Rhizosphere underground: Unraveling the role of microbes in stabilizing organic matter in soils

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This study aims to explore the development, dynamics and stability of microbially produced organic C associated with mineral surfaces of a select mineral matrix in the rhizosphere. Rhizosphere, the zone immediately surrounding the plant roots, plays an important role in production and stabilization of soil organic matter, with considerably more abundant microbial population than in the adjacent bulk soil environment.

We employed the laboratory setup of column-grown *Pinus resinosa* mesocosms [1] in a controlled environment, to provide a system not influenced by the presence of pre-existing soil humics. We applied a suite of high resolution imaging, crystallographic techniques, high resolution mass spectroscopy and 16S rRNA sequencing to characterize microbial communities, newly formed organic C associated with the plant roots and minerals surfaces, and eventual mineral weathering. As a field follow-up study to the lab experiment, we placed nylon in-growth mesh bags filled with an identical mineral substrate in the rhizosphere of *Pinus ponderosa* seedlings, following the experimental setup [2]. The material was colonized with native microbial communities, and the mineral substrate was processed, imaged and analyzed in a similar manner as the mesocosms, in effort to relate the common carbon compounds and microbially-induced mineral weathering in both systems. Although the lab columns didn't show any fungal DNA presence, we found common features in both experimental setups, with emphasis on extracellular polymeric substances and SOM stabilization. The findings of this study provide insights into the soil organic matter persistence and stability in ecosystems.

[1] Dohnalkova *et al. Microsc. Microanal.* **20** (2014), S3, 1192-1193.

[2] Wallander *et al. Soil Biol. Biochem.* **57** (2013), 1034-1047.