

Review for Beranoaguirre, A., Millonig, L. J., Albert, R., Marschall, H. R., and Gerdes, A.: U-Pb dating of sub-ng/g U garnet by LA-MC-ICPMS, EGUsphere [preprint], <https://doi.org/10.5194/egusphere-2026-3931>, 2026.

General Comments:

The manuscript introduces a method for dating ultra-low U garnet, and illustrates its application across different garnet samples. In my opinion, this work represents a useful geochronological tool that pushes current analytical capabilities to their limits. While some of the figures could benefit from polishing to make the data more accessible, this research is a valuable addition to the literature on garnet geochronology.

Specific Comments:

I noticed that the abbreviation for 'inductively coupled plasma mass spectrometry' is used interchangeably as 'ICP-MS' and 'ICPMS'. Please choose one and use it consistently throughout the manuscript. Additionally, element names written out in full are occasionally capitalized. Please check for this and use lowercase (e.g., 'uranium' instead of 'Uranium').

The data from the Kaapvaal craton are from a previous publication, as you mentioned. There, I saw that the sample ST70 also contains sillimanite measurements in the age calculations. From what I understood, the sillimanite measurements plot at a very low $^{238}\text{U}/^{206}\text{Pb}$, with comparatively high Pb concentrations. With these data points plotting at the more 'extreme' ratios, I suppose they influence the isochron regression to some degree. Could you add a few sentences to elaborate on this, and whether it helps to also measure co-crystallized sillimanites or not, and if they would not automatically be rejected with their 'high' Pb concentrations.

The manuscript's presentation and readability would benefit from a few visual improvements to the figures. (1) Figures 1, 3, 5, and 6 show concentrations or cps. Could you add the uncertainty of these values to those plots to allow for a clearer visual assessment of precision. If the uncertainties are smaller than the symbol size, please just state this in the figure captions. (2) The font sizes of the figures are not consistent throughout the paper, and particularly for figure 2 and 4, the font size of the tick labels is on the limit of being too small. (3) Please make sure, that you use appropriate and ideally consistent marker sizes and styles (e.g. in Figure 6 the individual points can not be differentiated. You could add for instance an edge color to the points for better visualization.)

Sample terminology and labeling across the figures, captions, tables, and text could be improved. For

instance, the sample G99-2 is labeled only by its sample number in the Tera-Wasserburg plot, described as 'sample G99-2 from Bohemian Massif' in the caption, and associated with 'Orlica-Śnieżnik' in Figures 1 and 3. To improve clarity and readability, I suggest establishing a unified naming structure throughout the entire paper to use in all figures and in the table, such as combining the sample code with a clear location identifier (e.g., as done in Figure 3). Using a consistent label across all figures, tables, and narrative text will make it much easier for readers to track individual samples throughout the study.

Technical Corrections:

Line 20-21: The placement of "during the 1980s" feels not ideal. You could place it either at the start of the sentence or at the end.

Line 50: MC is not defined yet.

Line 83: Could you please add the number in brackets of the 'sufficiently low-U concentrations.'

Line 129: 'Demantoid' I guess should not be capitalized.

Line 132: There is one lonely bracket.

Line 183: Also add the reference of the data to the caption.

Line 199: Am I mistaken, or is the average U concentration of ST66 0.7 ng/g instead of 1.1 ng/g (as it was listed in the original paper)? From figure 3, it also looks as if 1.1 ng/g is too high of an average. If so, please also adjust the number in table 1.

Line 224-226: Could you please elaborate on this. From an outsider perspective, who is not very familiar with the details of this approach, these are just a lot of numbers. Here it looks as if for 40 times higher background, the limit of detection increases only by four times. Is this what you wanted to get across? From the previous sentence, it sounds as if the limit of detection is generally low, due to a stable background (which I understand as meaning a low standard deviation in the background). How did this go into your numeric example?

Line 226-227: Before (Line 223) you mentioned that regardless of the background intensity, the background is generally stable (I interpret this as generally having similar standard deviations). So I do not follow the reasoning, why the limit of quantification changes a lot depending on the background intensity if it is mainly dependent on the standard deviation rather than the absolute value. Maybe you want to rephrase or elaborate on this. It would help to show the standard deviation as uncertainties in figure 5 for this argument.

Line 242: 'Geochronology' should not be capitalized.

Line 314: '... minerals that contain up to 3500 times less U than ...' This could be misleading, as I would understand it as the U concentration being 3500 times less in the measured garnets compared to zircon. The truth is much more extreme as you showed in table 1, of the concentration being >250'000 times less in the ultra-low U garnets compared to the GJ-1 zircon. Make sure to either refer to the concentration or the total U per spot analysis.

Figure 1: Here you use bold capitalized letters for your subplots, whereas in the other plots lower case letters with a bracket. I would suggest being consistent between all plots.

Figure 3: The cut in the axis is not ideal in my opinion. I would either suggest having two distinct subfigures or a single figure showing the entire range, and if needed with a zoom into the low U corner.

Figure 4: I saw in the original paper, in which you published the Kaapvaal data, that there are also silimanite measurements used for the age calculation in sample ST70. Is it possible to annotate these measurements in the diagram? I would also add the reference to the original paper in the caption.

Figure 5: You have two dashed lines at 50 and 100 cps background. In the text you mention that quantification of the ^{207}Pb signal for ultra-low-U garnets is only feasible for a ^{207}Pb background signal below 50 cps. Can you please annotate this line in the figure, or at least mention it in the caption. What does the 100 cps line stand for?

Figure 6: I have to admit that this plot is not very intuitiv to understand, and I am not sure I understand its purpose. Do you want to show, that for higher ^{207}Pb cps, the 2SE of the ratio will be lower? And if ^{207}Pb cps is getting too low, it approaches the limit of quantification? Annotations would be useful to get the purpose of the figure better across, like: What is the black line, and what does the kink mean? In the text you mention a signal of 2500 cps, and a lower limit of the technique of about 100 cps, which could be highlighted. It would also help to have a legend within the plot, rather than just mentioning the colors in the caption. An additional suggestion would be, to instead of plotting the orange points individually (since there should not be a direct relationship between 2SE of the $^{207}\text{Pb}/^{206}\text{Pb}$ ratio in the sample and the limit of ^{207}Pb quantification?), giving an overall ^{207}Pb -quantification-limit range for the sessions during which the background was low enough (<50 cps) to measure ultra-low U garnets. And finally, it could be beneficial, to merge figure 5 and 6 into two subfigures to make a better/direct link between the ^{207}Pb backgrounds in the sessions (color code the sessions, in which ultra-low U garnets were measured), and the respective limit of the technique and its precision.

Table 1: You compare total U per spot between zircon and garnet, for which you assume different ablation spot sizes. I would suggest adding this information to the table, to make the comparison of the numbers more accessible. To make sure, it does not come across as if you are saying that the GJ-1 zircon has a U concentration of 3500 times more than the ultra-low garnets, I would suggest rephrasing the last sentence of the caption to '... less uranium than a typical GJ-1 zircon analysis.' Or something similar.