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Climate of the Past Discussions

Interactive comment on "Early Jurassic climate and atmospheric CO_2 concentration in the Sichuan paleobasin, Southwest China" *by* Xianghui Li et al.

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In this manuscript, Li and coauthors present new descriptions of Jurassic sediments and paleosols and new carbon and oxygen isotope data. They use these data to interpret an overall drying trend from Triassic into Jurassic, which is well supported, and they relate climate and environmental change to atmospheric pCO2.

My concerns are primarily related to the new pCO2 determinations made. First, luminescent calcite (lines 141 and 142) is probably not a good material to use for paleoCO2 determinations because luminescent pedogenic carbonate is thought to form under anoxic conditions, associated with water-saturation when there is a poor connection

between soil pore spaces and the atmosphere (Mintz, J. S., Driese, S. G., Breecker, D. O., & Ludvigson, G. A. (2011). Influence of changing hydrology on pedogenic calcite precipitation in Vertisols, Dance Bayou, Brazoria County, Texas, USA: implications for estimating paleoatmospheric pCO2.ÂăJournal of Sedimentary Research,Âă81(6), 394-400.). The paleosol carbonates studied here might be 'weakly' luminescent, but it is hard to tell without any quantification/standardization. It is also possible that there are other factors that influence luminescence. But all of this needs to be discussed so readers can evaluate the selection of materials. I will say, however, that the careful petrography and drilling of dense micritic zones is a plus.

I am concerned that the CO2 changes the authors interpret here may not be statistically significant changes. This is impossible to evaluate without uncertainty quantification. The authors do consider the effect of using different input values for the pCO2 calculation, but my guess is that they have nonetheless largely underestimated the error associated with their approach. For instance, the authors calculate d13Cr values from d13C values of OM measured in different locations (across the globe) from the carbonate nodules. What magnitude of uncertainty might this introduce? Furthermore, d13Ca is calculated from d13Cr. Given the effects of CO2 and water stress on d13C values of C3 plants , this approach is associated with substantial uncertainty that is not addressed in this manuscript. The authors recognize that there is uncertainty associated with the value of S(z). However, their consideration of S(z) = 2000 and 2500 ppmV is not an accurate representation of the uncertainty. I suggest error propagation that includes uncertainty associated with each input to the equation on line 159 and the results shown as error bars on each CO2 determination.

The descriptions of the sediments and paleosols reported here will be useful. I'm not sure I would call these Aridisols, though, because redoximorphic features are prominent (at least in some of the soils, e.g., Fig 3 a,b,c). Are you sure these are not Vertisols? Are there wedge-shaped peds? The authors mention abundant slickensides- a feature common in Vertisols.