

Interactive comment on “Orbital control on the timing of oceanic anoxia in the Late Cretaceous” by S. J. Batenburg et al.

Anonymous Referee #1

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1. Does the paper address relevant scientific questions within the scope of CP? Yes, the authors want to show and explain climate control on the development of poor oxygenation conditions in the ocean during the Late Cretaceous.
2. Does the paper present novel concepts, ideas, tools, or data? This paper doesn't really present any new ideas, but it has many new data and a slightly different approach from previous papers on the same subject. This paper attempts to define the time frame of the Cenomanian-Turonian interval by integrating new radiochronologic data and using more recent astronomical data. Cyclostratigraphic analysis is performed on data in part different than previously.
3. Are substantial conclusions reached? No, because this article does not stand out enough from that of Mitchell et al., 2008 and the differences in interpretation are not

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sufficiently justified.

4. Are the scientific methods and assumptions valid and clearly outlined? More or less. The assumptions seem to be more or less valid, but there are too many assumptions. For example: - The correlation between MS et chert ; - The link between the different proxies studied and the carbon cycle - The contribution of nutrients from Caribbean plateau activity. One may ask how the transfer of material in view of the cenomanian paleogeographic configuration is. I think, as authors, both the climate and the Caribbean plateau activity are at the origin of the Cenomanian-Turonian anoxic nevertheless this paper does not really show it.
5. Are the results sufficient to support the interpretations and conclusions? No 1) Because there is no discussion on the choice and the climatic significance of the different proxies studied. Why do studied proxies differ according to stratigraphic interval? Unfortunately these proxies do not have the same meaning: The reflectance is controlled by the lithology. The SiO₂ concentration is function of both detrital influx variations and authigenic / biogenic silica content. The concentration of Al₂O₃ and TiO₂ reflects changes in detrital flow. Magnetic Susceptibility (MS) variations are function of the concentration in dia - para and ferromagnetic minerals. How do you explain the increase in MS in levels rich in diamagnetic minerals? Is it strange? Have you done a statistical analysis which shows the correlation between MS and authigenic/ biogenic SiO₂ content? 2) How did you measure the $\delta^{13}\text{C}$ in chert? These analyzes do not explain what is the minimum carbonate content for valid $\delta^{13}\text{C}$ values? 3) The authors state "we procure insights in the relationship between orbital forcing and the Late Cretaceous carbon cycle by deciphering the imprint of astronomical cycles on lithologic, geophysical and stable isotope records..." but the data shows that the imprint of astronomical cycles in the stable isotope records and specially $\delta^{13}\text{C}$ is very difficult for deciphering, that's why, the cyclostratigraphic analysis is applied to others proxies whose link with the carbon cycle is not shown. Some authors' conclusions are in agreement with Mitchell et al. (2008) works. Mitchell et al. in particular, show a

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cyclicality of about 2.4 Ma in the development of anoxia. Unlike Mitchell's works Batenburg et al. suggest that "the exact timing of major carbon cycle perturbations during the Cretaceous may be linked to increased variability in seasonality partner after the prolonged avoidance of seasonal extreme" at the 2.4 Myr scale. This interpretation is not confirmed on any figure. We don't see the 2.4 Myr cycles on Figure 3. Why are not the insolation variations calculated from La2011 data presented?

5. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? Yes, but scientific reasoning should be more explicit

6. Do the authors give proper credit to related work and clearly indicate their own new/original contribution? I don't doubt the quality of the data, but the choice of these data should be better explained. Their own new contribution is clearly indicated.

7. Does the title clearly reflect the contents of the paper? With this title and content, this article does not stand out enough of Mitchell et al. (2008) works.

8. Does the abstract provide a concise and complete summary? Yes

9. Is the overall presentation well structured and clear? I think the section "results" requires a total reorganization. Before addressing the proxy data and the link with the lithology, we should discuss the time frame of these series (radioisotopic dating + correlation). Any cyclostratigraphic analysis must begin with an accurate (bio)chronological framework. The authors indicate, correctly, that the stratigraphic timing is not based on biostratigraphic, but chemostratigraphic correlations with well-dated series. I believe in the validity of such correlation, but nevertheless to valid a correlation, two continuous chemostratigraphic records must be correlated, which is not the case in this work (see Figure 9). Figure 9 is not convincing and not valid since it lacks isotopic data of the Bonarelli level. On the other hand, this figure is misplaced. It should be positioned at the beginning of the article. Thus, a part of the results and some figures should be reorganized. Another figure that shows the link between $\delta^{13}\text{C}$ and 2.4 kyr orbital

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cyclicality should be integrated.

10. Is the language fluent and precise? Yes

11. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? Yes

12. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? Yes, In "Geological setting and proxy records" paragraph, the choice of proxies studied and their meanings must be explained. The "result" paragraph must be reorganized. Correlations and 2.4 kyr orbital cyclicality must be better argued. The modified Figure 9 should be placed at the beginning of the Article. The synthetic Figure 2 should be placed at end of the article.

13. Are the number and quality of references appropriate? Yes, but it is necessary to include additional references to explain the significance of the studied proxies

14. Is the amount and quality of supplementary material appropriate? There are not any

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