

# ***Interactive comment on “Speleothem oxygen record – thermal or moisture changes proxy? A case study of multiproxy record from MIS 5/MIS 6 age speleothems from Demänová Cave System” by Jacek Pawlak***

## **Anonymous Referee #1**

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Jacek Pawlak presents a new speleothem record from Slovakia that covers Termination 2 and the last Interglacial. The record is composed of multiple geochemical proxies (stable O and C isotopes, trace elements, and carbonate microfibrils) and supported by a U-Th chronology.

The record is new and of good quality, but I think the discussion of the results and placement in the regional and temporal context needs substantial more work before being accepted in CP.

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I found it quite difficult to follow the discussion in several instances. Part of this might be related to wording and language, I made some suggestions for improvement but more could be done to clarify the text. In addition, I think the figures 4 and 6 can be improved as they are quite hard to read at the moment. I made some suggestions in the specific comments.

I would suggest reorganising the discussion along three main sub-headings: 1) Drivers of d18O in Slovakia and comparison with other European d18O records. Here, I found it difficult to understand what is meant by “thermal” control, as d18O can be influenced by temperature in different ways, which the author describes, but then does not further elaborate on. More clarity in the language (what is meant by “thermal” or “temperature” effect in d18O at the different locations described?) and a more in-depth discussion of the likely controls on d18O at the DCS cave is needed. For example, is there monitoring data from the cave that can back up some of the interpretation of d18O? Nearby GNIP stations that can be used to test the modern relationship between temperature, moisture source, and d18O in precipitation? So far, this part of the discussion is tenuous and seems based mostly on speculation.

2) Interpretation of the other proxies. Again, I would welcome some more detailed reasoning on why the proxies are interpreted in the way they are. For d13C, it would be useful to know more about the soil cover and vegetation assemblage above the cave. Are there palynological/palaeoecological studies from the region that could shed light on expected changes in biosphere responses over glacial-interglacial timescales? The discussion of the trace elements similarly lacks depth. It is not clear to me whether the author is implying a control of prior calcite precipitation (PCP) control on Mg, Sr, and Ba, or whether the dominant control is thought to be the dolomite dissolution. In any case, this should be elaborated: what is the basis for the claim that dolomite dissolution is dominant? Are there measurements of the host rock composition? Overall, I think there is currently some overinterpretation of small wiggles in the trace element records (Mg, Sr, Ba), in particular, I don't see much variability in the older part of the Mg record.

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I would also caution against interpreting the trace element record at the base of the stalagmite, as this is often a region where effects that have nothing to do with climate play a role.

3) The temporal evolution of the proxies in JS9. In my opinion, the records are overinterpreted at this point. Many of the smaller wiggles are probably not resolvable given the chronological uncertainty in the record. I would suggest the author focus and expand the discussion on the larger and interesting features in the record, e.g., the large peak in  $\delta^{13}\text{C}$ , P, Fe, and Mn around 100 ka BP, as well as why TII is only weakly expressed in the record. It is possible that with some restructuring of the text this is already possible, but as mentioned above I found it quite difficult to follow at the moment. I think it would be better to use a more recent ice core record (NGRIP for example) to compare the speleothem records to.

Specific comments: - line 27 and rest of text: use “precipitation” instead of “rain precipitation”

- line 44 and following: I would not include Middle Eastern records in the discussion about European records. Rather discuss the European records and then add a sentence showing the similarities with the Middle East and linking that to the prevailing circulation patterns?

- line 52: I don't understand this sentence.

- line 55: Since it's a single author paper, change the “we” to first person.

- line 67: I think it should be “genesis of DCS” instead of “genese”

- line 78 and in other parts of the text: “peak” instead of “pick”

- line 95: Why were samples for dating drilled to be as thick as possible? This seems counterintuitive, as one would typically try and minimise the amount of sample to avoid integrating too much time within a single sample.

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- line 117: “To minimize the difference in resolution between the lower and upper part of the studied record caused by the sedimentation rate, which is slower for the lower part. The lower part of a stalagmite from 0 to 40 mm was additionally sampled with a resolution of one sample/0.3 mm.” I think these two sentences should be joined, as the first one does not make sense on its own.
- line 118: Use “growth rate” instead of “sedimentation rate” for speleothems
- line 212 and following: instead of “short time signal” it would be clearer to refer to “short term variability”.
- line 233: I think it’s interesting that the TII is only visible as such a muted response in  $d^{18}O$ , compared to the overall variability in the record. I would be interested in knowing more about why that is.
- line 255: The growth rate appears to be much lower in the interval 127-122, which stands at odds with the interpretation of the isotopes (wetter climate and well-developed soil). Any thoughts on why that might be? Also, I don’t agree with the following sentence on Mg, as I don’t think there is a significant trend there.
- Figure 1: the map of Slovakia could be improved by showing the topography (Tatra mountains) and location of Magurska Cave, plus the boundaries of climate zones or dominant air masses.
- Figures 4 and 6: I find these two figures very hard to read, as there is a lot of information. Given that they are so crucial to the discussion, I have a few suggestions to improve them: 1. I would add a second age scale at the top of the figures, to make it easier to read 2. Clearly label the TII, maybe as a bar that covers the figure 3. I wonder if it is necessary to show all the records in figure 6, I think focusing on some key records from each group (maybe the longest ones?) would make it easier to read. But this might be my personal preference. I like the colour scheme linking back to figure 5, please add the explanation of the different groups to the caption.

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