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## Comment on cp-2021-83

Clement Bataille (Referee)

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Referee comment on "Terrestrial carbon isotope stratigraphy and mammal turnover during post-PETM hyperthermals in the Bighorn Basin, Wyoming, USA" by Sarah J. Widlansky et al., Clim. Past Discuss., <https://doi.org/10.5194/cp-2021-83-RC1>, 2021

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Widlansky et al. present much-needed chemostratigraphic information for the Fifteenmile Creek area covering some of the Eocene hyperthermals. There are two main objectives with this study: 1) compare the carbon isotope results with those of Abels et al. 2016 and assess the terrestrial amplification of the  $\delta^{13}\text{C}$  signals and 2) provide a better chemostratigraphic context for some of the claims of Chew 2015 linking hyperthermal and faunal turnover. The authors produce an impressive isotope chemostratigraphic record with hundreds of samples. The analytical issues encountered were a bit surprising but they are well-explained and justified. I believe this is a good paper with a lot of potential to better explore the link between hyperthermals, climate and biostratigraphy at the scale of an entire sedimentary basin. However, at this point, I don't think this study is fully reproducible mostly due to the lack of details relative to the stratigraphic work. I suggest major revisions to account for this limitation and make sure the findings can be compared to other locations across the Bighorn Basin

Major comments:

I recommend the authors to read for example "Lehman et al. Stratigraphy and depositional history of the Tornillo Group (Upper Cretaceous-Eocene) of West Texas". When I worked there, I used that document and could easily correlate stratigraphic sections with each other and reproduce the work of the authors thanks to maps, tie-points and field photos. This was super helpful to build upon their work, particularly the maps with the different sections and the stratigraphic correlation between sub-sections. You can

also read the paper Bataille et al. 2016 Chemostratigraphic age model for the Tornillo Group: A possible link between fluvial stratigraphy and climate". I think your paper is more similar to Bataille et al. 2016 as it focuses mostly on chemostratigraphy and age model. I fully understand that this work is not a stratigraphic piece but I think that the study really needs to link with previous stratigraphic work in the area to strengthen the age model. So I am suggesting below some additional figures and material to help the readers use this new chemostratigraphic data.

So I suggest that:

- It is ok to focus on chemostratigraphic correlations (e.g. Fig. 5) but this needs to be done with a stratigraphic context. The authors should add a figure linking sub-sections with the selected tie-points and the method to correlate each section (see for example Fig. 6 in Lehman et al. or also Fig. 2 in Bataille et al. 2016 or supplement in Bataille et al. 2016). For example, we use the marker bed XX to correlate between sub-section XX and XX ...etc... Or we used elevation records to trace this bed... So that the reader can understand solid tie points and more uncertain ones... If available some field photos of these marker beds would be really useful so that they can easily be identified in the field. Giving a table of tie-points used and their stratigraphic level would also be useful.
- The authors should add some zoomed maps in the supplement for each sub-section measured showing where they were measured (see for example Fig. 5 in Lehman et al.). This is really helpful to go back on the field. I understand there is GPS but this is easier to look at a path on a map in my opinion.
- The author should add a full composite section of their subsections and compare it to Bown et al. 1994 with biostrat and magnetostatic data tie points.
- In Fig. 5 it might be good to change the symbol by sub-sections to check if some of the noise is related to stratigraphic mismatch between sub-sections or at least to add this figure in the supplement. A broader discussion of stratigraphic mismatch or uncertainties is also needed.
- Once this is done it would be good to plot the chemostrat record using all the available age model information similar to Fig. 5 in Bataille et al. 2016... This is far from perfect but it helps the reader a lot in my opinion to link this record with broader record either from this basin or at the global scale.
- I think these figures will also help the authors to improve a bit some of the discussion relating chemostratigraphy with faunal turnover and comparing chemostratigraphy with the Abels et al. 2016 section.

