ELEVATED BULK SILICA COMPOSITIONS ASSOCIATED WITH OLIVINE RICH BASALTS IN NILLI FOSSAE, MARS. E. S. Amador and J. L. Bandfield, University of Washington (1500 15th Ave NE, Box 351310, Seattle, WA 98195-1310; esamador@u.washington.edu)

Introduction: The Nili Fossae are a series of linear fractures bordering the northwestern rim of the Isidis Basin. The features are likely graben that formed from tensional forces associated with the impact formation of the basin during the Noachian [1]. The fossae present an interesting area to study because of the relatively high mineralogical diversity present. Previous studies have identified olivine-rich basalts using thermal infrared (TIR) spectral data from the Thermal Emission Spectrometer (TES) on board the Mars Global Surveyor and the Thermal Emission Imaging System (THEMIS) on the Mars Odyssey spacecraft [e.g. 2, 3], as well as from near-infrared (NIR) spectral data from the Observatoire pour la Minéralogie, l'Eau, les Glaces et l'Activité (OMEGA) and the Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) [e.g. 4]. Previous work has also revealed a diverse set of hydrated minerals in the region including phyllosilicates and carbonates [5-9].

Here we show that there is an interesting relationship between the bulk rock composition of this region and the hydrated mineralogy. We observe discrete elevated bulk silica deposits that are often associated with the olivine-rich basalts and are apparently unrelated to the phyllosilicate units observed in the NIR data. The silica-rich deposits represent a different material than the observed phyllosilicates in the region and signify another aspect of the Nili Fossae alteration history.

Methods: The CRISM NIR spectral data used in this study are corrected for atmospheric gas absorptions using the methodology described by McGuire *et al.* (2009) [10]. Spectral indices are constructed in a manner similar to Pelkey *et al.* (2007) [11] in order to quickly determine the general spatial context of the mineralogy in the area. The individual I/F spectra, as well as spectral ratios are also examined to confirm the presence or absence of a specific phase. Multispectral survey products (MSP) with ~200 m/pixel sampling are predominately used due to their greater spatial coverage. Full-resolution targeted (FRT) (~18 meters/pixel) images are also examined in the limited areas where they are available.

We use multispectral THEMIS TIR images (100 m/pixel) to identify surfaces with bulk compositions distinct from the surrounding terrains. Spectral variability within THEMIS images are identified by examining decorrelation stretch (DCS) [12] images of THEMIS band combinations and then followed by the examination of apparent emissivity data in areas of specific interest. Index maps were also created to isolate specific spectral properties and to quantify the relative amount of bulk silica within a given TIR image using THEMIS band ratios.

Surface textures and morphology are characterized using data from the High Resolution Imaging Science Experiment (HiRISE) and Context Camera (CTX). All datasets are spatially correlated using JMARS, a java based GIS program [13].

Initial Findings: The greatest amount of spectral variability in the TIR data is associated with the olivine-bearing units found around ~78°E and 22°N.

TIR data in this region show that there are two elevated bulk compositions in the area. The first is a previously identified olivine-rich basalt [2, 3]. The second is characterized by shorter wavelength emissivity spectral features that are characteristic of an elevated bulk silica composition. These high silica units are always found immediately adjacent to the olivine-rich basalt.

Regional phyllosilicates, while clearly associated with the olivine units, are spread across a greater area and not necessarily adjacent to the olivine-rich basalts. Phyllosilicate units are not distinct in the TIR spectral data, and appear to have a bulk mineralogy similar to the surrounding terrain. The high silica units found in TIR do not spatially coincide with the phyllosilicates except in a few rare instances where the two units may be mixing.

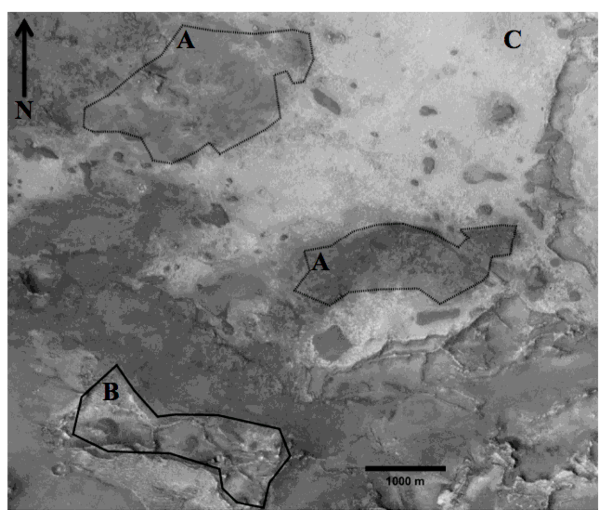

Fig. 1: CTX image of elevated bulk silica units (**A**), phyllosilicates (**B**), and olivine-rich basalts (**C**).

Surface textures and morphology. The elevated bulk silica deposits are darker toned than the phyllosilicates and have a smoother texture at meter scales than both the phyllosilicate and background terrain. High silica surfaces do not exhibit the same inverse ridged topography as the phyllosilicate layered units. In the few instances where the phyllosilicates are detected in the same spatial location as the high silica units, the surface textures appear to be a combination of the two. There are no evident stratigraphic relationships between the high silica units and the hydrated mineralogies.

Discussion: There is no clear association between the high bulk silica units and phyllosilicate units except their spatial association with the olivine-rich basalts. The smooth texture of the high silica deposits suggests that the material is mobile and able to mix readily with the surrounding material.

The consistent, immediate proximity of elevated silica units to the olivine-rich basalts implies a direct relationship between these two units. The silica units may represent areas produced by mechanical and chemical weathering of the olivine-rich rock units. This can be achieved through low water/rock ratios and a low pH environment, causing the olivine dissolution and subsequent precipitation of fine-grained amorphous silica and iron oxides [14].

Future Work: We will continue to investigate how the diversity in hydrated mineralogy relates to bulk compositional units in this region. We hope to determine the stratigraphic relationship between the different units and to understand the larger context of these deposits within the greater Nili Fossae region. Further investigation using the TIR spectral data is necessary to better understand the extent of the silica-rich units. It is evident that multiple processes are acting on the olivine-rich units in the Nili Fossae region, leading to the need for further investigation and a more detailed understanding of the geologic evolution of the region.

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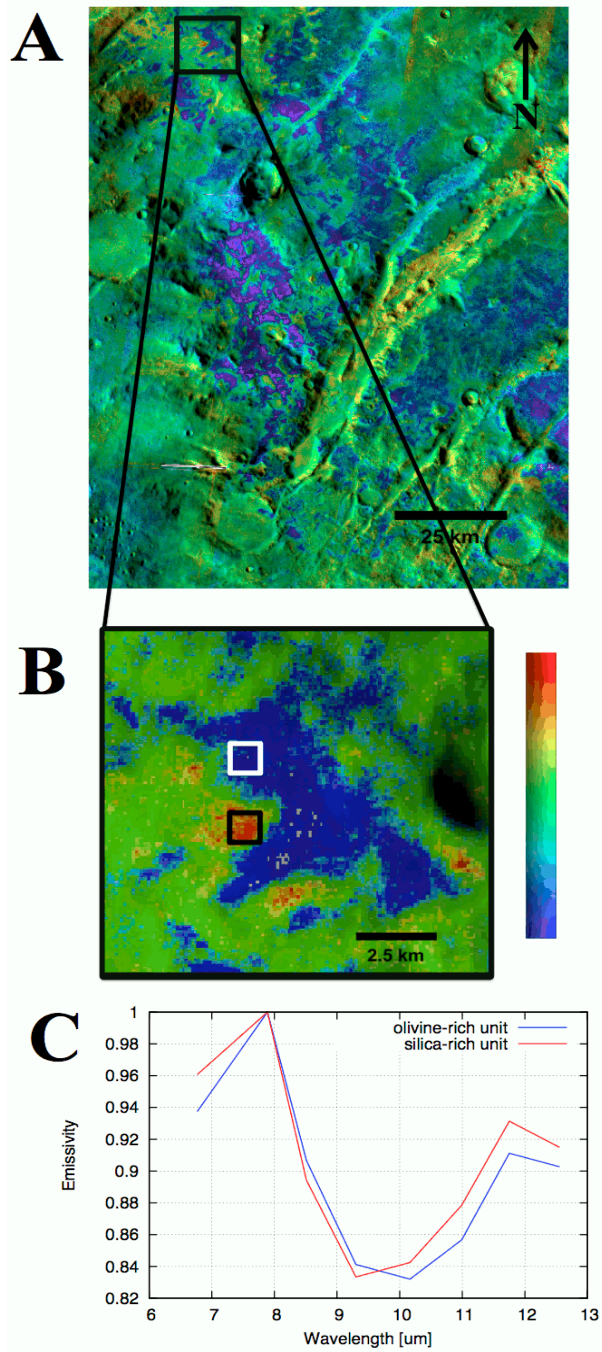

Fig. 2: **A.** Bulk silica index map draped on THEMIS daytime IR map. Index ranges from red being highest concentration of bulk silica to blue being the lowest, corresponding to olivine-rich basalts. **B.** The white box highlights a site of olivine-rich compositions with the corresponding apparent emissivity spectrum shown in blue in **C.** The black box indicates a silica-rich surface with the corresponding apparent spectrum shown in red in **C.**