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Corrigendum to "New insights into the ∼ 74 ka Toba eruption from sulfur isotopes of polar ice cores" published in Clim. Past, 17, 2119–2137, 2021

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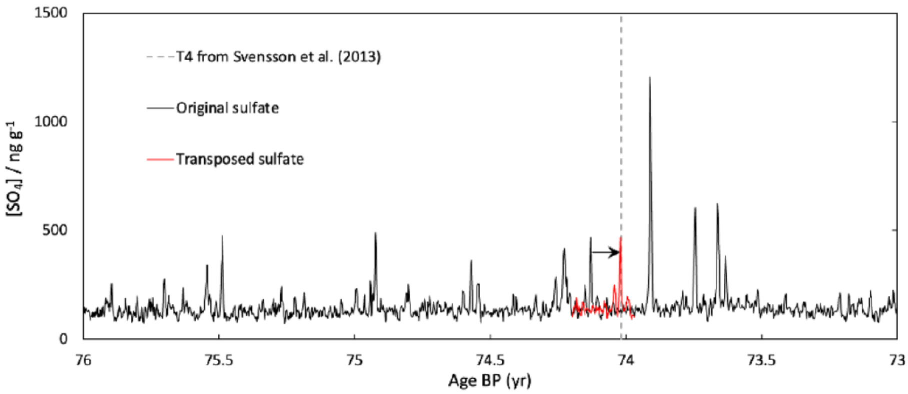
Since publication of "New insights into the 74 ka Toba eruption from sulfur isotopes of polar ice cores" it has come to light that a section of the EPICA Dome C (EDC) ice core was misplaced during initial analysis. As such we have made minor revisions to our original data. It appears that prior to continuous sulfate analysis, two consecutive 1.1 m sections of ice were swapped. This is evidenced by the mismatch between the peak electrical conductivity measurement (ECM) and dielectric profiling (DEP) in the EDC core at the T4 Toba candidate depth and the lack of a corresponding sulfate concentration peak; this disparity has been shown in previous studies (Svensson et al., 2013, their Fig. 8).

If the sulfate concentration profiles for the two 1.1 m sections at this depth are transposed, we observe a shift in the position of the sulfate peak that now aligns with the depth proposed for the T4 peak in EDC from ECM data, this shift is demonstrated in the figure graphic on the next page. Original (black) and transposed sections (red) of sulfate from the EDC ice core over the Toba period are shown, and the dashed grey line indicates the position of T4 on the AICC2012 age model determined by Svensson et al. (2013) from ECM data. The black arrow indicates the shift of the sulfate peak originally identified as T4b, which we now propose is the deposited sulfate from T4 in EDC.

Further, we find that the peak in sulfate aligns with the sulfate peaks of T4 in other ice cores, such as EDML and NGRIP (see the amended Fig. 1). This section of ice has been analysed for sulfur isotope composition and was originally identified as a peak in sulfate between T4 and T5 in EDC, labelled "T4b" in this study. We propose that we have in fact analysed T4 in EDC. Although this does not alter the conclusions of this study, we submit the following updated results regarding T4 in EDC. We are grateful to Mirko Severi for identifying this issue, and further information is available from the original dataset (Severi et al., 2022). The changes to the samples in this study are presented in the table on the next page. The table shows corrected depths for the six samples affected by sulfate data transposition, also showing the change in sample depth and the corresponding change in age in the AICC2012 age model, along with the continuous fast ion chromatography (FIC) sulfate data and the discrete sulfate concentrations measurements undertaken at the University of St Andrews.



Sample	Original depths (m)	New depths (m)	Original ages (ka)	New ages (ka)	Measured sulfate ($ng\,g^{-1}$)	FIC sulfate ($ng\,g^{-1}$)
EDC537	1083.28	1082.18	74.118	74.006	146.03	130.15
EDC538	1083.32	1082.22	74.122	74.010	184.74	154.48
EDC539	1083.36	1082.26	74.126	74.014	239.83	191.67
EDC540	1083.40	1082.30	74.130	74.019	430.68	439.25
EDC541	1083.44	1082.34	74.134	74.023	186.88	257.92
EDC542	1083.48	1082.38	74.138	74.027	135.19	130.94

We have amended Figs. 1–3 and 7 from the original article to reflect this correction and have made minor changes to Fig. S2 and Table S1 in the Supplement.

When T4 in EDC is considered alongside T4 in EDML, we observe a similar δ^{34}S signal evolution with a minimum value of +3.6 ‰, with +0.40 ‰ measured in EDML. The primary difference is that for T4 in EDML we measured a non-zero mass-independent fractionation (MIF) value of −0.40 ‰, whereas in EDC for T4 the MIF for all samples was within an error of zero (see amended Fig. 3d below). As we do not see a correlation between $\delta^{34}S_{volc}$ and $\Delta^{33}S_{volc}$ for T4 in EDML (see Fig. 4b in the main text), we propose that the T4 sulfate peak is the result of an extratropical, stratospheric eruption.

Corrections to the main text

Abstract, sentence 5, "11 of these potential Toba sulfate peaks" should be "10 of these potential Toba sulfate peaks".

Section 2, paragraph 1, sentences 3–5, should now read "Six of the candidate peaks have also been identified in the EDC core sulfate record. Samples from EDC included Toba candidates T1, T2, T3, and T4".

Section 3, paragraph 3, sentence 3, "as well as T4 from EDML" should be "as well as T4 from EDML and EDC".

Section 3, paragraph 7, sentence 2–3, should now read "T4 in EDC had the lowest sulfate deposition of the Toba candidates in the sampled peaks from EDC at 26 $mg\,m^{-2}$. T4 in EDC was the only peak in this study where all samples had Δ^{33}S values within 2σ of 0 ‰".

Section 4.1, paragraph 1, sentence 3–4, should now read "The only event that had a zero S-MIF was T4 in EDC. This result suggests that only the tropospheric sulfate component associated with this eruption was deposited at EDC. Given the non-zero S-MIF at T4 in EDML it may have been a local, stratospheric eruption that deposited a small amount of tropospheric sulfate at EDC and both stratospheric and tropospheric sulfate at EDML".

Section 4.1, paragraph 2, sentence 1–2, should now read "For the four peaks that were measured in EDC and EDML (T1–T4), there is good agreement in the S isotope records between the two cores (see Fig. 3). For T1–T3 EDC δ^{34}S and Δ^{33}S are consistently more negative than those measured in EDML".

Section 4.1, paragraph 6, sentence 5, should now read "In the case of T4, this could help explain why the sulfate isotopic composition in EDC is indicative of tropospheric origin if a large portion of the sulfate from T4 was deposited directly via the upper troposphere/lower stratosphere".

Amended figures

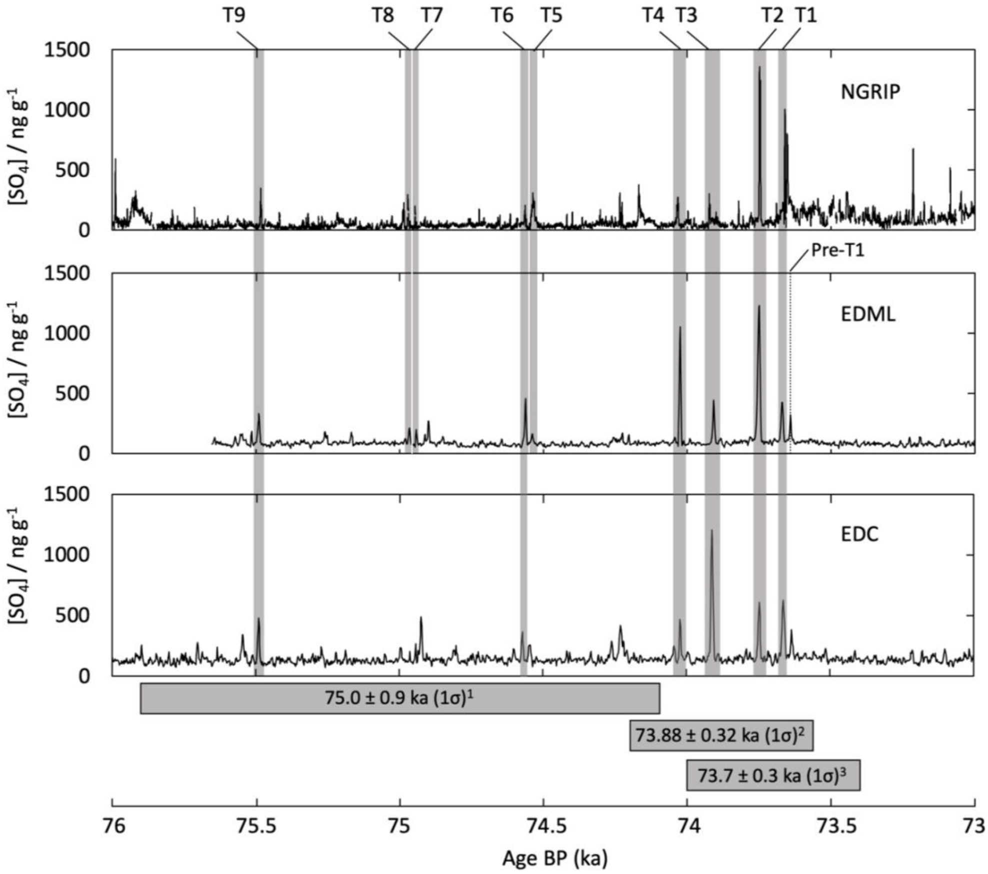


Figure 1. Toba candidates identified in both Greenland (NGRIP) and Antarctic (EDML, EDC) ice cores by Svensson et al. (2013). Sulfate concentration data from Svensson et al. (2013) (NGRIP and EDML) and Sparks et al. (2021) (EDC). The AICC2012 ice core chronology (Bazin et al., 2013; Veres et al., 2013) was applied to both Greenland and Antarctic ice cores. The dotted line indicates the additional Pre-T1 peak measured in EDML. The age estimates for the Toba eruption from (1) Mark et al. (2014), (2) Storey et al. (2012), and (3) Mark et al. (2017) are represented by horizontal bars indicating 1σ for each date. Note that the stated uncertainty in AICC2012 dates at this period is around 1500 years.

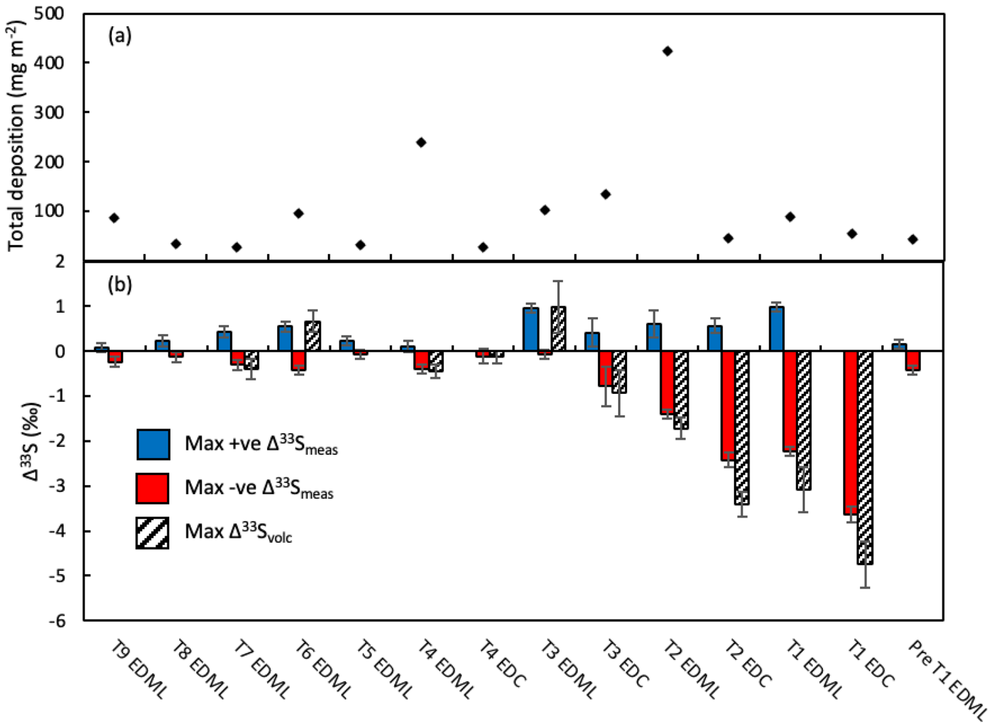


Figure 2. Total deposition and Δ^{33}S data for the 14 Toba candidate peaks. Panel **(a)** shows the total deposition for each peak. **(b)** Filled bars show the maximum positive and negative fractionations measured. Patterned bars indicate the maximum magnitude $\Delta^{33}S_{volc}$ determined by isotopic mass balance for each peak with samples with $f_{volc} \geq 0.65$; one data point from T3 in EDML with $f_{volc} = 0.63$ has also been included. The 2σ errors have been included for $\Delta^{33}S_{meas}$ data, and propagated 1σ errors have been included for $\Delta^{33}S_{volc}$.

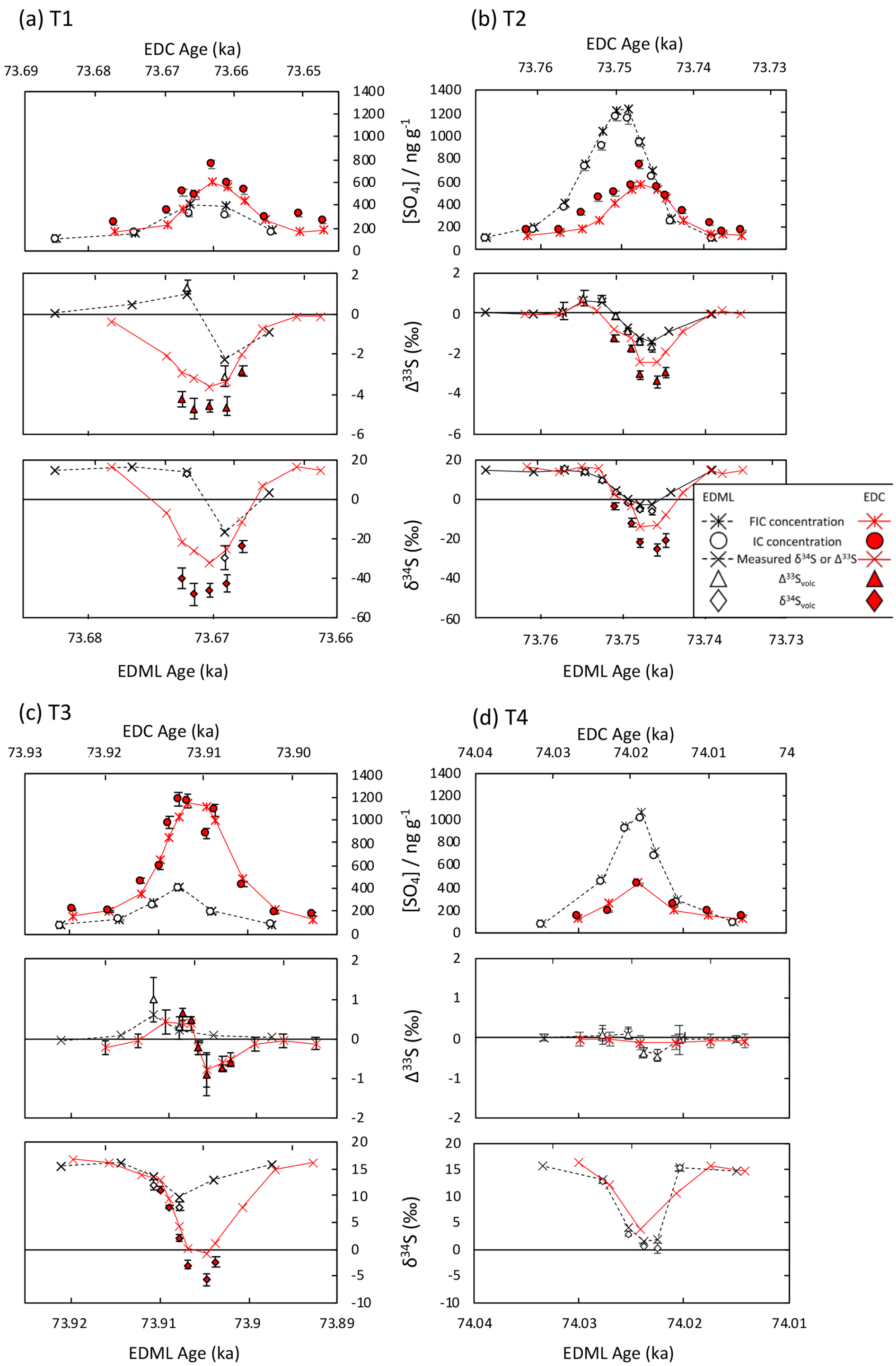


Figure 3. Sulfur isotopes in sulfate from T1, T2, T3, and T4 in both EDC and EDML. Red lines and filled symbols are data from the EDC ice core, and black represents EDML. Both FIC (lines) and IC (points) data have been plotted for concentration. Lines on the isotope plots show measured values, and symbols are background corrected data where $f_{volc} \geq 0.65$, as well as one point from T3 in EDML with $f_{volc} = 0.63$. Error bars indicate 2σ for measured ratios and 1σ for background corrected ratios. Where error bars are not visible, the error is smaller than the symbol. Peaks have been aligned visually based on the isotope records, and this results in minor (< 15 years) differences in the AICC2012 age model alignment between the two cores. Note the different scale for the isotopic data in **(c)** and **(d)** compared to **(a)** and **(b)**.

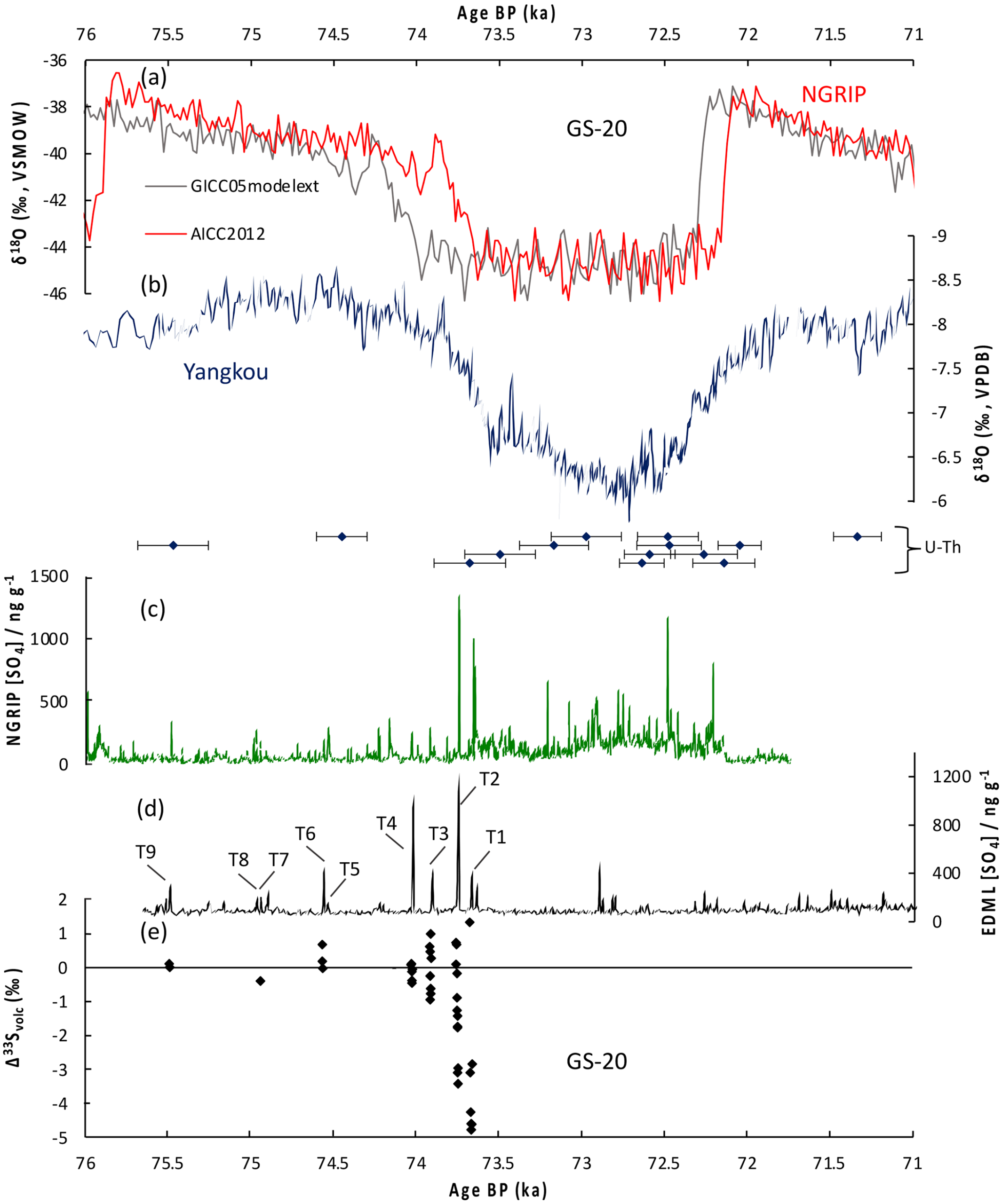


Figure 7. Paleoclimate indicators across GS-20 (highlighted in blue based upon NGRIP δ^{18}O with the transition in purple). All ice core data are plotted using the AICC2012 age model unless indicated otherwise. **(a)** Ice core oxygen isotope data from NGRIP (North Greenland Ice Core Project Members, 2004) on both the AICC2012 age model (red) and GICC05modelext age model (Wolff et al., 2010b) (grey). **(b)** The δ^{18}O speleothem records from Yangkou, China; the U-Th age data for Yangkou has also been included (blue diamonds), along with their associated 2σ error (Du et al., 2019). Continuous sulfate concentration in NGRIP **(c)** and EDML **(d)** (Svensson et al., 2013). **(e)** $\Delta^{33}S_{volc}$ measured for Toba candidates in this study.

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