EMERGING CONNECTIONS BETWEEN TIR AND VNIR OBSERVATIONS OF MARTIAN PHYLLOSILICATES. S. W. Ruff[1], [1]School of Earth and Space Exploration, Arizona State University, Tempe, AZ 85287-6305, steve.ruff@asu.edu

Introduction: With the advent of two visible/near infrared (VNIR) imaging spectrometers, the Mars Express OMEGA and Mars Reconnaissance Orbiter CRISM, spectral evidence for phyllosilicates on Mars appears definitive [e.g., 1, 2]. In contrast, thermal infrared (TIR) spectra from the orbiting TES instrument on the Mars Global Surveyor have not yielded such definitive evidence. Similarly, TIR spectra from the Mini-TES instrument on the two Mars Exploration Rovers (MER) have not shown unequivocal features of phyllosilicates, which is consistent with results from the Mössbauer (MB) spectrometer. Despite the sensitivity of TIR spectroscopy to even thin coatings (<10 microns), the lack of a clear identification of phyllosilicates has been enigmatic.

Laboratory TIR spectra of the dioctahedral smectites commonly observed with OMEGA and CRISM display two features in the low wavenumber range covered by TES and Mini-TES (~530 and ~465 cm^{-1}) that result from M-O-Si deformation and Si-O bending modes [e.g., 3]. The Si-O bending feature near 465 cm^{-1} also is found in primary and secondary amorphous silicates and zeolites [4]. This feature has been identified in Mini-TES spectra of some rocks in the Columbia Hills of Gusev Crater that MB and APXS spectra indicate are highly altered [e.g., 5, 6]. A similar feature (the 465 index) has been mapped globally using TES spectra [7] and may serve as a proxy for some of the rocks encountered in the Columbia Hills. I have now discovered that many of the locations identified by OMEGA and CRISM as phyllosilicate-bearing display this feature in TES data, including parts of Mawrth Vallis, NE Tyrrhena Terra, and Nili Fossae. To date, I have observed the M-O-Si deformation feature near 530 cm^{-1} along with the ~465 cm^{-1} in one location near Nili Fossae. The full spectra from this location strongly resemble weathered basalt.

Mawrth Vallis: A map of the TES 465 index representing only the globally highest band depth values is shown in Fig. 1 along with an OMEGA phyllosilicate index map from [2]. The correlation between the two maps is notable along the west side of the valley. The presence of strong 465 index values in this location is especially notable given the relatively high albedo values (~0.2) of much of this terrain. Such albedo values elsewhere on the planet typically are associated with dusty surfaces that have no identifiable 465 feature.

Although there are areas with a positive correlation, other areas show a negative correlation. The dark-toned intracrater splotches display high 465 index values but no corresponding elevated phyllosilicate index. Because the 465 index is sensitive to a feature common to phyllosilicates and primary volcanic glass, the dark splotches probably contain minimally altered glass.

NE Tyrrhena Terra: Tyrrhena Terra is dominated by the spectral signature of TES type 1 basalt [8], yet displays isolated examples of strong 465 index values [7]. One such example in the northeast portion occurs in a crater that has been identified by [2] as having a strong phyllosilicate detection (Fig. 2). Although the CRISM data for this crater do not provide full coverage, there is a strong spatial correlation between the TES and CRISM indices. In this example, the full TES spectra are similar to the "Assemblee" type rocks measured by Mini-TES in the Columbia Hills, especially in the low wavenumber region. The type example was measured by MB and APXS. Although neither MB nor Mini-TES data provided clear evidence for phyllosilicates in this rock, the APXS data suggested a composition consistent with montmorillonite [6].

Nili Fossae: A crater at the transition between Syrtis Major and Nili Fossae shows a well-correlated TES 465 index and OMEGA phyllosilicate index [2] (Fig. 3). This is a rare example where the TES 530 index also is elevated. The combination of elevated 465 and 530 indicies is necessary but not sufficient for a robust TES detection of dioctahedral smectite. The full TES spectra from this crater clearly resolve a feature near 465 cm^{-1} and a strong shoulder near 535 cm^{-1}. This spectral character is comparable to that shown by [9] in the spectra of smectite-bearing weathered Columbia River basalts.

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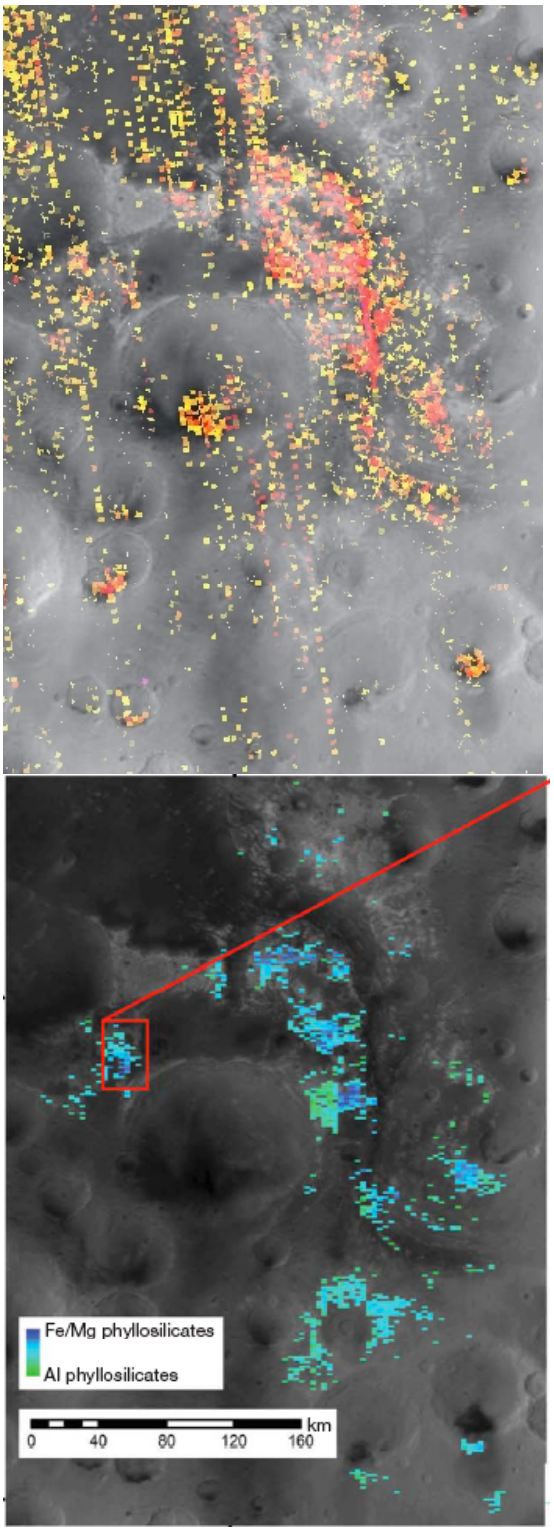

Figure 1. TES 465 index (top) and phyllosilicate indices from [2] for Mawrth Vallis.

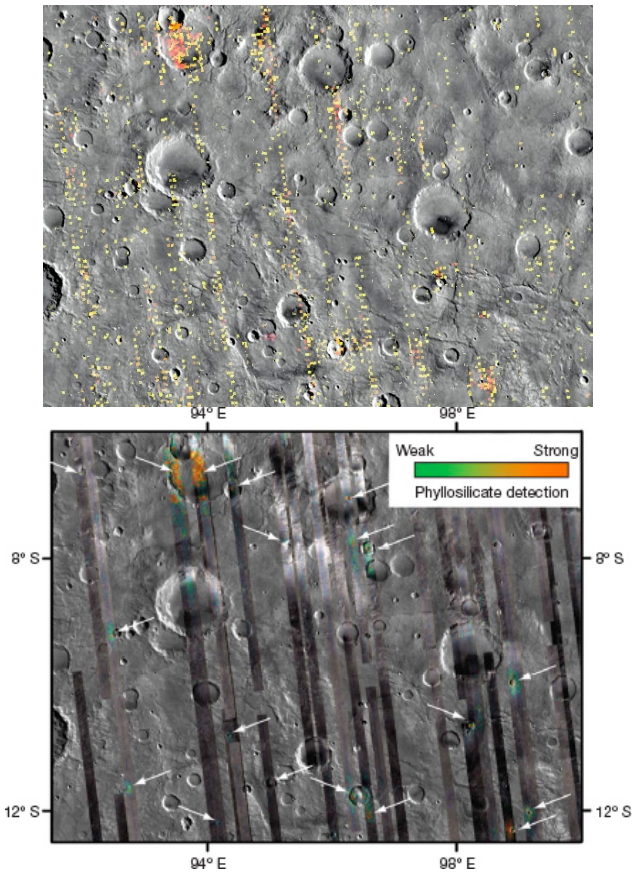

Figure 2. TES 465 index (top) and phyllosilicate index (bottom) from [2] for a portion of NE Tyrrhena Terra.

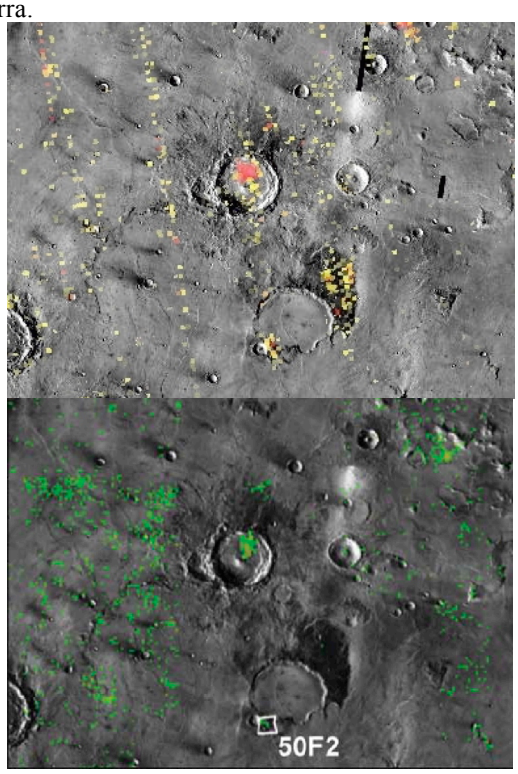

Figure 3 (right). TES 465 index (top) and phyllosilicate index (bottom) from [2] near Nili Fossae.