

The Cryosphere Discuss., referee comment RC2  
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## Comment on tc-2022-18

Anonymous Referee #2

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Referee comment on "Cosmogenic nuclide dating of two stacked ice masses: Ong Valley, Antarctica" by Marie Bergelin et al., The Cryosphere Discuss.,  
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### Summary

This paper describes cosmogenic nuclide dating of buried ice masses in the Ong Valley, Antarctica, based on measurements from an almost 1000cm deep ice-sediment core. The main goal is to constrain the age of these (very old) ice masses. In order to achieve this, an exciting new forward model is presented that uses multiple cosmogenic nuclides measured in sediment samples throughout the core to constrain the age using some simple principles and assumptions. The dataset, model, and approach here will all obviously be important contributions to the scientific literature and I look forward to seeing these published. Although there are a few things that could be clarified (or reorganized?), in general this was a very rigorous treatment of the topic and all the information was provided here in order to fully understand the calculations and model (including available, well-commented code). The conclusions are based strongly on the data and the clearly stated assumptions and the conclusions are put fully in context of other publications and are aligned with the relevant uncertainty on the final results.

### Specific Comments

At several points, I had questions on various things (density, grain sizes, steps in a process), but they all ended up getting covered later in the manuscript. However, the number of notes I had like this might mean that there is some reorganisation that could help.

L221-222: already introduced cosmo terminology (including proper superscripts), so probably easiest to follow that here.

L277-278: The description of the factors that the supraglacial debris layer depends on clearly lists 4 factors, including concentration of debris in ice. The forward model presented immediately after this mirrors these factors except for the debris concentration. This was confusing until it gets explained significantly later in the paper. It would be useful to explain why this is not considered here (or that the 'missing parameter' will be explained later?).

Description of eqns (starting ~300): Not quite sure what all the subscripts were ( $E_T$ ,  $Z_T$ ) and the text wasn't consistent on parameters in italics, etc. (not huge, but slightly confusing). Could explain meaning up front (if relevant)

L489: Describing two observations – 'the set of samples that display monotonically decreasing nuclide concentrations' was a bit confusing because I didn't initially realise that these were being considered across the entire profile and not just within the different layers that had been identified (albeit identified using the nuclide concentrations?). Might help to specify.

Figure 7: I absolutely love this figure! I did wish that I could see the zoom in of the S1 somewhere (to see the profile there). Also, the horizontal/vertical boxes (clearly visible in Ne the best) are not explained (I assumed horizontal width was uncertainty, but not sure what the different horizontal lines are? Divisions between samples that were combined?)

L524: Not sure what the surface sample is referring to – S1, E1 and E2 are all perfectly clear here. Perhaps refer back to the appropriate section/table since this hasn't been recently discussed.

L546: Are there samples that are not used for forward model fitting that are NOT in the recycled surface material? Not sure if I missed something here...

Figure 11: The red dots are very hard to see (tiny and almost covered by label text).

The majority of the paper is very easy to understand, but there are some sections where a bit of editing might help readability (extra commas needed, small edits to grammar: e.g. L529 'as follows' instead of is following). Nothing huge, but a few times where I had to read a sentence twice to figure out clauses, etc.