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Comment on cp-2021-108

Anonymous Referee #2

Referee comment on "Low-latitude climate change linked to high-latitude glaciation during the Late Paleozoic Ice Age: evidence from the terrigenous detrital kaolinite" by Peixin Zhang et al., *Clim. Past Discuss.*, <https://doi.org/10.5194/cp-2021-108-RC2>, 2021

Clay mineralogy is well outside my area of expertise so my comments are confined to the paleogeography and general aspects of chronostratigraphic correlations which are essential in reaching conclusions about climate responses across latitude in the Late Paleozoic Ice Age.

The paleogeographic context is inadequate. Fig. 1a is a cartoon with virtually no documentation of how the North China Block was positioned in the Early Permian, e.g., Liu1990 cited is a one-page comment/reply and Blakely2011 has no quantitative analysis for determination of paleolatitude, whereas Yang+Lei1987 and Zhou2002 are not readily accessible and would need to be described here for a broader audience. The authors state that the NCP was located at ~5-15°N but there could be a huge lithostratigraphic consequence between being in the tropical humid belt (5°) and the arid belt (15°). Unless the authors have alternative methods, paleolatitudes are based on paleomagnetism and hence the authors might consult references to the modern paleomagnetic literature and syntheses for the NCB and Tethyan environs in papers like Torsvik+2012 ESR or Kent+Muttoni2020 Palaeo3.

There is a bewildering array of regional and global stage names and fossil zonations for the Late Paleozoic but one would have to be a real aficionado to decipher from Fig. 1c where in the geologic column all the names are supposed to be: Early Permian? A very rudimentary paleogeographic map (Fig. 1b), which should at least show lines of paleolatitude, is labeled Cisuralian but that time-stratigraphic interval is not indicated in the stratigraphic column in Fig. 1b.

Two U-Pb dates are quoted as 270.7 Ma and 299.4 Ma based on 5-11 zircons selected from an astonishing number (1000 to 1500!) grains extracted from two levels. The technique is not described (presumably laser-ablation ICPMS) nor how the 1:100 grains were selected, or what was done with the remaining zircon grains (were they measured?). What about potential lead-loss? These dates are extremely important for the chronostratigraphy and correlation to the wider world and must be described in much

more detail; the reportage of Gehrels+2020 Geochronology may provide a useful example.

A thickness-age plot (with cumulative thickness scales and not simply scale also shown in the stratigraphic diagrams in Figs. 1c, 4, 8,) would be useful to assess temporal resolution of stages and fossil zonations.

In summary, the authors should take the opportunity to provide a broader and deeper context for their results, including more detailed map and stratigraphic charts with explicit proposed tie-lines to standard columns, especially when so much of the literature is so difficult to obtain let alone read by most of us outside of China. As it stands, the spatiotemporal and this climate significance of the work remains unfortunately superficial.

My suggestion is that major revisions are needed before the paper can be reconsidered.