Clim. Past Discuss.,
https://doi.org/10.5194/cp-2019-130-RC2, 2020

Climate of the Past Discussions

Interactive comment on "Climatic subdivision of Heinrich Stadial 1 based on centennial-scale paleoenvironmental changes observed in the western Mediterranean area" *by* Jon Camuera et al.

Anonymous Referee #2

Received and published: 3 February 2020

This paper presents the details of the recently published new Padul pollen record for the Heinrich Stadial 1 and Lateglacial interval.

The pollen record reveals significant changes over the study interval, presented in the form of pollen-based indices with established use in the study area. The record is also at a high temporal resolution offering new insights into centennial-scale variability during the study interval.

There are fascinating visual parallels between the pollen indices for the Heinrich Stadial

1 interval and SST records from the nearby W Mediterranean (Alboran Sea) which generally support the interest and interpretation of rapid climate variability during this interval.

The main difficulty for the manuscript is the chronology of the record. In essence, the Heinrich Stadial appears "too old" in the Padul record, and this creates difficulties for the analysis and interpretation. The manuscript seems to have a "split personality" – attempting to interpret both (A) the difference in ages between the Padul record and other records as a real and meaningful phenomenon, e.g. with implications for reservoir ages, etc. and (B) propose synchroneity of events between Greenland and S Iberia, e.g. as shown by wiggle-matched records in some figures and direct labelling of pollen changes with Greenland event stratigraphical terminology. It should be noted that conceptually (A) and (B) are mutually exclusive and they sit together very uncomfortably in the manuscript.

Regarding (A), the authors suggest that changes in marine reservoir effects might explain the difference in apparent age of the Heinrich stadial between Padul and the Iberian margin records. However, the logic is reversed here and the apparently older age of the Padul record cannot be explained away by marine reservoir effects which would tend to give older ages in the marine realm, not the terrestrial. Furthermore, the study of coupled land-sea tracers in nearby Alboran records (Combourieu Nebout et al., 2009; Fletcher et al., 2010) already reveals a synchronous (within age model uncertainty) coupling of climate changes over the W Mediterranean and the high-latitudes, with possible modest enhancements of up to ~200 years of the marine reservoir effect.

Overall, I suspect that there are uncertainties in the site-specific age model which are not dealt with fully in the manuscript. Essential information for the validity of this study about stratigraphy, age control data and rejected dates must be included and discussed in the main manuscript and not placed in the supplementary material. Inspecting the radiocarbon data, it is evident that there are difficulties with reservoir ages or old carbon sources leading the authors to reject several dates obtained on bulk carbonates and

gastropods. However, I do not see that it can be excluded that old carbon effects are not impacting also on the included dates made on bulk sediment. The authors need to deal with this more directly in the presentation of the record and ultimately the interpretation of the data. If the uncertainties in the age model are too great to support (A) then this shortcoming should be accepted and the implications of (B) can still be tentatively explored.

Without a more open and direct appraisal of the age control issue, I do not think that the time series analysis can be sustained. Although there do appear to be interesting pseudo-cyclical patterns in the proxies for some time intervals, the authors must be cautious about over-interpreting weak spectral signals (e.g. at 80%, 90% confidence levels) and cautious about identifying spectral peaks at high frequencies occurring close to three times the sampling resolution which may be spurious.

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