Dear Prof. Appy Sluijs,

We thank Referee #2 (Prof. Dan Breecker) for re-revision of our manuscript. We appreciate your edition of our manuscript numbered as cp-2020-35!

According to suggestions by Referee #2, we have revised Table S4 and try to re-calculate pCO_2 and to propagate errors with different way of $\delta^{13}C_a$ determination. Below are notes on how we did with questions one by one.

The authors have largely addressed my comments. One thing remains to be done in my opinion and that is to tidy up supplementary table S4 to make it most useful to readers. This table may be more heavily used than anything else in the manuscript. Here are my suggestions:

Columns 7 and 8 are not described, it is not '$d^{12}O$' (columns 8 and 9).

We have added the description for columns 7 and 8, and also for column 2 in Table S4.

Column 13- provide the references for d13Cr here in the supplementary table

References have been provided in column 13, and corresponding references are increased below the table.

You did the error propagation, show the uncertainty on atmospheric CO2 in this table. Definitions of columns 4 and 5 are confusing- please explain what these are more clearly.

We revised notes of columns 4 and 5 in Table S4. Below are the revised:

4 Horizon (cm) of calcrete sample to the base of individual (calcisol) BK

5 Location (cm) of calcrete sample at the depth of the whole section (log)

Below the description of column 18, the table reads "Crossed data are invalable. " what does this mean?

We are sorry. It is a mistake. It could be caused by editing. We have deleted this note.

If you can determine d13Ca form marine carbonates, the uncertainty in CO2 would be lowered. You use d13C values of OM to get d13Ca, but we know that in climates where soil carbonates form vegetation is of water-stressed, which affects the carbon isotope fractionation between plant and atmospheric CO2. There is also subsntatial evidence, although there are arguments in the literature, that CO2 concentrations affects this fractionation. I think it is acceptable to move forward as is because your approach is clearly described, but if it is possible to use marine carbonates instead (or as another point of comparison) I would urge you to do so.

Up to date, global carbon isotopes of the Early Jurassic organic matters are well recovered and constructed, but those of coeval carbonates are not good as the organic matters (comp. Fig. 8a and 8b). The carbon isotope data of coeval carbonates are mainly derived from different basins in western Tethys, showing distinct differences of carbon isotopes. More importantly, there are no secular records of surface water carbon isotope reported, which can represent the balance of carbon fractionation between sea-water and atmosphere. Though the carbon isotope of belemnite and ammonite carbonates is available in a few intervals, the isotope data could not reflect results of carbon fractionation in a stable surface water regime.

Supposed that the carbon isotope of belemnite to somewhat is eligible to the fractionation balance between sea-water and atmosphere, we tried to use the data from Cleveland Basin, UK. (Korte and Hesselbo, 2011) and from Pieniny Klippen Belt, Carpathians (Arabas et al., 2017) for the $p\mathrm{CO}_2$ calculation and error propagation of the late Sinemurian-earliest Toarcian (~196-179 Ma). Due to few data of the early Sinemurian (~199-196 Ma) carbon isotope of planktonic fossil carbonate, we temporally use the carbon isotope of benthic oyster fossils from SW Britain (Korte et al., 2009) for $p\mathrm{CO}_2$ calculation and error propagation. Results are attached as the supplementary Table S8, if required.

As shown in Table S8, both $p\mathrm{CO}_2$ and errors are lowered, ~400 ppmV and 200 ppmV lower than those by $\delta^{13}\mathrm{C}_a$ transferred by organic matter $\delta^{13}\mathrm{C}_{om}$. However, the uncertainty is almost same each other. Please compare the results: mean values of $p\mathrm{CO}_2$, error, and uncertainty: 1274 ppmV, 495 ppmV, 38.84% by carbonate (Table S8) and 1661 ppmV, 647 ppmV, 38.97% by organic matter (Table S5). And so quite similar are the uncertainty for each sample and its tendency (comp. Table S5 and S8).

We agree with Referee #2 that by the determination or transfer of $\delta^{13}\mathrm{C}_a$ from marine carbonates, the uncertainty in $p\mathrm{CO}_2$ could be lowered. In other hand, this relies on the conditions of parameters for the $p\mathrm{CO}_2$ calculation and error propagation, particularly for the usage of S(z), paleosol depth of the BK, etc. We think there could be three main factors that causes the result of the same uncertainty using different $\delta^{13}\mathrm{C}_a$ determination methods. The first factor is the aforementioned parameter condition; the second one is that $\delta^{13}\mathrm{C}_c$ of planktonic fossil carbonates are not available for the Early Jurassic interval, which are the real representative of balanced carbon isotope fractionation between sea-water and atmosphere; the third one is the standard error of the Quaternary $S_{(z)}$. As discussed in text, the third one is still the largest source of the uncertainty.

For the reasons above, we don’t think it is necessary to add the detailed results and discussions in text and Fig. 8. In the newly-uploaded manuscript, we only added one sentence explaining the similar uncertainty.

Thank you for time!

Yours sincerely,

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