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Reply on RC2

Sarah J. Widlansky et al.

Author 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-AC3>, 2021

Thank you for your comment and for taking the time to review this work. We will incorporate your feedback in the final version. We agree that the criteria used to define the excursions were somewhat ambiguous, partially due to variation in the ways the CIEs are preserved in the record. We feel that the Basin Draw section introduces the most uncertainty in our interpretations for several reasons (e.g., difficulty correlating to the other sections, ambiguous carbon isotope results, and complicated cut-and-fill deposition that likely obscures the stratigraphic patterns). Taking this into account, we will be revising our interpretation to not include the ETM2 excursion in this section. Instead, we will list this as a potential interpretation and clearly describe the uncertainty surrounding this section in the text. Keeping this section in will provide a target for future work in the area that may help resolve the Basin Draw section further.

We feel that the BCM levels, while not perfect, do provide a reasonable basis for correlating between the different sections. These levels were based on rigorous bed-tracing, measurement, and mapping that represents the best available stratigraphic framework that exists for the area (Bown et al, 1994). The primary uncertainties for this framework are: (1) bed tracing is inherently difficult in this area, and (2) knowing which stratigraphic level was used for fossil localities with multiple fossiliferous levels. Also, because sections were not measured concurrently with sampling for stable isotope work, there will be some inevitable offset. We did trace additional beds while measuring our chemostratigraphic sections to confirm the relative levels between sections, and the details of this work will be added to the next version to help strengthen our stratigraphic interpretations. We also agree that the isotope record itself can be used to correlate between sections. In the example you mentioned (correlation between Kraus Flats and North Fork) the isotope correlation is consistent with the correlations using BCM levels and dGPS. The primary difference between the three methods of correlation is the relative spacing between the excursions (which is expected given the different methods, and associated uncertainties, used for measuring stratigraphic thicknesses). Our composite section takes this into account by using only the minimum isotope excursion values for each excursion (and lining them up) and then using the thickness measured using a Jacob staff. This way, it does not include the uncertainty associated with BCM levels or elevation and uses only the uncertainty associated with Jacob staff measurements. The fossil record, while promising as an additional tool for correlation, is difficult to use due to considerable variation in numbers of specimens from each locality and low numbers of

localities from each section. Additionally, one of the primary goals of the study is to develop a chemostratigraphic framework that does not rely on the fossil faunas so that the previously observed faunal turnover can be independently compared to the carbon cycle record.