

January 29, 2024

Dear Dr. Reyes,

Thank you for handling our manuscript. We have responded to the reviewer comments, which have substantially improved our interpretation and also our description of the Ogallala Formation more generally. Though we go into detail in response to each of the reviewers' comments, we summarize here three major points raised by the reviewers and our responses:

1. We have substantially revised our description of the Ogallala Formation in Section 3 (we note that we use the terminology "Formation" throughout the manuscript) based upon the feedback from the reviewers. We have incorporated (1) more accurate descriptions of the calcic units found throughout the Ogallala, (2) additional references, and (3) highlighted the regional variations in the Ogallala, particularly between the southern and northern High Plains.
2. We now report (in Table 1 and Table 3) the  $\delta^{13}\text{C}$  of our data and of the compiled carbonate data. We now also provide a statistical overview of this data in Section 5.2. Table S1 also contains all of the  $\delta^{13}\text{C}$  data. If the doi remains unavailable until publication, please use the following link to access Table S1: <https://datadryad.org/stash/share/sY5SXxVH-Hfp104CZ4m-grrcnOh-RAwdbCNrF1Avcg>
3. We now address, in Section 6.2.3, why our stable isotope data suggest that these carbonates formed in the late Miocene. In short, there is very little variation in the  $\delta^{18}\text{O}$  values of our carbonates and the uniformity of  $\delta^{18}\text{O}$  values spans different types of samples, suggesting that all of the carbonates formed from the same source waters. Additionally, in nearly all of our sections (except those in eastern New Mexico, see response to reviewers for further details), the  $\delta^{13}\text{C}$  values are low and much lower than published Pliocene and Pleistocene carbonate  $\delta^{13}\text{C}$  values that record the spread of C4 grasses in the Plio-Pleistocene. Consequently, we suggest that nearly all of our samples formed in the late Miocene and record late Miocene environmental conditions.

We look forward to further comments and feedback on our manuscript and again thank you and the reviewers for your thoughtful and helpful comments on our study.

Sincerely and on behalf of all authors,



Jeremy K. Caves Rugenstein