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Interactive comment on "Paleoclimate reconstruction in the Levant region from the petrography and the geochemistry of a MIS 5 stalagmite from the Kanaan Cave, Lebanon" *by* C. Nehme et al.

Anonymous Referee #2

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Review of the manuscript "Paleoclimate reconstruction in the Levant region from the petrography and the geochemistry of a MIS-5 stalagmite from the Kanaan Cave, Lebanon."

It is a well written manuscript that describes a MIS-5 climate record in central Levant, basing on U-Th chronology, growth rate variability, d18O/d13C profile and petrography of a single stalagmite from Kanaan Cave near Beirut, Lebanon. The authors suggest that a warm humid phase occurred on the onset of the last interglacial period (Marine isotopic Stage (MIS) 5e) at ∼129 ka and lasted until ∼125 ka. This period is charac-

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terized by low d18O values of -7‰ - -8‰.After ∼125 ka the authors report gradual shift inïĂăd18O values towards higher values, with the onset of the glacial inception around ∼122 ka. The latter was interrupted by a short period of the lighter d18O, probably during the sapropel S4 in the eastern Mediterranean Sea. During the later period the authors report decrease in growth rates and higher stalagmite's d18O and d13C values, till the end of the record around ∼84 ka. They interpret high speleothem d18O and d13C and low growth rates, as a transition to drier conditions.

This is an original study, showing a first speleothem record from MIS-5 in central Lebanon. I consider this study as an important contribution that together with other published regional paleoclimate data provides necessary information about the regional climate during this relatively warm period. I find this study publishable in Climate of the Past Journal after the authors address the following comments and suggestions:

Major comments:

1) I find the U-Th chronology incomplete. There is only one age determination below D1 discontinuity, what makes proper chronological framing of the lowest part of the d18O/d13C profile impossible. There is also very few age determinations in the upper part of the stalagmite, with no appropriate age framing for the peak of negative d18O around 93 ka, as well as for the peak of positive d13C around ∼90 ka. I suggest adding at least one U-Th age determination at the bottom of the stalagmite in the very beginning of the d18O/d13C profile, and at least two ages 3 cm and 5 cm from the stalagmite's top.

2) Stalagmites' growth rates can vary a lot in the same cave during the same time intervals. Therefore increase or decrease in growth rate of the single stalagmite does not necessary reflects variations in the effective precipitation above the cave. Only if the same growth rate changes occur in two or more speleothems situated far from each other, it more likely to reflect change in water seepage to the entire cave, reflecting a climate change. Lebanon is prone to severe earthquakes, which can open and close

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cracks above the cave, significantly affecting the water flux to a single speleothem.

3) Hendy tests are necessary check, but passing a Hendy test doesn't a guarantee that substantial kinetic fractionation between the seeping water and precipitation calcite hasn't affected the speleothem. It is always better to have more than one speleothem from the same cave, or from two adjacent caves, exhibiting similar trends of changing oxygen isotopic values at least on the part of the record. While having only a single stalagmite, the problem can be partly addressed by comparing its isotopic profile to published records of the nearby caves, what the authors do. It is interesting that the increase in d18O values occurs at 125-123 ka, exactly when it takes place in Tzavoa Cave, on the desert boundary in Israel (Vaks, Bar-Matthews et al. 2006). However it is not clear how the d18O values of the two caves relate one to another in the beginning of the MIS-5e, between 132 and 129 ka, because of the lack of the age determination in the bottom of the Kanaan stalagmite. Therefore it is important to find when exactly the Kanaan stalagmite started to grow. It may also improve the comparison with Peqi'in and Soreq caves, where the trends of d18O values differ more significantly from those observed in Kanaan Cave.

Minor comments:

4) The authors write on page 3245, line 21: "MIS-5e... was characterized by surface temperature at least 2°C warmer than present". Do they mean a global mean temperature? The global mean temperature during the MIS-5e was only ∼1°C warmer than during the preindustrial period (Medina-Elizalde and Lea 2005; Hansen, Sato et al. 2006).

5) The location of the Lebanese southern border isn't precise (page 3245, line 4): it is 33°03' and not 32°34'.

6) The authors frequently cite Vaks, Woodhead et al. (2013) regarding the climate conditions in the most arid part of the Levant during the MIS-5. However, the mentioned paper is not dealing with MIS-5, but with Pliocene and Early Pleistocene climate in the

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region. The correct reference for this purpose is Vaks, Bar-Matthews et al. (2010).

7) The authors should consider adding a table with the speleothem d18O/d13C values vs the age model to the Supplementary Materials.

8) The local meteoric water line of Lebanon, published by Saad, Slim et al. (2005) is difficult to obtain from the web. It could be useful if the authors will add the plot of Lebanese Meteoric Water Line with its formula to the Supplementary Materials, plotting the cave water d18O and dD values on it.

9) Could the authors add a reference for "cavity-ring down spectroscopy (CRDS) technique"?

10) Page 3254, line 22: Is the last glacial now officially starts at on 118 ka? It was previously accepted that the last glacial period started on the onset of MIS-4, approximately at 74 ka BP. It could be useful if the authors present a reference when the correction from 74 ka to 118 ka was made by the scientific community.

11) Page 3255, line 2: The d13C can shift to more positive values due to the change in the type of vegetation, or change in its density, not only because of degradation of the soil cover.

12) Page 3257, line 25: The MIS-5a humid event was recorded by speleothem growth in Tzavoa Cave on the desert boundary in Israel (Vaks, Bar-Matthews et al. 2006), but not in the caves of the drier desert further to the south (Vaks, Bar-Matthews et al. 2010). Therefore it is more likely that MIS-5a event originated in more precipitation coming from the Atlantic-Mediterranean cyclones, and not from the Indian monsoon.

13) Page3260, line 2: the most appropriate citations for the glacial/interglacial changes of the intensity in rain shadow effect in Jordan/Dead Sea valleys are Vaks, Bar-Matthews et al. (2003); Lisker, Vaks et al. (2010), and not those mentioned by the authors.

14) Figure 2: it could be useful to add a small map of central Lebanon showing where

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the cave is located relative to the city of Beirut.

15) I suggest simplifying the article's title, for example: "Reconstruction of MIS-5 climate in central Levant using a stalagmite from Kanaan Cave, Lebanon."

16) Page 3243, line 5: "onset" instead of "onst".

Journal's review criteria

Scientific significance: Good. Scientific quality: Fair, will become good after the corrections are made. Presentation quality: Good.

1. Does the paper address relevant scientific questions within a scope of CP? Yes. 2. Does the paper present novel concepts, ideas tools or data? Yes. 3. Are substantial conclusions reached? Yes. 4. Are the scientific methods and assumptions valid and clearly outlined? Yes. 5. Are the results sufficient to support the interpretations and conclusions? Not yet, more data is needed, see "Major comments". 6. Is the description of experiments and calculations sufficiently complete, and precise enough to allow their reproduction by fellow scientists (traceability results)? Yes, although some clarifications and corrections are needed, see comments. 7. Do the authors give a proper credit to related work and clearly indicate their own/new original contribution? Usually yes, but corrections are needed in citations, see comments. 8. Does the title clearly reflect the contents of the paper? Yes, although it can be simplified, see "Minor comments". 9. Does the abstract provide a concise and complete summary? Yes. 10. Is the overall presentation well-structured and clear? Yes. 11. Is the language fluent and precise? Yes. 12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? Some need clarification, see the "Minor comments". 13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined or eliminated? Yes, see comments. 14. Is the number or quality of references appropriate? Generally yes, corrections are needed, see "Minor comments". 15. Is the amount and quality of supplementary material appropriate? More material should be presented; please see "Minor comments".

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References:

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Please also note the supplement to this comment:

http://www.clim-past-discuss.net/11/C1453/2015/cpd-11-C1453-2015-supplement.pdf

Interactive comment on Clim. Past Discuss., 11, 3241, 2015.