

The Atacama Desert in Northern Chile as an Analog Model of Mars

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Abstract

The Atacama Desert is by far the driest and oldest desert on Earth, showing a unique combination of environmental extremes (extreme dryness, the highest UV radiation levels on Earth, and highly saline and oxidizing soils), explaining why the Atacama has been largely investigated as a Mars analog model for almost 20 years. Based on the source and the amount of water available for life and its analogy with Mars, two ecosystems are of interest in the Atacama: its Coastal Range and the much drier hyperarid core, which we here review in detail. Members of the three domains of life have been found across these ecosystems living at the limit of habitability, suggesting the potential dry limits for each domain and also unveiling the highly patchy distribution of microbial life in its most extreme regions. The thorough study of the Atacama has allowed us to understand how life has adapted to its extreme conditions, the specific habitats that life occupies in each case (thus suggesting the most likely places in which to search for evidence for life on Mars), and the number of biosignatures detected across this desert. Also, the characterization of west-to-east transects across this desert has shown to be of significant value to understand the potential adaptations that Martian microorganisms may have followed in an ever-drying planet. All of this explains why the Atacama is actively used as the testing ground of the technologies (detection instruments, rovers, etc.) that were sent and will be sent to Mars. We also highlight the need to better inform the exact locations of the sites studied to understand general trends, the need to identify the true native microbial species of the Atacama, and the impact of climate change on the most arid and most Martian desert of Earth. Copyright © 2022 Azua-Bustos, González-Silva and Fairén.

Author keywords

astrobiology; Atacama; desert; hyperarid; Mars analog