

Reviewer #1

Review of the Manuscript Number: cp-2020-99

Title: Million-year-scale alternation of warm-humid and semi-arid periods as a mid-latitude climate mode in the Early Jurassic (Late Sinemurian, Lurasian Seaway)

Author(s): Thomas Munier et al.

Article Type: Research Paper

General comments

The research is original, novel and considered as important to the field, so it is a good candidate to be published in CP.

The structure is appropriate and, in my opinion, the used language is correct. The manuscript presents a substantial contribution to scientific progress within the scope of Climate of the Past.

The scientific approach and applied method referring the clay minerals are valid, but some of the isotopic data are not fully reliable and they should not be used for palaeoclimatic interpretations. The results are discussed in an appropriated way and the references are appropriated.

The scientific results and conclusions are presented in a concise, clear and well-structured way, and the number and quality of figures is correct.

There are no major points of conflict, as it is a high quality palaeoclimatic study mainly based on the study of clay minerals reflecting an alternation of humid and semi-arid periods during the Late Sinemurian, comparing the data obtained in two boreholes drilled in western UK (Mochrasa) and northern France (Montcornet). However, the isotopic data, mainly obtained from the Mochras borehole, are strongly suspicious to be strongly affected by burial diagenesis, as the $\delta^{18}\text{O}$ presented values are too low to reflect normal seawater values and cannot be used for palaeoclimatic studies.

Consequently, the paper would need a **MINOR REVISION**.

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Specific comments.

The manuscript represents an analysis of the vertical distribution of clay mineral and stable isotope during the Late Sinemurian and the Sinemurian— Pliensbachian boundary, based on sampling of two boreholes drilled in the UK and in France.

Line 96. This latitude is also corroborated by the palaeomagnetic data presented by Osete et al., 2011 (Tectonophysics, 502, 105-120).

Line 216. Reader has to wait until line 216 to confirm that the drill holes have recovered a supposedly continuous core of the drilled sections. That should be specified before in the text, including the core diameter and percentage of recovery of the core. Could some of the gaps found in the Montcornet hole due to the losses of core in some intervals? I assume that the hole was drilled using the wireline method, but it would be convenient to specify that in the manuscript. If the drilled section is dipping, were the thicknesses corrected respect to the depths?

Lines 129 to 146. It is quite singular to perform ammonite biostratigraphy in cores, due to their limited diameter, especially in the case of the Montcornet hole, were as said in line 129-130, some important hiatuses occur, and the ammonites are relatively scarce. This does not support the “High resolution data ” mentioned at the beginning of the Abstract.

Section 4.3.1. It seems clear that the isotopic data of the study are the weakest part of the paper. Values of $\delta^{18}\text{O}$ up to -6.54‰ reflect the presence of strong diagenetic overprints. Also the $\delta^{13}\text{C}$ carb curve is completely different respect to the $\delta^{13}\text{C}$ org curve, confirming the presence of the strong diagenetic overprints. As a consequence, none of the isotopic data are useful in a palaeoclimatic study (see line 324) as it is supposed to be the present paper. A diagenetic study of the carbonates is essential to be sure that your isotopic data reflect the original Jurassic seawater conditions. Why this diagenetic study has not been performed?

Line 260. “Abundant smectite indicate a limited diagenetic influence”. In the paragraph above it seems that the diagenesis in the carbonates of the Mochras borehole is not negligible, but is it in the clays? Some additional justifications together with the shallow depth of burial would be welcome.

Section 5.1.2. Even of $\delta^{18}\text{O}$ isotopic data from the Montcornet borehole are not included, it seems that diagenetic overprints are also present, showing numerous indications in the lithology. However the $\delta^{13}\text{C}$ org curves show similar trends in both localities, indicating that this data could be reliable.

The main concern is to be sure that the climatic fluctuations are not the result or are influenced by the diagenetic processes.

Line 399. The ammonites zone or Zone should be uniform. Better obtusum Zone. Please check the rest of the text.

Line 407-408. Obtusum and the oxynotum zones.

Line 412. “Low $\delta^{18}\text{O}$ values consistent with warm conditions”. In previous sections it has been established that $\delta^{18}\text{O}$ values cannot be used as a palaeoclimatic criteria, so it should not be

used here as indicative of warm conditions, and this is contradictory with the stated in the following lines of the manuscript.

Lines 416-417. Reference(s) supporting the interpretation of *Classopollis* as an indicator of warm climate is needed. *Classopollis* is a long-term pollen showing a distribution probably from the Triassic up to the beginning of the Paleogene (Vakhrameyev, 1980) surviving lots of climatic changes. So taking it as a good indicator of warming could be at least very risky, if it is not supported by more reliable data.

Line 417-418. "Surprisingly this negative $\delta^{13}\text{C}$ org excursion is less clearly recorded in inorganic carbon at Mochras than in the Copper Hill drillhole". This could be another indication of the strong diagenetic overprint at Mochras. That could be an indication that the multiple papers based in the isotopic signal of the Mochras borehole are values affected by the diagenetic overprint, reflecting local conditions and no global ones.

Line 425-438. It would be a nice explanation but, has been compared the age of the SPBE $\delta^{13}\text{C}$ sift with the absolute ages of the CAMP emissions? This data should be incorporated into the manuscript and supported with more data.

Line 461-462. "Hot and humid interval expressed by low values of $\delta^{18}\text{O}$ ". Again, this $\delta^{18}\text{O}$ values cannot be used for palaeoclimatic interpretations.