MARS: NEAR-INFRARED COMPARATIVE SPECTROSCOPY DURING THE 1986 OPPOSITION; **James F. Bell, III and Thomas B. McCord (Planetary Geosciences Division, HIG, Univ. of Hawaii, Honolulu, HI 96822)**

Near-infrared (0.7-2.5μm) spectral observations of Mars during the 1986 opposition were carried out at the Mauna Kea Observatory utilizing the University of Hawaii 88" telescope. Spectra were obtained of several martian locations using a continuously variable filter (CVF) spectrometer with a resolution of 1.25% ($\Delta\lambda/\lambda$) (1). During two separate runs in June and August, a number of distinct spots between 354° and 163° longitude and 32° N and 78° S latitude were observed at an angular resolution of $\simeq$ 0.5 to 1.5 arcseconds, corresponding to a spatial resolution on Mars of $\simeq$ 220 to 460 km, varying with nightly seeing conditions. These different spots fall roughly into a set of 8 distinct geologic regions: volcanic regions, ridged plains, ridged volcanic plains, scoured plains, impact basins, channels and canyons, densely cratered regions, and layered terrain and ice (2). The spectra exhibit typical errors $\leq$4%.

In order to analyze these spectral data, spot-to-spot ratios were produced between spectra taken in different geologic regions. Spectral features observed in these ratios can act as indicators of mineralogic differences between areas under consideration; this method can also be used to infer the mineralogy of an unknown region which has been compared to one or more well-characterized areas. This exercise produced several interesting results.

In a few of the ratios, weak, broad features were identified which corresponded to Fe^{2+}, Fe^{3+}, or cation—OH absorptions (3,4), however identification of these features was typically the exception rather than the rule. Complications were added to these ratios due to the presence of rapidly variable extinction associated with telluric water bands at 0.718, 0.810, 0.935, 1.130, 1.395, and 1.870 μm (5) as well as martian atmospheric (gas) and surface (frost) CO_2 bands at 1.4, 1.6, and 2.0 μm (5,6) which all exhibited some degree of time- and space-variable behavior. Thus, characterization, by this method, of any features which may exist in close proximity to these bands is difficult except under very stable observing conditions, or when comparing spectra taken close together in time and/or space.

Perhaps the most striking result obtainable from the many ratios taken close in time and under similar viewing geometries was the consistent lack of noticeable differences between spectra taken of areas which, in Viking Orbiter images, appear to have vastly differing morphologies (figures 1 and 2). This observation leads to several possible conclusions: (a) the CVF sensitivity was too low to pick up weak bands or slight differences in band depths between regions. (b) The spatial resolution of spots observed on Mars was not high enough (i.e., the local morphology varies significantly within the aperture region and many units "blur" into one). (c) All of these regions look the same spectrally in the near-IR. It is proposed that conclusions (a) and (b) can be dismissed for a number of reasons and that conclusion (c) is most valid. Additionally, it is proposed that these regions look the same spectrally because a layer of fine dust which represents a single composition global weathering product blankets much of the observed surface, at least down to 200 km resolutions.

References: **(1)** McCord, T.B., R.N. CLark, and R.L. Huguenin (1978) *JGR, 83,* 5433-5441. **(2)** Carr, M.H., *The Surface of Mars,* Yale Univ. Press, 1981. **(3)** Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff (1971) *Mod. Geol., 2,* 195-205. **(4)** McCord, T.B., R.N. Clark, and R.B. Singer (1982) *JGR, 87,* 3021-3031. **(5)** Blake, P.L. (1983) Master's Thesis, University of Hawaii. **(6)** Kieffer, H. (1970) *JGR, 75,* 501-509.

MARS: COMPARATIVE SPECTROSCOPY

J.F. Bell, III and T.B. McCord

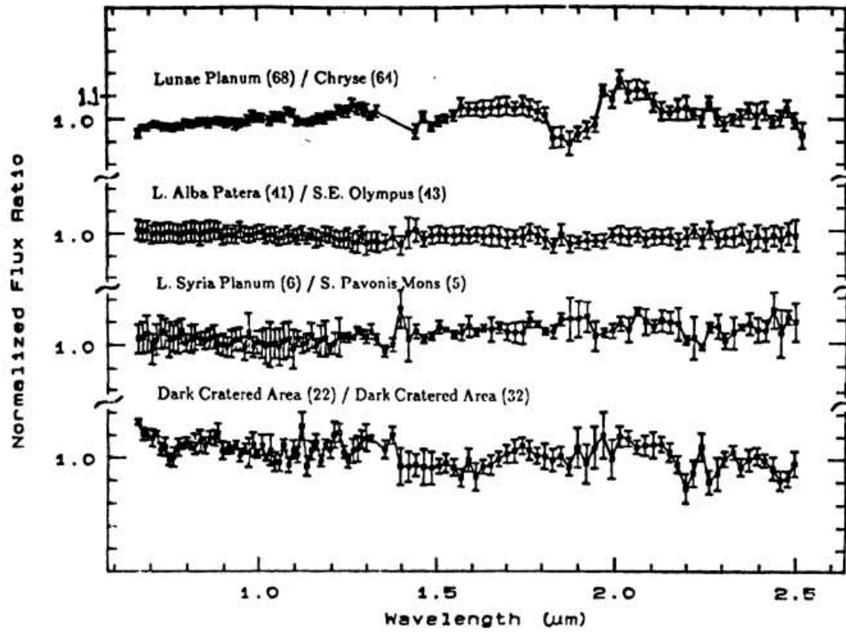

Figure 1: Four ratios of areas exhibiting nearly similar morphology as seen in Viking Orbiter low resolution images. By simple photogeological inference, one would expect that the mineralogy of the areas compared should be grossly similar and thus the ratios should be relatively flat. This is, in fact, what is generally observed. Most features seen in these ratios do not exceed ≃2-3σ of the noise, and thus it is difficult to interpret them as being due to real mineralogical differences.

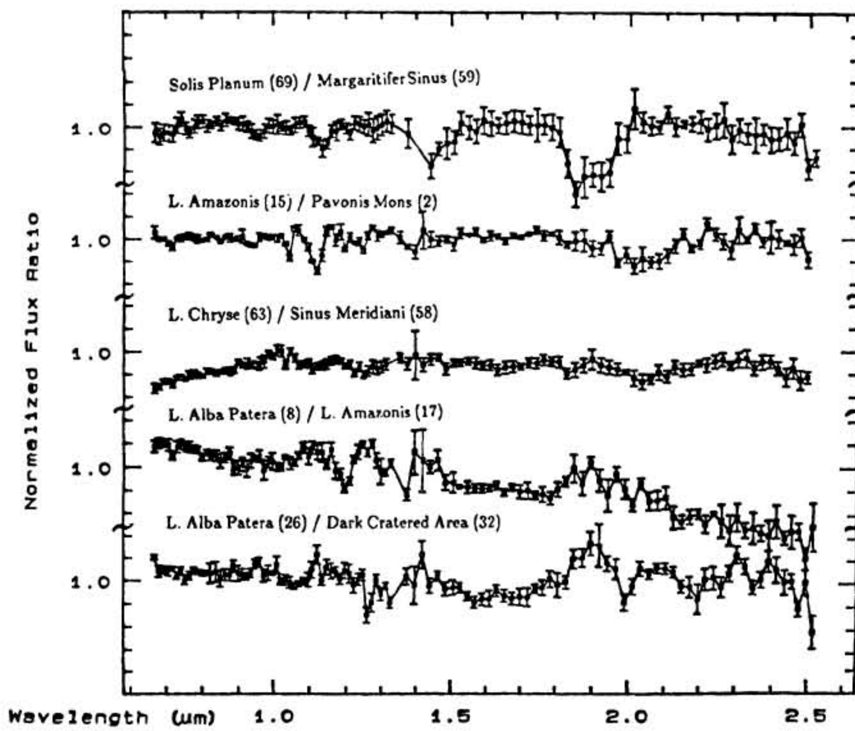

Figure 2: Five ratios of areas, unlike figure 1, exhibiting vastly differing morphology as seen in Viking Orbiter low resolution images. Thus, based on photogeological inferences, one would expect to see noticeable differences in the spectra of the regions compared. In fact, the ratios are just as flat down to the 2-3σ level as those in figure 1. Except for a few mild slope features, gross mineralogic differences do not emerge in these comparisons. This leads us to conclude that a fine layer of dust and/or global weathering product blankets much of the surface which we observed.