

## ***Interactive comment on “Where microorganisms meet rocks in the Earth’s Critical Zone” by D. M. Akob and K. Küsel***

### **Anonymous Referee #1**

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The development of the holistic concept of the Earth’s critical zone (CZ) has stimulated integrated biogeochemical research to better understand the functioning of our earth and to increase our capability to predict the response of biogeochemical processes to changing environments. Recently, Lin (2010) published a review paper to describe this concept in detail but without going into details of microbial processes. The authors of this review paper aim “to summarize the factors controlling where microbes (. . .) live within the CZ and what is known to date about their diversity and function”. I admit the large efforts of the authors to compile the information but I cannot recommend to publish the current version of this manuscript.

The paper is much too long in relation to the new knowledge presented. The authors touched a wide range of different topics. They tried to combine the description of the

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different habitats (e.g. soils, groundwater, caves) with processes controlling important properties of these habitats and the diversity and functioning of the microbial communities living there. This approach resulted in a lot of textbook knowledge presented making the paper very long. At page 2534 (lines 1-4) the authors wrote that they will focus on subsurface habitats but they did not follow this scheme.

I had some problems with the definitions of the different parts of the CZ as illustrated in Figure 1. To my opinion, the definitions as given by Lin (2010, Fig. 1) are more straightforward. Soils are not restricted to the A and B horizon. I not agree with the presentation of the different processes in Figure 2 as well. The reader might get the impression that subsurface processes do not occur in soils although many of the mentioned processes are typical soil processes. I would indicate that the intensity of these processes varies with increasing depth. Most difficult might be the definition of the (deep) subsurface. Maybe we can use the borderline where the biosphere is independent on photosynthesis which might be much deeper than the C horizon of a soil profile.

I would recommend to re-write the paper completely and to transform it into a much shorter discussion paper. It should really focus on the concept of the critical zone and the role of microbial processes in this concept. Particularly I would expect to get a stimulating discussion about the special features of the deep subsurface and the interactions / response of microbial communities and their functions. For instance the role of fungi in anaerobic environments might need a reappraisal. That would also mean the implications for future studies should be given in more details. We know that we need to understand the exact role of microbes in weathering and geochemical cycling. We would need more detailed research questions and approaches to improve this understanding.

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