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Climate of the Past Discussions

Interactive comment on "Aptian-Albian clumped isotopes from northwest China: Cool temperatures, variable atmospheric pCO_2 and regional shifts in hydrologic cycle" *by* Dustin T. Harper et al.

Anonymous Referee #1

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The manuscript entitled as "Aptian-Albian clumped isotopes from northwest China: Cool temperatures, variable atmospheric pCO2 and regional shifts in hydrologic cycle" by Dustin T. Harper et al., present new results of pedogenic carbonate stable isotopes (δ13C, δ18O and Δ47) from the lower mid-Cretaceous (Aptian-Albian) Xiagou and Zhonggou formations, Yujingzi Basin of NW China. Authors estimate the MAT using Δ47 of carbon ad oxygen isotopic values and the MAP using CALMAG of mudrocks, further calculate the pCO2 using MAP and δ13C of pedogenic carbonates with other parameters, and discuss the carbon and hydrologic cycles for the interval of the

Aptian-Albian. This work is a new progress of the land quantitive paleoclimate in North China, even in East Asia. It would provide clues and references for the climatic reconstruction of the greenhouse Cretaceous period. However, more data and evidence need to further enhance and refine, and some issues have to solve.

1) Geological data to complement. Though figure 1 shows the locations of samples in outcrop, it does not have any geological significances. It does not exhibit any stratigraphic sequences with sample horizons. In my opinion, it is important that sampling locations are plotted in a geological sketch. And it is advised that a sampling log is added.

2) Data age. Authors used the organic stable carbon isotope chemostratigraphic records for the site (Suarez et al., 2018) to have the studied strata age-controlled. Albeit more than 400 organic stable carbon isotopes were correlated and suggested the Aptian-Albian in Suarez et al. (2018), it is not assured and persuaded due to lack of precise age reference-point and age-index fossils. This is a common issue and problem of the land materials for paleoclimatic analysis. It is cautious to make the precise correlation for the terrestrial strata and samples.

3) Field description of paleosols. It is key to make sure the observed horizons are real paleosols, i.e. authors claimed the paleosols a kind of vertisol. I do not see the details of the paleosols even though authors have done analyses of CL and microfacies for the calcareous nodules. Shape, size, content, and occurrence of nodules can provide us reference for paleosols. Color, structures, and ped types can give us some information about the paleosols. Other more, vertisols are a kind of paleosols we do not easily observe and distinguish in practice in field recognition. Detailed notation of evidence seems necessary for the classification of the vertisol.

4) Drilling samples for clumped isotopes. It is a good job for the clumped isotope. But it is also a problem to take powder samples from the calcretes. This is because we only need <0.1 mg for the common C-O analyses of carbonates, but we have to take over 5

mg for clumped isotope analysis. It is difficult to take so much from a calcretes sample according to much experience. So, how to get the enough quantity of the powder sample may need to expain.

5) Low temperature and low pCO2 in the Aptian-Albian. As we know from lots paleoceanographic and paleoclimatic achievements, the mid-Cretaceous is the hottest interval in the Phanerozoic. So, the conclusion from the authors that a low temperature had been in the Aptian-Albian may need to further examine except for the short "cold snap". It may be paradox that low temperature is consistent with low pCO2 in the Aptian-Albian in Northwest China. This is because the pCO2 is almost global in nature, but the temperature in a basin, North China, was probably local record to great degree on land. Actually, we know the Cretaceous climate was not homogeneous in China.

6) Some references are not regularly lined in text. For examples, references cited in Lines 55, 269, etc. are neither listed in the sequence of publishing time nor of surname letter.

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