Dear Editor,

Thank you again for your prompt and careful decision on our manuscript. For your convivence, here is a list of relevant changes made in the manuscript:

Text changes:

- Throughout text changed "ellipsoid" to "ellipsoidal" (per Rich Ketcham's comment)
- Throughout the text (after Sect. 6.3) changed the subscripts to reflect the change from the "orig" and "new" subscripts to "2D" and "GCM" (per Rich Ketcham's comment)
- L18: removed hyphen
- L106: changed "renders" to "renderings from CT data"
- L149: changed "mineral diffusion" to "helium retention" and edited sentence to say "…helium retention can depend on grain size, which must therefore be…"
- L160: changed software citation style (per Rich Ketcham's comment)
- L220: changed "is based on" to "was designed to be representative of…"
- L313-322: added a sentence and clarified previous text to describe how we measure the minimum width of apatite grains (per Christoph Glotzbach's comment)
- L399: changed software citation style (per Rich Ketcham's comment)
- L414: changed "Like" to "As"
- L431: changed "like" to "such as"
- L503-508: added a sentence to describe why our 2D minimum width measurements are smaller than the 3D minimum width measurements (per Christoph Glotzbach's comment)
- L514: added text to figure caption to clarify 1:1 line.
- L544-546: added a sentence to address how our measurement of the minimum width impacts the "both widths" correction.
- L1094: made "grains" singular (grain)
- L1105: added a bullet point under Step 2 to clarify why measuring your grain is a necessary step.
- L1591: updated He and Reiners (2022) citation to include journal information.

Figure changes:

- Figure 1: changed "ellipsoid" to "ellipsoidal" in the labels
- Figure 3: changed "ellipsoid" to "ellipsoidal" on the axes
- Figure 4: changed "ellipsoid" to "ellipsoidal" in the labels
- Figure 6: Updated the axes so that for each plot the x and y axes are the same, making it clearer that the line is a 1:1 line & changed "ellipsoid" to "ellipsoidal" in the legends
- Figure 7: changed "ellipsoid" to "ellipsoidal" in the legends
- Figure 8: Updated the axis titles to reflect the change from the "orig" and "new" subscripts to "2D" and "GCM".
- Figure 9: Made clarifying changes (removed the split in Box 2; added text to Box 4 and 5) based on Rich Ketcham's comment
- Figure B1: changed "ellipsoid" to "ellipsoidal" on the axes

- Figure C1: changed "ellipsoid" to "ellipsoidal" in the legends
- Figure D1: changed "ellipsoid" to "ellipsoidal" in the legends

Table changes:

- Table 3: changed "ellipsoid" to "ellipsoidal"
- Table 4: changed table headers, table title, and table caption to reflect the change from the "orig" and "new" subscripts to "2D" and "GCM".
- Table E1 (L1338-1449): changed table headers, table title, and table caption to reflect the change from the "orig" and "new" subscripts to "2D" and "GCM".

Below you will find our point-by-point response to each of the reviewer's comments in bold.

Thank you,

Spencer Zeigler

Report #1: Christoph Glotzbach

Dear Dr. Glotzbach,

We would like to thank you again for your prompt, detailed, and thorough review. Below, we respond to your points with the line numbers of the changes.

Dear Authors,
First of all, I would like to thank you for seriously going through my comments and corrections (and those of the other reviewer). I only have a single point that I would like to be addressed by the authors:
Thanks for showing your minimum width measurements compared to the minimum values from the CT data, but why are your manual measurements smaller than the CT data? 2D microscopic measurements cannot be smaller. I agree with you that it is difficult to orient the crystals to see/measure the minimum width and that it is very likely to measure something in-between the maximum and minimum width (but not smaller!). Since your measurements of the minimum width are 'too small', the resulting V, FT and RFT underestimate the real values. You are using this to argue in the discussion that it does not reduce the inaccuracy of the data, but instead, corrections and uncertainties are higher. Please explain why you have 'too small' minimum widths, which, as this point, shows me that you did something wrong during the measurement. Please clarify and correct if necessary, and based on this, I would ask you to adopt your argumentation.
We are glad you brought this point to our attention! In order to address this comment, we added clarifying language to several sections:

Sect 4.2 (L313-321)
"This was followed by attempting to roll the grain 90°, acquiring another grain photograph, again measuring the long axis using the Leica software to obtain a second

length measurement, and estimating and measuring the apatite's "minimum width". Typically, the minimum width that was measured was less than the observed width following grain rotation, because it challenging to efficiently position the grain such that its true minimum width is perfectly visible for measurement in the field of view. This difficulty of rotating and stabilizing the grain for a photograph while the grain is balanced on its minimum width axis makes it difficult to determine and measure the apatite's minimum width accurately. For rounded grains (GEM C, ellipsoidal idealized geometry), the length and widths can be particularly difficult to identify."

Sect 5.1 (L503-509)

"The systematic 2D underestimation of the minimum width is because the analyst was aware that the observed width of the grain after attempting to roll it 90° from the maximum width position (Sect. 4.2) was larger than the apatite's actual minimum width, and then overcompensated for this fact by acquiring a measurement that was not only smaller than the observed width but also inadvertently smaller than the true minimum width."

Sect 5.2 (L544-546)
"The underestimation of 2D values when using both widths is due to microscopy measurements that systematically underestimate minimum width values (see Sect. 5.1)."

I hope you find my comments and suggestions helpful.
We did, thank you!

Technical corrections:

Line 462-464: You stated before that it is difficult to measure the minimum width of a grain, and I fully understand that. But why are your 2D measurements smaller than the CT data's minimum width? It should be the opposite, and I hope you have a reason for it (I do not have one). This also leads to underestimating the volume, Ft and SER in Fig. D1.
See above response.

Line 494-496: The reason for this is very likely the 'too' short measurements of the minimum width (see the comment before).
Thank you for this point; we agree and have added a sentence to section 5.2 (L544-546) to clarify this, as noted above.

Report #2: Rich Ketcham

Dear Dr. Ketcham,
Thank you for your prompt and helpful review.

That additions have improved the paper, and I recommend it's publication. I only have a few final, minor comments and suggestions.
Line numbers are based on the manuscript with changes marked (egusphere-2022-1005-ATC2)

[line 19] Replace hyphen in "computed-tomography" with a space.
Done.
[line 129] Change "renders" to "renderings from CT data"
Done.
[line 190] Change "mineral diffusion" to "helium retention"
Done.
[line 191] Consider changing to "… can depend on grain size, which must therefore be included…"
Done.
[line 202] Software citation still odd. I recommend giving the citation for each after the name on line 201, and using (Object Research Systems, v.2020.2) for Dragonfly.
Thank you for catching this again, we have made this change!
[line 283] Consider replacing "…is based on the size distribution…" with "was designed to be representative"
Done.
[line 515-516] Same comment as for line 202
Done.
[line 530] Change "Like" to "As"
Done.
[line 544] Change "like" to "such as"
Done.
[Figure 6 caption] What are the lines – 1:1, or fits? Please specify (it's hard to tell because the x and y axes don't match).
Done.
[line 701] Here you use "ellipsoidal" rather then "ellipsoid", as in the rest of the paper. You can either change this one, or change all the others. "Ellipsoidal" seems preferable, as it's an adjective.
We agree with your suggestion and the change to 'ellipsoidal' has been made throughout the text, figures, and tables.
[line 1012] "New" is sort of a funny term and subscript to use in the subsequent text and figures, as it's not very descriptive; it's OK in the immediate context of this paper, but it would odd down the road to report one's measurements as "new". Maybe something to indicate it's a corrected value would be better, such as a "corr" subscript, or even "GCM".
Excellent suggestion! We have made this change throughout the text/figures.
[line 1175] Change "grains" to "grain", as you use the singular for the rest of the description.
Done.
[Figure 9] Why does the Step 2 box separate medium and large grains? I can't see where that distinction changes how the grain is subsequently treated; if it doesn't, it's confusing to have it in the workflow. If it does change something, specify it.
We agree that this is confusing, we made clarifying changes to both the figure and the accompanying text.