

## ***Interactive comment on “A Stalagmite Test of North Atlantic SST and Iberian Hydroclimate Linkages over the Last Two Glacial Cycles” by Rhawn F. Denniston et al.***

### **Anonymous Referee #2**

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I have previously reviewed this manuscript for Geology and I see some improvements from that previous version (particularly in the presentation of age models, Fig. 5, that is now correct) but still many other of my previous concerns are valid now. This manuscript presents major problems, mainly related to the “quality” of presented samples, the lack of necessary information about the studied caves, and the representation of data, which prevent me to accept it for Climate of the Past. I detail below my main concerns and some suggestions the authors should follow to get their work published.

Still, I would like to emphasize the importance of this dataset, covering with several stalagmites from two Portuguese caves almost entirely last 250 ka (although with very

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low overlap). I am totally convinced that speleothems can provide the needed information about land-sea correlations in this region and, in this case, the presented record represents an improvement (I agree with the authors), in terms of chronology and sampling resolution, from previous terrestrial records (eg. lake sediments, see Moreno et al., 2012). The organization of the manuscript, specially the Results section, can be also improved with a more systematic order of data presentation.

1.- Chronology. The six speleothems used for this study are complicated samples in terms of growth axis (very variable along the samples), evidences of dissolution, minor and major hiatus, etc.). In fact, the growth of the six speleothems is very discontinuous and thus making difficult the detection of all the hiatus by U-Th dates. I see two possible ways of improving the chronologies that should be carried out by the authors.

• First, more dates are necessary in some stalagmites and, this time, analysing a higher amount of calcite would be desirable (I already pointed out this in my previous review. . . 50-150 mg for U-Th dating is insufficient with samples where U concentration is low as it happens here). Sampling a higher amount is possible and necessary to get more accurate dates. Errors of above 2000 years are common in Table 1 and I think they can be improved.

• Second, I suggest including some petrographic analyses (thin slides) to help on the identification of hiatus. I am not sure if the authors have done that study since it is not shown but comments on the textures and fabrics are made on 146-157 lines. A figure on this issue in the Supplementary material would be desirable.

Additionally, I would like to see a figure with all the age models together (an example is provided in Fohlmeister et al., 2012) to show the intervals that are really replicated. The authors emphasized along the manuscript the good replication of this dataset and I cannot agree with that. They refer to Fig S2 many times to show replication in  $\delta^{13}C$  records. . . . And in that figure it is evident that replication is really minimal (very short periods and not well reproduced patterns). The authors have to focus their interpre-

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tations where chronology was better assessed and replicated and be very cautious where the presence of hiatus was not so well replicated. In fact, sentences like “deposition of multiple stalagmites was punctuated by hiatuses of similar time spans. . .” (lines 181-184) should be avoided (they are not true) and need to be more concrete: I just see one interval where two stalagmites stop growing at the same time, at ca. 100 ka BP. Other example: “The reproducibility of carbon isotope ratios between coeval BG stalagmites argues that their d13C values may be viewed as an integrated time series not substantially impacted by inter-sample isotopic offsets” (lines 223-225). There is also highlighted the coincidence with hiatus in S France and N Spain stalagmites (lines 291-296) and this is not always true (Figure 6).

2.- Present-day cave environment. To my knowledge, this is the first time paleoclimate records from these two caves are presented. Then, it should be mandatory to understand present-day processes that would help to interpret past records. For example, distinguishing if the correlation of hiatus is with cold or with dry events (or both) is important and must be supported by more present-day data. The authors need to understand what is happening today regarding calcite precipitation in the cave. Does it happens the whole year or focused in the rainy season? Is it more abundant during warmer years? In lines 238-239 it is said that “any seasonal biases in calcite crystallization remain poorly constrained”. Then, how can they link the data to NAO that is a winter process? I think that some interpretations will be better supported by more monitoring data.

Besides, the switch of 2 per mil in the d13C record from sample CGL6 “for ease of comparison to SST” needs a justification in the text, not a simple note in the figure caption. I do not think such shift in measured values is justified at all without a deeper understanding of the cave environment (soil, host rock, etc).

3. Representation of data. Finally, I also have some concerns on the representation of data versus age. In general, I find too “optimistic” sentences or interpretations in the text that are not always easy to seen in the figures. A good example is Figure 6 that

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is used to emphasize the excellent correspondence of  $\delta^{13}\text{C}$  from the stalagmites with other records but the scale does not permit to see it!! Examples: how can we see the positive change during the YD (lines 299-300)? How can we see the hiatus at 80-78 ka (lines 292-293)? What about the “effective moisture from 170-160 ka and 145-135 ka? (lines 303-304). Figure 6 needs more ticks in the x-axis to follow the text and some dashed lines or bars to help the reader to find in the figure the events indicated in the text. Regarding representation of data, I also missed some other records that are cited and compared in the text several times, such as Villars cave or many other marine records. Fig. 8 where a zoom is shown for two different intervals would be the place to include those other records. If not, the reader has to go to previous references to compare visually other figures with this new dataset. For the YD, for example, there are many other records available.

Additionally, I have not found in the text any explanation about the representation of pollen data. Is that a combination of records? A stack? How is it made?

And regarding the representation of ice cores, why do not use the “real” ice core for the beginning of the record? The older part can be compared to the synthetic curve, but for the 0-125 ka I suggest to include NGRIP record.

Minor remarks: - line 285 and line 293. Why Fig. 2?? This is certainly a mistake, I am afraid.

- line 119-120: explain the correction you did using cave drip water
- Table S1. There are many reversals not explained in the text.

References cited: Fohlmeister, J., Schröder-Ritzrau, A., Scholz, D., Spötl, C., Riechelmann, D.F.C., Mudelsee, M., Wackerbarth, A., Gerdes, A., Riechelmann, S., Immenhauser, A., Richter, D.K., Mangini, A., 2012. Bunker Cave stalagmites: an archive for central European Holocene climate variability. *Clim. Past* 8, 1751–1764. doi:10.5194/cp-8-1751-2012

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