CORRELATION OF THE CRISM CRYSTALLINE HEMATITE SIGNATURE WITH HEMATITIC CONCRETIONS AT MERIDIANI PLANUM. T. Condus[1] and R. E. Arvidson[1], [1]Washington University in St. Louis, McDonnell Center for the Space Sciences, Department of Earth and Planetary Sciences, tcondus@wustl.edu.

Introduction: A widespread surface deposit of crystalline hematite in the Sinus Meridiani region of Mars was revealed by the Mars Global Surveyor Thermal Emission Spectrometer (TES) [1, 2]. This discovery led to the selection of Meridiani Planum (in southern Sinus Meridiani) as the landing site for the Mars Exploration Rover Opportunity because the hematite may have had an aqueous origin [3]. Ubiquitous hematite-rich concretions were observed by the rover, confirming the orbital signature. The concretions have been concentrated on the surface as a wind-blown lag deposit by weathering of the sulfate-bearing sandstones of the Burns formation [e.g., 4, 5].

In this abstract, a link is established between areal abundance of hematitic concretions as seen by Opportunity, and the 0.86 µm band depth in Mars Reconnaissance Orbiter Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) observations of Meridiani Planum. The 0.86 µm band minimum is due to a crystal field transition of ferric iron, and is diagnostic of crystalline hematite [6]. This band minimum is shifted towards slightly longer wavelengths in the CRISM data because of the mixing of basaltic material and nanophase ferric oxides, and has also been seen in Opportunity Pancam spectra [7, 8]. With the positive correlation between rover and orbital data established we then extend mapping of the concretion abundances across Sinus Meridiani.

Data Processing: The WUSTL processing pipeline [9] was used to retrieve surface single scattering albedos (SSA) from CRISM S data (0.362 to 1 µm) [10]. Dust and ice aerosols were modeled, and a modestly backscattering Hapke function was used as the surface boundary condition. CRISM data, which have pixel sizes ranging from 18 to 36 m for targeted observations, are regularized to account for the instrument spatial and spectral transfer functions and extract the best SSA values [11, 12]. The 0.86 µm band depth spectral parameter (BD860_2) [13] was then generated and map-projected.

Percentage of concretion cover was calculated from segmentation of the concretions in Hazcam and Pancam calibration target images. These data were utilized for consistent views of the surface throughout Opportunity's mission. The segmentation takes advantage of the large, round shapes of the concretions, and the percent coverage values are plotted along the traverse at every site.

Results and Discussion: At Endeavour crater, there are correlatively high BD860_2 values and concretion cover percentages within the Botany Bay rim gap (Fig. 1a). The high values are interpreted to be due to wind blowing up and out of the crater, concentrating the relatively large and dense concretions at the surface [14]. A similar pattern has been observed at Iazu crater, directly to the south [15]. The high BD860_2 values and concretion cover percentages are also associated with dark wind streaks emanating from craters, such as Victoria (Fig. 1b). Basaltic sands sourced from the interior of this crater are blown up and out by southeasterly winds [16].

A BD860_2 spectral parameter map of Sinus Meridiani has been produced using high quality CRISM mapping survey images at 100 or 200 m/pixel (Fig. 3). The improved spatial resolution of CRISM relative to TES (3 x ~6 km/pixel) [1] and OMEGA (2-5 km/pixel for global mapping) [17] allows for more detail to be seen, such as the mantle of BD860_2 values around the ejecta deposit of Bopolu crater.

Future Work: We will continue to create BD860_2 spectral parameter maps from CRISM mapping surveys to fill in gaps of coverage in Sinus Meridiani. BD860_2 maps for all targeted CRISM observations across the region will be created and analyzed together with HiRISE, CTX, and CRISM-derived thermal inertia [18]. A campaign to acquire additional targeted S band CRISM observations and HiRISE images for select locations in the region will be requested. The products will then be analyzed to understand the stratigraphic and erosional contexts for the concretion abundances.

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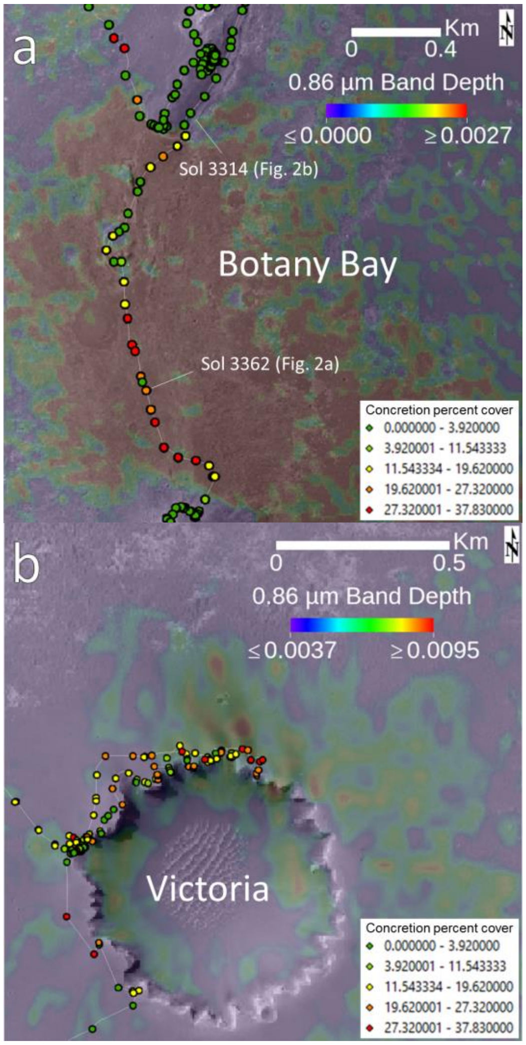

Figure 1. a) CRISM HRL0000D09A and b) FRT000122A1 BD860_2 spectral parameter maps overlain onto HiRISE basemaps. Percent areal coverage by hematitic concretions are plotted along the Opportunity rover traverse.

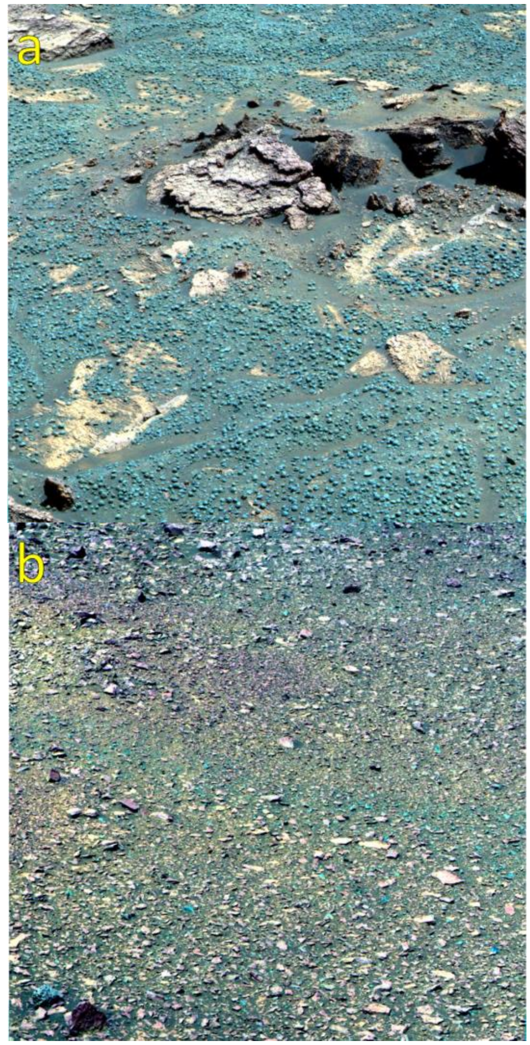

Figure 2. a) Sol 3362 false color Pancam image within Botany Bay. Note the high abundance of concretions in this area, up to 10 mm in diameter. b) Sol 3314 false color Pancam image just before entering Botany Bay, showing a lack of concretions.

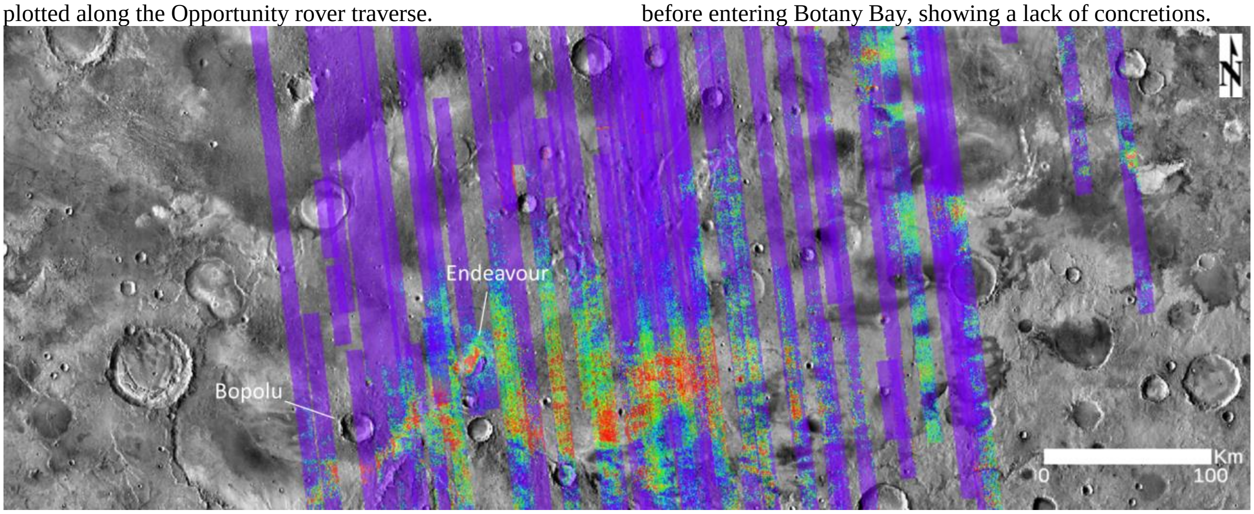

Figure 3. BD860_2 spectral parameter map of the Sinus Meridiani region, using CRISM mapping survey observations at 100 or 200 m/pixel resolution. Basemap is a THEMIS infrared daytime mosaic.