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# *Interactive comment on* "Exploring the advantages and limitations of *in situ* U-Pb carbonate geochronology using speleothems" *by* Jon Woodhead and Joseph Petrus

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The authors provide a summary of data collected so far in their lab, comparing isotope dilution (ID) results for U-Pb dates from speleothems with laser ablation (LA-)ICP-MS results from the same samples. They concur with recent studies that LA dating of low-U carbonates is feasible and demonstrate that speleothems represent a particular challenge due to their generally low U concentrations and young age for the samples of interest. The authors conclusions favour ID approaches where material and spatial resolution allows and broadly this is the case. However, with improved precision comes resolution of complexity and ID results can often be more scattered than LA results due



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Discussion paper

to the low resolution of scatter of imprecise LA data but also because ID methods require 10,000 times (as cited by the authors) more material than LA methods and so are more likely to intersect open system material and/or mix different age or common-Pb zones. The inclusion of these variables may be reflected in high MSWD's for ID work (e.g. Fig.3 top left plot) or their homogenisation by the large amount of material required for ID work may mask this variability in the same way that low-precision LA data can. Perhaps some commentary along these lines to provide a balance of assessment might be warranted. The authors also normalise their LA data to WC-1 for both Pb/U and Pb/Pb. This constrains the LA data to be no more precise than the reference value uncertainty. Using a better quantified reference material for Pb/Pb normalisation would reduce the uncertainty on the intercept somewhat and likely better constrain the uncertainty on the Pb/U intercept. The instrumentation and acquisition strategy (Attom, Escan) the authors use may have fortuitously reduced or eliminated any bias in the measured 207Pb/206Pb but other instruments and acquisition strategies may not respond in the same way. The need for a more precisely known 207Pb/206Pb reference material should therefore be noted for other use cases. The 'rotation' of the 207Pb/206Pb intercept for LA data noted by the authors and the consistent bias to higher intercepts than for ID data is curious and something that needs more complete understanding. Until this can be realised the LA 207Pb/206Pb intercepts can only be considered to be inaccurate. It would be good to see a change to the terminology used to represent uncertainty and measurement precision. On page 4 particularly but also throughout the manuscript, the term 'error' is used where this should be uncertainty, and the term 'internal error (or uncertainty)' is used where the authors mean measurement precision. This change in terminology would reflect more up to date VIM recommendations on nomenclature. None of these comments seriously affect the manuscript, merely providing some balance and considerations to the authors arguments. The manuscript is well written and engagingly easy to read, making simple the understanding of the authors data and arguments. I therefore recommend publication after consideration for the minor comments I have made here and in the attached

edited pdf.

1. Does the paper address relevant scientific questions within the scope of GChron? - Yes 2. Does the paper present novel concepts, ideas, tools, or data? – Yes, new data 3. Are substantial conclusions reached? – A useful review of the interim state of the method, but perhaps rather simplistic in its outlook. There are many occasions when ID results provide scattered uninterpretable results and LA resolves the U/Pb and closed system regression. The authors appear to imply that the ID approach always succeeds when the opposite experience is also true. 4. Are the scientific methods and assumptions valid and clearly outlined? - Yes 5. Are the results sufficient to support the interpretations and conclusions? - Yes 6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? I think this could be improved. 7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution? - Yes 8. Does the title clearly reflect the contents of the paper? - Yes 9. Does the abstract provide a concise and complete summary? - Yes 10. Is the overall presentation well structured and clear? - Yes 11. Is the language fluent and precise? - Yes 12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? – Yes, but address terminology 13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? - No 14. Are the number and quality of references appropriate? -Yes 15. Is the amount and quality of supplementary material appropriate? – N/A

Please also note the supplement to this comment:
https://www.geochronology-discuss.net/gchron-2019-8/gchron-2019-8-RC1-supplement.pdf

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