

Interactive comment on “Bunker Cave stalagmites: an archive for central European Holocene climate variability” by J. Fohlmeister et al.

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I strongly recommend the publication of the article provided it is revised by addressing and replying to suggestions and comments proposed by two anonymous reviewers.

In particular, Reviewer 1 is asking for “a more thorough explanation of the climatic links between the North Atlantic and central Europe, and the inherent influences on the O isotope ratio signal of the Bunker cave speleothems in relation to processes which may change the O isotope ratio signal of rainfall at the site. Reviewer 1 requires that the Author comment on the possibility that storm tracks may have changed during Holocene temperature perturbations, and on the effects of seasonality on the O isotope ratios

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variability. On this latter aspect, Reviewer 1 suggested to add additional information to section 2.1 relative to seasonal changes in rainfall amount and rainfall O isotope ratios at the study site. Finally, Reviewer 1 suggests to provide more insight on temperature influences on speleothem calcite O isotope ratios based on present-day monitoring data, which should be considered.

Reviewer 2 raised a major concern relative to the effects of cave ventilation, which may have been altered in recent years following the enlargement of the cave entrance, which may have impacted on the chemical properties of the recent precipitates. Although I personally believe that it is a very difficult issue, I encourage the Authors at attempting to answer. A comparison between C isotope ratios profiles in Bu1 and Bu4, whose records overlap for the past circa 1500 years and partially overlap for the Mid-Holocene may provide insight to the answer. As pointed out by the Authors, although the two records show a “broad” similarity, the absolute values of the trends differ, and they show short-term discrepancies, with B1 having, at circa 5 ka, more positive values than B4, which is not “the norm” for this stalagmite. The C isotope ratio variability on the short term has been interpreted by the Authors as related to PCP and drip rate variability, but Reviewer 2 is correct in pointing out changes in the extent of degassing driven by cave ventilation. The particular intriguing discrepancy between the C isotope ratio profiles in Bu1 and Bu4 between ca. 7.5 and 5 Ka could also be related to fabrics, which bear themselves relation to kinetics and ventilation, although the petrographic “bars” do not allow for a precise correlation of the C isotope profile and the complexities of fabrics (dendritic, coralloid, columnar) in the two stalagmites. The fabrics of the two stalagmites as seen from the slabs in Fig. 1 appear to be actually defining two very different characteristics of the feeding systems, with Bu1 being characterized by shift of the impact point, possible dissolution phenomena, input of impurities, alternation of more translucent and compact fabrics with more porous, milky, opaque layers which point to variability in drip characteristics, but also on the extent of degassing. Also, the growth rate of the two stalagmites is different and its discussion on the influence of the $\delta^{13}\text{C}$ values could be incorporated in the response to Reviewer 2. Regarding

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Point 2 raised by Reviewer 2, I am aware that the Authors may find vague “I would like to see some further analysis of the concept”. To my understanding, the only “serious” speculation by the Authors relates to the assumption that there was more dolomite in the Last Glacial loess deposited onto the surface of the cave, which brings me to point 2i raised by Reviewer 2. It is unclear to both the Reviewer and myself why the loess should have had more “late diagenetic dolomite. . . , which is sporadically found in the host rock”. But where did the loess come from? It should not come from the same host rock as it is an Aeolian, not a residual, deposit. Is there any reference to the composition of the loess, and whether it was really dolomite rich? This point should actually be clarified as requested by Reviewer 2. Reviewer 2 further asks for a budget calculation of soil carbonate and in particular how much dolomite would be necessary to alter the Mg/Ca ratio of the solution (and the stalagmites). Unless the interpretation is changed (that is the loess is found not to be dolomite rich), then this is an important point, as it would provide robustness and novelty to the manuscript (see the final point on the Conclusions raised by Reviewer 2). Could the Authors provide a soil carbonate budget for Bunker cave? Please provide correlation analysis as per point 3 raised by Reviewer 2. Point 4 is somewhat linked to Point 1. Please comment on this and, if feasible, provide a scheme summarizing the shifts and what may have caused them. If feasible, rely on fabric analysis for robustness of the interpretation. Please reply to Point 5 and note the final paragraph on the Conclusions. The issue Raised by Reviewer 2 is important. The Authors did a lot of work, there are undoubtedly extremely useful information for the speleothem-based palaeoclimate community, and what is novel in their work should be stressed.

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