COMBINING TES AND OMEGA DATASETS AT REGIONAL SCALES TO CONSTRAIN SURFACE COMPOSITIONS: PRELIMINARY RESULTS. J.W. Nettles, M.B. Wyatt, and J.F. Mustard, Department of Geological Sciences, Brown University, Providence, RI, USA (Jeffrey_Nettles@brown.edu).

Introduction: The martian surface has been imaged by both visible/near-infrared spectrometers such as Mars OMEGA and thermal infrared spectrometers such as MGS TES. In general, determinations of primary igneous compositions (primarily low-calcium pyroxene to high-calcium pyroxene ratios) and distributions from these two instruments are in agreement. For example, [1&2] calculated low-calcium pyroxene to high-calcium pyroxene (LCP:HCP) ratios ranging from approximately 20:80 to 40:60 based on OMEGA data. TES determinations of the same ratios have ranged from 15:85 to 45:55 [3&4].

On a regional to local scale, however, the agreement is not always as good. For example, [4&5] reported LCP:HCP ratios ranging from 6:94 to 18:82 for Syrtis Major based on TES data. Analysis of OMEGA data for Syrtis Major by [6], however, yielded ratios of 40:60. Thus important questions remain unanswered when comparing TES and OMEGA surface compositions on regional scales.

The absolute and relative abundances of pyroxenes, as well as other phases, are important to our understanding of the petrogenesis of the martian crust and its subsequent modification and chemical alteration. Therefore, we are attempting to integrate TES and OMEGA results in order to develop a combined thermal-infrared (TIR) and visible/near-infrared (NIR) characterization of regional- and local-scale surface compositions. The purpose of this work, of course, is not to prove that any one dataset is more useful than another, but instead to combine the different datasets to better constrain the composition of the martian surface. We report here on work done to date, which has focused primarily on OMEGA data.

Methods: [4&5] defined 11 low albedo regions of the martian surface that display unique TES signatures. These 11 regional endmembers were defined from a search of 29 martian surface areas with TES data by [4&5] based on unique TIR spectral characteristics. The first goal of our work was to examine those same 29 martian surface areas with OMEGA data to see if grouping those areas into the same 11 TES endmembers is warranted.

We created vector outlines of the 29 TES surface areas based on geographic coordinates provided in [5]. We then searched publicly-released OMEGA data for image cubes with pixels within those study areas (Figure 1). Those cubes were georeferenced and cropped. Georeferenced pixels that were interpolates of sensor-space pixels were masked, as were any obviously noisy pixels. Spectral averages were then extracted. For the purposes of this initial report, we chose the most representative single image cube from all the cubes falling within one of the 29 study areas. We then evaluated those 29 average spectra to see if they warrant being grouped into the same 11 endmembers as defined by TES studies.

Results: Figure 2 shows a plot of the spectral averages for the 29 study areas, which have themselves been grouped into the same 11 endmembers defined by TES analyses. If these TES endmember regions are also valid OMEGA regional endmembers, there should be spectral diversity present in these average spectra. The lefthand plot in Figure 2 shows the 11 regional average spectra, while the righthand plot is the same as the lefthand plot but an average spectrum (for all 11 spectra in the plot) has been divided out of the spectra on the left, so that differences in the endmember spectra are highlighted.

Some spectral diversity is present in the endmember spectra. The Solis Lacus region, for example, appears most unique, with what appears to be the deepest average 1µm band depth and a slope different from the rest. Some TES endmembers, however, appear quite similar in OMEGA data. The Aonium-Phrixi and Mare Sirenum average spectra, for example, probably warrant being combined into a single endmember based on OMEGA data.

Conclusions and Future Work: The OMEGA data analyzed to date supports the definition of the same regional endmembers defined by TES in some cases, but not in others. We are working to include more spectra in our study areas, and exclude more noisy spectra, so that our averages are more representative. Those improved averages will be presented at the conference.

The next goal of our work is to reconcile the differences in regional endmember spectra. To do that, we will use Modified Gaussian Model [MGM,7] –derived LCP:HCP ratios from OMEGA data and create a "synthetic" pyroxene spectrum to use as an endmember in TES linear deconvolution. We will also use modeled plagioclase abundances from TES linear deconvolutions and attempt to use those in OMEGA MGM modelling. Another option is to use a Shkuratav radiative transfer model as in [8]. [8] compared TES and OMEGA results for a different (but partially overlapping) set of study areas than those used here. Our results, then, should complement that work and help reconcile the differences in regional spectra for the two datasets and help constrain local and regional variations in martian surface compositions.

References: [1] Mustard J. F. et al. (2005) *Science, 307,* 1594-1597. [2] Bibring J.P. et al. (2005) *Science, 307,* 1576-1581. [3] Bandfield J.L. et al. (2000) *Science, 287,* 1626-1630. [4] Rogers A. D. and Christensen P. R. (2007), *JGR, 112,* E01003, doi:01010.01029/02006JE002727. [5] Rogers A. D. et al. (2007), *JGR, 112,* E02004, doi:02010.01029/02006JE002726. [6] Kanner L.C. et al. (2007), *Icarus, 187,* 60-74. [7] Sunshine J.M. et al. (1990), *JGR, 95,* 6955-6966. [8] Poulet F. et al. (2009), *Icarus, 201,*84-101.

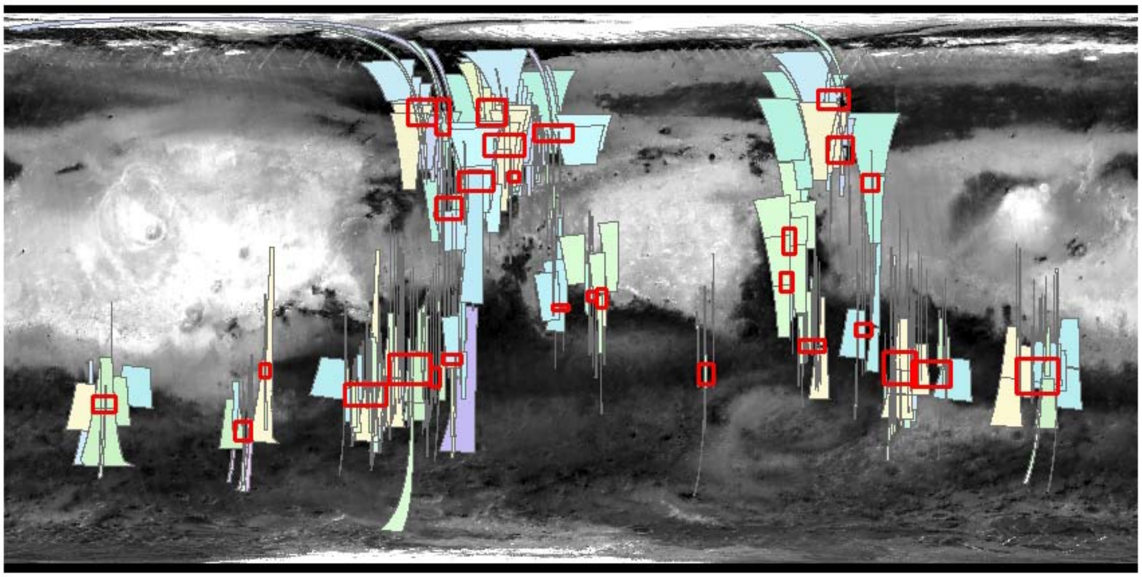

Figure 1. Study area locations (red outlines) and OMEGA coverage (colored polygons). The 29 areas shown in this image were combined into 11 regional endmembers based on TES emissivity spectral properties (see text). Background image is a TES albedo map.

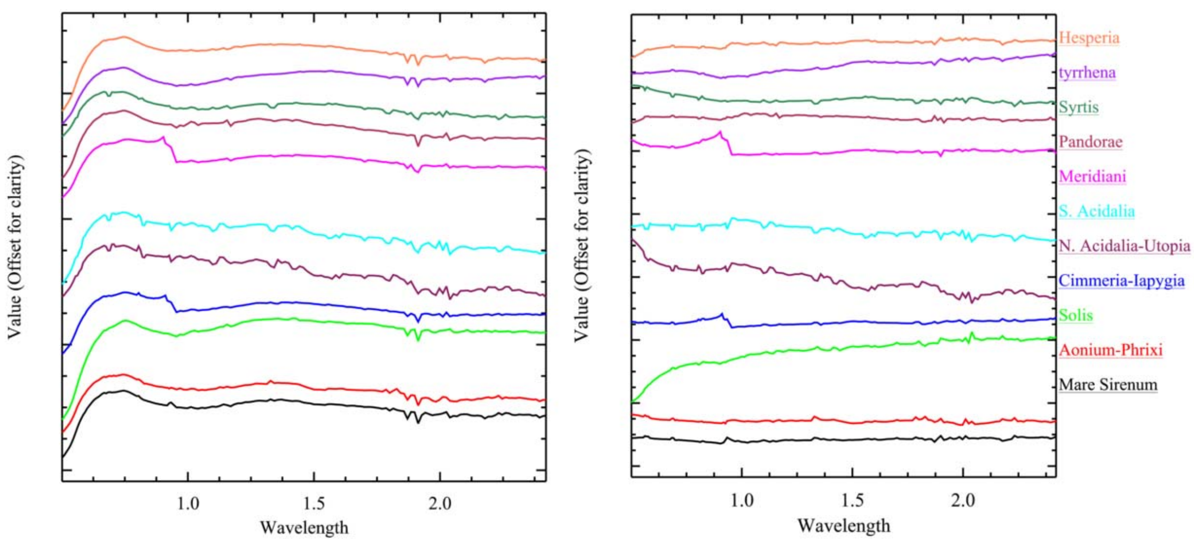

Figure 2. Average OMEGA spectra for the 11 TES low-albedo regions as defined by [3&4]. The plot at left is the spectral averages of all 29 study areas, grouped into the same 11 endmembers as defined by TES Studies. The plot at right is the same as the plot on the left, except the spectra are divided by the average of all 11 spectra so that the plot at right shows how the spectra are different from each other. Labels on the plot at right also apply to the plot on the left. The features at approximately 0.9 µm in the spectra for the Meridiani and Cimmeria-Iapygia region are caused by noise in the data.