Geophysical Research Abstracts
Vol. 21, EGU2019-18834, 2019
EGU General Assembly 2019

The origin and role of biological rock crusts in rocky desert weathering

Nimrod Wieler, Osnat Gillor, and Roey Angel

In drylands, microbes that colonise rock surfaces were linked to erosion because water scarcity excludes traditional weathering mechanisms. We studied the origin and role of rock biofilms in geomorphic processes of hard lime and dolomitic rocks that feature comparable weathering morphologies though originating from arid and hyperarid environments, respectively. We hypothesised that weathering patterns are fashioned by salt erosion and mediated by the rock biofilms that originate from the adjacent soil and dust. We used a combination of microbial and geological techniques to characterise rocks morphologies and the origin and diversity of their biofilm. Amplicon sequencing of the SSU rRNA gene suggested that bacterial diversity is low and dominated by Proteobacteria and Actinobacteria. These phyla formed laminar biofilms only on rock surfaces that were exposed to the atmosphere and burrowed up to 6 mm beneath the surface, protected by sedimentary deposits. Unexpectedly, the microbial composition of the biofilms differed between the two rock types and was also distinct from the communities identified in the adjacent soil and settled dust, showing a habitat-specific filtering effect. Moreover, the rock bacterial communities were shown to secrete extracellular polymeric substances that form an evaporation barrier, reducing water loss rates by 65-75%. This reduction in evaporation, may limit salt transport and its crystallisation in surface pores, which is thought to be the main force for weathering. Concomitantly, the biofilm layer stabilises the rock surface via coating and protects the weathered front. Our hypothesis contradicts common models, which typically consider biofilms as weathering-promoting agents, while, we propose that microbial colonisation of mineral surfaces acts to mitigate geomorphic processes in hot, arid environments.