

Dear editor and reviewers,

Thank you for your comments and suggestions on this manuscript. The manuscript have been corrected and improved based on your positive and effective comments. Most of the corrections are based on the two referee comments. The files uploaded contain Abstract, Manuscript, Supplement (all the figure files of .jpg or .pdf are included in the file of "Figure.zip") and Author's Response. Now it's modified as following.

The title of this manuscript is changed to "The climate reconstruction in Shandong Peninsula, North China during the last millennia based on stalagmite laminae together with its comparison to $\delta^{18}\text{O}$ ".

We have tried to modify the grammatical errors and awkward expressions to make the manuscript much easier to read. We have checked the whole manuscript again and corrected many wrong words and awkward expressions. For instance, the word "layer" in this manuscript are replaced by "laminae", and the "climate and environment significance" are replaced by "climatic-environmental meanings". Much more corrections are in the manuscript already uploaded.

We have verified the time scale of the sample again and added the \pm uncertainty after the years. Also, we have inserted many new references to support the interpretation of the results (section 4).

In order to show the relation between the variations of laminae thickness and both $\delta^{18}\text{O}$ ratios of stalagmite ky1 and change of climate, we calculated cumulative departure values of the drought/waterlog index in the area of Kaiyuan Cave from 1470AD to 1894AD. The data source is the *Yearly charts of dryness/wetness in China for the last 500-year period*, the charts are compiled by Chinese academy of meteorological sciences of China Meteorological Administration according to the abundant Chinese historical literature and published by China Cartographic Publishing House in 1981AD with 510 drought/waterflog distribution maps ([Chinese academy of meteorological sciences of China Meteorological Administration, 1981](#)). In the

charts, the degree of drought/waterlog is represented by the drought/waterlog index which has five values including 1, 2, 3, 4 and 5 with 1 representing waterlog and 5 representing drought, and its distribution is represented through the index isoline maps. We have drawn a cumulative departure curve from 1470 to 1894AD and analyzed the relation between the variations of laminae thickness and both the $\delta^{18}\text{O}$ ratios of stalagmite ky1 and change of climate (section 4.5).

In section 1, three new references are cited. We have compared the transmitting laminae characteristics of stalagmite ky1 with the annual laminae of Shihua Cave in Beijing, and the two have all the typical characteristics of the latter laminae, which consist of so-called Northern type laminae. The 678 laminae of stalagmite ky1 are continuous transmitting annual laminae clearly. We have moved some expressions about the wider implications and the importance of this manuscript to section 5.

In section 2, we have added a figure to show the location of stalagmite in Kaiyuan Cave and deleted the introduction of tree species in study area. The expressions about laminae shape characteristics are moved to section 3.1.

In section 3, we have adjusted the order of section 3.1 and section 3.2. In section 3.1, we add many expressions about laminae shape characteristics from section 2 and add Figure 4 in this section. We have mainly modified the expression of section 3.2 and section 3.3 to avoid ambiguity and misleading expressions. In section 3.3, the criteria for selecting the samples for oxygen isotopes analysis is basically following the principle of interval test in order to avoid the mixed pollution between adjacent samples. Fewer measurements look like to be performed for the earlier part of the $\delta^{18}\text{O}$ record, this is because the laminae thickness are not the same, the $\delta^{18}\text{O}$ ratios in the earlier part are less because the laminae thickness is lower so that there are less samples in the earlier part. We have corrected some awkward expressions in section 3.3 to solve the problem of a comment in Anonymous Referee #2.

In section 4, we have inserted section 4.5 and some new references in

this section. In section 4.1, we have changed the word "reckon" to "calculate" and corrected the age interval of "65 years", and used the 25mm data to compare with 6mm data. In consider of the error of laminae thickness measurement accumulating downward layer-by-layer, we chose the 133th laminae corresponding to the horizon of 6mm as the datum to calculate the age of other lamiane in the upper part of stalagmite ky1. We have added the expression of "the dating error is ± 20.3 years, similarly hereinafter for AD age in this paper" to show the dating error in this manuscript. We have cited 8 references and corrected the awkward expressions in section 4.2. We corrected the range symbol in section 4.3, and the periods we divided are based on the inflection points and variation trends of the curve. We deleted the expressions of "sustaining..." because they are inappropriate in this manuscript. The standard deviation (1σ) for replicate measurements on NBS-19 is $< \pm 0.10\text{‰}$ of $\delta^{18}\text{O}$ isotopes test.

The section 4.5 is a new and very important section to show the relation between the variations of laminae thickness and both the $\delta^{18}\text{O}$ ratios and the changes of climate. In section 4.6, the error of the age model is ± 20 years in section 4.1, and we have inserted Table 2 to show the Hendy Test results. "Detention time" is replaced by residence time with means of the time of the water staying in the rock fracture during its moving from the earth surface to underground cave.

The name of section 5 has been changed to "Conclusions". We moved some expressions about the wider implications and the importance of this manuscript from section 1. It is better to put these expressions at the end of the manuscript.

Table 1: We add a new row to show the age corrected in AD, and illustrate the age corrected in BP in the annotation below the table. In BP (Before Present) of this paper, the "present" in this table refers to 2013 AD.

Table 2: Hendy Test results.

We have adjusted the order of all figures.

Figure1: The location where we collected the sample in Kaiyuan Cave.

Figure2: We have changed the font sizes and the labels in this figure, and added some expressions in captions.

Figure5: We have added a stalagmite photo and made some corrections to show the dating process more clearly. We have added some expressions in figures and captions.

Figure7: We have added a cumulative departure curve from 1470 to 1894AD with rising trend representing the change of becoming dryer and declining trend representing the change of becoming waterlogging. We have added some expressions in captions.

Thank you very much for your patience.

Regards,

The Authors