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Climate of the Past Discussions

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Interactive Comment

Interactive comment on "Isotopic and lithologic variations of one precisely dated stalagmite across the Medieval/LIA period from Heilong Cave, Central China" *by* Y. F. Cui et al.

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General comments: The authors present a manuscript of good quality that fits well into the scope of Climate of the Past. Their multi-proxy approach, combined with good age control, gives detailed insights into changing climatic conditions. I see this manuscript fit for publication in Climate of the Past, but I would like to suggest several improvements as outlined below. The main issue that I find needs some attention is the age model. The age model is the base for any interpretation. The authors use linear interpolation between U-series dates. This procedure is not adequate and not realistic, because its highly unlikely that the growth rate changed at exactly the sampled spots. I

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suggest that a more realistic age model is build, in the knowledge that several software routines are freely available (e.g. Stalage by Scholz and Hoffmann 2011), which also allow uncertainty estimation. The uncertainty estimates can (and should) be used to establish which variations are significant and which are within uncertainties and thus indistinguishable from background uncertainty. This test will help improve the interpretation of short-term variations in the presented record. Furthermore, the English of the manuscript needs some attention. Finally, I summarize minor comments/typos in detail below. I suggest that this manuscript should be considered for publication after minor revision.

Response: We thank the referee for his/her thoughtful comments on the age model. Following this comment, we try to use the StalAge model (Scholz and Hoffmann 2011). The two age models (linear interpolation and StalAge, indicated by Fig 1a in our response) give little inconsistency except for two limited time windows (yellow bands in Fig 1a). As StalAge method indicated, two growth hiatuses seem to exist between the third/fourth, and the seventh/eighth dating points. However, no significant change in the lithology can be found on the polished surface (Fig 1b). Therefore, we prefer to use the linearly-interpolated age model as a more robust estimation. High uranium concentrations (6-10 ppm) ensure 230Th dates precisely (age errors less than 20 yr and no age inversions) and eleven dates are enough to build the age model. Irrespective of the dating errors, the age uncertainties for our age model mainly come from changing growth rate of white-porous and dark-compact laminae. Our age model probably enlarges the growth duration of the dark-compact laminae and reduces the duration of the white-porous laminae.

Specific comments:

Results 3.1 Chronology line 11 develop the

Response: We did the change.

line 15-16 use a different age modeling procedure please (as outlined above)

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Response: This is an excellent suggestion. We discussed the two age modes as above.

line 16 of the stalagmite

Response: We did the change.

3.2 Proxy line 20 Hendy tests

Response: We now delete the word “A” and change “test” to “tests”

line 21 show

Response: change “shows” to “show”

line 23 deposited close to - I am not convinced that Hendy tests are faithful tests for equil. conditions, as has been discussed by Mickler et al. and others. Fig. 4 Please show also the d13C profile (dist from axis). The distance from the axis does not exceed 10mm, but to fully see degassing or evaporation effects, the profiles should be longer and in both directions from the axis. Please comment on your sampling strategy and or improve on this! X-axis title> it must be axis, not axix Caption> for stalagmite BD

Response: We did the changes in line 23 and Fig. 4. This is a good suggestion. As deficit of replication test and monitoring work, we here tentatively use the Hendy tests to check the equilibrium conditions for the calcite deposition, although this method is not convinced enough in the practice (Mickler et al., 2004, 2006; Dorale and Liu, 2009).

line 24 climatic origin

Response: change “climate” to “climatic”

page 7, line 3 interval between 0 and 73 mm (please check this also in the rest of the manuscript) line 17 please change 0 -73mm as above. . .

Response: We checked this interval and did the change.

line 4 studies suggest

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Response: change “suggested” to “suggest”

line 9 The weighted mean

Response: We did the change.

line 10 1996 is -7.0

Response: change “was” to “is”

line 11 Please refer the standards to VSMOW (and explain the shortcut when introduced for the first time)

Response: reported relative to Vienna Standard Mean Ocean Water (VSMOW)

line 19 the remaining record (the MWP) smaller during the

Response:We did the change.

line 21 in soil CO2

Response: delete “the”

line 23/24 please comment here also on CO2 degassing (and refs.), as this is an important factor for d13C changes

Response: The sentence in line 20-22 is now changed to “Variations of δ13C depend upon type of vegetation (C3 or C4), changes of CO2 degassing, drip rate of water, bedrock dissolution rate and seasonal variations in the soil CO2 in a complex fashion”. Comment: Calcite deposition typically occurs by degassing of CO2 from carbonate-saturated drip-waters on entering the cave atmosphere. Degassing is driven by the difference between the pCO2 of the soil and that of the cave air (McDermott 2004). Progressive CO2 degassing leads to increases in calcite δ13C due to the preferential loss of 12C in degassed CO2. For example, studies from Heshang Cave (close to Heilong Cave) showed that the winter periods with very little rainfall (< 50mm/month) were characterized by high δ13C values, indicating a greater fraction of CO2 degassing.

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Following the wet periods, rainfall begins to increase, decreasing the fraction of CO2 degassing, and hence decreasing δ13C (Johnson et al., 2006).

line 25 The profile of elemental Sr in bulk Sr generally

Response:We did the change.

line 27 measurement has

Response: delete the word “number”

page 8, line 5/6 please comment on PCP and other potential influences on Sr variations (changes in soil composition, loess?).

Response: Due to lack of cave monitoring, it is now a challenge for us to assess the relative role of the PCP and other potential influence factors on Sr variations. Here, we follow the traditional explanation of the Sr content as an indicator of drip rate because: (1) Fairchild et al. (2006) listed five sources that influence trace elements, i.e. atmospheric, vegetation/soil, karstic aquifer, primary speleothem crystal growth and secondary alteration. Since overlying limestone typically releases a significant amount of Sr, transported downward by the seepage water, the Sr in speleothems is expected to be derived mainly from the overlying limestone. Changes in the Sr content of a stalagmite are dominantly controlled by dissolution-precipitation processes in the unsaturated zone, due to differences in water residence time (Roberts et al., 1998; Bar-Matthews et al., 1999; Fairchild et al., 2000); (2) The strong similarity between carbon isotopic data, gray level, elemental Sr, and growth rate, suggests a common control mechanism, the most likely of which is changes in the amount of CO2 degassing and calcite precipitation from the saturated drip water. The PCP, related to the variations in the amount of CO2 degassing (Verheyden et al., 2000), can resulted in Sr-enrichment. This process is seasonally variable associated with hydrological and/or ventilation factors. (Fairchild et al., 2006)

4. Discussion 4.1 line 11 with high values, corresponding

Response: delete “of gray level”.

line 12 low values correspond

Response: We did the change.

line 13 with negative excursions

Response: We did the change.

line 14 replace: and low. . .laminae) with gray

Response: We did the change.

line 15 delete: of gray values, respectively profile shows

Response: We did the change.

line 17 while low Sr intensities

Response: We did the change.

line 19 unclear> what do you mean with among them?

Response: change “among them” to “between δ13C, gray level and Sr curves”.

line 21 0-75mm

Response: We did the change.

line 22 shows a much

Response: We did the change.

line 22/23 please reorganize this sentence, as it is not very clear

Response: We did the changes. The first phase (0-75 mm from the top, spanning the LIA), mostly composed of dark-compact laminae, has a low growth rate about 15 mm/100 yr. The second phase (75-220 mm, covering the MWP), with more white-

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porous laminae, has a higher growth rate (âĹij29 mm/100 yr) .

line 22/23 also change 29-58 mm and 148 to 192 mm

Response: We did the change.

page 9, line 2 faint occurrence of

Response: We did the change.

line 6 climate with a strong

Response: We did the change.

line 7 45 to 120

Response: We did the change.

line 12 G+Q proposed that annual

Response: We did the change.

line 19 lead to a reduced

Response: We did the change.

line 20 delete: dissolving in the seepage water

Response: We did the change.

page 10, line 2 Intra-seasonal by “active”

Response: We did the change.

line 7 shifts of the

Response: We did the change.

line 13 790 to 1320

Response: We did the change.

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line 19 and the subtropical

Response: We did the change.

line 21 maybe you better use Mei-Yu, because you have introduced it in line 19

Response: We did the change.

line 24 the ITCZ

Response: We did the change.

line 25 Under LIA

Response: We did the change.

line 26 climate conditions, the of the Mei-Yu

Response: We did the change.

line 27 subtropical high, its

Response: We did the change.

line 28 in the mid-low

Response: We did the change.

page 11, line 1 Therefore, LIA

Response: add “in LIA” after the word “Mei-Yu” at the page 11, line 2.

line 6 Mei-Yu

Response: We did the change.

line 10 intensity during LIA

Response: We did the change.

line 16 replace idea with hypothesis

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Response: We did the change.

line 17 the tropical

Response: We did the change.

line 19 tropical monsoon corresponding

Response: We did the change.

line 21 When the ITCZ

Response: We did the change.

line 23 may have reached from a

Response: We did the change.

page 12, line 11 vice versa

Response: We did the change.

line 20 indicating relatively drier conditions.

Response: We did the change.

line 21 The relationship

Response: We did the change.

line 22 mode during the LIA

Response: We did the change.

line 27 the ITCZ may have reached from

Response: We did the change.

Fig 2: please adjust the subfigures B and C, they are not of the same size as A. Please rotate the scale bars and put them into the respective figure (with good contrast), it will

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safe space. Please place the labels A, B, C into a better visible place and with better contrast, maybe into the upper left corner of the respective subfigure

Response: We did the change.

Reference:

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McDermott, F.: Paleo-climate reconstruction from stable isotope variations in spleothems: a review, Quaternary Sci. Rev., 23, 901-918, 2004.

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Roberts, M. S., Smart, P., and Baker, A.: Annual trace element variations in a Holocene speleothem, Earth Planet. Sc. Lett., 154, 237-246, 1998.

Verheyden, S., Keppens, E., Fairchild, I.J., McDermott, F., and Weis, D.: Mg, Sr and Sr isotope geochemistry of a Belgian Holocene speleothem: implications for paleoclimate reconstructions, Chem. Geol., 169(1-2), 131-144, 2000.

Fig. 1. (a) Comparison between the age model by linear interpolation (red line) and StalAge (black line). (b) Macroscopic features and locations of dating points.

Interactive comment on Clim. Past Discuss., 8, 1275, 2012.

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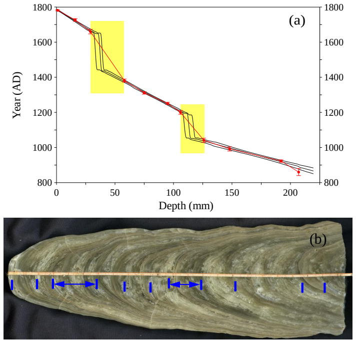

Fig. 1. Comparison between the age model by linear interpolation and StalAge

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