

Reviews of:

“Warming drove the Expansion of Marine Anoxia in the Equatorial Atlantic during the Cenomanian Leading up to Oceanic Anoxic Event 2”

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Alexandre Pohl (CNRS Researcher @ Biogéosciences, UMR 6282 CNRS, Université de Bourgogne, 6 Boulevard Gabriel, 21000 Dijon, France)

Paper summary:

Al Farid Abraham present new sea-surface temperature (SST) and organic redox proxy data for water column anoxia and water column and photic zone euxinia for the Cretaceous. Data come from Demerara Rise, a site that was situated in the central Atlantic, and more specifically from Ocean Drilling Programme Leg 207, site 1258. The data cover 3.8 Myrs, mostly preceding but also covering and slight exceeding OAE 2. The authors show that SSTs and TOC increase before OAE 2 and that water-column anoxia and euxinia spread at the studied location before OAE 2. Photic-zone euxinia only occurred during OAE 2. SST kept increasing in the aftermath of OAE 2. The authors conclude that warming played a critical role in the spread of anoxia in the central Atlantic before, and during OAE 2.

General comment:

The manuscript is concise and clear and overall very well constructed and pleasant to read. New data are not really unexpected nor ground-breaking (since they overlap in part with van Bentum et al., 2009 and O'Brien et al., 2017), but they are interesting and new. Above all, I really appreciated the way the authors used previous work: the reader easily follows what data were generated in this study, what data come from previous work, and the authors compare their new data with previous work in a clever and accurate way. I write this review more rapidly than usual because I am asked to send it by May 1st, and I am currently at EGU, but that's fine with me since I have only minor comments and suggest prompt publication after minor revisions anyway (Please note that I'm no geochemist and am not able to evaluate the robustness of the geochemical analyses).

Minor comments:

1. Impact of the orbital configuration: The authors very rapidly approach the question of astronomical forcing (line 294). I think they could tell a bit more about that, notably in the light of key modeling (Sarr et al., 2019) and data (Laurin et al., 2016; Li et al., 2017) studies. I think that invoking the orbit:

- is important in the introduction;
- might help explaining the onset and/or termination of OAE 2 against a background of increasing SSTs.

2. Please check the figures:

- I think Fig. 1 is not called in the main text, but should be kept in the MS;
- I think Fig. 2 is not called and am not sure it's really useful;
- Fig. 3 is very nice but laterally very compressed, so that all temporal trends are difficult to read (e.g., the large SST increase, which looks like a flat line; or similarly:

“TOC contents in excess of 5%” on 187: this is typically very difficult to see on the figure). Would that be possible to solve that problem? It would at least be helpful to draw vertical lines for key values (i.e., a figure ‘grid’). Also, on line 141, the authors refer to some depth interval, but depth is not shown in Fig. 3. Please add it or convert depth to age in the text.

3. Lines 146–147: “SSTs are lower than those of Foster et al (2007)”. By how much? Again, this is difficult to estimate based on Fig. 3.

4. Lines 182–183: “from the Albian to the Cenomanian”. Albian not shown?

5. Lines 226–227: Regarding sulfurization of OM during OAE 2, please consider the very nice quantification by (Hülse et al., 2019).

Technical comments:

- Line 44: ‘key biogeochemical cycles’
- Line 76 and throughout (e.g., lines 140, 142, 157): Fig. 3.1 should be Fig. 3 I think.
- Line 226: I guess “OC” stands for organic carbon, please define upon first use or remove the acronym (which I think is used here only).

References cited:

- Hülse, D., Arndt, S., Ridgwell, A., 2019. Mitigation of Extreme Ocean Anoxic Event Conditions by Organic Matter Sulfurization. *Paleoceanography and Paleoclimatology* 34, 476–489. <https://doi.org/10.1029/2018PA003470>
- Laurin, J., Meyers, S.R., Galeotti, S., Lanci, L., 2016. Frequency modulation reveals the phasing of orbital eccentricity during Cretaceous Oceanic Anoxic Event II and the Eocene hyperthermals. *Earth and Planetary Science Letters* 442, 143–156. <https://doi.org/10.1016/j.epsl.2016.02.047>
- Li, Y.-X., Montañez, I.P., Liu, Z., Ma, L., 2017. Astronomical constraints on global carbon-cycle perturbation during Oceanic Anoxic Event 2 (OAE2). *Earth and Planetary Science Letters* 462, 35–46. <https://doi.org/10.1016/j.epsl.2017.01.007>
- Sarr, A.C., Sepulchre, P., Husson, L., 2019. Impact of the Sunda Shelf on the Climate of the Maritime Continent. *Journal of Geophysical Research: Atmospheres* 124, 2574–2588. <https://doi.org/10.1029/2018JD029971>