

Functional complexity of organisms determines long-term pedogenesis

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Soils sustain life over tremendous time spans and under severe climatic constraints. Under a high temperature regime, the environmental services offered by soil are increasingly challenged, as many of them are a subject to soil water, although soils formed in very dry climates often show high resilience to extreme events. Understanding the processes behind this soil development and the reasons for its resilience represents an asset for future soil protection and management on an increasingly warmer planet in general, and in Israel in particular. The overarching goal of this study is to investigate the interrelation of three major biological processes contributing to soil formation; (a) biogenic mineral weathering, (b) energy supply for biogenic weathering as a function of carbon allocation to soil, and (c) the resulting pedogenesis as driven by specific functional traits of the acting organisms, including their symbiotic chains. The study will be carried out at two sites along aridity gradients in the Negev desert (Israel) and the Atacama Desert (Chile), both spanning from wet Mediterranean to hyperarid conditions. This comparative study along two of the most severe climatic gradients on Earth will provide insight into the interplay of water and nutrient supply from a biogeochemical perspective and shed light on the co-evolution of functional complexity via biotic adaptations to both constraints. Knowing the functional traits, the drivers of change across a gradient of increasing complexity in functional traits, and the interplay of life and soil properties offer the opportunity to identify and understand what stabilizes desert ecosystems.

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