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Mars-like Soils in the Atacama Desert, Chile, and the Dry Limit of Microbial Life. Navarro-González, et. al.

Natural Science: The Atacama Desert

By Jordan Savoie, Civil Engineering Freshman

When most people think of environments in South America, the picture involves a combination of impenetrable rainforests, swollen rivers, and/or mountain ruins. However, the Atacama Desert on the coastal side of the Andes Mountains lacks any of these landscapes. Running several hundred kilometers along the Chilean coast, the Atacama Desert isn't merely a dry place with little vegetation, but a hyper-arid wasteland that has a surface which is, in some areas, completely sterile of any life.

Lying between the Andes and the Chilean Coastal mountain ranges, the desert is caught in a double rain shadow. A rain shadow is the dry area that results from air being forced up by mountains that lie in the way of rain-bearing winds. High altitudes push temperatures down, causing water vapor to precipitate, falling as rain or snow. Caught in a double rain shadow, the Atacama receives an average of 1.5 cm of water per year, and the amount of rain can dip as low as .3 cm annually. For comparison, the common delimiter for desert rainfall is 50 cm per year; U.S. deserts receive 28 cm per year, and the inland Sahara also receives 1.5 cm per year.

Despite being an uninhabitable wasteland, the desert is home to world-class observatories operated by the European Southern Observatory, the Carnegie Institute of Science, the U.S. National Science Foundation, and various partner institutions. Seven of the world's optical telescopes larger than five meters operate there, and two of the next generation of extremely large telescopes, the 39.3 m European Extremely Large Telescope and the 24.5 m Giant Magellan Observatory, are planned to begin operating in the Atacama Desert by the mid-2020s.

What brings astronomers to this desert? Well, the very fact that it is an uninhabitable wasteland. The arid conditions of the Atacama mean exceptionally clear skies,

with many observatories seeing more than three hundred cloudless nights a year. Even without cloud cover, some types of observation simply aren't possible in humid areas because of water's opacity to certain wavelengths of light. Also, the sparse population of the desert means there is little light pollution, allowing observation of objects more faint than possible in most places on Earth. Further adding to the quality of possible sites, the mountainous terrain of Western South America allows for observatories to be built at thousands of meters above sea level, eliminating a great deal of atmospheric interference.

Serving not only as a place to gaze into space, the Atacama also serves as an analog for scientists studying the surface of Mars. Specifically, the desert is a favorite place for astrobiologists to examine, letting them test their ideas of how potential Martian life might live and interact with its environment. Scientists replicated the Viking experiments, performing the same tests on samples taken from across the desert, and found the same results as the Viking had on Mars. Because of these results, ideas for future experiments are tested there. Since 2016, the NASA Ames Research Center has sent a team to work in the Atacama Desert to develop technology for testing soil samples on a rover. The Ames rover is about the size of the Spirit and Opportunity rovers that trekked across the Martian surface gathering geological samples, and the Ames rover carries a suite of instruments to test for over five hundred compounds of interest. Researchers hope that the field testing will lead to the miniaturization and automation many tests that are normally done in a laboratory, making it possible to include them in future space missions.

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