

## Review of egosphere-2022-1352

General comments: I would like to thank Luo et al. for their submission to SOIL. I enjoyed reading about toposequences in this region of China. The authors presented a suit of physical, chemical, and mineralogical data for 5 toposequences forming from similar parent material in the Sichuan basin. They general found changes in bulk elemental composition with slope position. The current state of the manuscript is not ready for publication and needs major revision. Currently, this manuscript presents a lot of data but lacks organization and direction in terms of the manuscript objectives, findings, and discussion.

First, why the use of “microtopography”? When I think of microtopography, my references scale is maybe a meter to 3 meters, I think of swale topography or tree throw. Here, this is hillslope scale topography, you could use “toposequence” or more classically “catena” to describe the scale upon which the work is relevant. I would also prefer the title be written, currently is grammatically incorrect. Just write as a statement describe the major finding of the work: “Topographic influences on pedogenesis in the mudstone derived soils of the Sichuan basin”.

The introduction is general and unorganized. You could better hone this by starting more generally presenting how topography impacts soil formation and why on a small scale it overrides other soil forming factors. Then becoming more specific and reviewing other relevant examples of toposequences, their findings, and how there is a gap in the current literature that your work will ultimately fill. Finally, the manuscripts objectives should be clarified. Currently, I think the three that are listed are just different ways of saying the same thing: we are going to investigate how landscape position influences soil formation. You have a lot of data, you also discuss some of the human influences that are landscape dependent, which I think is a potential interesting way to investigate human activities as a soil forming factor. What other objectives/hypotheses could be developed and tested using the data that you already have?

The methods appear incomplete. In terms of sites, do you select sites that all had the same aspect? And if so, what were they? You cited a reference and stated that you followed similar methods. You should still provide the reader and relatively sufficient summary that they could reasonably understand what you did and replicate your study. You later presented mineralogy data but added no mineralogy prep methods, this should be added to the methods section. You also wrote certain sections that reference significance without statistics or describing how stats like ANOVA and person’s correlations were calculated. These methods and statistical techniques should be added to the methods section.

The discussion is mainly just generalities about soil formation with little discussion of the results in context of the available literature. Once you reformulated and thought through your hypotheses, you can use them to guide your discussion. Did you confirm the hypothesis? If so, what does that mean for soil formation? If not, what else may be occurring that could explain your results. Providing context from other toposequences would be highly valuable. What have others found in similar toposequences? Do they align with your results? Do they not? Why or why not? This discussion would provided greater context for your findings.

Specific comments:

Line 14: delete “the” at beginning of sentence.

Line 19: Do you mean “deposits”? not ‘deposition’?

Line 19-20: Could you provide more relevant geographic information? For example the approx. distance from the site to dominant city in the Sichuan basin?

Line 22-24: Revise sentence to: “From the summit to the toeslope, soil thickness increased significantly and profile configuration changed from A-C to A-B-C.”

Line 24-26: I do not currently understand how the patterns in Ca, Na, Al, Fe, and Mg changed as written. Are you saying that you find that in the summit Ca and Na were enriched in the soil relative to the PM but was depleted in the Footslope? Same goes for Al, Fe, and Mg.

Line 29-31: You also have the addition of weathered components and I think from the previous sentence enrichment of Al, Fe, Mg. Longer residence time for sure, but also additions of these elements.

Line 82-85: As written, these aims are the same. You are equating slope positions with microtopography, correct?

Line 86: How does this work lead to regulation of soil forming processes? Are you trying to say that you could use this work as a basis for soil management?

Line 127-128: Did you perform any pretreatments for your PSA? Like removal OM?

Line 149: Should be ‘silt loam’ not ‘silty loam’.

Table 2: You can’t use the ‘h’ suffix with the A horizon. I’m not sure what you are saying with the “Ah” horizons, which is consistent across your summit positions.

Line 161: You need to cite Torrent et al. (1983) for the redness rating calculation.

Line 163: I do not agree that the RR you have calculated is “low”, 10R and 2.5YR hues are really red, I think that you should think more carefully about the RR values in light of the soil colors you have described in Table 2.

Line 164: So the max RR is in the C horizon, so could you have a red parent material and the soil is just inheriting this color. If this is the case, is RR/color a good indicator of soil development?

Line 175: How did you assess porosity? Is this just assuming a certain mineral density? Or did you evaluate this in the lab? Please provided these methods in the methods section.

Line 177: Do mean the bulk density of the A horizons was less than the B horizons?

Line 178 – 181: Your reasoning about the differences in bulk density between A and B horizons is incorrect. The A horizons have a lower bulk density because they have higher OM and from your texture more clay content, which has a lower density than inorganic minerals. The B horizons likely have a higher bulk density due to compaction from the overlying A horizon mass, a loss of OM, and an increase with sand content. Also, how could it be that the A horizons are not also disturbed by the human activity but the underlying B horizons are? Are you trying to suggest this is a plow pan?

This should also be moved to the discussion section.

Line 188: When you say significantly higher, did you do a statistical test to test this? Please report your p values and test statistic here. This applies to the entire results section.

Line 232, Fig 5: Large easy to read text indicating which elements is being present. I also think this figure might be more informative as a table.

Line 233-238: How do you know that there were significant differences, please present some statistics to help us evaluate these differences.

Line 238-239: Again, please report statistics for these correlations.

Line 239-246: What figure are you referencing when discussing the trends in CIA, CIW, and Na/K changing between landscape positions within the A, B, and C horizons?

Line 244: What do you mean by “strongly detached”? I think that you are just saying that the B horizon is comprised of eroded and weathered material from higher landscape positions.

Line 251-254: What are the migration coefficients and how are they calculated? Are these tau values? Or some other indicator of element enrichment/depletion?

Line 262-267: How did you prep your samples for mineralogy? Are these oriented clay slides? What XRD instrument and scan parameters did you use. What treatments did you use to differentiate minerals?

Line 276: Please provide these statistical techniques in the methods section.

Lines 276-281: This should be moved to the result section.

Lines 283-292: How does your data provide a measure of Fe/Al oxide content/concentrations? Did you perform dithionite or oxalate extractions to assess the presence of crystalline/amorphous Fe/Al oxides? Further, this is rather general review information and does not provide a specific context for your results? Can you dig deeper into your data to provide some context for topographic influences on the mineralogy and geochemistry that you presented?

Lines 296-298: This is redundant to what is reported in the results in lines 239-246. Please delete here and report statistics in the results section.

Line 298-301: I'm really not sure what the sentence is saying. How are the soils at the summit and shoulder positions developed under natural conditions whereas other slope positions are not? Are you trying to say these have experienced less human influences? Please explain what you mean by 'natural hydrothermal status'. Are these soils impacted by hydrothermal (i.e., heated groundwater) processes? If so, that substantial changes some of the interpretations about your data.

Line 302: Sodium is not a necessary nutrient for most plants. For this reason, we often use it as an indicator of chemical weathering and leaching because it is not biocycled. I also don't think that cycling

of Ca, Mg would slow chemical weathering, it could change the distribution of Ca and Mg within soil profile, but there will always be some leaching and loss from the soil.

Line 306: Instead of rust spots, do you mean redoximorphic features?

Line 308-312: I think it is a big leap to say that tillage causes greater chemical weathering. If you wanted to discuss this potential it would have been informative to include a representative catena that is largely unimpacted by humans.

Line 312-313: Unnecessary sentence. Please delete.

Table 5: Move to the results please.

Section 4.2: Could you compare your study to other toposequence studies? I'm sure there are relevant examples of other subtropical monsoonal toposequences? Maybe these are even in similar parent material or different aspects to compare?