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Climate of the Past Discussions

Interactive comment on "Lignin oxidation products as a vegetation proxy in stalagmite and drip water samples from the Herbstlabyrinth, Germany" *by* Inken Heidke et al.

Anonymous Referee #1

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Heidke and colleagues present a quantitative record of lignin oxidation products (LOPs) from a Holocene stalagmite, together with the LOPs results from 16 months drip water monitoring in the same cave. By comparing with the previously published data, such as drip rate, d13C and elemental concentration, they argued that LOPs extracted from stalagmites had the potential to be acted as a highly specific vegetation proxy. With the merits of wide distribution and highly precise dating, it is worthy to evaluate the paleoecological potential of LOPs in speleothems, which can favor to decipher the relationship between vegetation and climate changes across multi timescales, and ultimately to aid to mitigate the potential influence of global warming on terrestrial ecosystems. However, the current manuscript seems like a report of their experimental data, and does

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not encompass some general summaries to advocate its applications to other regions or different epochs. Thus, I suggest the authors to perform a major revision before the consideration for possible publication in the journal Climate of the Past.

The major concern is about the objectives and the new findings in this study. To be honest, reading of the current manuscript is not an easy task, particularly for audiences beyond the field of speleothems. In addition, it is not easy to extract the new findings in this study, and to be aware of how these findings can help us to improve the understanding of the processes that affect the transport of lignin into the cave and finally incorporated into the speleothems. In the introduction part, the authors did not clearly show their objectives. In the discussion part, they conducted many kinds of comparisons between the new and published data, and then present relatively complex explanations on the observed not simple relationships between proxies. Such a situation is clearly reflected in the abstract part. In the abstract, the authors mainly present detailed information about their results; however, summaries on the broad implications of the applications of this novel approach were nearly absent. Through the current text, evidence is not convinced to support the LOPs as a new, highly specific vegetation proxy in speleothems. In contrast, the audiences will be confused by the extremely complex pattern among LOPs proxies and the published ones from the same cave. In this way, the authors need to reframe the main text, and to focus how to constrain the major factors affecting the transport and preservation of LOPs in cave system on different timescales.

Another concern is on the integration of drip water data and the stalagmite data. In the current main text, these two datasets seem independent. These data were shown and discussed in different parts in the Results and Discussion parts separately. They need to explain why present these two types of data in the same paper, and to consider how to integrate these data. In fact, both data are useful for understanding the transport and preservation of LOPs in cave system. The data of drip water LOPs over the course of a hydrological year can yield useful information on seasonal timescale, though it is

cautious the influence of dwelling time in the epikarst zone. LOPs data from stalagmite facilitate to understand the processes on centennial to millennial timescales.

The final concern come from the interpretation of the seasonal variation of LOPs. D1 dripwater, Mg2+ and PO43- showed the opposite seasonal pattern compared with LOPs. The authors assumed the overlying reservoir was constant and highlighted the seasonal signal of LOPs was mainly controlled by hydrological effects, e.g. LOPs are be diluted in winter when recharge is higher; however, according to this mode, the seasonal variation of Mg2+ and PO43- in the dripping water will be similar to the pattern of Lops, other than the observed results (lower value in dryer summer and higher value in wetter winter)

Some minor comments: L8-9 in abstract, “The LOP ratios C/V and S/V, which are usually used to differentiate between angiosperm and gymnosperm and woody and non-woody lignin sources” should be “The LOP ratios S/V and C/V,. . ...”. L15 in P1: 500.000 years? If this is right, why keep three decimals? By the way, The 230 Th-U dating range has been expanded to 640.000 years (Cheng et al., 2016). L8 in P2: italic ‘n’. P4: suggest to delete the only subsection ‘2.3.1’. Fig. 3. Annotation is required for the grey lines in the uppermost panel. In addition, please add the title of the y-axis for this panel. Fig. 9. Correct the title of the y-axis and add the unit for the oxygen isotope data.

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