Clim. Past Discuss.,
https://doi.org/10.5194/cp-2020-36-AC3, 2020

Climate of the Past
Discussions
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Interactive comment on "Clay mineralogical evidence for mid-latitude terrestrial climate change from the latest Cretaceous through the earliest Paleogene in the Songliao Basin, NE China" *by* Yuan Gao et al.

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Received and published: 10 June 2020

My general comments on Gao et al. "Clay mineralogical evidence for mid-latitude terrestrial climate change from the latest Cretaceous through the earliest Paleogene in the Songliao Basin, NE China" are summarized here. The Earth's climate state of late Cretaceous was characterized by high atmospheric CO2 and global warmth. Significantly, the late Cretaceous era is a key period for biotic evolution. However, our knowledge of Earth's state during this period is mostly from marine records, owing to a lack of well-dated high-resolution terrestrial records. The paper by Gao et al. presents well-

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dated high-resolution clay mineralogical records of the Upper Cretaceous and Lower Paleocene terrestrial deposition from the Songliao Basin, northeastern China. Their data shown that the relative percentages of the clay minerals were mainly controlled by regional paleoclimate and sedimentary environment, and they utilized three clay mineralogical proxies for paleoclimatic reconstruction. They found these proxies varied sensitively in responded to global climate changes during the latest Cretaceous to the earliest Paleogene. Their clay mineral data provide independent evidence for climate changes through the latest Cretaceous to the earliest Paleogene from the Songliao Basin, and would shed light on further investigations in biotic evolutionary during this period. The layout of this paper is good and the writing is in good shape. As such, I think this paper deserves to be published in Climate of the Past and potentially to be interested by a wide range of readers, albeit some aspects are still need to be improved. The following are some weak points that in my opinion should be addressed to improve the paper.

Response: We appreciate the helpful comments by Anonymous Referee #2.

My main issue with the study is that the authors have to further justify their clay mineralogical proxies are reliable proxies for paleoclimatic reconstruction. In fact, in addition to climate and weathering, many other factors, such as provenance, recycling of sedimentary parent rocks, transport processes, and depositional environments, all could influence the type and proportion of clay minerals. I suggest the authors to evaluate to what extent these factors have influenced their clay mineralogical proxies. Lines 24-26: These clay minerals can be also sourced from recycled sedimentary parent rocks. How to preclude this? See the comment above.

Response: We rewrote section “5.1 Origin and paleoclimatic significance of clay minerals in the SMF of the SK-1n core” to better constrain the origins of clay minerals and the rationales of clay mineralogical indicators as paleoclimatic proxies. We consider weathering of parent rocks and pedogenesis as two main origins of clay minerals of SMF. In a wetter hydroclimate, with an intensified hydrologic cycle, increased chem-

ical weathering on parent rocks and higher rates of transformation and neoformation in soil profiles are expected to generate more smectite versus illite, higher illite chemistry index, and more clay minerals versus clay-sized quartz. We also consider other sedimentary processes, such as differentially settling and sedimentary recycling, have little influence on our clay mineralogical records, because the Songliao Basin contained only small ponds or lakes and had a relatively flat morphology at the latest Cretaceous. Please see new text for more details.

Lines 97-106: What are the new contributions of this paper beyond Gao et al. (2013; 2015b)?

Response: We add 213 new data in the current paper, and include 91 data points published previously in Gao et al. (2013) and Gao et al. (2015b).

Lines 106-108: I suggest the authors to mark the published data in their figs. 2, 4, and 5.

Response: We marked new and published data with different symbols in Figure 2. However, we keep the same symbol for all data in Figures 4 and 5 so as not to distract readers, because these two figures are focused on terrestrial climatic evolution in the Songliao Basin and correlations to the paleosol stable isotope and global records.

Lines 423-429: If the clay mineral proxies can only response to the long-duration climate events (>200 kyrs), then how to explain such many minima in their clay mineralogy proxies (such as percent of smectite, illite, and ratio of smectite/illite) in the figs. 2, 4, and 5?

Response: We consider the minima and/or maxima in the clay mineralogy proxies actually reflect influences of in-situ clay formation during pedogenesis. In a paleosol profile, the clay composition in the top horizon and the bottom horizon may have differences larger than 50% (Maher et al., 2009).

Fig. 2: I suggest to 1) add the published observed magnetozones to geomagnetic

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polarity timescale (GPTS), 2) legend for lithostratigraphy, and 3) include labels like a), b), c) for the subplots.

Response: We revised Figure 2 following this comment.

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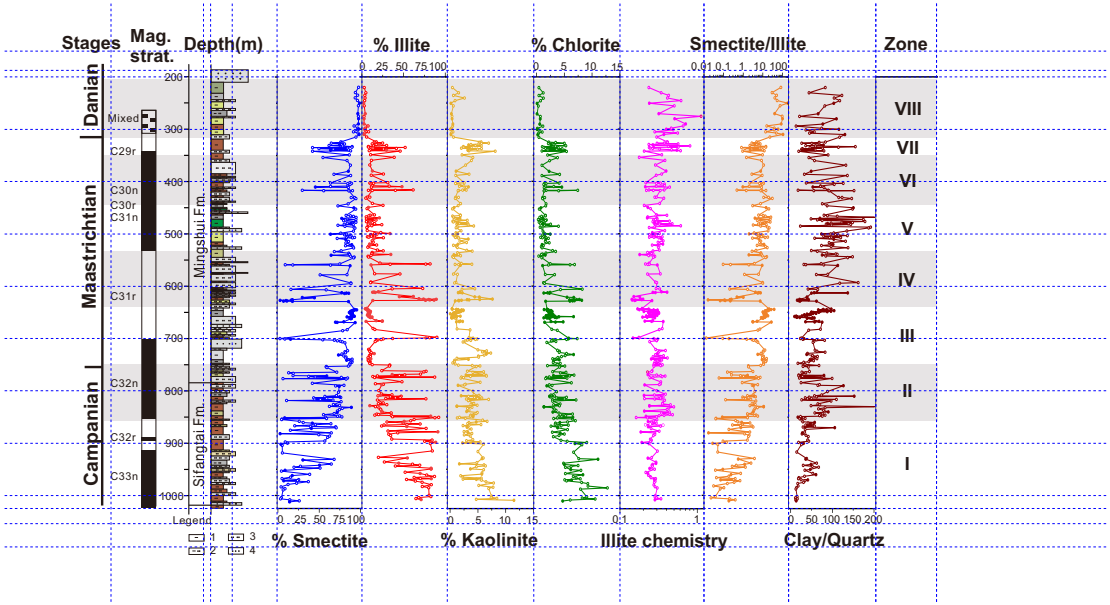

Fig. 1. revised figure 2

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