Earth Surface Dynamics Discussions

Earth Surf. Dynam. Discuss., author comment AC2
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Reply on RC3

Beth A. Fisher et al.

Author comment on "Mineral surface area in deep weathering profiles reveals the interrelationship of iron oxidation and silicate weathering" by Beth A. Fisher et al., Earth Surf. Dynam. Discuss., https://doi.org/10.5194/esurf-2022-9-AC2, 2022

Note: The reviewer comments are in light text, the authors replies are in bold.

To the Editor

Dear Ed.,

I read this article with interest, as it present a different approach to study weathering profiles compare to classical studies based on geochemical or isotopic analyses. Indeed, mineral specific surface area (SSA) are used as a tool to study weathering profiles. Measurement were completed by XRD analyses in samples, induced and remanent magnetizations and seismic multichannel analysis of surface waves. This work is part of on more extensive one as the study site with two weathering profiles are part of the Critical Zone Observatory in the Pennsylvania Piedmont. The first author has previously present geochemical data from those two wells in Fisher et al., 2017a.

My first comment is linked to the introduction: Figure 1: it is not very clear for me why this figure is introduced here whereas there are elements on studied sites in it, which are introduced only after. This figure and its description should be moved at the beginning of part 3 “study site”.

In reassessing the location of this figure, which began as a conceptual diagram and migrated to a schematic data plot in revisions, we moved the hillslope figure to the results section.

The Hypothesis (part 2) should be developed after and then only should come the Study site (part 3). In short, I would suggest reorganizing the beginning of the article and maybe re-named this part as following: Geological Setting (or another subtitle): 1) figure1 + description, 2) Hypothesis and 3) Study site.

We think we rearranged sections according to this suggestion. In considering the suggestion we also realized that Geological Setting was a better heading for our comprehensive description of the study site and it’s geological context.

My second point is linked to the chosen method. We clearly understand the approach of the first author, who use different methods to better constrain/understand chemical weathering processes record in depth weathering profile. After using classical geochemical

approached in Fisher et al., 2017b, which involve models, authors get more in details by identifying threshold within the profile. So my question is, why co-authors of this article don't use preview work done on same sites to correlate their SSA measurement to a chemical weathering index, which would corroborate transitions identify by this method in the weathering profile?

If by Chemical Weathering index, you mean the "tau" of Brimhall & Dietrich 1987, we realized from your comment that we did not reveal how this model is connected to our existing elemental depletion measurements, so have now referenced this connection in the hypothesis.

In addition, a minor comment: is it useful to define what is a "bedrock" (l42)? Or a "crital zone" line 36? These general definitions are given in details, which contrast with methods and results of the article, which supposed to have a specific background in chemical weathering studies.

We added the following to the definition: We did not encounter saprolite or saprock in our weathering profiles, which are more friable than the weathered rock we observed, so we chose to describe our rock with the more general "weathered rock" designation.

Finally, I would like to thank you for giving me the opportunity to review this article, I would be pleased to review others in the future and as I mentioned it previously my name can appear as a reviewer for this article.

Best regards,

Sétareh Rad

Reference

Fisher, B. A., Rendahl, A. K., Aufdenkampe, A. K. and Yoo, K.: Quantifying weathering on variable rocks, an extension of geochemical mass balance: Critical zone and landscape evolution, Earth Surf. Process. Landforms, 42(14), 2457–2468, doi:10.1002/esp.4212, 2017b.