Geochronology Discuss., referee comment RC2
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Comment on gchron-2022-7

Anonymous Referee #2

Referee comment on "Technical note: Rapid phase identification of apatite and zircon grains for geochronology using X-ray micro-computed tomography" by Emily H. G. Cooperdock et al., Geochronology Discuss., https://doi.org/10.5194/gchron-2022-7-RC2, 2022

This manuscript presents a detailed description of a microCT method for distinguishing apatite from zircon. The authors clearly lay out an optimized methodology, along with excellent figures that illustrate various aspects of the data and measurements. Besides some suggestions that I provide below for clarification, I have no issue with this manuscript being published. I appreciate the authors' efforts to develop another way to use microCT together with geochronology methods. However, I'm skeptical this method will be widely adopted for distinguishing apatite from zircon. The authors might consider shifting the manuscript emphasis in places, as suggested below, to potentially make this contribution more impactful.

- In my view the problem being addressed (distinguishing apatite from zircon in mineral separates) is greatly overstated. In the vast majority of circumstances, it isn't challenging to distinguish apatite from zircon under the microscope after separation with LST. These minerals are distinct in morphology, relief, and other properties. Even for newbies, after a few hours of getting one's eyes calibrated at the microscope, it is not particularly difficult to distinguish these mineral phases. It arguably becomes more important for detrital mineral suites – it may be effective for the authors to specifically emphasize this challenge, rather than trying to argue that this is a routine problem when it really isn't and most reading this paper will know this.
- Agreed that performing mineral separation with toxic chemicals is undesirable, but again this strikes me as overstated given that one can alternatively use LST and then i.d. the minerals typically without too much trouble.
- Although not emphasized in the abstract or introduction, elsewhere in the paper the authors highlight attempting to distinguish apatite from titanite with microCT. These phases are even easier to differentiate than apatite and zircon, with titanite typically coming off at a more magnetic level on the frantz than apatite. It may be better to

eliminate this comparison in this paper entirely.

- It would be helpful to provide some estimate of the total time required per grain (including mineral selection, mount making, analysis, data reduction) to 1) use the proposed microCT method to distinguish different mineral phases and 2) additionally identify inclusions and acquire grain geometry information.
- Is the microCT method for mineral i.d. faster than alternative analytical methods that could be used to identify these phases? For example, in my experience, mineral identification using an EDS system on an electron microprobe or SEM requires only a few minutes to place individual crystals on carbon tape and then seconds per grain for EDS identification. This seems faster than the microCT method described here, and EDS systems are more common and therefore more accessible than microCT systems. If this is incorrect, then it would be helpful to clarify this in the paper.
- If one is going to the trouble of making the mount, then why not use the longer scan times to acquire the additional information about inclusions and grain geometry? This strikes me as a more compelling reason to use this method, and could be emphasized more strongly as a motivation in the paper. Or perhaps this could become the paper's primary motivation.
- Lines 33-43: Suggest revising the second sentence. The characterization of the crystal shape does not matter for U-Pb and fission-track, unlike what is implied by the structure of these two opening sentences.