WEATHERING AND SALT ACCUMULATION AT DON JUAN AND DON QUIXOTE PONDS IN THE ANTARCTIC DRY VALLEYS AS AN ANALOGUE FOR ALTERATION AT MARS.

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Introduction: Investigation of alteration in the Antarctic Dry Valleys (ADV) provide insights into alteration that may have occurred in a dry and cold environment on Mars. Saline ponds in the ADV have unique terrestrial calcium, chlorine, and sulfate weathering, accumulation, and distribution processes [1, 2]. The formation of Don Quixote Pond by simple shallow and deep groundwater [1] contrasts more complex models for Don Juan Pond in the South Fork of Wright Valley [3]. For this study we are characterizing sediments from Don Juan and Don Quixote Pond as as possible models for salt formation and weathering on Mars.

Sampling Locations: Don Quixote Pond is located in the western part of the North Fork about 100 m above Mean Seawater Level. The Don Quixote Pond brine is seasonally frozen [1]. Figure 1 shows sampling locations and zones of coloration (1-5) that grow lighter with distance from the center of Don Quixote Pond. Don Juan Pond is located in the southern region of Wright Valley. Analyses of sediments from this region have shown increased chemical alteration a few cm below the surface [4, 5].

Methods: Samples were collected from the surface across Wright Valley and as depth profiles near ponds and interesting surface sites during the 1979/1980 field season [4]. These samples were analyzed by X-ray diffraction, reflectance spectroscopy and other analysis methods [6]. Surface samples from Don Quixote Pond are under study from every color zone (Figure 1). A subset of surface samples were investigated from a radial sampling traverse to the south, extending more than 50 m from the pond center.

Results and Applications to Mars: Increased abundances of soluble cations and anions were observed in sediments a few cm below the surface in a soil pit at the Don Juan Pond site. This is attributed to increased chemical activity just below the surface and could represent an analogue for Mars, where chemical activity may also be possible a few cm below a cold and dry surface environment.

Halite was observed to decrease radially outward across zone 3 at Don Quixote Pond, while gypsum and anhydrite increase radially outward. The sulfates observed include gypsum, anhydrite, bassanite and thenardite. We are investigating variations in gypsum and anhydrite abundance with depth and distance from the center of the pond in order to determine if the hydration level of these Ca sulfates can be related to other salt abundances or iron oxide or clay mineralogy. Color zones are not correlated to salt abundances except for Color Zone 3, which has 15% salts of varying composition in all samples. All sediments also contain quartz, pyroxene and feldspar as observed in other studies [e.g. 5]. Alteration at Don Quixote Pond could represent an analogue for salt formation on Mars, where high Cl and S levels are observed.

References: [1] Harris H.J.H. & Cartwright K., (1981) *Antarctic Research Series 33*, 193-214. [2] Torii T. & Yamagata J. (1981) *Antarctic Research Series 33*, 141-157. [3] Dickson J. L. et al. (2013) *Sci. Rep. 3*: 1166. [4] Gibson E. K. et al. (1983) *JGR 88*, A912-A928. [5] Patel S. N. et al. (2015) LPSC #1537. [6] Bishop J. L. et al. (2014) P*hil Trans Royal Soc. A*, **372**, 20140198.

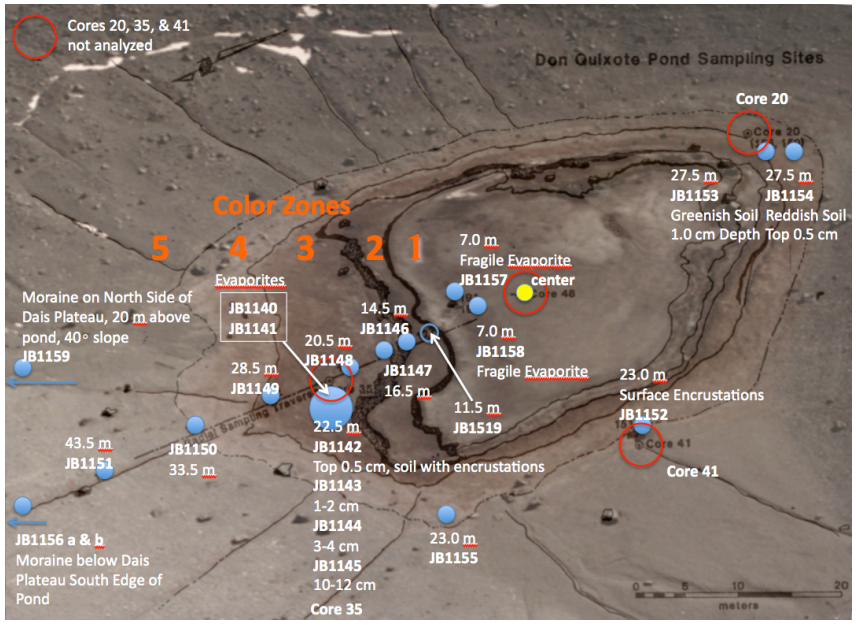

Figure 1. Don Quixote Pond Sampling Locations. Sampling sites at the pond and nearby are marked in blue. Color zones extend radially outward.