Author comments:
We thank the reviewer for taking the time review the manuscript and provide thoughtful and constructive feedback. All comments and suggestions have been addressed, please see the below replies in blue italicized text.

Reply to anonymous reviewer (RC3):

I enjoyed reading about the novel approach applied to the Mount Brown South core array to discover two cryptotephra horizons in the MBS-Alpha surface firn core, and the integration of seasonal glaciochemical signals, atmospheric modelling, and geochemical fingerprinting to support the proposed source attributions. The manuscript presents a thorough method for sample preparation and a well-considered rationale for source attribution that acknowledges the challenges of identifying (crypto)tephra in Antarctic ice cores. The reported discovery of cryptotephra horizons derived from the 1991 CE Cerro Hudson (Chile) and 1985 CE Mt. Erebus (Antarctica) eruptions establishes promising new satellite era time-stratigraphic markers for East Antarctica, and highlights the value of future investigation of the MBS-Main ice core to further enhance the emerging tephrochronological framework for Antarctica.

> *We thank the reviewer for acknowledging the value of our work, and for providing comments which will improve the manuscript.*

Overall the content of this manuscript is logically presented and well-written, however there are some minor errors and inconsistencies that should be addressed to improve the presentation of key data and subsequent discussion. In particular, I would like to draw attention to the following areas:

Core selection and justification: It is unclear from the main text (sections 2.1-2.2) why the MBS-Alpha firn core was selected for examination instead of MBS-Bravo or MBS-Charlie. Was this selection based on differences in accumulation rates? The Figure 1 caption suggests that the MBS-A core was chosen "due to larger available sample volume", please clarify.

> *Thank you for raising this concern. As the core selection justification was also raised by other reviewers, it is clear that this can be clarified further in the text of the manuscript. We will therefore revise the methods (Section 2) to include a clearer justification of the sampling procedure chosen and the reasonings behind our use of the MBS-Main and -Alpha cores. We will be sure to include the following information:*
>
> - *Amount of MBS-Main ice remaining and available for sampling and how this impacted the samples collected from MBS-Main*
> - *Challenges faced with the sample mounting procedure used for the MBS-Main core*
> - *Sample availability of the MBS-Alpha core*
> - *Comparison between MBS-Main and MBS-Alpha (based on pre-existing chemistry and isotope data) and justification for using MBS-Alpha to infer about the tephra archive potential of MBS-Main.*

Sample selection and SEM-EDS data: Please clarify why 19 samples from the MBS-Alpha firn core were not selected for further analysis by EPMA-WDS (Figure 2a-7; lines 169-171). Was there glass identified in these samples but deemed too small for analysis? Are the results of the SEM-EDS analyses conducted (Figure 2a-7) available, and if so do they concur with the EPMA-WDS results presented for samples that progressed (Figure 2a-8)? Considering the use of a small beam diameter of 2 µm for EPMA-WDS please clarify why a further 17 samples were not analysed by EPMA-WDS (Figure 2a-8), were there no glass shards identified or was the material too small for analysis (lines 171-172; cf. line 179)? Define what is meant by "tephra grains of suitable size" (line 123), which would help justify the reasons for why these samples may have been suitable for further analysis.

The questions raised here make it apparent that more clarity is needed throughout section 2.2 on the analyses conducted, how the samples were chosen for each analysis, and the resulting data from each step. We will add text in the relevant sections that more thoroughly describes the sample selection steps and procedure, including the following:

- *Detailed description of what analyses were conducted on each sample*
- *Clearer definition of the criteria used at each step of sampling (e.g. glass shard size criteria for EPMA-WDS)*
- *Which samples were not selected for further analysis and why.*

EPMA-WDS analytical conditions and Na loss: Please provide some further clarification and justification (line 145) as to why these analytical conditions were used for EPMA-WDS. For example, Innes et al. (2024) propose that a 3-μm EPMA beam is suitable for use on all glass compositions provided that the beam current is reduced to 1 nA. Given the use of the "broad beam overlap" method of Iverson et al. (2017) why not use a larger beam of ≥ 5 μm in diameter for larger microparticles identified? This would have reduced the need for multiple analyses of individual glass shards from MBS-A sample 14-1 that likely increased the likelihood of Na loss.

While the best practices proposed by Innes et al. (2024) are robust and a good framework for conducting EPMA analysis on fine grained tephra, our analyses were performed before these recommendations were published. EPMA analytical conditions were selected based on the recommendation of the expert microprobe staff technicians we worked with, with the aim of obtaining as robust or analytical totals as possible on our small glass shards while minimizing alkali ion migration and maintaining consistent analytical conditions across all measurements. While we agree that for some shards, a larger beam area would have resulted in robust measurements using the broad-beam overlap method, we prioritized consistent analytical techniques and the ability to obtain results from the largest number of glass shards possible in our samples. We will update the text to explain our justifications for the analytical conditions selected.

On this point, I disagree with the statement made on lines 277-281 and consider that the lower Na2O values obtained relative to the published values of Cerro Hudson eruptive material is instead indicative of minor Na loss (visible in Figure 7). Consider the effect of successive analyses of particles by SEM-EDS and EPMA-WDS (inferred from Figure 2), as well as the effect of measuring multiple spots (two to three) per glass shard, the majority of which showed a decline in Na2O wt. % (see supplementary materials). It would be interesting to see the individual data, rather than averaged values, plotted against the Cerro Hudson fields to see if there is a better correlation. Presented values may also be low because of the small beam size and current used. The minor Na loss can be explained and does not adversely affect your correlation or source attribution. Please offer some consideration of these points in the text.

We agree that the lower Na_2O values could be a result of sodium migration due to successive microprobe measurements. We will update the text to clarify that while efforts were taken to minimize alkali ion migration, the lower Na_2O values may be a result of beam size/current and repeated analysis, and that despite this, the majority of our measurements are still in the range of the Cerro Hudson Na_2O values and thus the source attribution is not impacted by these decreased Na_2O measurements. Additionally, we will provide a figure in the supplementary materials that plots the individual data points plotted with the Cerro Hudson literature data to demonstrate the correlation with the non-averaged data points.

Minimum threshold for acceptable analytical totals: Given the literature cited (lines 154-157), please justify why analytical totals of at least 50 % were presented in this study. Without adequate justification, it would be preferable to remove values that have analytical totals <67 % given the use of the "broad beam overlap" method of Iverson et al. (2017). However, considering the very small beam diameter used (2 µm) it may be even better to instead apply a higher minimum threshold for acceptable analytical totals (e.g., 90 %), or to discuss why lower totals were produced from shards measuring up to 15 µm in diameter.

We agree that ideally, a higher threshold for analytical totals would provide more precise results, however, due to the characteristics of the cryptotephra analyzed, in some cases, we made the decision to include analyses with low totals and indicate to the reader which measurements had the lowest totals (i.e. below 60 wt. %). In their recent "best practices" guidelines paper, Innes et al., (2024) report good accuracy despite somewhat lower precision for EPMA analyses of very fine grained tephra shards resulting in analytical totals ranging from as low as 35 wt.% up to 101 wt. %.

As to why we may have returned low-totals measurements from larger glass shards, our best assessment is that the while the shards are "large" (up to 15 µm) in at least one dimension, we are only able to measure the size of the shards in two dimensions, and it is possible that the shards are very thin (either naturally, or due to the amount of polishing required), resulting in an interaction volume depth that includes the resin substrate below the shards. Additionally, due to the more complex morphology of some of the larger shards, it is also possible that the resin was not uniformly removed from the surface of the shards, resulting in some resin being included in the beam area. While this could be resolved by further polishing, due to the variable size of shards in the samples, further polishing risks fully polishing away some of the smaller shards in the sample. As a result, we chose to accept slightly lower totals in order to include analyses of as many shards as possible.

We will expand the text in this section to more thoroughly explain the rationale behind the analytical conditions selected, as well as the limitations of our results.

Complete reporting of the point-by-point data: Please correct Table 1 to present the identification of 3 rhyolite shards and 1 rhyolite shard in samples 8-5 and 17-1, respectively. The analytical totals presented in the supplementary materials should also be included in Table 2, along with the exact number of analyses completed per shard for sample 14-1. This data is very important to include within the main text, particularly with regard to the consideration of possible Na-loss that may explain the discrepancies in correlation to the published data for the 1991 CE Cerro Hudson eruption visible in Figure 7.

Thank you for pointing out the typographical errors in Table 1. They will be corrected accordingly. We have indicated in Table 2 which values correspond to low analytical totals, and will direct readers to the analytical totals for all measurements provided in the supplementary info. We will also update Table 2 to include the number of analyses conducted that comprise the averaged composition values.

MBS-A glass morphology: The images presented in Figure 3 illustrate the sparsity of microparticles present in samples 14-1 and 17-9, however it is very difficult to see individual particles and inspect the general size and morphology of the volcanic glass shards present. Consider replacing these images, or including additional panels that present magnified images of some of the shards found in each sample. This would better support your descriptions of glass shard morphologies in section 3.1. From the current images presented, it appears like there is more material that could have been analysed. Furthermore, it would be helpful to see images of the sparse rhyolite shards, which could be included as additional panels or in the supplementary materials.

We will ensure the images in Figure 3 uses our best images at the highest resolution we have to demonstrate the shard morphology. Additionally, while there is a significant amount of material in the samples, EPMA analyses indicate that many of the particles in the sample are mineral grains, most likely from wind-blown terrestrial dust, rather than volcanic glass. Accordingly, we only present compositions for geochemically confirmed tephra. Additionally, while best efforts were made to section the majority of glass shards in the samples, as described previously, some of the small grains sit below the surface of the resin and were not able to be fully exposed during polishing without the risk of polishing away the already exposed shards. We will clarify in the text and figure captions that there is material present in the samples other than the glass shards conclusively identified as tephra (mineral grains, diatom fragments, etc.).

Source eruption dynamics: The discussion of source attribution could be further improved by providing more details about the proposed source eruptions for both englacial cryptotephra horizons discovered in MBS-A. For example, what was the estimated or known duration of these recent eruptions, maximum plume heights, and total amount of ash ejected? Some of this information is presented, such as in section 4.2.1, but could be summarised earlier when first mentioning the potential source eruptions. Differences in eruption duration, style, and magnitude between the proposed source eruptions (i.e., line 313) could be better used to support the source attributions, complementing the geochemical correlations and atmospheric modelling presented.

Detailed descriptions of eruption dynamics were initially left out for brevity; however we understand that they could be helpful to the reader. Published observation records exist for both the 1991 eruption of Cerro Hudson and several instances throughout the mid-1980's eruptive period of Mt Erebus. We will add text to the relevant subsections within section 4 to better describe the observed eruption dynamics of these eruptions.

Presentation of literature values: In the supplementary materials, please include the published EPMA data that was used to create the geochemical fields and reference points presented in Figures 6, 7, and 9. Where possible include the beam diameter and analytical totals for these published major element analyses. This information would be very useful to better understand the correlative similarities and discrepancies between the published reference data and new data presented by this study, for example, the discussion of rhyolitic glass compositions in section 4.1 (lines 224-228) and similarity to shards produced by the 1991 CE Pinatubo eruption.

We will update the supplementary materials to include a file with published EPMA data of literature values used in the figures in the manuscript.

Minor Comments:

Title: Consider referring to the Mount Brown South ice core array, acknowledging the work undertaken on both the MBS-Main and MBS-Alpha cores.

Thank you for the suggestion. We will consider updating the title to reflect the multiple cores used in the study.

Line 13: Make consistent with the abstract, consider changing to "Earth system".

We will correct this.

Line 17: Suggest inserting a full stop after eruption histories, and begin the next sentence with "Analyzing".

Thank you for the suggestion, we will revise these sentences.

Line 23: Include a reference to non-sea-salt conductivity (see Winstrup et al., 2019) as another soluble tracer used to identify volcanic horizons.

Thank you for the suggestion. This is not intended as an exhaustive list, we will consider adding further examples of soluble tracers.

Line 24: Replace "eruptions events" with "eruption events".

We will correct this.

Line 26: Tephra and cryptotephra.

We will correct this.

Line 33: Studies reported in this paragraph mostly refer to the discovery of cryptotephra rather than tephra. The terms are used interchangeably throughout the text, creating some confusion about the nature and number of (crypto)tephra horizons discovered in Southern Ocean-Antarctic palaeoarchives.

Throughout the manuscript, we use tephra as an umbrella term encompassing both visible and cryptotephra. We will update the text to be more specific in places in the text where confusion is likely to arise.

Line 35: Consider a reference to the identification of (crypto)tephra in blue ice areas, which are emerging as critical archives to help further develop and refine regional tephrochronological frameworks.

Thank you for the suggestion. We have limited our discussion here to ice core tephra, however we agree that blue ice tephra are an exciting emerging archive for tephrochronology work. We will consider adding reference to other Antarctic englacial tephra studies as well.

Line 36: Consider replacing "eruptions" with "sources". Remove the forward slash between "Aotearoa" and "New Zealand" (here and throughout the text), and include the macron in "Taupō".

These corrections will be made.

Line 44: Remove "short", as there are studies cited in this sentence that investigated a range of intermediate and deep ice cores, as noted in Abbott et al. (2024). Consider including explicit reference to some of the ice cores from higher resolution sites referred to, such as WDC06A.

Thank you for the suggestion. We will remove the specification of "short" and consider referring to specific cores in this section.

Line 48: Consider replacing "seen in Antarctic records" with "identified in Antarctic ice core records".

Text will be updated accordingly.

Line 50: Replace "Aoteroa" with "Aotearoa".

We will correct this.

Lines 51-52: I would recommend clarifying here that only some of the volcanoes from the common source regions for volcanic products identified in Antarctic ice have been active in the satellite era. The previous sentence and cited literature refer to volcanic sources that have not been active in the satellite era or even past 1,000 years (i.e., Taupō volcano).

We appreciate the suggestion and agree that the wording is unclear here. We will clarify that while relevant to our understanding of the types of volcanic signals found in Antarctic ice cores, some of these particular eruptions are out of the scope of the MBS shallow cores.

Line 53: Replace "deep" with "intermediate" when referring to the MBS-Main ice core, and replace "3" with "three". Round up "25 m" to "26 m", given that the depth of the MBS-Charlie firn core extends to 25.89 m depth.

The suggested changes will be made in the text.

Figure 1: Please consider increasing the size of the figure and including the location of other ice cores (e.g., WAIS-Divide, RICE, Law Dome, Siple Dome, Vostok, Talos Dome, Dome Fuji) and other volcanic source regions referred to in the text.

The final figure size will be decided upon final typesetting (two-column formatting, etc.), but we agree it should be large enough to be legible with all relevant information. We will add the locations of additional ice core sites and relevant volcanic sources to the final figure.

Line 64: Replace "site" with "location", and include an in-text citation to support the proposed claim of "known teleconnections across the region".

We will update the text and add references that support the teleconnections of the East Antarctic.

Line 65: Replace "Antarctic ice cores" with "the Antarctic ice core array".

We will correct this.

Line 74: Mean accumulation rates?

Yes - will be corrected.

Line 75: How do the mean accumulation rates compare for the MBS-Bravo and MBS-Charlie firn cores?

Thank you for raising this - in looking into this we have found an error in the text. The text will be updated to state that the mean annual accumulation rates are "0.309 ± 0.08 m yr^{-1} IE (ice equivalent) for the main core and 0.298 ± 0.07 m yr^{-1} IE for the MBS-Alpha core"

The accumulation rates are described in Crockart et al. (2021); the accumulation rate reported for MBS-Charlie is 0.295 ± 0.08 m yr^{-1} IE, and there is no published accumulation rate for MBS-Bravo. As we did not work directly with either MBS-Bravo or MBS-Charlie, however, we do not consider it necessary to include this in the text.

Lines 81-82, and throughout: Be consistent with the use of in-text citations throughout the text, see line 80 and line 105 for contrast. Consider removing brackets around year of publication and replacing the comma with a colon, for example: "(chemistry/trace impurities: Vance et al., 2024b; Harlan et al., 2024b)".

Thank you for pointing out the inconsistencies in referencing. We will refer to the Copernicus Publications style guide and update to ensure consistency throughout the text.

Line 98: Fine tune.

We will correct this.

Lines 99-100: Good consideration, was MBS-Alpha therefore chosen out of the three surface firn cores to be used for a particular reason? Provide an example of future analyses that may require large sample volumes, such as the analysis of sulfur isotopes, iron fertilisation, or trace metals.

We will add text to explain and justify our use of the MBS-Alpha core for this analysis as described in the reply to a similar comment made earlier in the reviewer comments above.

Line 105: First mention of the age model, consider replacing with "on the MBS2023 chronology". Please clarify in the text whether this chronology can be applied to all four cores.

We agree that this is an oversight - we will update the text to introduce the use of the Vance et al., (2024) MBS2023 chronology in section 2.1 of the text describing the MBS ice cores.

Figure 2: Missing step 4. Please correct the units used for cross-sectional area (e.g., step 1 [~2 cm2] and step 5 [~10 cm2]), and replace "Alpha" with "MBS-Alpha" in the step 3 caption. Insert a hyphen between "MBS" and "Alpha" in step 5. Replace "MBS main core" with "MBS-Main ice core" in the figure caption.

The identified errors will be corrected in the figure.

Line 112 and throughout the text: Insert hyphen, please check that this is consistent throughout the text and figures.

Will be corrected at this instance and throughout the text.

Line 123: Considering the use of a small beam diameter of 2 µm for EPMA-WDS please clarify what is meant by "tephra grains of suitable size". This will will help inform why some samples were discarded for further analysis.

This will be addressed as described earlier in this response document.

Lines 123-125, and throughout the text: Please check the text to ensure that acronyms are defined on their first use. The acronym EPMA is first used in the Figure 2 caption and again in line 123 without being defined until line 125, whilst the acronym SEM is not currently defined in the text. Please insert "scanning electron microscopy by energy dispersive spectroscopy (SEM-EDS)" in line 125, and clarify where the FEI MLA 650 ESEM was used (see lines 143-146 for contrast).

We will update the text to ensure acronyms are appropriately defined at first instance in the text.

Lines 130 and 132: Please define what is meant by high(er) resolution.

We will specify the resolution of our samples compared to the other studies referenced here.

Lines 139-141: Consider inserting a reference to the work of Winstrup et al. (2019), which quantified the seasonality of impurity influx to Roosevelt Island visible in the RICE CFA records using the RICE17 timescale. Further comparison could be drawn between MBS and Roosevelt Island given the coastal location of both sites, and the inherent challenges faced in locating volcanic horizons.

Thank you for the suggestion. We agree that a more thorough description of the seasonality of impurities seen in the ice core is warranted in this section. While the Winstrup et al. (2019) paper is an excellent description of seasonality of impurity influx at a coastal site, we think that it would be more appropriate in this instance to refer to Vance et al. (2024), which similarly presents the seasonality of impurities, as it is specific to the MBS site, and describes some of the complexities of MBS.

It is a good suggestion to refer to the Winstrup et al. (2019) Roosevelt Island work as comparison when it comes to coastal Antarctic ice cores, and we will consider incorporating reference to this into the discussion section.

Line 145: Five WDS spectrometers (see Table 2 caption for comparison).

We will correct this.

Lines 147-148: Please state here which elements were analysed.

The text will be updated to specify the elements analyzed.

Line 149: Provide a reference for the secondary glass standards used.

Reference for secondary standards will be provided.

Lines 152-153: Please revise this statement, as 27 of the 52 EPMA-WDS analyses presented in the supplementary materials have analytical totals <90 %.

We will update the text to be more specific when referring to how many samples have totals over 90%.

Line 158: Replace "based on the as recommended" with "as recommended".

We will correct this.

Line 161: HYSPLIT acronym first used in section 2.2 on line 92.

Will update the text to define the HYSPLIT acronym at first instance.

Line 170: BSE.

We will correct this.

Line 174: Consider referring to the sample ID rather than sample depths, for example: "Glass shards were most abundant in sample 14-1 (13.28-13.34 m depth)".

Thank you for the suggestion. We made the deliberate decision to refer to the samples only by depth and/or age, as the sample IDs are not useful to the reader without knowledge of their depth, and are explained in Table 1.

Line 175, and throughout the text: Be consistent with units, replace micron(s) with µm.

We will correct this for consistency throughout.

Lines 176-178: Please clarify as it is uncertain from the current wording if only one of the glass shards identified in this sample was found to be >10 µm in diameter (in this case ~15 µm).

You are correct that one shard was larger than 10 µm (~15 µm). The wording in the text will be updated to clarify this.

Table 1 Caption: Please clarify in the caption that this is a "Summary of the 12 MBS-Alpha core samples analyzed by EPMA-WDS", as a total of 48 of the 70 prepared samples were reported to contain volcanic glass shards. Here and throughout the text, please be consistent with the chosen expanded abbreviation for TAS (contrast presentation in the caption for Table 1 with that of Figures 4, 6, 7, and 9, as well as line 183).

Figure and table captions will be updated as needed.

Line 185: Consider reordering in order of particle abundance.

We will correct the text accordingly.

Line 186: One andesite.

We will correct this.

Line 187, and throughout the text: Ensure capitalisation for in-text references to the Tables, as with Figures.

Will update to ensure consistent capitalization throughout the text.

Line 190, and throughout the text: Please be consistent with reference to tables and figures, contrast with line 197 (Fig. vs. Figure).

The text will be corrected to ensure that it follows the Copernicus style guide for figure and table referencing.

Line 199: Trace element chemistry?

We are referring here to trace elements as well as trace ions.

Line 204: Replace "non-seasalt sulfate" with "non-sea-salt sulfate (nssSO4-2)", and revise accordingly in the text caption for Figure 5 and line 245.

The text will be updated accordingly.

Table 2: In the caption, replace "glass tephra shards" with "volcanic glass shards". Please consider using another symbol for particle 18-1_014.

The table caption will be updated accordingly.

Line 212: Majority? Only 12 samples analysed by EPMA-WDS of the initial 70. Does this refer to data from SEM-EDS not presented in this study?

The text will be updated to specify that here we refer to "the majority of tephra-bearing sample depth ranges."

Figure 4: Why not present sample ID rather than mean depths? The symbol used here for sample 18_1 is different to Table 2 but much easier to read.

We have chosen to refer to sample mid-depth throughout as the sample ID numbering system does not directly relate to depth, and thus does not provide meaningful information about the sample to the reader.

Figure 5 Caption: Water isotopes.

Figure caption will be updated accordingly.

Lines 242-243: Interesting discussion in section 4.1, which could be better supported by providing images of some of the rhyolite glass analysed by EPMA-WDS to illustrate their size and morphology in comparison to the proposed primary dacite and phonolite populations.

Where possible, we will include BSE images of additional samples in the supplementary materials.

Line 247: Delete additional space in "sample , we".

We will correct this.

Line 257: What literature values? Please provide a reference.

References will be provided earlier in the sentence to clarify the literature values used.

Line 271: Remove "13.3" and replace with "1991".

We will correct this.

Line 274: Reported literature values.

We will correct this.

Line 295: Please revise the Cerro Hudson eruption dates to "August 8-15, 1991".

Date will be corrected.

Lines 328-331: I would also recommend referring to the age of the ice that the dacite cryptotephra was found within relative to the nssSO42- peak of Pinatubo (i.e., the MBS2023 chronology and trace impurities from Figure 5). These are convincing lines of supporting evidence for your proposed source attribution.

> *We have chosen not to rely on this line of evidence, as the two-month period between the eruptions of Pinatubo (June) and Cerro Hudson (August) is below our ability to resolve based on dating uncertainty and the ~5 cm samples used for this work. We will update the manuscript to include this reasoning.*

Line 333: Replace "volcanoes" with "volcanic eruptions".

> *This will be corrected in the text.*

Figure 9: It is difficult to read and distinguish some of the published values from the presented values. Please consider including the cited data used here within a supplementary file.

> *As indicated previously, the supplementary data files will be updated to include literature values where possible.*

Line 374: The 1985 cryptotephra, please be consistent throughout (see line 376).

> *The text will be corrected to ensure consistent phrasing.*

Lines 375-377: Excellent point, but it is likely that the shards are too small to analyse for trace element compositions by LA-ICP-MS.

> *The shards may be small for trace element analysis by LA-ICP-MS, but we will retain this point in the text as other techniques (possibly synchrotron XFM?) or future technological developments may make these measurements possible.*

Line 411: Such as? Please state what eruptions you are referring to here - are they the eruptions presented in line 432?

> *Here we refer to Table 3 in Vance et al., 2024. We will update the text to reflect this.*

Line 416: MBS as a cryptotephra archive.

> *We will correct this.*

Section 5.3. There are some intriguing claims and findings proposed, however I find this section of the discussion difficult to follow as it lacks the clarity and structure of previous sections.

> *We appreciate the feedback. We will carefully review and check section 5.3 for clarity.*

Line 480: 42 volcanic glass shards.

> *Will update the text to be more specific here.*

Line 481: Please revise this sentence as only 13 shards were reported from sample 14-1 (1991 CE) and this is not an entirely homogenous population (with 12 dacite and 1 andesite shards analysed).

Text will be updated to correct the typo and clarify that the populations are "largely homogeneous."

Reference List: Please check each reference to ensure that no key elements are missing, such as author names, the DOI, page numbers, volume number, and journal titles. There are inconsistencies and minor errors throughout the reference list that need to be addressed.

The reference list will be reviewed and corrections will be made as needed.

Supplementary Materials, MBS-Alpha Glass Worksheet: Please revise the caption to reflect that the analyses were completed on samples from the MBS-Alpha core. Apply subscript for element titles, align the column headings with the data presented below, and please make the cited reference consistent with the presentation and format used in the main text. Is there a data point missing for sample 14-1_025a?

Corrections to the spreadsheet will be made as needed.

Supplementary Materials, Secondary Standards Worksheet: Could you please clarify which MBS-A EPMA datasets the three analytical sessions and therefore secondary standards data presented align with.

Supplementary data will be updated to include the analytical sessions corresponding with secondary standards data.

References:

Crockart, C. K., Vance, T. R., Fraser, A. D., Abram, N. J., Criscitiello, A. S., Curran, M. A. J., Favier, V., Gallant, A. J. E., Kittel, C., Kjær, H. A., Klekociuk, A. R., Jong, L. M., Moy, A. D., Plummer, C. T., Vallelonga, P. T., Wille, J., and Zhang, L.: El Niño–Southern Oscillation signal in a new East Antarctic ice core, Mount Brown South, Climate of the Past, 17, 1795–1818, https://doi.org/10.5194/cp-17-1795-2021, 2021.

Innes, H. M., W. Hutchison, and A. Burke.: Geochemical analysis of extremely fine-grained cryptotephra: New developments and recommended practices, Quaternary Geochronology 83, page 101553. https://doi.org/10.1016/j.quageo.2024.101553, 2024.

Vance, T. R., Abram, N. J., Criscitiello, A. S., Crockart, C. K., DeCampo, A., Favier, V., Gkinis, V., Harlan, M., Jackson, S. L., Kjær, H. A., Long, C. A., Nation, M. K., Plummer, C. T., Segato, D., Spolaor, A., and Vallelonga, P. T.: An annually resolved chronology for the Mount Brown South ice cores, East Antarctica, Climate of the Past, 20, 969–990, https://doi.org/10.5194/cp-20-969-2024, 2024.

Winstrup, M., Vallelonga, P., Kjær, H. A., Fudge, T. J., Lee, J. E., Riis, M. H., Edwards, R., Bertler, N. A. N., Blunier, T., Brook, E. J., Buizert, C., Ciobanu, G., Conway, H., Dahl-Jensen, D., Ellis, A., Emanuelsson, B. D., Hindmarsh, R. C. A., Keller, E. D., Kurbatov, A. v., … Wheatley, S.: A 2700-year annual timescale and accumulation history for an ice core from Roosevelt Island, West Antarctica, Climate of the Past, 15(2), 751–779. https://doi.org/10.5194/cp-15-751-2019, 2019.