MIXING PATTERNS IN VIKING ORBITER COLOR IMAGE DATA FOR THE EQUATORIAL REGION OF MARS. *R.E. Arvidson and M.A. Dale-Bannister, McDonnell Center for the Space Sciences, Dept. of Earth and Planetary Sciences, Washington University, St. Louis, MO 63130*

In the 1990's, the Mars Observer Orbiter will return spectroscopic information on surface properties in both the reflected and emitted parts of the spectrum. Elemental information will be obtained from a gamma ray spectrometer and data on physical properties will be acquired during a number of investigations. Key to understanding the evolution of the planet is determination of the chemistry and mineralogy of igneous rocks exposed at the surface, and the products that have weathered from these materials. It is well known that Mars has an active aeolian environment dominated by lateral mixing of debris on a variety of timescales and length scales. The purpose of this paper is to utilize Viking Orbiter color image data covering the equatorial regions of Mars to evaluate the complexity of wind transport and mixing of soils, and the extent to which debris of local origins can be separated and characterized. The primary data utilized are violet (.42 to .48 μm), green (.45 to .64 μm), and orange (.54 to .64 μm) Viking Orbiter images that have been digitally processed and distributed as part of the Mars Consortium efforts (see 1). These color frames, processed to have brightness values proportional to bidirectional reflectance, each cover approximately 1000 km in width, with 1 km pixels.

Previous examination of these data, particularly for the Oxia Palus region, show at least three distinct color units (1, 2, 3). Similar units were also found in the Kasei Valles region (4). According to (3), the units correspond to a bright red material with low thermal inertia, a dark gray unit with high thermal inertia, and a dark red unit with intermediate thermal inertia. Erosion of superimposed, thin sedimentary layers was invoked to explain the patterns, although the superposition relationships were noted to be uncertain (1, 2).

Detailed examination of one hundred color triplets in this study, cover the entire equatorial region. Compilation of plots of orange vs. violet reflectances demonstrate that mixing among discrete color end members is the rule rather than the exception. Mixing occurs at a variety of scales and includes simple geometric or checkerboard mixing and intimate mixing of end members. The patterns are readily explained, in general, by invoking lateral transport, sorting, and mixing of debris by aeolian processes. Abundant aeolian features (e.g., wind streaks from craters; dark splotches on crater floors, etc.) further support this hypothesis. Interpretations that invoke erosion and exposure of discrete layers (i.e., 1,2) are inconsistent with the strong degree of mixing.

Further, the patterns of mixing among the units vary greatly from region to region and no obvious latitudinal trends are evident. For example, mixing trends for southwestern Arabia (frame 669A39) have bright red and dark red units mixing together. Bright red and dark gray units also mix; dark red and dark gray units do not mix. In fact, examination of color composites shows that there is always a bright red border between dark red and dark gray materials. In Lunae Planum, in apoapsis frame 586A16, dark gray materials mix with both bright red and bright, less red materials. In this case, the two brighter materials do not appear to mix together. Because of uncertainties in absolute reflectances for these data sets it is impossible to correlate Lunae Planum and Oxia. New calibration files and procedures produced by the USGS-Flagstaff as part of the Planetary Data System activities may allow us to pursue regional comparisons of end member units.

VIKING ORBITER COLOR IMAGE DATA
Arvidson, R.E., and Dale-Bannister, M.A.

At this stage of analysis it is difficult to decipher which materials are of strictly local origins, although the bright red deposits may be thin accumulations of dust that are mobile and, therefore, thoroughly mixed by winds. Also, it is difficult to delineate which units are of regional as opposed to local in extent. Again, the bright red materials offer the best choice for a unit of global extent. It is clear that much more effort is needed in deciphering these trends on local to regional scales, since the patterns indicate that any given Mars Observer datum will consist of signals received from more than one type of material. Our results demonstrate that the character and extent of mixing varies strongly with scale and location. Coupled with probable temporal variations, analyses of Mars Observer data will be challenging indeed.

REFERENCES

[1] Kieffer, H.H., P.A. Davis, and L.A. Soderblom (1981). "Mars' Global Properties: Maps and Applications", *Proc. Lunar Planet. Sci.*, **12B**, 1395-1417.

[2] Strickland, E.L., III (1980). "Martian Color/Albedo Units: Viking Lander 1 Stratigraphy Vs. Orbiter Color Observation", *Lunar and Planet. Sci. Abstracts*, **XI**, part 3, 1106-1108.

[3] Presley, M.A. and R.E. Arvidson (1987). "Characterization of Surficial Units in the Central Equatorial Region of Mars", *Lunar and Planet. Sci. Abstracts*, **XVIII**, submitted.

[4] Singer, R.B., E. Cloutis, T.L. Roush, P.J. Mouginis-Mark, B.R. Hawke, and P.R. Christensen (1984). "Multispectral Analysis of the Kasei Vallis-Lunae Planum Region of Mars", *Lunar and Planet. Sci. Abstracts*, **XV**, 794-795.