**IDENTIFYING COMPOSITIONAL HETEROGENEITY IN MARS' NILI PATERA CALDERA USING THEMIS AND TES DATA.** S. W. Ruff[1] and P. R. Christensen[1], [1]Arizona State University, Department of Geological Sciences, Tempe, AZ, 85287-6305, ruff@tes.asu.edu.

**Introduction:** Spectral anomalies in Nili Patera, a central caldera of the Syrtis Major shield volcano, were first observed by [1] using Thermal Emission Spectrometer (TES) data. With the advent of data from the Thermal Emission Imaging Spectrometer (THEMIS), it is now possible to explore in greater detail the nature of the volcanic materials that give rise to both spectral and spatial anomalies within and adjacent to the caldera.

**Observations:**

*THEMIS.* A pair of THEMIS images is shown as a mosaic in Figure 1. Bands 5, 7, and 8 where registered and converted to red, green, and blue using a decorrelation stretch. The result is a dramatic display of the spectral and spatial heterogeneity of the caldera that was more crudely identified using TES and Viking data [1]. The region identified as Anomaly 1 in the figure shows such heterogeneity down to the limits of THEMIS resolution. Anomaly 2 is more homogenous but crops out in several places on the floor of the caldera and ~50 km to the south.

*TES.* The apparent spectral similarity of the northern and southern occurrences of Anomaly 2 that is evident in the THEMIS image was confirmed using TES data. Because a single orbit track passed over both the southern Anomaly 2 and Anomaly 1, the spectra from these regions are shown in Figure 2a to facilitate the comparison between the two. Although the spectra show strong atmospheric features, the differences between the two are due to surface emissivity.

**Deconvolution:** To investigate the compositional character of the two anomalies, a surface-atmosphere separation was performed using the technique of [2] with the 7 endmember spectra of [3]. Figure 2b shows the results following removal of the atmospheric constituents. The modeled surface spectra are also shown. Anomaly 1 is well modeled using only the Syrtis-type basalt spectrum. Anomaly 2 is modeled more poorly, using the Acidalia-type spectrum in a ratio of 2:1 relative to the Syrtis-type spectrum.

**Discussion:** Anomaly 2 is poorly modeled using only the Mars-based spectral endmembers (Fig. 2b). This suggests that there are spectral components that are missing. A critical distinguishing spectral feature between the two anomalies occurs at ~470 $cm^{-1}$ where a prominent narrow and relatively deep trough is present. This feature is absent from the Syrtis-type endmember but present in a less pronounced form in the Acidalia-type. Figure 2c shows that the feature at

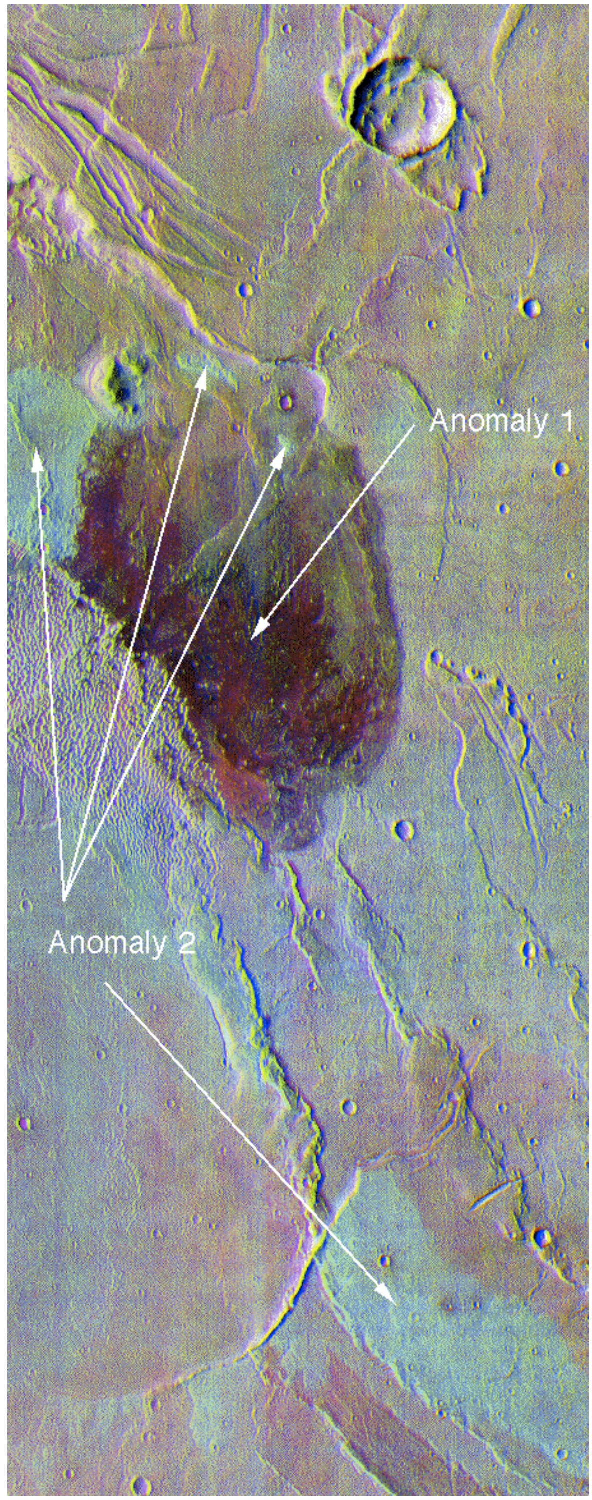


**Figure 1.** THEMIS mosaic of I02207005 and I02569002, bands 5/7/8 R/G/B decorrelation stretch.

~470 $cm^{-1}$ is common to volcanic glass, some phyllosilicates, and zeolites. In fact, the entire spectrum of these materials is very similar. Such similarity could cause ambiguity in spectral deconvolution. However, critical distinctions are present at wavenumbers >500 where additional features are observed. This spectral region is excluded from TES spectral deconvolution because of the absorption of atmospheric $CO_2$. The excluded region is wider than necessary in an effort to avoid confounding effects of $CO_2$. However, $CO_2$ absorption remains relatively transparent in the region of the critical distinguishing features of the above mineral groups. So careful scrutiny of non-atmospherically-corrected TES spectra may serve to distinguish between glass, phyllosilicates, and zeolites.

**Initial Conclusions:** The Anomaly 1 spectrum strongly resembles the Syrtis-type basalt of [3] and displays enhanced spectral contrast that is consistent with bedrock. This anomaly has the spatial appearance of a caldera lava lake. The spectrum of Anomaly 2 bears some resemblance to the Acidalia-type spectrum of [3] but clearly is modeled incompletely using the 7 Mars-derived endmembers. It has a prominent feature at ~470 $cm^{-1}$ consistent with either volcanic glass, phyllosilicate, or zeolite. The outlying occurrences of the northern Anomaly 2 material suggest a previously more continuous layer of this material. It may represent an eroded tephra deposit. The presence of what appears to be an eroded volcanic cone on the floor of the caldera lends support to this idea.

**References:** [1] Ruff, S. W. and V. E. Hamilton (2001) *LPS XXXII*, Abstract #2186. [2] Smith, M. D. et al. (2000) *JGR,* 105, 9589-9607. [3] Bandfield et al. (2000) *JGR*, 105, 9573-9587.

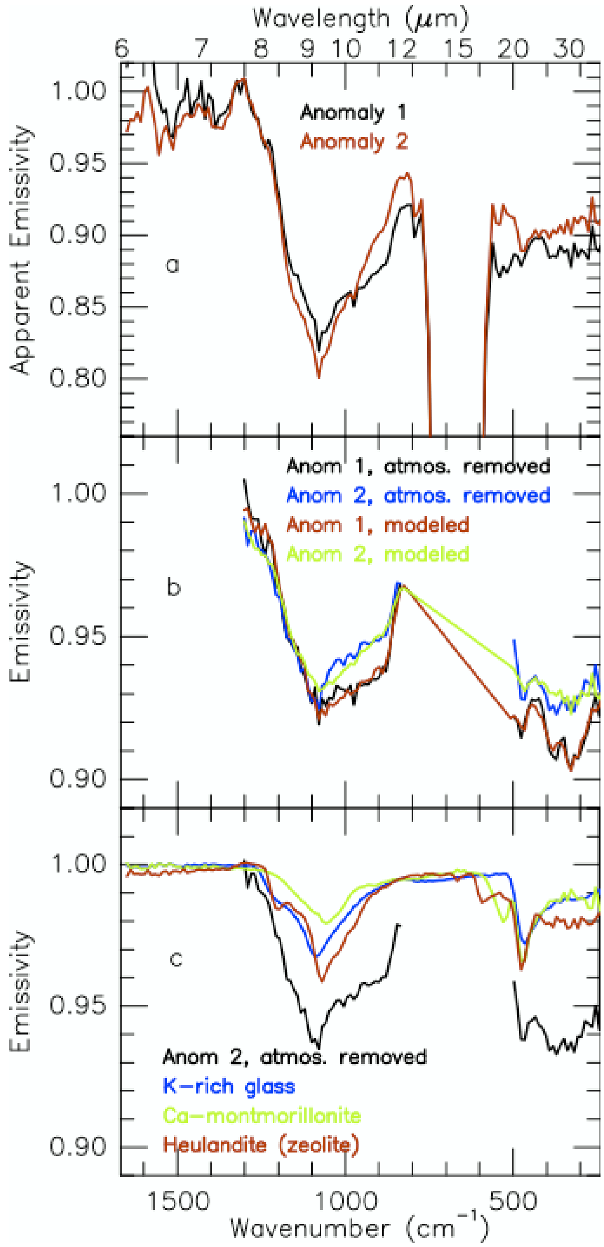


**Figure 2.** TES spectral analysis of Nili Patera anomalies. (a) Non-atmospherically-corrected average spectra from OCK 5836, ICK 1820 DET 5//6, ICK 1821 DET 2//3//6 for southern Anomaly 2 and ICK 1830 DET 3//6, 1831 DET 3 for central Anomaly 1. (b) Deconvolution results using 7 Mars-based spectral endmembers ($CO_2$ and water vapor regions excluded). (c) Comparison of atmospherically-corrected Anomaly 2 spectrum with scaled laboratory spectra. The feature at ~470 $cm^{-1}$ is a critical distinction between Anomaly 1 and 2 (see 2a) and is present in the laboratory example spectra.