Clim. Past Discuss., 9, C298–C302, 2013
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Climate of the Past Discussions

Interactive comment on "Stable isotope record of Eemian seasonal temperature from MIS 5e tufa stromatolite; Somme Basin, Northern France" *by* J. Dabkowski et al.

Anonymous Referee #1

Received and published: 29 March 2013

I have read the manuscript "Stable isotope record of Eemian seasonal temperature from MIS5e tufa stromatolite; Somme Basin, Northern France" by J. Dabkowski and collaborators. I provide a general comment of my review and some additional specific comments. Despite the quality of some of the data here presented, I'm afraid that my decision is to reject/provide a negative report of this manuscript, not recommending a subsequent submission to CP. Although the reasons to do such recommendation are described in detail below, the two main points for supporting my decision are: (1) that the discussion is based on unrealistic assumptions regarding the stable isotope system (which compromises the finding of this research), and (2) that there is a lack of a monitoring campaign to characterize the isotope system, which is an essential

requisite to perform the analysis here pretended without basic assumptions. I hope my comments would be of help to improve/redirect this research and to plan further research actions.

General comment.

The topic of the manuscript is of interest to a growing audience studying paleoclimate based on carbonate deposits and stable isotopes. Although the text is quite short to show the full potential of the research carried out, there are some details of quality, as the petrographic study and the genera classification of the stromatolite. The manuscript could have been improved by providing wider description and discussion of these points. However, the paper focuses on the stable isotope record of the tufa and the thermal seasonality preserved in the signal. From the four main factors that could affect their isotope signal, according to the authors, (i.e., diagenesis, kinetic fractionation, water isotope composition and temperature) they focus in the fourth control (temperature) to explain their oxygen isotope variability assuming that the contribution of the other controls is negligible. Based in the data presented in the manuscript, diagenesis does not seems a likely significant control on the isotope signal, but kinetic fractionation and seasonal changes in the isotope composition of water are expected to be major variability contributors in the tufa system here described.

Fig. 1. If any of the dates described in the introduction was sampled in the section here presented should be presented. If not, a better description of the chronostratigraphic-morphostratigraphic correlation is required in the main text. Fig. 3. There is a lack of reference in the figure caption to the arrows pointing the microfacies I. The reason for them to be blue in colour should be specified. Further description in the main text for the lack of correspondence with the isotope signature is required.

Kinetic effects. In the manuscript it is described a statistical correlation between carbon and oxygen stable isotopes along the record. Although covariation of isotopes could exist in near-equilibrium conditions, the correlation is normally an indicator of kinetic

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fractionation. So, under a stable isotope covariation scenario, the equilibrium conditions needs to be demonstrated in order to assume precipitation under near-equilibrium conditions and cannot be assumed. Additionally, the depositional environment of the tufas is also of importance here. These tubular tufa stromatolites are typically found in pools, where water flow is restricted (Pedley, 1990. Sed. Geol. 68: 143-154) and evaporation is enhanced in comparison to other environments. Further description of the sedimentary environment would be appreciated to highlight this circumstance. Considering the depositional environment and the stable isotopes covariation, the assumption that the precipitation took place under near-equilibrium conditions is not supported by evidence. To refute a likely kinetic fractionation of the tufa, some analogue studies in the system would be needed. If no current tufa exist in the site (its occurrence or not is not mentioned in the manuscript), monitoring of d13C of the DIC, d18O and dD of river waters during at least a seasonal cycle would provide information on an eventual covariation of isotopes and possible evaporation in the system.

Oxygen isotope composition of water. The manuscript needs additional description of the river and spring waters that originated the tufa sediments. In any case, based on the information presented, seems that the origin of water flowing in the river is non-exclusive of one/several local springs. For deeper evaluation of the seasonal isotopic composition of these waters, basic information of the drainage area (e.g., size of the basin), the geology of the area (e.,g karst vs other lithologies) and the description/characterization of local springs are essential. It is important to know if the karst waters have long residence time in the aquifers to mute the seasonal isotope cycle of rainfall waters. Also it is critical to know/estimate how much water derives from runoff compared to ground water in the river, in order to evaluate the importance of the isotope seasonality in the flowing water (i.e., runoff vs karst waters). Isotope monitoring of river/spring water is required in order to assume that isotope composition of this site does not affect the isotope variability (e.g., O'Brien, 2006. Quat. Res. 65: 366-379). In a river with 12 °C of thermal seasonality the runoff percentage is probably significant/dominant, and changes in water isotope composition is expected to be non-trivial

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depending on the river discharge and basin size (e.g., Darling et al., 2003, Hydrology & Earth System Sciences 7, 183-195; Ogrinc et al., 2008, J. Hydrology 359: 303-312). Thus, for a river of the size of Somme, oxygen isotope seasonality >1-2 per mil could be expected, and if the site represent a small catchment in the basin, seasonal variability could be even higher. Considering the isotope variability recorded in the tufa, the water isotope composition could be a major control. Assuming a constant isotope composition of water without monitoring the current system is unrealistic considering the characteristics of the studied system. Thus, evaluation of temperature effect of tufa cannot be addressed without characterizing the isotope composition of that parent waters.

Detailed comments:

1658-25. There is no reference to the dates cited. The chronological information is too vague in comparison with the specific statement that the tufas precipitated during the MIS 5e period. 1661-1 and 2. It is said that there is no internal lamination and in the next phrase thick laminas ae described. Please, use different nomenclature for different sediment structures. 1663-4. Based on the data presented in this manuscript the link between the microfacies I and its precipitation during summer-like period is not demonstrated. The criteria used to establish the link is not clear and the impossibility of microfacies I precipitation during other periods of the year is not evaluated. 1663-7. The term “winter” for characterizing the period of precipitation for the rest of the microfacies is inadequate, since the calcite precipitation has been considered to be continuous through (at least) most of the year. 1663-18. It is unrealistic to do such assumption for the presented system. The system needs to be characterized before doing such a statement. 1663-25 to 29. The system described here is a river in which a fraction of the water flowing (likely a large fraction) does not derivate from spring waters but from runoff in the basin. In such a case the mixing is not so efficient and seasonal component of the precipitation becomes very important in the composition of river waters. Even, in karstic waters, the seasonal isotope composition could be

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significant if residence time is not too long or if the spring waters are impacted by fast response to rainfall (e.g., Hori et al., 2009. GCA 73, 1684-1695). 1664-2 to 3. There is no justification for considering unlikely the seasonal changes in isotopic composition at the studied site. In fact, I consider it likely. In order to evaluate this point it should have been measured the isotope composition of the current system as an analogue of the past. There are methods for measuring past waters in carbonates if there would be concerns of dramatic changes in the system seasonality. In any case, measuring current or ancient waters is essential in order to do further considerations, since this assumption is easily avoided by performing the measurements. 1664-10. Avoid the term "winter" 1664-15 to 16. In order to use that or any other isotope-temperature equation, some principles have to be satisfied. As the equilibrium condition state and the variability of the oxygen isotope composition of the parent water are unknown, the results of the equation are uncertain and further discussion on the paper based on a weak base lacks any significance. 1666-9 In this section of conclusions the use of the words "demonstrate" and "confirms" should be avoided. The core of the manuscript is focused in analysis based on doubtful assumptions that provide unexpected results. This study has not demonstrated or confirmed much from the stable isotope system since some of the critical parameters to properly understand the system have not been considered.

Interactive comment on Clim. Past Discuss., 9, 1657, 2013.