SEEKING SIGNS OF LIFE IN ANCIENT MARTIAN HOT SPRINGS WITH ICELANDIC ANALOGS. J.R. Skok[1], J.D. Farmer[2], G. Jerman[3], J. Gaskin[3], N. Lindsey[4], C. Munoz-Saez[4], H. Kaasalainen[5], D. Tobler[6], M. Parente[7], K. L. Craft[8]. [1]SETI Institute, Mountain View, CA. jrskok@seti.org. [2]Arizona State University, Tempe, AZ. [3]NASA Marshall Space Flight Center, Huntsville AL, [4]University of California, Berkeley, CA. [5]Luleå University of Technology, Luleå, Sweden. [6]University of Copenhagen, Denmark. [7]UMass Amherst, MA, [8]Applied Physics Lab, Johns Hopkins University, Laurel, MD.

Introduction: The Mars community is actively developing strategies to explore for biosignatures in a variety of geologic environments. Here we describe an ongoing effort to develop a mission profile for biosignature detection in ancient siliceous hydrothermal systems. This is motivated by the spectral and chemical identification of silica deposits the Nili Patera caldera of Syrtis Major [1, Figure 1] and the Home Plate deposit in Gusev crater [2,3].

Analog Sites: Three field sites in Iceland have been selected for examination during the summer of 2016. Sites have been chosen to represent a range of hydrothermal activity from active, pristine sinter deposits to extinct systems that have undergone significant degradation.

Hveravellir: This active system has multiple hot springs, with boardwalk accessible environments that range from active vents, to outflow channels, ponds and older overlapping sinter apron deposits. This site provides access to biofilm communities over a broad temperature and pH range, where there is active sinter deposition and where biofilms are undergoing active mineralization. Hveravellir provides access to the earliest stages of biosignature capture and preservation, as well as silica diagenesis

Gunnuhver: The Gunnuhver [Figure 2] site is a siliceous sinter mound on the Reykjanes Peninsula that developed upon local basaltic flows. The sinter mound is today dominated by acidic fumarolic activity that has altered the original basaltic host rock. Here we will refine strategies for the physical exploration of sinter mounds and their effects on local bedrock sequences, particularly role of acid sulfate weathering of basalt and the associated mineral and textural changes that accompany acidic alteration [3].

Lysuholl: This is an older, inactive siliceous hydrothermal field consisting of multiple vents and coalescing sinter aprons that have experienced widespread surface brecciation and weathering. This site provides access to a complete array of sinter mound facies where the impacts of post-depositional processes (diagenesis) can be fully explored. This site is probably most closely analogous to what could be encountered on Mars. Operational strategies and approaches to sampling will be an important focus for this site.

Instrumentation: This project will determine the datasets and instrumentation that will be required for the detection and characterization of biosignatures in sinter deposits. Field instrument deployment will focus on Visible and Near Infrared (VNIR) imaging and geophysical exploration while an extensive sample collection and laboratory analysis campaign will test most known spectral, geochemical and imaging techniques common to planetary science. We expect that the critical datasets will include an electron scanning microscope and microscopic imager for textural and elemental identifications and spectral imaging for phase mapping. Testing these types of datasets with others will develop the optimal suite.

Mission Design: We will test different mission designs by collecting samples and imaging data over a broad a range of scenarios that will mirror potential missions from a lander to sample return. Each mission design will have different payload and sample access abilities. Comparing the results from the different scenarios will determine which scenarios are optimal, acceptable or unlikely to yield definitive results.

Figure 1. South Mound in Nili Patera is 20 m tall and 100 m wide. The white, surfical material has a 2.21μm Si-OH absorption.

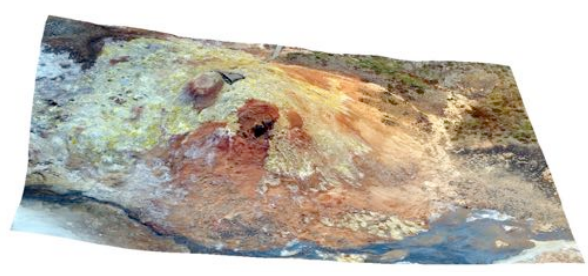

Figure 2. Gunnuhver, Iceland is 10 m tall and 100 m wide and is a silica sinter covered mound of altered basalts.

References: [1] Skok et al., 2010, *Nat Geosci.,* 3 (12) [2] Squyres et al., 2008, *Science*, 320(5879) [3] Ruff et al., 2011, *J. Geophys. Res.,* 116.