

## ***Interactive comment on “Influence of the North Atlantic subpolar gyre circulation on the 4.2 ka BP event” by B. Jalali et al.***

**Anonymous Referee #3**

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This is an interesting paper which on the base of new and upgraded marine proxy records from the subpolar North Atlantic contributes to a better understanding of the ocean's constraints for the 4.2 event. Based on high-resolution sea surface temperature reconstructions of two sites in the North Atlantic subpolar gyre the authors conclude that a weakened subpolar gyre may have been related to blocked atmospheric circulation, may have caused / modulated this RCC event. The potential implications on western Mediterranean climates are discussed against a background of currently available paleoclimate and - environmental records, as well as with regard to recent climate model simulations of the LIA. Opposite SST patterns across the 4.2 event (3600-4400-3800 y BP) found at the sites from the North Iceland shelf and SW of Iceland, respectively are interpreted in terms of a temperature "dipole". The new high-resolution

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records here presented indeed provide new pieces of evidence for the North Atlantic mechanisms behind the 4.2 event, and possible links for the its detailed evolution of the 4.2 event in the western Mediterranean. Thus publication of this article is highly recommendable.

Yet a more critical evaluation of the new proxy results and thus robustness of conclusions drawn appears well indicated. There are in particular issues with lacking informations about accuracy, analytical and calibration errors, potential seasonal bias as well as the regional performance of biomarker proxies here employed. This information should be integrated into the very brief results section, or alternatively into the methods section. In particular seasonal patterns are crucial to understand potential forcing of subpolar gyre and ocean atmosphere dynamics. An array of earlier alkenone studies have outlined the problems with the Uk37/proxy which has been "globally" calibrated for annual mean sea surface temperatures. Yet this proxy has been shown to have problems to properly reconstruct SST in the high latitudes and in polar water masses (generally very low alkenone concentrations), in particular. Accordingly it cannot be excluded that the opposite patterns reported from the two sites may to some extent a result of seasonal bias (thus challenging the dipole interpretation). Further reading suggestions: e.g. Moros et al. 2004, Bendle et al. 2005. It could be helpful for instance in Fig. 2 to show additionally the alkenone concentrations to gain a better insight into the reliability of these records. A second issue in my view very interesting but insufficiently addressed in this paper is the timing and duration of this event in the North Atlantic and western Mediterranean area. This also requires to address the accuracy of the age models (already outlined by the 2nd reviewer). Given the high resolution of the new records there is a chance to narrow down the timing of the RCC regionally. Nevertheless a broad time window of 600 year duration (4400-3800 y BP) for 4.2 event is adopted, nevertheless a narrower window of 4400 - 4000 to y BP is used in fig. 4. An explanation for this discrepancy is missing.

I moreover hook up the arguments of two already available reviews for this manuscript

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provided by Chamarro and an anonymous reviewer with regard to the role of seasonal patterns, and with obvious differences between LIA and 4.2 scenarios and their potential forcing.

While the paper is generally well and clearly written, and nicely illustrated there is quite a large number of inconsistencies, slips and typos which make it eventually difficult to fully understand this text. Those must be eliminated prior to acceptance. I spent quite some time with that, yet not being an English native speaker myself I certainly cannot identify all of them and therefore I strongly recommend careful English proof reading.

References Bendle, J., Rosell-Mele, A., Ziveri, P., 2005. Variability of unusual distributions of alkenones in the surface waters of the Nordic seas. PALEOCEANOGRAPHY, VOL. 20, PA2001, doi:10.1029/2004PA001025.

Matthias Moros, M., Emeis, K., Risebrobakken, B., , Snowball, I., Kuijpers, A., Jerry McManus, J., and , Jansen, E., 2004. Sea surface temperatures and ice rafting in the Holocene North Atlantic: climate influences on northern Europe and Greenland. Quaternary Science Reviews, 23, 2113–2126.

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Here is my list :

P1 L 19. What do you mean with "reduction of the subpolar gyre circulation"? strength / intensity or extension? L 28. Must be Mayewski insted of Mayewsky L 39. Must be megadrought instead of Megadrought L 51. Must be Berkelhammer instead of

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berkelhammer

p2 L 60. I guess there should be an article: the equatorial Atlantic L 83. Even of the East Greenland Current are relatively low saline, to my knowledge in the ocean there are no 'freshwaters'. You may say 'relatively fresh' L 87. Sentence should start with 'The age model' instead of 'Age model' L 90. Must be 'IMAGES program instead of 'IMAGE program'. You may also give additional information what it is/was about (International Marine Past Global Change Study, <http://www.images-pages.org/>) L 102. Please provide the reader here with information of where those 'changes' are explored

P3 L 110. This list of trees seems to be incomplete as indicated by the dots. Do you want the reader to complete it? L 112-113. Incomplete sentence? Do you mean 'Altitudinal forest taxa Abies and ... were grouped? L 114. ... 'interpreted as a decrease in temperature' Should be 'interpreted as a result of a decrease in temperature' L 116. Spell sea surface temperature (SST). Alternatively introduce abbreviation in the abstract (L 15) L 125. Must be 'include' instead of 'includes' L 128. Must be 'Nordic Seas overflow, a major... instead of Nordic seas overflow a major... L 133. Do you mean diatom assemblages? L 135. 'dynamical proxy reconstructions. What do you mean? L 138. Sentence should start with 'A similar temperature pattern' L 142, 143. Severe climate. What do you mean? 'Severe winters'? L 144. 'Regression of the subpolar gyre. What do you mean? Contraction?, attenuation?, weakening? L 154, 155. Must be 'Globigerina bulloides' instead of 'Globigerna.bulloides'

P 4 L158. Which index? Do you mean the difference between surface and subsurface waters, or the ratio between the contributions of NAI and polar waters? L 160. What is SS? Do you mean SST or sea surface salinity? Please clarify L 173. Do you mean 'A decreasing influence of polar waters'? L 175. ... 'an increasing influence... ' L 182. Must be 'Cassidulina neoteretis' instead of 'casidulina neotertis' L 185. Must be 'Barents Sea' instead of 'Barents seas' Sentence L 189 -191. I cannot follow the argument. Why should an unchanged Arctic fauna (in the Nordic Seas) support the hypothesis of low Arctic water influence? Do you mean ongoing low influence? L

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198. Say 'high-resolution SST...' instead of 'high-resolution of SST...' L 203. Must be 'seem to' instead of 'seems to' L 205. 'coldest SSTs' compared to what? L 208. 'over the adjacent continental regions?' L 209. Must be 'follow' instead of 'follows' L 213. 'and an increase' L 215. Must be 'not necessarily ... relatively' L 216. '<750mm'. Do you mean (>750mm)? L 222. Better use 'complex' instead of 'different'? Sentence L 224 -228. Please split this long one into two sentences and rephrase. L 230. Who abandoned the cave?

figures The figures well illustrate the paper. If space is to be saved it is maybe not necessary to repeat the same alkenone records 3 times (figs. 2,3 and 4).

Fig. 4 b. the yellow labels, scales and curve can hardly be read. Better use another color instead.

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Interactive comment on Clim. Past Discuss., <https://doi.org/10.5194/cp-2018-159>, 2018.