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Field work at Ojos del Salado: a new high altitude extreme Mars analogue candidate site in Atacama desert

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Abstract

First report is presented on a candidate Mars analogue site at the highest volcano in Atacama Desert, Ojos del Salado. The low temperature, dryness, strong wind and UV exposure provide ideal locations to survey geology and astrobiology related aspects.

1. Introduction

Field work at Mars analogue sites provide useful information to better understand the Red Planet [1, 2, 3], including astrobiology relevant aspects [4, 5] and logistics connected to future missions [6, 7, 8, 9]. Below a new suggestion site is characterized in Atacama Desert.

2. High elevation at dry Andes

Several aspects of the Atacama desert as range of potential Mars analogue sites have been already analyzed [10, 11, 12] mostly at the lower elevation region, while at locations above 3000-4000 m are also accessible and provide interesting features too. Between 11th February and 3rd March 2018 a five person expedition was realized to the Ojos del Salado region from Copiapo with the stops along the Laguna Santa Rosa (3700 m), Laguna Verde (4328 m), Atacama (5300 m) and Tejos (5837 m) camps route.

Experiences and logistics were available from earlier works by Nagy B. et al. [13, 14, 15] as climate monitoring and biological [16] expeditions there, this year the planetary science and Mars analogue aspects were surveyed of this specific site.

3. Main characteristics

The average annual temperature of this site is around -10 °C, however in summertime around noon could be above +10 °C. The amount precipitation is difficult to estimate because of its stochastic fluctuation, but the region might get almost no precipitation for a year but also could be around 200-300 mm annually. The geological and biological important features to analyse there include: ephemeral water flows, cryokarstic features, hydrothermally heated high altitude lake, wind transported volcanic sand, extreme mineral alteration, salty lakebeds, buried ice and snow masses. Examples of these features will be presented at the EPSC meeting.

4. Future as a Mars analogue site

Beside the described physical conditions, and the range of potential Mars relevant geological processes and extreme organisms, an important advantage of the discussed site is the access. Because of a helicopter accident some years ago bulldozers produced roads up to 5300 m elevation that could be reached by regular cars (with specific preparation driving is possible up to 5800 m elevation). The difficulty is the physiological adaptation that is required for regular work: at least 2 weeks long expeditions should be planned, however important locations (like salty lagoons) could be analysed during this adaptation period. Altogether the site is worth for more detailed analysis, but specific preparation and working methods are necessary there to realize effective research work despite the harsh conditions and physiological challenges.

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Figure 1. Example images of the field site. a: drilling at the salty flat of Laguna Santa Rosa, b: debris covered recent snow on the slope of the volcano, c: hot spring at Laguna Verde, d: ephemeral ice melting produced runoff at a channel on the flank of the volcano, e and f: typical scenes of the region with many rock boulders, g: salty lake shoreline and a snow covered volcano.