Clim. Past Discuss.,
https://doi.org/10.5194/cp-2018-82-AC2, 2018

Climate of the Past Discussions

Interactive comment on "The 4.2 ka BP event in the Levant" *by* David Kaniewski et al.

David Kaniewski et al.

david.kaniewski@univ-tlse3.fr

Received and published: 21 August 2018

Dear Harvey Weiss,

We would like to thank you for having commented our manuscript and we would like to apologize for the delay in our answer. Please find our detailed answers to each comment appended below.

Comment 1 - For Turkey, the Sofular Cave speleothem's absence of 4.2 ka BP signal is noted as a useful 4.2 ka BP proxy without mention that its eccentric Black Sea orography and high precipitation does not reflect surrounding Mediterranean westerlies vectors, problematically also displays other climate change events, and is the exception to the abrupt ca. 4.2 - 3.9 ka BP megadrought events observed across Anatolia at the Bosporus, Nar Lake, Lake Tecer, Lake Van, and adjacent Iranian Lake Neor and Gol-e Zard.

Answer - The Sofular Cave (very close to the Black Sea; Göktürk et al., 2011) is and will remain a useful proxy for the 4.2 ka BP event (as well as for the 5.2 ka BP event and the 3.2 ka BP event) because the cave does not show the same climate evidence as several other time-series. Understanding the climate patterns linked to the 4.2 ka BP event, with the different local pressures that may have more or less influenced the signal [here, the local effect of the Black Sea (sea effect precipitation) and the North Anatolian mountain range], is of key importance in studying the spatial-temporal scheme of this event. We agree with Harvey Weiss that local conditions may have modulated the signal at Sofular. The authors of the original study have even noted that: "The modern climate in this area exhibits a significantly different rainfall regime compared to the neighboring regions in the Eastern Mediterranean, despite similar large scale influences from the North Atlantic, Eurasia and Monsoon realms" (Göktürk et al., 2011). Our mistake was probably to have not included in our manuscript a comment on the local effects that may have influenced some of the time-series. This will be done in the revised version.

Comment 2 - Suggest delete replication of Bryson's 1997 "blackbox" model that uses no paleoclimate proxy data for the 4.2 ka BP event at "Kameshli", "Tell Leilan" and elsewhere.

Answer - The data were calculated by Fiorentino et al. (2008) using the model developed by Bryson (1992) and, of course, also published by Bryson and Bryson (1997). The authors mentioned "In agreement with this model, we have corrected directly the ancient precipitation trend estimated by Bryson at Qameshli using best-fit linear coefficients obtained by modern observations" (Fiorentino et al., 2008). So, Fiorentino et al. (2008) also bring corrections to the initial modelled-data. We agree with Harvey Weiss that these calculated "time-series" are somewhat questionable. We also want to stress that the data are not from Tell Leilan, but from Ras El-Ain. We believe that these model-based reconstructions must be cited and commented upon, because they are published and available in the literature. We believe that our mistake was to have not

included comments on these models and this will be done in the revised version.

Comment 3 - The two relevant data sets from Lebanon, Jeita Cave (Cheng et al 2015) and al-Jourd marsh (Cheddadi and Kather 2016), with synchronous abrupt three century aridification events at 4.2 ka BP, are obscured by discussion of a) the replaced low sampling Jeita cave isotope analysis of Verheyden et al (2008), and b) the older, low resolution, 14C dating of two other Lebanon marshes (Ammiq and Chamsine) that are misleadingly said to “clearly delineate that the drier phase started earlier, between 4700 and 4400 BP”.

Answer – We agree that the two main sequences from Lebanon concerning the 4.2 ka B event are Jeita Cave (Cheng et al., 2016) and al-Jourd marsh (Cheddadi and Khater, 2016). We also believe that the low sampling resolution at Jeita Cave (Verheyden et al., 2008) must be cited as this may be one of the causes behind the lack of evidence for rapid climate shift around 4.2 ka BP. Concerning the two other time-series from the Beqaa Valley (Cheddadi and Khater, 2016 and references therein), the chronology is based on their AMS 14C and can be discussed. We will add comments on this particular point in the revised version of the manuscript.

Comment 4 - The Israel data from the Dead Sea are presented uncritically, along with Roberts’s unlikely hypothesis that low coastal precipitation reduction accompanied high inland precipitation reduction at 4.2 ka BP.

Answer – We agree that we have not commented upon the data from the Dead Sea. We have mainly focused upon what is really of interest: the W-shape climate evolution related to the 4.2 ka BP event, an argument long suggested by Harvey Weiss. We will add some comments on the Dead Sea in the revised version. Concerning the low reduction / high reduction (coast versus inland), this is an argument also developed by many others for modern climate change (e.g. Kafle and Bruins, 2009 for Israel), and this is what appears in the time-series. In light of this, we believe that it is important to underline this argument, even if it can be discussed and, maybe, refuted in the future.

Comment 5 - The authors accept Roberts’s east–west Mediterranean climate seesaw (east dry, west wet) hypothesis that seems disproven by abundant western Mediterranean terrestrial and marine core proxies. The authors’ cite their models that are of limited utility, as their limited representation of initial conditions accompanies limited external forcing mechanisms.

Answer – This quite hard to answer: model disproven by abundant cores, and a model of limited utility! This is a personal opinion of the author of these lines. Even if a single climate model would have been “wonderful” to explain everything, we believe that the climate scheme is much more complex, both in space and time. We totally agree that numerous time-series show a clear climate shift during the 4.2 ka BP event, and we strongly support the importance of this climate event. But, some discrepancies between the “numerous terrestrial and marine cores” are recorded, suggesting that there is not a single climate pattern, but several different modes that interact. For the models mentioned above, there is no “pre-selection” of cores, so, the outcomes are clearly a mix of all the results from several locations in the Mediterranean for a same period (according to the published chronology for each sequence). Harvey Weiss also forgets to mention that Brayshaw et al.’s 2011 model shows a similar pattern, with a reconstruction at 4000 BP that displays decreasing precipitation along East-Mediterranean coasts and in Turkey, while the wider Mediterranean exhibits an increasing trend. We agree that these are “merely" modelling data, but they are useful in trying to understand the full range of climate change during this period at a large geographical scale, and to identify the mechanisms driving this important event. To date, the keys to fully understand the climate scheme of the 4.2 ka BP event remain elusive.

Comment 6 - Suggest paper be re-focused upon their very significant presentation of the high resolution data from Lebanon and Israel.

Answer – We think that our manuscript, based on the Levant, needs this “enlarged view” to fully contextualize the "Mediterranean" scheme, with two different west-east branches, North-Mediterranean and South-Mediterranean. We agree that the main

data of our paper come from Lebanon and Israel, but without taking into account the whole basin, it is impossible to argue on the particularities of the Levantine datasets.

We strongly congratulate Harvey Weiss who has promoted and defended the 4.2 ka BP event for so long. This event is finally being recognized as a major climate shift and is now used as a formal boundary for the late Holocene.

David Kaniewski & colleagues

Brayshaw, D.J., Rambeau, C.M.C., and Smith, S.J.: Changes in Mediterranean climate during the Holocene: Insights from global and regional climate modelling, The Holocene, 21, 15-31, 2011.

Bryson, R.A.: A macrophysical model of the Holocene intertropical convergence and jetstream position and rainfall for the Saharan region, Meteorology and Atmospheric Physics, 47, 247-258, 1992.

Bryson, R.A., and Bryson, R.U.: High resolution simulations of regional Holocene climate: North Africa and the Near East., in: Third millennium B.C. climate change and old world collapse, NATO ASI Series, vol. I 49, Dalfes, H.N., Kukla, G., and Weiss, H. (Eds.), Springer-Verlag, Berlin Heidelberg, 565-593, 1997.

Cheddadi, R., and Khater, C.: Climate change since the last glacial period in Lebanon and the persistence of Mediterranean species, Quaternary Science Reviews, 150, 146-157, 2016.

Cheng, H., Sinha, A., Verheyden, S., Nader, F.H., Li, X.L., Zhang, P.Z., Yin, J.J., Yi, L., Peng, Y.B., Rao, Z.G., Ning, Y.F., and Edwards, R.L.: The climate variability in northern Levant over the past 20,000years, Geophysical Research Letters, 42, 8641-8650, 2015.

Fiorentino, G., Caracuta, V., Calcagnile, L., D'Elia, M., Matthiae, P., Mavelli, F., Quarta, G.: Third millennium B.C. climate change in Syria highlighted by carbon stable isotope analysis of 14C-AMS dated plant remains from Ebla, Palaeogeography, Palaeoclima-

tology, Palaeoecology, 266, 51-58, 2008

Göktürk, O.M., Fleitmann, D., Badertscher, S., Cheng, H., Edwards, R.L., Leuenberger, M., Fankhauser, A., Tüysüz, O., and Kramers, J.: Climate on the southern Black Sea coast during the Holocene: implications from the Sofular Cave record, Quaternary Science Reviews, 30, 2433-2445, 2011.

Kafle, H.K., and Bruins, H.J.: Climatic trends in Israel 1970–2002: warmer and increasing aridity inland, Climatic Change, 96, 63-77, 2009.

Verheyden, S., Nader, F.H., Cheng, H.J., Edwards, L.R., and Swennen, R.: Paleoclimate reconstruction in the Levant region from the geochemistry of a Holocene stalagmite from the Jeita cave, Lebanon, Quaternary Research, 2008, 70, 368-381, 2008.

Interactive comment on Clim. Past Discuss., https://doi.org/10.5194/cp-2018-82, 2018.