Climate of the Past Discussions

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Comment on cp-2021-162

Anonymous Referee #1

Referee comment on "A 300,000 year record of cold-water coral mound build-up at the East Melilla Coral Province (SE Alboran Sea, western Mediterranean)" by Robin Fentimen et al., Clim. Past Discuss., https://doi.org/10.5194/cp-2021-162-RC1, 2022

Review of Fentimen et al.

The authors provide a comprehensive multiproxy study in which they propose a link between a) increased run-off and b) enhanced water column mixing during interglacials fueling cold water coral (CWC) proliferation at Brittlestar Ridge, Alboran Sea (western Mediterranean Sea). They further find that Bryozans are dominant mound-builders during glacial periods, as they are more adopted to the glacial environmental conditions than CWC. The paper is very well written, with an instructive summary sketch (Fig. 10), albeit the figures might be improved in some instances. In summary, the authors present a very interesting data set shedding light on a variety of environmental parameters that might influence CWC growth, while also acknowledging the limits of their approach due to the particular environmental setting of the CWC mound that generates a particular hydrodynamic microenviroment and stratigraphic uncertainties.

In general their main hypothesis appear plausible on first sight, however, when looking at the proxy data more closely the claims are not always convincingly and consistently corroborated by data. This might be partly due to the graphic display which does not allow direct comparison of paleoenvironmental parameters with CWC abundance (see below), but also leave the impression of over-interpretation and over-simplification of the proxy data and involved processes. Hence, in a revision the authors need to better support their conclusions by data or re-evaluate their interpretation. Notably, this paper has been previously submitted to CP, and my concerns partly echo those raised in relation to the earlier version of the manuscript.

Main comments:

1) The authors infer that enhanced terrestrial sediment and nutrient input fueled CWC proliferation during interglacials. However, when looking at either Si/Al and Rb/Al, both ratios do not show an glacial-interglacial pattern. The long-term smooth of Rb/Al appears to show no distinct fluctuations at all, Si/Al has some variability which might be more related to precession rather than glacial/interglacial cycles. A precession forcing of dust input is also not unlikely given the precession imprint on the African Monsoonal system which determines the expansion and proliferation of dust from North Africa. As mentioned above it would help to plot the CWC abundances from Fig. 3 next to the Si/Al and Rb/Al curves to allow for a direct comparison. Because all parameters are measured on the same core, stratigraphic uncertainties do not play a role here. I would also recommend to expand the scale for both parameters to better visualize their variability. For this purpose the figure might be rotated by 90° (the other figures as well). The same issue arises also for the other environmental proxies discussed in relation to CWC abundance: please show them in direct comparison to the CWC variability.

2) The same lack of good correlation arises also for the discussed parameters sortable silt (bottom current speed) and planktic-benthic $d^{13}C$ gradient (vertical mixing). Even considering that the CWC mound itself might bias both proxies (as discussed in the text), a better tentative correlation to CWC abundances should be expected. I also wonder why the authors did not compute the d18O and d13C gradient and plot them next to CWC abundance. A decreased d18O gradient should also indicate a better vertical mixing by an increased gyre activity.

3) It seems that the best fit of CWC abundances is with benthic d18O and the presence/absence of certain foraminiferal species (e.g. *Bulimina* spp.) pointing at a major influence of sea level and bottom water oxygenation and/or nutrient availability. While I can follow the arguments for a stronger gyre activity during interglacials from a conceptual point of view, the relatively shallow water depth makes this site very sensitive to vertical shifts in water masses. When I understand correctly the authors infer from the presumed change in the d13C gradient between surface and bottom water that stratification would be the driving force behind d13C variability, but what if a different water mass is bathing the site, which might be a simple effect of glacial/interglacial sea level changes?

4) One way to tackle the factors influencing CWC presence more objectively might be by including statistical methods such as simple correlation coefficient or via conducting a PCA.

5) The authors should reference the dissertation by Thomas Krengel (2020) "550,000 years of marine climate variability in the western Mediterranean Sea revealed by cold-water corals" (https://archiv.ub.uni-heidelberg.de/volltextserver/27990/), in which he investigated CWC mound growth at Brittlestar Ridge based on a MeBo drill core, covering the past ~700 ka. In his thesis he basically conveys a similar idea as the paper by Fentimen et al., i.e. that an increased interglacial hydrological cycle on the continent invigorates CWC proliferation due to enhanced input of nutrients. Hence, including the data provided by Krengel (2020) and referencing this study is pivotal.

6) The authors devote quite some effort in both introduction and discussion to compare CWC in the Alboran Sea with the North Atlantic CWC provinces. The comparison to North Atlantic CWC is listed as the major research aims (l. 93). To me becomes not clear why they compare their record specifically with those in the North Atlantic which is a hydrographic distinctly different basin as the Alboran Sea. What insights should be gained, or hypothesis tested? The authors should much more focus the respective parts of the discussion on similarities and divergences of the environmental factors inferred to have been instrumental for CWC growth (or its suppression).