Identifying New Soil Microhabitats in the Hyperarid Atacama Desert, Chile.

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Abstract

In the core of the Atacama Desert, where hyperarid conditions prevail, microbial life is challenged to adapt to these extremes and is constrained to a few islands of habitability. Strategies of survival can either be to remain viable but dormant until the next precipitation event occurs (Schulze-Makuch et al. 2018) or perhaps to become active during more frequent morning dew. This occurs preferentially when surficial hygroscopic salts undergo deliquescence, forming temporary habitable brines (Heinz et al. 2018). However, these very low biomass microbial communities are only sporadically active in micro- to mesoscopic niches and have remained difficult to identify and characterize. We here describe two potential surficial microhabitats located in the Yungay Valley east of Antofagasta, which contain hygroscopic nitrate and chlorate salts causing soil damping of confined patches during the morning hours when relative humidity is high. The habitability of these micro-environments was assessed initially through in-situ measurements of soil conductivity, relative humidity and temperature (incl. IR-mapping), and further characterized in the laboratory with respect to their water content and activity, as well as their sedimentology and geochemistry. Additionally, the presence of an active microbial community was assessed through in-situ measurements of CH4-, CO2-, H2O-soil-respiration during day cycles. In addition, we determined the amount of ATP of recovered cells as well as their 16S rRNA to determine microbial activity and diversity. Although, microbial processes may be sustained or enhanced by the process of deliquescence (Davila et al, 2008, Davila and Schulze-Makuch, 2016) our preliminary results indicate that the abundance and activity of microbial soil organisms does not correlate well with the maximal soil water activity and content. Hence, supporting the notion that soil habitability of salt-rich hyperarid micro-environments depends on more factors,

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such as type of substrate, salt, temperature and the availability of carbon. Thus, these soil patches may present microhabitats, which should be further explored, both in the Atacama Desert on Earth and as part of future missions that search for life on Mars.
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