

Reply to comments of referee #2 Paul F Dennis

We thank Paul Dennis for his appreciation of our work and for the pertinent elements given on speleothem isotope measurements background.

Referee #2: *...The data that is shown for speleothems, however, is impressive in terms of the measurement precision where repeat samples are available. Importantly they show that the measured isotope composition is robust with respect to variations in water amount released. It is harder to assess the accuracy of the reported values. The only test the authors apply for the Borneo specimens is to point out that the data lie on the Global Meteoric Water Line (GMWL). This might or might not be a good way to evaluate the data. What would be very interesting would be for the authors to include data on modern precipitation in Borneo so as to compare the data. Does precipitation in Borneo have a deuterium excess of +8? If not then either the hydrogen or oxygen isotope composition of the recovered water may have shifted. For example in the modern speleothem material from Milandre Cave (Switzerland) the oxygen isotope composition is shifted by ca. 1 per mille from that of modern drip waters. The authors suggest this might be due to post precipitation isotope exchange between the inclusion water and speleothem. This is certainly possible but there is not enough data to rule out artefacts associated with crushing this particular specimen.*

We agree with the reviewer that the connection to modern conditions is important. We therefore added the following reference which discusses the modern precipitation (Moerman et al., 2013) to the legend of figure 12. Unfortunately, this reference gives limited information about the deuterium excess, namely only for one rainfall event.

Regarding the offset between the precipitation and fluid inclusion water isotopes, we changed the corresponding section as follows, since the second reviewer pointed out a similar shortcoming:

The observed isotopic offset between drip water and fluid inclusion for $\delta^{18}\text{O}$ of around 1 ‰, while δD values of drip and fluid inclusion water are identical, might indicate an exchange between calcite and inclusion water after its formation or it could document a kinetic fractionation (similar in magnitude for both oxygen and hydrogen isotopes) during the enclosure of the fluid inclusion water. The latter would be easily observable for $\delta^{18}\text{O}$ within its uncertainty of 0.4 ‰ but not for δD due to its larger uncertainty of 1.5 ‰.

In summary, this is a first class piece of work that should be published as soon as possible. I don't have any major recommendations to make that would materially improve the manuscript. As far as I am concerned it is an exemplar of a well written methodological study. My only suggestion would be to give a little more background on the natural speleothem material studied and to draw the caveat that despite the extensive testing of the method with standard waters, standard injections etc. there is only a limited data set for natural samples.

We agree with the reviewer that the sample descriptions were kept very short. To a certain degree this was our intention because we would like to focus on the method and not on the sample material. However, we added some additional information. Moreover, the second reviewer made a similar remark, so we changed the corresponding section as follows:

The stalagmite was active and the measurement corresponds to a mixture of fluid inclusions coming from the top comprising the last 40 years. The sample grows exactly under the stalactite where drip water was collected and monitored. The collection was made on a three

month interval during the last two years and the isotopic composition of the drip water shows fairly small variations ranging between -8.71 ‰ and -9.20 ‰ in $\delta^{18}\text{O}$.

Referee #2: Specific points

Points 1) through 7) are just to make the prose flow more easily.

Point 6) asks what is meant by the term potentiometer in the context of the work.

Point 8) asks for clarification of the calibration procedure

Point 9) concerns Figure 8 which I don't think is referenced in the text anywhere.

1) Page 431, line 19: change made for make

2) Page 433, line 6: insert a between of and water

3) Page 435, line 10: replace trough with through

4) Page 435, line 16: replace avoid that with prevent

5) Page 435, line 17: replace travel with travelling

Points 1) to 5) will be corrected in the revised version of the manuscript.

6) Page 436, line 23: what do the authors mean by potentiometer in this context?

The speleothem sample is fixed on a plate that can move on the horizontal axis by manually adjusting a mechanical screw, whereas the wire moves on the vertical direction. This device allows cutting curved paths and thereby a better follow-up of the growth layers of the stalagmite. This will be corrected.

7) Page 437, line 12: Insert Whilst at the start of the sentence "It was recommended....."

It will be corrected in the revised version of the manuscript.

8) I didn't quite follow the calibration procedure of the CRDS system that is outlined in section 2.4.1. Is the injection of the standard via the peristaltic pump, or via the septum port prior to the crushing cell? My reading of the section is that it is via the peristaltic pump but this is not made explicitly clear in the text.

The method should be explicit because users of CRDS systems usually calibrate by injecting standard waters directly into the evaporator and may conclude that you have done something similar and not quite understand what you mean by "Injection of each standard lasts at least three hours to ensure that the system reaches an equilibrium state".

The standards are injected via the peristaltic pump. We will state it in the text.

9) I think Figure 8 is an important diagram and should be referred to in section 3 - Raw data evaluation. However you only refer to Figures 9 (the water amount calibration curves) and Figure 10 which is just a schematic of the eluted sample peaks. Perhaps the best place to refer to Figure 8 is in section 3.1 where you describe how you determine the peak start and end times based on the rate of change of the water amount in the cell.

Reference to Fig. 8 will be added in section 3.

Reference

Moerman, J. W., Cobb, K. M., Adkins, J. F., Sodemann, H., Clark, B., and Tuen, A. A.: Diurnal to interannual rainfall $\delta\text{O-18}$ variations in northern Borneo driven by regional hydrology, *Earth Planet Sc Lett*, 369, 108-119, DOI 10.1016/j.epsl.2013.03.014, 2013.