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Climate of the Past Discussions

Interactive comment on "Hydroclimatic variations in southeastern China during the 4.2 ka event reflected by stalagmite records" *by* Haiwei Zhang et al.

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Short comment by C. Tziavaras

The purpose of this paper is to examine the link between environmental changes in the 5.3 and 3.6 ka BP period and the collapse of several Neolithic cultures in China like the Shijiahe Culture which was located in the middle reaches of the Yangtze River. Bigger focus is given on the 4.2 ka BP event during which dryer conditions insisted on the northern parts of China compared to the southern part, where the conditions where more wet. This is done by reconstructing regional monsoon intensity from a stalagmite in Shennong Cave (SN17). The reconstruction is done through _18O and _13C proxy

analysis. The results are cross-referenced with other proxy data from previous work done on China monsoon. The explanation claimed for these climatic changes on the 4.2 ka BP event are attributed to a weaker East Asian summer monsoon (EASM) due to reduced Atlantic Meridional Overturning Circulation (AMOC) which led to a southward migration of the Intertropical Convergence Zone. Paleoenvironmental reconstruction research to help us understand about the conditions surrounding the development of past civilizations and cultures is very important. This paper can give another aspect on this research front, with a greater focus on Southeastern Asia.

Thanks very much for your comments and suggestions.

Comments. (1). The methods chapter was very simply put with references provided so if readers are further interested they could further examine the details of techniques used.

Answer: Yes, the related references were provided. Because the methods of U-Th dating and stable isotope measurement are extensively used in speleothem and paleoclimatic studies, the readers can find the similar descriptions in many papers.

(2). This paper's results can give further information on how the EASM intensity can be derived from _18O concentration in speleothems.

Answer: We discussed the significance of the speleothem δ18O from the region of spring persistent rain in southeastern China. According to two reviewers' suggestions, we will also add more discussion about this issue in revision.

(3). Are there enough evidence which support that ice-rafted debris decreased AMOC intensity during that period?

Answer: Not enough, AMOC might be a possible reason. In the published papers, such as Wang et al. (2001), Tan et al. (2011, 2018), Chiang et al. (2015) and Railsback et al. (2018), a reduced AMOC was considered a possible reason causing a southward migration of ITCZ and a weakened East Asian summer monsoon. The weakened

monsoon during 4.2 ka BP event corresponds to higher amounts of ice-draft debris in North Atlantic (Figure 7I). The CPD paper Yan et al. (2018), published in the special issue 4.2 ka BP event, discussed the possible reason of 4.2 ka BP event using a set of long-term climate simulations. In their paper, all-forcing experiment show that the 4.2 ka BP event could be related to the slowdown of the AMOC, and the comparison between the all-forcing experiment and the single-forcing experiments indicates that the event was likely caused by internal variability. We will discuss these in the revision.

(4). E'mei cave is being mentioned on 171 line without the being labeled on Figure 1 where all the other sites are recorded. Since the regional environmental changes have a spatial significance it would be appropriate if it was presented.

Answer: The location of E'mei Cave will be shown on Figure 1.

(5). Various parameters are presented that are able to influence the _18O of the paper's speleothem. It would be useful that the conditions of these parameters were presented for the other speleothems used in this paper to compare with the data acquired by the authors. Also to this note it may be good if the paper urges other researches into further investigating the reasons behind the amplitude difference between the SN17 and Jiuxian and Xianglong speleothems.

Answer: According to the second reviewer's suggestion and yours, we will add more discussions about the significance of speleothem δ18O from Shennong Cave in the revision. In addition, we will discuss the timing and nature of 4.2 ka BP event in northern and southern China by comparing with different speleothem δ18O records from monsoonal China. Therefore, we will also discuss the reasons behind the amplitude difference among these records, which might be related to the rainbelt shift derived from the intensity variations in East Asian summer monsoon.

(6). Shennong Cave is located in an area that is influenced also from spring persistent rain. Maybe this is something that needs further investigation since it provides the area with a surplus of water compared to the more naturally dry northern part of China. Do

the authors think that this is something worth considering?

Answer: We will describe more details about the seasonal variabilities of precipitation amount and δ18O in the region of spring persistent rain, which is different from the other regions in the monsoonal China.

(7). In Figure 6 there is a good correlation in the _18O records between the SN17, Dongee and Xianshui during the 4.2 ka BP event, but for the other dates the fluctuations vary considerably. How can one examine the effect that different spatial distribution of precipitation could have on this environment.

Answer: The spatial distribution of precipitation in monsoonal China is caused by the rainbelt shifts derived from the intensity variations in East Asian summer monsoon, because the northward migrations of the rainbelt are characterized by two discontinuous jumps when summer monsoon increases. Similar to your fifth question, we will discuss the spatial distribution of precipitation during 4.2 ka BP event and its influencing factors in the revision.

(8). In Figure 7.H the _13C values for SN17 should be displayed according to the header underneath. The scale seems to be wrong and should be corrected.

Answer: For figure 7H, the labeling of Y-axis should be δ13C, the values are right.

(9). In Figure 7 _18O concentration on C speleothem is lesser indicating intensified monsoon at the 4.2 ka BP event. In contrast to A,C, D where the concentration has higher values. C and D are very near and in a slightly lower latitude whereas A is slightly westwards. What would be the explanation for these values given the spatial connection of those speleothems?

Answer: Similar to your fifth and seventh questions, we will discuss the spatial distribution of precipitation and its influencing factors during the 4.2 ka BP event in the revision.