Clim. Past Discuss.,
https://doi.org/10.5194/cp-2020-99-RC2, 2021

Climate of the Past Discussions
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Interactive comment on "Million-year-scale alternation of warm-humid and semi-arid periods as a mid-latitude climate mode in the Early Jurassic (Late Sinemurian, Laurasian Seaway)" *by* Thomas Munier et al.

Anonymous Referee #2

Received and published: 2 March 2021

This paper is an interesting contribution to the paleoclimatic reconstruction of the Early Jurassic using a multi proxy approach including Clay minerals and stable isotopes. This on 2 cores located Mochras in the Cardigan bay basin (Mochras borehole) and the Paris Basin Montcornet borehole). The topic fits therefore well with the scope of the CP journal.

The paper is well written and well structured. The figures are informative and of good quality. This Ms can only be accepted only after medium to major thorough revisions, since I have some important concerns about the quality of the data and some interpre-

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tations, which are not always supported by the data.

Sample resolution

In the first line of the abstract, the authors claims that it is a high resolution study (223 clay analyses). High-resolution is may be a slight overstatement, since (if we look at figures 5-6) only some 70-80 clay samples have been analysed along a 200m section at Mochras (1 sample/2.5m). The sample resolution is a little bit better in the Moncornet Borehole (around 60 samples for a 60m thick section.

Biostratigraphy

It looks that all the biostratigraphy is based on ammonites, it is maybe OK for the Mochras core, but not so evident for the Moncornet borehole, where several marquers are missing. It would be good to complete the biostratigraphy using nannofossils. At lines 128, the authors claim that the section is complicated by some important hiatuses and scarcity of ammonites. It would be important to discuss and especially locate these hiatuses. The upper Sinemurian are made of Gryphaea accumulations, probably resulting from storms interrupted by P- rich condensed levels. This makes the correlation quite difficult and some of the ammonites may be reworked.

Stable isotopes

This is the weakest part of this paper. δ18O values are significantly too negative and reflects a strong diagenetic overprint. I agree that these sediments have not been too much buried, since smectite and kaolinite are still present. But it does not mean that other diagenetic processes were not acting. The presence of siderite is a good indication of a strong diagenetic process. It would have been good to analyse the bulk mineralogy by XRD (easy and fast to perform). Moreover, the most negative values of both δ18O and δ13Ccarb occur in levels, in which calcite contents are quite low (<15%). Some simple cathodoluminescence analyses would help to retrace the diagenetic story of these sediments. δ18O and δ13Ccarb can't be use for paleoclimatic reconstructions

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as the authors did in their figure 10 or at line 30 of the abstract. This is clearly confirmed by the observed discrepancies between the δ13Ccarb and δ13Corg. At Mochras the δ13Ccarb curve is really very different from the δ13Corg. This must be discussed in details. The δ13Ccarb shows a huge excursion in the oxynotum zone, which is not present in the δ13Corg curve. The correlation between Mochras and Montcornet based on δ13Corg curves is not convincing, since very are too many hiatuses. The authors must also explain why the δ13Corg values are more negative in the raricostatum zone of the Mochras core (down to -28) compared with coeval Montcornet values (-26). This maybe due to a difference in organic matter origin (see Schoellhorn et , 2020 or Suan et al, 2015). In addition, the authors may try to correlate their δ13Corg curve with the one published by Peti et al, 2016, which appears to show a different trend. I suggest also to examine the δ13Corg published by Schoellhorn et al, 2020 (Dorset section), which shows several shifts in the upper Sinemurian, which can't be found neither at Mochras nor at Montcornet. Note also that Schoellhorn et al (2020,) found a negative shift in both δ13Ccarb and δ13Corg curves in the obtusum zone, confirming that the isotopic data from both Mochras and Montcornet cores are quite suspicious and can't really used for correlation. It would be good to try to correlate these isotopic records together.

Clay minerals

This is the most interesting part of this MS. The alternation of humid and semi-arid periods during the Late Sinemurian at Mochras is very convincing and their paleoclimatic interpretation is correct. However, it is not the case at Montcornet, where these cycles are not present. Contrary to Mochras, the kaolinite is not showing significant variations (20-30%). Since there is almost no smectite at Montcornet, I understand that the authors can't provide a SM/K ratio for that core, but they could have shown the K/I ratio, which exhibits at Mochras nice cycles showing that illite and potentially chlorite are not coupled with kaolinite, which may have originated from coeval paleosoils weathering. A different trend seems to characterize the clays distribution at

MontCornet, where kaolinite, illite and chlorite shows the same trend (a simple statistic multivariate approach would be very helpful). I am therefore not convinced that the two cores can be correlated based on clay minerals. At line 405, the authors underline the good correlation with the most prominent kaolinite increase with increased Sr ratio in the obtusum-oxynotum zones. Interestingly, this interval corresponds to very high CIA values (Schöllhorn et al,2020). The absence of smectite is difficult to understand and must be better explained. At line 465, the authors wrote that the different clay minerals trends may be due to the fact that Montcornet was located in a more distal location than Mochras. If it is the case, I would expect more smectite and it is really not the case. The authors linked the high amounts of smectite with sea-level low and the erosion of London-Brabant Massif. This is rather unlikely, since high smectite contents are generally linked with high sea-level (e.g. Godet et al, 2008, Ruffel et al, 2002, Gibbs et al, 1977). Moreover, sea-level lows are characterized by a mix of clay minerals such as illite, chlorite, kaolinite..etc (Deckoninck, 1985). I suggest that the authors try to correlate their clay minerals data with the ones published by Schöllhorn et al (2020) in the Dorset. The upper Sinemurian (even if more condensed) is characterized by similar K/I and Sm/K cycles confirming that these cycles can be globally correlated and represent true paleoclimatic (semi-arid-humid) changes.

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