

Interactive comment on “Dynamic climate-driven controls on the deposition of the Kimmeridge Clay Formation in the Cleveland Basin, Yorkshire, UK” by Elizabeth Atar et al.

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We thank Dr McKay for a detailed and constructive review. Please see the attached PDF for our point-to-point reply.

Interactive comment on Clim. Past Discuss., <https://doi.org/10.5194/cp-2018-172>, 2019.

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We thank Dr McKay for her time and detailed review, which has certainly improved our manuscript. Please find our point-to-point reply below. Text from the review is in blue and our replies are in black.

This manuscript uses a wide variety of geochemical proxies, which they integrate with sedimentological information, to investigate the depositional environment of the Kimmeridge Clay Formation in the Cleveland Basin. In general, the conclusions they reach are valid and after some moderate revisions I recommend publication of this manuscript.

Important revisions:

1. Section 3 (Materials and methods) should include information about precision and accuracy, as well as better descriptions of the analytical methods; notably for the analysis of carbon isotopes. Details are provided below.
2. The manuscript is a bit disorganized in places (e.g., interpretations more suited to the discussion are found within the result section, figures are out of order). Details are provided below.
3. The discussion of the $\delta^{13}\text{C}_{\text{org}}$ data is limited and lacking in detail. The authors simply say lighter values indicate more terrestrial organic matter. While this is correct they do not providing references / background information to support this interpretation. In general, Section 5.2 is lacking in appropriate references.

The important revisions listed above are expanded upon in specific comments section so they are addressed below.

Specific Comments:

Page 1, Line 27 - You talk about “three states that produced a distinct cyclicity” however the paper is primarily divided into two units LVMs and HVMs. This is a bit confusing.

We have rephrased this to explain that that HVMs comprise carbonate-rich and organic carbon-rich units.

Page 3, Lines 27 and 28 - Why are “ocean overturn, salinity/temperature stratification and redox conditions” mentioned in this sentence about organic carbon enrichment? Something does not make sense here.

We have reworded this to make it clearer.

Page 4, line 13 - The sediments might be thermally immature but 425°C is high and would have undoubtedly affected the sediments. Diagenetic alteration can occur at temperatures below 100°C. Just something to keep in mind especially when looking at the Hg data.

We agree. We have added a sentence to consider this. Ongoing research suggests thermal maturity would affect Hg contents depending upon which sedimentary component hosts the Hg. i.e. if the Hg resides in the pyrite, it may be less susceptible to diagenetic alteration (Them et al., 2019).

T.R. Them, C.H. Jago, A.H. Caruthers, B.C. Gill, S.E. Grasby, D.R. Gröcke, R. Yin, J.D. Owens, Terrestrial sources as the primary delivery mechanism of mercury to the oceans across the Toarcian Oceanic Anoxic Event (Early Jurassic). Earth and Planetary Science Letters, Volume 507, 2019, Pages 62-72, ISSN 0012-821X, <https://doi.org/10.1016/j.epsl.2018.11.029>.

Fig. 1.

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