

Response to Referee 1 – Jakub Sliwinski

The authors explore whether chemical etching of apatites for AFT has any influence on subsequent U-Pb dates, concluding that although etched samples tend to be a bit young compared to unetched samples, the results are well within uncertainty. The study is straightforward, and the message is clear, so I have very few comments, apart from noting that the presentation needs to be cleared up in places to avoid ambiguity.

Dear Jakub, thank you for your comments and reviewing our manuscript. Please, find our responses (in red italics) to each of your comments below.

General comments:

1. Perhaps the most substantial comment: While this study demonstrates an important effect, it does not address the fact that a very similar experiment was already undertaken by Hasebe et al., 2009 looking only at U concentrations. While I see this citation in the introduction for the very general concept of AFT, I do not see any other recognition, or any motivation explaining why this present study was undertaken. Furthermore, I see no discussion or comparison with Hasebe's study in the discussion.

OK, done. We compared and mentioned Hasebe's study.

2. Already in the abstract I see a few grammatical mistakes and would therefore strongly recommend a friendly review by a colleague who is a native English speaker. Most of these mistakes are minor (misuse of articles, e.g. "the etching" instead of "etching") but correcting them will improve the quality of the manuscript.

OK, done. Thank You. In our view, the grammar was improved.

3. I find the abstract a little bit disappointing. While I normally enjoy concise writing, I find that a substantial part of the abstract is just "LA-ICP-MS" written out in full, and there is a lack of summary statistics for the analyses that would provide a quick and easy summary of the main results. Furthermore, given how short the abstract is, the "Short Summary" afterwards is completely redundant!

OK. Abstract was improved. Short Summary is required by the Journal.?

4. When reporting the ages and uncertainties (perhaps as early as the abstract), please note clearly if you're using 1s or 2s uncertainties.

OK, done.

5. In Hasebe, 2004 there is a short note on the potential effect of etching on LA-ICP-MS of apatites. While you show no significant difference between etched and unetched grained, the fact that you note a slight young bias makes me curious. I've worked a lot with chemical abrasion of zircons, and while the abrasion process generally removes areas of Pb loss (making the zircons older), the annealing process actually reinforces the matrix and makes the zircon look younger. This is why we always normalize abraded zircons to abraded standards. In iolite, you can actually visualize this with the time-resolved integration and see that the down-hole Pb/U fractionation is more prominent in radiation-damaged, unannealed zircons. I'd be really curious to see a down-hole fractionation signal for apatites, as this would help to determine if the slight younging is indicative of some sort of matrix-damaging process, or if it is purely due to statistical chance. This is entirely optional, however (only for my own curiosity), so I leave it to the authors to include it or not.

Thank You for recommendation. You are right, U-Pb ages are slightly younger on etched apatite crystals. This was now discussed.

Detailed comments

(format: page number_line)

2_30: also U-Th dating!

OK, Thank You.

2_39: I find the structure of this paragraph a bit confusing and ambiguous. Please be very clear in saying that LA-ICP-MS can be used to obtain U concentrations for AFT, as well as U-Pb ratios for U-Pb dating. Also, I don't understand the sentence "therefore, there is a doubt . . ." I don't see how the doubt follows what you previously wrote.

OK, done. The sentence was improved.

4_87: perhaps note very quickly which “conventional” techniques you used (e.g. bromoform? Methylene iodide? Frantz?)

OK, done. We used sieving, Frantz, and bromoform.

4_89: combine these two sentences.

OK, done. Thank You.

4_90: what is 4pi geometry?

4pi geometry is generally used for AFT dating. 4pi geometry referees to polishing up to the interior of crystals (e.g., for apatites, removing 15-20 microns, o more).

Table 2: Excellent table with a summary of analytical parameters. I would just note that the masses can be arranged by mass (with ^{238}U at the end).

OK, done.

Figure 1: The third panel is likely unnecessary here . . . it’s just the second panel copied and labelled with another spot location.

OK. The third panel was removed.

Figure 2: The aspect ratio of this figure is going to ruin its quality in the final print of the manuscript (i.e. it’s too long to fit on a single page). Please consider splitting it into two parts, with a 3x2 grid and a 2x2 grid for two separate pages. Also, what uncertainty is reported? 1s or 2s?

Ok, done.

Figure 3: Just a suggestion, but maybe try plotting in log space in order to minimize the amount of blank space in the figure? Are these error bars 1s or 2s?

I think if we plot in log scale, we cannot see well error bars. 2SE bars.