

## ***Interactive comment on “Cretaceous Oceanic Anoxic Events prolonged by phosphorus cycle feedbacks” by Sebastian Beil et al.***

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The manuscript presents an impressive dataset of P-speciation data and high resolution XRF core scans, which help build on earlier works regarding i) the duration of OAEs, and ii) the hypothesis for P-cycling as an important feedback mechanism for OAE development. The work involved in this manuscript could feasibly represent two papers, if the authors saw fit, as the cyclo-stratigraphy aspect over-shadows the P speciation and the data presentation become very lengthy. I have read through the detailed comments from Hugh Jenkyns and Cristian Maerz and agree with their inputs. I will try to give additional contributions, rather than repeating their observations. Generally, this is an impressive dataset and it shouldn't take much work to address these comments.

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## General Comments:

I think there is a missed opportunity here in that one of these cores has been extensively studied previously by the authors (Scholz et al., 2019), with Fe-speciation, redox sensitive metals (Mo, V) and N isotopes. The new P-speciation data would complement this previous study very nicely and more could be made of integrating the two datasets. This could be valuable for the discussion of redox and P cycling through OAE2 and would help give more contextual information, particularly with reference to the evolving nature of redox conditions through the core. I think it would be very useful to the community to examine P-speciation results within the context of the established redox framework that varies locally from nitrogenous to euxinic, and compare this to intervals of ferruginous and euxinic deposition elsewhere (Poulton et al., 2015), and so I am somewhat mirroring a comment made by Dr. Maerz.

## Minor comments:

Line 93: 'oceanic anoxia'

Line 114: The MCE is referred to frequently as it appears in the records, however not much background is given on the significance of this event. Please detail if this is a local feature or a global event comparable to the other OAEs studied.

Line 160: As a disclaimer, I am not so familiar with XRF core scanning techniques, but I would be suspicious of using Fe as a terrestrial element, included in the logTerr/Ca proxy, as there is likely redox-dependent behaviour in these settings that would obscure or bias trends in terrestrial elements if Fe is included. It might be that Fe is lost from the sediment due to reduction in the pore-waters (thereby removing any Fe cycles), or that Fe has been enriched through Fe-shuttling across the basin. It would be possible that the stepped increase in Terr/Ca could be caused by an increase in Fe, due to enrichment of highly reactive Fe-phases (e.g. at the onset of OAE1a). It is also possible that this could create apparent cyclicity, analogous to the cyclicity in FeHR/FeT in other Tarfaya data (Poulton et al, 2015). If Fe is plotted separately or removed from this

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measure, do you see any behaviour that might be indicative of local redox changes dominating the record?

This could be an opportunity to add additional information on redox systematics. . . Can you pull out Fe/Al from the XRF data to aid comparison to the Fe-speciation cyclicity observed by Poulton et al., 2015 in the other Tarfaya core and the previous Fe-speciation data of Scholz et al., 2019?

Also, what about the dilution effect of Ca from high organic carbon production, would this potentially create cycles or stepped changes through the OAEs. There seems to be cycles in TOC from just looking at the linescan photograph, so how much of the cyclicity in logTerr/Ca can be explained by simply changing CaCO<sub>3</sub> concentration?

Could you also please clarify what NGR represents in terms of sedimentary components that drives the cyclicity, and how this links to the orbital pacing mechanisms.

Line 196: is smoked the correct term for this? ashed?

Line 280: the PCE is often associated with faunal changes that represent different water mass movements or local re-oxygenation. I think it is a bit misleading to focus on the extinction aspect. More could be done to reference other studies here.

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