

LOOKING FOR LIFE IN THE SINTER DEPOSITS OF PAMPA LIRIMA, CHILE: A NEW MARS ANALOG SETTING. C. Nicolau¹ and J.G. Blank², ¹School of Geology, Universidad Mayor (constanza.nicolau@gmail.com), ²NASA Ames Research Center & Blue Marble Space Institute of Science (Jennifer.G.Blank@nasa.gov).

Introduction: Recent reports have documented the occurrence of silica-rich outcrops and soils near the “Home Plate” feature in Gusev crater, detected using the Mars Exploration Rover, Spirit [1], [2]. The mineralogy corresponding to opal-A and composition of 65–92 wt % SiO₂ of these materials is in agreement with a hydrothermal origin. It has been proposed that silica precipitation occurred from near neutral, silica-rich hydrothermal solutions at a hot-spring setting [3, 4]. Therefore, studying the microbial textures preserved in active hot spring-systems on Earth may be relevant toward understanding habitable environments on ancient Mars.

Prior Mars analog studies in Chile in the Atacama desert and El Tatio geothermal system, therein, have proposed that its environmental conditions, such as low average temperature, large diurnal temperature variations, high solar radiation, and low precipitation, may be similar to the those early in Mars’ history [5]. Sinter deposits at el Tatio show abundant silicified microbial material that includes diatoms and filamentous cyanobacteria [5]. They also exhibit a low degree of mineralogical maturation and are composed composed of opal-A, with a minor occurrence of opal-A/CT and opal-CT [6], [7]. Accessory minerals present in these sinters include halite, sylvite, realgar, nobleite, teruggite, sassolite and cahnite, and are a result of the particular water geochemistry [7], [8], [9]. The silica depositing thermal waters are characterized by a sodium-chloride composition and high content of silica (up to 285 mg/L) and arsenic (up to 31 mg/L), and their pH range from 6.5 to 7.4. [9].

Pampa-Lirima as new Mars analog site: The Pampa Lirima geothermal field (19°53’S – 68°56’W) is located 4100 m above sea level, in northern Chile, where environmental conditions are similar to those at El Tatio. However, the chemistry and hydrodynamics of the thermal waters differ from those at El Tatio. The thermal features at Pampa-Lirima correspond to non-eruptive pools and fractures, surrounded by extensive siliceous sinter deposits. Measured temperatures of the hot-spring water range from 38–80°C. Water have a near neutral pH (6.9–7.5) and chlorate sulfated-sodium composition [10]. Sub-aerial sinter reveals horizontal massive laminations, while sub-aqueous sinter form ledges at the walls of the pools. Microbial mats occur commonly in the borders of fractures and pools, displaying millimetric to centimetric thickness and green to

brown coloration. Salts are usually accumulated in the soil adjacent to the pools (Figure 1).

We collected water and sinter samples in November 2014 and will report on our preliminary results based on water analyses mineralogical and textural evaluation of sinter sampled from a 1.5m vertical section adjacent to the largest geothermal pool at the site. Analyses of complementary microbial samples collected and will be reported elsewhere.



Figure 1. Large quiescent pool showing sub-aqueous and sub-aerial sinter deposit (brownish coloration). Salt is abundant adjacent to the pool (white coloration). Brown microbial mat can be recognized in the border of the pool. Note that a 15 m –long trench extends from the pool at the top center of the photograph, allowing effluent to drain.

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