

Response to Reviewer #2

We thank the reviewer for the careful reading of the manuscript, the positive assessment, and the helpful suggestions.

General comment – elevation versus local glaciological controls

AC: We agree with the reviewer. Our intention was not to imply that the importance of local glaciological and topographic conditions is a new finding. Previous studies have already shown that these factors play an important role in the preservation of old ice.

We have therefore reformulated this statement. The revised text now emphasizes that the main novelty of the Tödi record is its marked deviation from the previously proposed empirical age–altitude relationship and the resulting limitation of elevation alone as a predictor of basal ice age.

Line 62 – Spagnesi et al. (2026)

AC: Thank you for the suggestion. We have added Spagnesi et al. (2026) at this point in the manuscript.

Line 93 – lowermost 83 cm of TÖ23-BH1

AC: We agree that the transition was not sufficiently clear. We have revised the text to state explicitly that this passage refers to the lowermost 83 cm of TÖ23-BH1, consisting of 72 cm recovered in one drilling run and a further 11 cm recovered immediately before reaching bedrock.

Lines 125–135 – core-cutting schematic

AC: We agree that a schematic would make the cutting procedure and the cutting ratios easier to understand. We have therefore added a schematic of the core-cutting procedure to the Supplementary Information.

Line 145 – temporal applicability of ^3H

AC: Tritium (^3H) dating, as applied here, operates on a fundamentally different premise compared to ^{210}Pb and ^{14}C dating. Here, ^3H is used as a time-stratigraphic marker associated with the large amounts of tritium released into the atmosphere by thermonuclear weapons testing during the 1950s and early 1960s (before the Limited Nuclear Test Ban Treaty was enacted). The ^3H injected into the stratosphere and subsequently entering the hydrological cycle via precipitation produced a characteristic temporal signal in snow and ice. Thus, unlike ^{210}Pb or ^{14}C , the age information provided by ^3H derives from signal detection and the known timing of the anthropogenic atmospheric input, and not from calculating an age based on radioactive decay of an initial natural baseline activity and the half-life of the isotope. Nevertheless, it is true that the deposited ^3H continues to decay after deposition; the 12.3-year half-life affects the present-day detectability of the signal, which also depends on the initially deposited activity concentration and the detection limit of the analytical method. We therefore consider it most appropriate for this study to describe ^3H as providing dating information relative to the thermonuclear weapons testing era, rather than assigning it a conventional radioactive-dating range based solely on its half-life. In the revised manuscript, we will rephrase accordingly for clarification.

Line 421 – abbreviation “CG”

AC: Corrected as suggested. The full glacier name is now given in the text for consistency.