VISIBLE AND NEAR-IR SPECTRAL IMAGING OF MARS DURING THE 1988 OPPOSITION.

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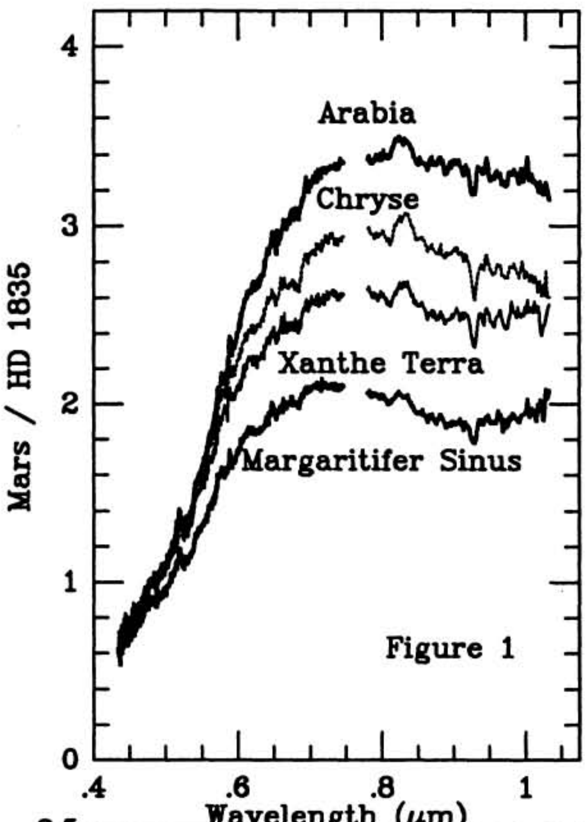
We conducted a major program of spectral imaging of Mars in the visible and near-IR (0.44-1.05μm) centered around the excellent 1988 opposition. The objective was to produce detailed reflectance spectra for contiguous, spatially resolved surface elements covering most of the planet. In this abstract we present some initial results from these observations.

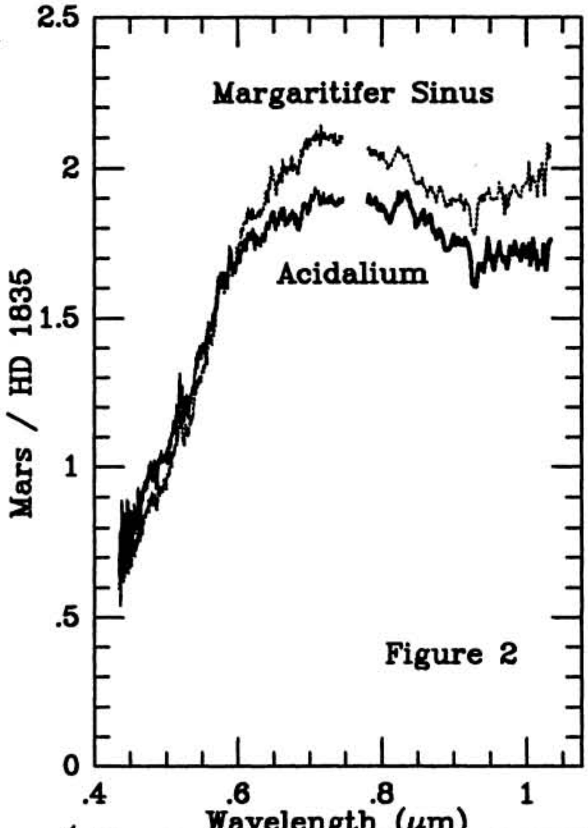
A total of 6 observing runs, of 3-4 days duration each, were conducted on the University of Arizona's 1.5m telescope on Mt. Bigelow. Nearly all of Mars south of 40°N was observed at least once. Instrumentation consisted of the LPL Echelle Spectrograph (D. Hunten) and the LPL CCD system (U. Fink). A prism in the spectrograph gave spectral resolution of 2nm in the blue and 10nm in the near-IR. The best-case spatial resolution is 250km by 150km per pixel. Careful standard star observations were made to facilitate accurate spectrophotometric calibrations. Differential refraction in the Earth's atmosphere was also properly accommodated for. A photographic record of the slit position on Mars was made for every CCD exposure to allow the locations of our observations to be calculated accurately. These spectral images will eventually be calibrated to radiance factor (R_F) [1] through the solar analog star 16 Cyg B. The data presented here are calibrated in a relative sense to solar analog star HD1835: the zero reflectance level is accurately known, and the relative signal level from all observed areas is correct. At present these data have some narrow residual atmospheric and stellar spectral features which will be removed as the calibrations are refined.

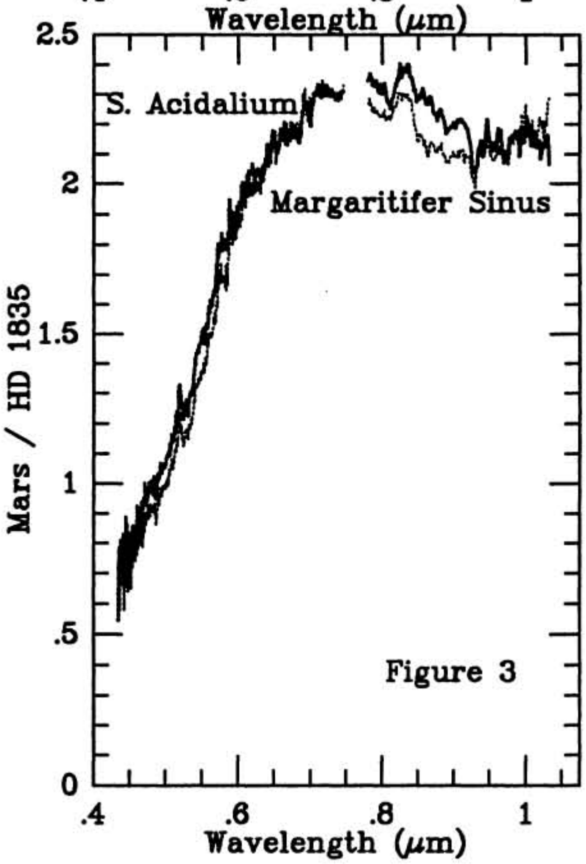
Figure 1 shows a range of spectral and albedo types observed for a number of regions on Mars. As expected, the steep visible slope is relatively smooth, in contrast to ferric-oxide minerals with long-range crystalline structure. However, definite slope changes are visible near 0.53μm and 0.63μm, related to incipient ferric-iron crystal-field absorptions. These features indicate a slightly greater degree of crystallinity for the common weathered soil on Mars than seen for the least-crystalline Hawaiian palagonites. The low-albedo region Margaritifer Sinus has a well-developed Fe^{2+} band with a minimum near 0.95μm, indicating low-Ca, high-Fe clinopyroxene [2]. Slightly different pyroxene band depth and position are seen for Meridiani Sinus in Figure 4. Spectral differences related to Fe^{3+} mineralogy and/or crystallinity are seen in the other figures. The Acidalium spectrum in Figure 2 is less absorbing in the visible than a typical dark region (Margaritifer) but more highly absorbing at longer wavelengths. We interpret these spectral differences as indicating a somewhat more-crystalline ferric oxide at this location on the planet [e.g. 3]. In Figure 3 spectra for Margaritifer Sinus and a region at the southern extreme of Acidalium overlay very well except at wavelengths between roughly 0.8 and 0.9μm. Such a difference is best explained by variation in a *different* Fe^{3+} crystal-field absorption as seen in the previous example.

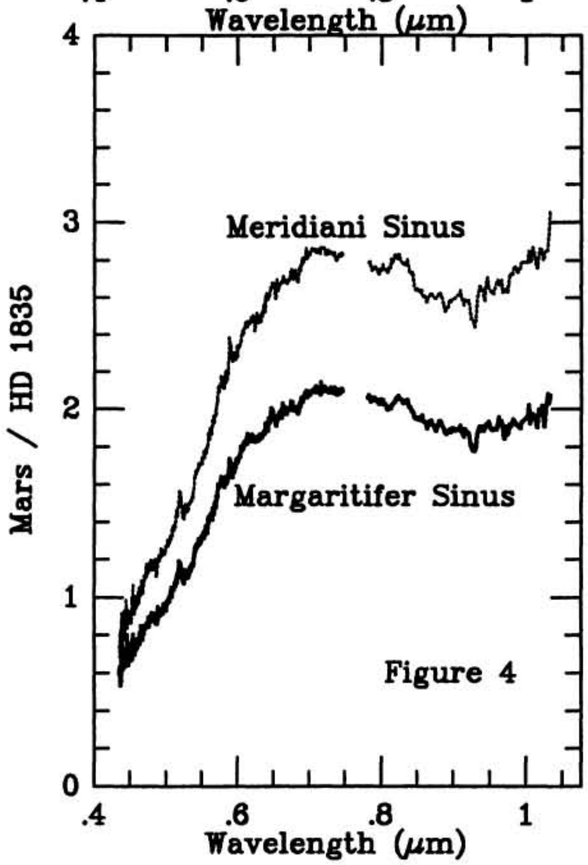
These new results, as well as those of others [4], are refining our knowledge of Mars surface composition on a local to regional scale. Greater variation has been observed, related to differing compositions and processes. It should be noted, however, that most of the spectral differences we have seen so far are relatively subtle. Typical high-albedo regions such as Arabia still indicate limited long-range Fe^{3+} crystalline structure in the common weathered soils and dust.

[1] Hapke, B. (1981) **JGR**, **86**, 3039.
[2] Adams, J.B. (1974) **JGR**, **79**, 4329.
[3] Singer, R.B. (1982) **JGR**, **87**, 10159; Sherman, D. *et al.* (1982) **JGR**, **87**, 10169.
[4] Bell, J.F. III *et al.* (1990) **JGR**, in press.


Arabia
Chryse
Xanthe Terra
Margaritifer Sinus
Figure 1
Mars / HD 1835
Wavelength (μm)


Margaritifer Sinus
Acidalium
Figure 2
Mars / HD 1835
Wavelength (μm)


S. Acidalium
Margaritifer Sinus
Figure 3
Mars / HD 1835
Wavelength (μm)


Meridiani Sinus
Margaritifer Sinus
Figure 4
Mars / HD 1835
Wavelength (μm)