

Geochronology Discuss., referee comment RC1  
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## Comment on gchron-2021-30

Anonymous Referee #1

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Referee comment on "Technical note: Accelerator mass spectrometry of  $^{10}\text{Be}$  and  $^{26}\text{Al}$  at low nuclide concentrations" by Klaus M. Wilcken et al., Geochronology Discuss., <https://doi.org/10.5194/gchron-2021-30-RC1>, 2022

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### Review Summary:

In this work, the authors describe the challenges of measuring low-count  $^{10}\text{Be}$  and  $^{26}\text{Al}$  AMS samples and use performance metrics from datasets analyzed at ANSTO and prepared at three different prep labs. The importance of characterizing various sources of contamination is demonstrated and the authors outline useful steps for characterizing and quantifying these sources for both nuclides. Their results show a surprisingly significant impact of mis-characterized contamination on calculated ratio for low-count samples. Given the wide range of science questions being addressed with low-level  $^{10}\text{Be}$  and  $^{26}\text{Al}$ , their results are important and highly relevant to the Geochronology audience. Additionally, I found the manuscript to be well structured, written clearly, and generally an interesting read. I have a few minor comments below to be addressed, but otherwise I feel this work should be accepted for publication.

### Comments:

Lines 103-104: It might be useful to state where the charge state peak is for  $3+$ . Also, this sentence is slightly confusing. Are the transmissions  $\sim 35\%$  and  $\sim 18\%$  at the  $3+$  peak or are these just the efficiencies at the max energy for 6 MV acceleration voltage?

Line 109: I am slightly confused by the idea that the raw ratio is 80-90% of the reference value. Isn't the raw ratio in units of counts/nC? Presumably the total charge and charge state was used to convert to atoms  $^9\text{Be}$ , but this should be made clear since raw ratio might be incorrectly interpreted. This phrasing is also used in Line 162.

Lines 135-142: This is super interesting! Is the only difference between the blue and black current trends really just the cathode voltage? I suspect the authors also had to reposition

the target with respect to the ionizer to optimize the Cs focus between these settings. Maybe that doesn't matter for the ANSTO setup though? I think it would be useful to know if the authors examined the cathodes after the analysis and noticed any differences in sputter style between 6.5 and 4.5 kV.

Lines 151-154: It would be useful to know if there are any specific differences in the prep methods between labs that might explain such significant differences in output. Perhaps looking at a subset of blanks would at least control for elemental impurities.

Lines 182-187: I get the point the authors are trying to make here with the higher production rate in quartz compensating for the 10x poorer ionization efficiency. However, there is the additional complication of the  $^{26}\text{Al}/^{27}\text{Al}$  ratio being fundamentally limited by the native  $^{27}\text{Al}$  in the quartz, which somewhat dampens the point they are trying to make here. Also, the authors should note that this surface production ratio is specific to quartz.

Lines 214-217: Yes!!

Lines 240-242: Please describe how the 10B test samples were artificially elevated. Diluted drops of boric acid added to a carrier solution before final hydroxide precipitation?

Line 248: This makes me curious about what sort of source memory build up is typically observed. For example, what is "early in the run"? Also, was this effect considered for the later experiments looking at the Ag and carrier blanks? Some further detail here would be relevant.

Lines 269-272: One consideration that might be added to the discussion, perhaps in this section(?), is that distinguishing the contribution of "sample process" and "carrier" atoms could be done by analyzing process blanks with different carrier masses. Plotting measured atoms vs. mass of carrier added, then fitting a line, should give you both.

Lines 310-311: Are there significant differences in current between process blanks and carrier blanks? Probably not twice as much. Also, the currents would likely be lower for the process blank (opposite what would be needed to explain the count rate difference with higher currents). However, this is important to the conclusion drawn here so some comment on current similarity would be useful.

Lines 372-373: This, along with Figure 8., is profound and cool! Weighting by total charge makes sense, but I would not have expected the other methods to be so poor.

Figure 1: The light grey used for the data and text annotation in the plot made it slightly difficult to read on screen and extremely difficult on a printout. I recommend using a higher contrast color. This also applies to Figure 6.

Figure 5: It would be interesting to also see where the theoretical best curves are—that is, what counting statistics one could get if a target was exhausted vs. ratio.

Table 1: For clarity, you might replace (26Al [cnts]) with (26Al [tot cnts]) since this is the sum of all counts measured over N targets.