the purpose of the KDE maps in Figure 4 caption.*