Dear Editor,

We express our sincere gratitude to the reviewer for their careful and comprehensive evaluation of our paper. Responses to the additional points, along with the revisions made to the manuscript, are presented below.

The line numbers refer to the track changes file

I appreciate the author's responses to my questions and comments on the last version, and I am happy to see that my question about Ra-228 ratios has helped support the paper's conclusions. I have only a few minor comments on the revised version, outlined below. In particular, related to newly added discussion of the 228/223 ratios, I suggest the authors add a bit more explanation to clarify what makes ADE-1 different from ADE-17 in terms of diffusion timescales (see my comment related to line 649 below). Line numbers are in reference to the tracked changes document.

Line 19: Parent isotopes need to be updated to reflect the change from 226/224 to 228/223

Thanks, we changed it (Line 19).

Line 20: "…have Na/Cl…" should be "…has Na/Cl…"

Thanks, we changed it (Line 20).

Lines 640-645: I cannot reproduce the values given for this calculation. I get a range of 10,000-40,000 dpm/L rather than the 5,000-30,000 that the authors report. Please double check the math and/or consider providing an equation to make the calculation easier to follow. Also, is the 50% emanation referring to release to pore space via recoil, or to the amount of Ra that avoids being adsorbed?

Thanks for the question. Actually, the exact numbers do not matter so much. Please see attached calculation.

230Th	4	4	8	8	dpm/g
dry density	2.5	2.5	2.5	2.5	g/cc
porosity	0.25	0.5	0.25	0.5	
226 production	30000	10000	60000	20000	dpm/l
emanation	0.5	0.5	0.5	0.5	
226 released (supposedly	15000	5000	30000	10000	dpm/l
*note that with a 0.25 porosity, the ratio of solid (75%) to pore space is 3:1, and with 0.5 it is1:1					

Line 647: should “shoes” be “those”?

Thanks, we corrected it (Line 552).

Line 649: What is a possible explanation for the slower diffusion here? Would a more frozen pore space slow it down, or a different water:rock ratio result in more adsorption? Another sentence or two of explanation is needed to help explain the hypothesis here, because my understanding is that these cores were collected very close together so it is difficult to imagine why they might have such different isotope behavior.

Correct. We now elaborated on this text, as follows.
“Diffusion time constraints are further illustrated by the ground ice in ADE-1. While (226Ra/slRa)AR in this core are similar to shoes in ADE-17, its (^{228}Ra/^{sl}Ra)AR are actually very similar to those of ADE-2. This probably means that in this location (within 10’s meters) ^{228}Ra from inside the grains did not make it to the pore space. This should have to do with somewhat slower diffusion, which could be due to slightly different cryogenic conditions (e.g. less liquid water)” (Lines 554-555).
Please note that as we show in Figure 13, more liquid water should lead to enhanced diffusion, even if very high adsorption is considered.

Figure 8: filled black circle symbols on panel c are larger than the same symbols on panels a-b

Thank you for that one, it is now fixed.

Table C2: There are still some cells that have “—“ instead of NA or ND; please fill in the appropriate code to indicate why the data is missing here.

Thank you for that comment. It is now fixed in Table C2 and Table C1.

Figure 13: In the caption, 4 and 6 should be superscript in the last sentence (10^4 - 10^6, not 104-106). Also, it appears as if the figure is a screenshot because the cursor can be see after the superscript 6 on the bottommost line label (and that line is highlighted green, I’m not sure if that is intentional).

Thank you it is now fixed.