Climate of the Past Discussions

Clim. Past Discuss., referee comment RC1
https://doi.org/10.5194/cp-2022-87-RC1, 2022

Comment on cp-2022-87

Stephane Bodin (Referee)

Referee comment on "Environmental changes during the onset of the Late Pliensbachian Event (Early Jurassic) in the Cardigan Bay Basin, Wales" by Teuntje P. Hollaar et al., Clim. Past Discuss., https://doi.org/10.5194/cp-2022-87-RC1, 2022

The authors present a high-resolution geochemical, palynological, and clay mineral assemblage dataset from the Upper Pliensbachian of the Mochras core. This dataset is used to discuss the factors at the origin of the Late Pliensbachian cooling event. Overall, this study brings new and interesting data and discussion about an event that could have seen the development of polar glaciation during the Mesozoic, and I therefore recommend it for publication after moderate revisions. Those suggested revisions are linked to my two main comments about this manuscript; Firstly, the structure of the discussion; Secondly, the claim of an earliest onset of the North Sea doming compared to a Late Toarcian – Early Aalenian onset as generally described in the literature

- The Chapter 1.5.2 is rather long and confusing as the main guideline of the discussion is not straightforward. I would recommend to separate the discussion about the origin of the clay mineral and their assemblage variation in a separated subchapter that should appear at the beginning of the discussion. Further subdivision of this chapter might also help its readability.
- In the literature, the onset of the North Sea Doming is said to occur around the Toarcian-Aalenian transition (e.g., Underhill & Partington, 1993). The claim of an earlier onset of this tectonic event can be tracked to the discussion part of Korte et al. (2015) as a putative explanation for the Late Pliensbachian cooling in light of the Aalenian cooling example. These authors were using the argument of regressive facies in the upper Pliensbachian of the North Sea region to substantiate their proposal of an earlier onset. However, Late Pliensbachian regression is a worldwide phenomenon observed in far away regions such as North Africa, the Sverdrup Basin in Canada, the Neuquen Basin in Argentina, or the Arabian Plate. Using this regressive trend as an argumentation for an earlier start of the North Sea Doming is therefore not warranted. I would suggest to tone this hypothesis down throughout the manuscript and clearly emphasise its limitation. This applies notably for the abstract, as well as the part in lines 492–494, where sentences such as "An early phase of regional tectonic updoming of the North Sea disrupted the circulation in the N-S Laurasian Seaway (including the Viking Corridor) and therefore diminished the connectivity between western Tethys and the Boreal realm…" give the impression that this putative early updoming phase is a well-established fact.

In general, I actually don't think that there is a need to evoke such tectonic phase. The global Late Pliensbachian sea-level low stand might on its own account for poor connectivity between western Tethys and the Boreal realm without having to invoke a regional uplift in the North Sea. Hence, instead of using "North Sea doming", I would for instance adopt a more neutral position and favour terms like "shallowing in the North Sea and Viking corridor".

Below, I also list some line specific comments. Overall, I enjoyed reading this manuscript and I'm happy to see that Mesozoic cooling events are also of interests for other research groups.

Stéphane Bodin

Specific comments:

Line 35: Problem in the numeration of the chapter. The Introduction should by numbered under "1" and "1.1"? Same remark for all the main chapter of this manuscript.

Line 44: You could here make reference to Bodin et al. (2023) which further confirms the temporal correlation between the LPE and a long-term sea-level low stand.

Adding a figure (maybe in Figure 1) showing the Upper Pliensbachian of the Mochras core and its d13C record, and highlighting in it the high-resolution studied part would help to better contextualize the here-presented data.

Line 336: Shouldn't that be a reference to Fig 4 instead of Fig 2 as written?

Lines 357–359: "pelagic settings in the Tethys region often received abiotic fine grained carbonate […] via carbonate producing organisms (such as coccolithophores in zooplankton pellets)". Calcareous nannoplankton production was very limited during the Jurassic and likely not at the origin of limestone-marl alternations. These latter are best explained by the cyclic export of shallow marine carbonates, as deduced from the disappearance of limestone-marl alternations during time of neritic carbonate factory collapse (e.g. Krencker et al., 2020)

Lines 388–392: “The grainsize changes inferred here reflect two overall coarsening upwards sequences (Fig. 3 and 4). These sequences may reflect changes in clastic transport due to changes in the proximity to the shore/siliciclastic source, changes in runoff due to a changing hydrological cycle, or accelerated bottom currents with greater carrying capacity of coarser sediments”. Could this grainsize change also reflect weathering intensity, with parent rocks being weathered down toward finer grain size during more intense weathering periods as indicated by high K/I and low S/I, and vice versa?

Lines 399–417: This discussion about the interpretation of clay mineral assemblages change should appear earlier in the text as the K/I and S/I ratio are already used in chapter 1.5.1.

Lines 514–515: “siliciclastic versus clay content”. Change “siliciclastic” for “silt” as the clay in the core are also siliciclastics.

Lines 540–541: “These regressive facies may have been caused by an early phase of North Sea doming”. As already stated earlier, this regressive trend is seen on a global scale and can therefore not be considered as a footprint of the North Sea Doming.

References cited:

Bodin, S., Fantasia, A., Krencker, F.-N., Nebsbjerg, B., Christiansen, L., Andrieu, S., 2023. More gaps than record! A new look at the Pliensbachian/Toarcian boundary event guided by coupled chemo-sequence stratigraphy. Palaeogeography, Palaeoclimatology, Palaeoecology 610, 111344.

Krencker, F.-N., Fantasia, A., Danisch, J., Martindale, R., Kabiri, L., El Ouali, M., Bodin, S., 2020. Two-phased collapse of the shallow-water carbonate factory during the late Pliensbachian–Toarcian driven by changing climate and enhanced continental weathering in the Northwestern Gondwana Margin. Earth-Science Reviews 208, 103254.

Underhill, J.R., Partington, M.A., 1993. Jurassic thermal doming and deflation in the North Sea: implications of the sequence stratigraphic evidence. Geological Society, London, Petroleum Geology Conference series 4, 337–345.