Clim. Past Discuss.,
https://doi.org/10.5194/cp-2020-36-RC3, 2020

Climate of the Past Discussions

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.

Anonymous Referee #3

Received and published: 9 May 2020

Dear Natascha Töpfer

Thanks for your invitation for the review of the manuscript submitted by Gao et al.(2020, doi:10.5194/cp-2020-36). The manuscript reported a clay mineralogical record from the late Cretaceous to early Paleocene, especially across the dramatic K-Pg boundary with a high-resolution record, and concluded a novel climate change based on clay mineralogical proxies. The paper is generally well-written and organized. The scope of this manuscript is well-chosen and will meet the broad interest for geologist. I give moderate revision because I think some issues which are the base of interpretations

need to be more discussed. The concerns are listed as follow:

1. The authors chose mudstones rather than sandstones to avoid the authigenesis during the diagenetic stage. However, how to prevent the influence of clay minerals from pedogenesis, which was widely developed throughout the SMF (in lines 152-153). In the pedogenic process, in general, clay minerals could form in solutions or transfer from other clays. The authors claim the clay minerals need to be primarily detrital in origin to use for paleoenvironmental reconstruction (Lines 240-241). However, two sources of smectite are discussed in the manuscript, in which in-situ formation is not excluded (Lines 264-265). It seems too simple to describe the factors affecting the interpretation of clay mineralogy, such as parent rock weathering, pedogenic formation, and differential settling on origins. (Lines 283-292). 2. According to Lines 188-194, the authors seem to add random mixed-layer illite-smectite to smectite when semi-quantifying the abundance of smectite based on the 17 Å peak area. As a matter of fact, the random mixed-layer illite-smectite could be a very wide peak between 10-15.5 Å under air-dry XRD pattern, which will split into two peaks at ∼17 Å and 10 Å after ethylene-glycol solvation. From Figure 3, we can tell the intensities of peaks at 10 Å enhanced after ethylene-glycol solvation besides the enhancements of peaks at ∼17 Å. From this point of view, the semi-quantitative amount of smectite could be questionable. Furthermore, the mixed-layer illite-smectite is an independent mineral phase, which could be the detrital phase from old strata or authigenic phase transformed from illite during pedogenesis. The amount of mixed-layer illite-smectite will likely affect the proportions of other clay minerals. Why the randomly ordered mixed-layer illtie-smectite and smectite have similar origin and paleoclimatic significance (Lines 253-254)? 3. In Figure 2, I suggest the authors add the age constrains, and then readers can know clay mineral trends and mutations along with the age. 4. I suggest the authors point out which pattern denotes what kind of treated slides in Figure 3. I can understand the black, blue, and red curves denote patterns of air-dry, ethylene-glycol solvation, and heating at 490 °C, respectively, which could not be the case for non-clay mineralogists. From the patterns of heating at 490 °C (Figure 3a, b, and f), we can read the peak at ∼14 Å

could be chlorite. However, why the authors did not present patterns of heating at 490 °C to further confirm having or having not chlorite in samples in Figure 3c, d, and e. 5. The author claimed the stronger chemical weathering under more humid climate would produce more clays compared to quartz (Line 297-298). I think it is promising on condition that it happened in in-situ pedogenic profile. However, the grain-size distribution in this study could largely depend on sedimentary process.

Interactive comment on Clim. Past Discuss., https://doi.org/10.5194/cp-2020-36, 2020.