COMPOSITIONAL DIVERSITY OF THE MARTIAN CRUST: PRELIMINARY DATA FROM THE MARS ODYSSEY GAMMA-RAY SPECTROMETER. William V. Boynton[1], G. J. Taylor[2], D. Hamara[1], K. Kerry[1], D. Janes[1], J. Keller[1], W. Feldman[3], T. Prettyman[3], R. Reedy[4], J. Brückner[5], H. Wänke[5], L. Evans[6], R. Starr[7], S. Squyres[8], S. Karunatillake[8], O. Gasnault[9] [1]Lunar and Planetary Lab, Univ. of Arizona, Tucson, AZ 85721. [2]Hawaii Inst. of Geophys. and Planetology, Honolulu, HI. [3]Los Alamos National Laboratory, Los Alamos, NM. [4]Inst. of Meteoritics, Univ. of New Mexico, Albuquerque, NM. [5]Max-Planck-Institü für Chemie, Mainz, Germany. [6]Computer Sciences Corp., Lanham, MD. [7]Dept. of Physics, Catholic Univ. of American, Washington, DC. [8]Center for Radiophysics and Space Research, Cornell Univ., Ithaca, NY. [9]Centre d'Etude Spatiale des Rayonnements, Toulouse, France.

Introduction: We report preliminary data on the concentrations of Si, Fe, H, K, and Th on the Martian surface. K and Th are also discussed in the context of crustal evolution and the bulk composition of Mars in a companion abstract [1]. The data reveal that the varies considerably in composition. We present these variations and use the data to assess the nature of surface materials and their relationship to Martian meteorites and suspected andesitic and basaltic surface types. In this abstract we confine our interest to the equatorial region between approximately 70 degrees north and 50 degrees south.

Data Reduction: The gamma spectra have been summed on 10- by 10-deg and 15- by 15-deg bins and peak areas of the various gamma-ray emission lines were determined. (The 10-deg bins were used for the maps and the 15-deg bins used for scatter plot.) The peak areas were then compared to expected counts based on Monte Carlo calculations for a model Mars composition similar to Mars Pathfinder soil [2]. The data have been corrected for atmospheric attenuation, for variations in production rates with atmospheric thickness, cosmic ray intensity and H content, and for efficiency of the detector. At this preliminary stage we still have uncertainties in our procedures, so we normalized the data for Fe and Si to an average value determined for soils at the Mars Pathfinder [2] and Viking-1 [3] sites, and for K we normalize to just the Mars Pathfinder data.

Overview: Maps of the concentrations of Si, K and Fe are shown in Fig. 1. (The data are smoothed by a circular boxcar filter, and each 10 deg bin has a one-sigma absolute uncertainty of about 2% for Fe, 4% for Si, and 0.04% for K). Two important points stand out in these maps. First, each element varies quite widely in its abundance. This indicates that the Martian surface is far from uniform in spite of the similarities in chemical composition between the Viking and Pathfinder soils [3; 4] and the possibility that the pervasive dust on Mars is similar in composition everywhere. The variations appear to be more complicated than simple mixing between one surface rock type and differing amounts of the global dust. Local variations in the compositions of rock and alteration products appear likely. Considering the current statistical uncertainty in the data, the Si contents (Fig. 2) are generally lower (12 to 22 wt%) than in SNC meteorites (19-24 wt%) or in the Pathfinder soil-free rock (26.5% [4]). Fe concentrations also vary widely, from 8 to 17 wt%. The higher values overlap those of basaltic shergottites (13 to 17 wt%) and Pathfinder soils (13 to 16 wt%) and the lower values correspond to Viking soils (11 to 13 wt%). Si and Fe are correlated, though there is considerable scatter in the data (Fig. 2). Though the absolute concentrations are subject to normalization uncertainties, the relative concentrations are felt to be robust within the currently large statistical uncertainty in the data.

Geographic and Geologic Correlations: On Figs. 1a and 1c we have drawn outlines of the surface type 1 and 2 regions identified by Bandfield *et al.* [5] and Hamilton *et al.* [6]. The type 1 region, characterized by Bandfield *et al.* as basaltic, appears no different in K or Si content than the majority of the mid-latitude region, but the type 2 region appeears to be more enriched in both Si and K. This observation is consistent with both the suggestions made by Bandfield that the type 2 material is andesitic, and by Wyatt and McSween [7] that the material is weathered basalt.

References: [1] Taylor, G. J. et al, this volume. [2] Wänke, H. et al. (2001) *Space Sci. Rev.* **96**, 317-330. [3] Clark, B. C. et al. (1982) *J. Geophys. Res.* **87**, 10,059-10,067. [4] Bruckner, J. et al. (2001) *LPS XXXII*, Abstract #1293. [5] Bandfield, J. et al. (2000) *Science* **287**, 1626-1630. [6] Hamilton, V. et al. (2002) *LPS XXXIII*, Abstract #1937; also submitted manuscript. [7] McSween, H. Y. and Keil, K. (2000) *Geochim. Cosmochim. Acta* **64**, 2155-2166.

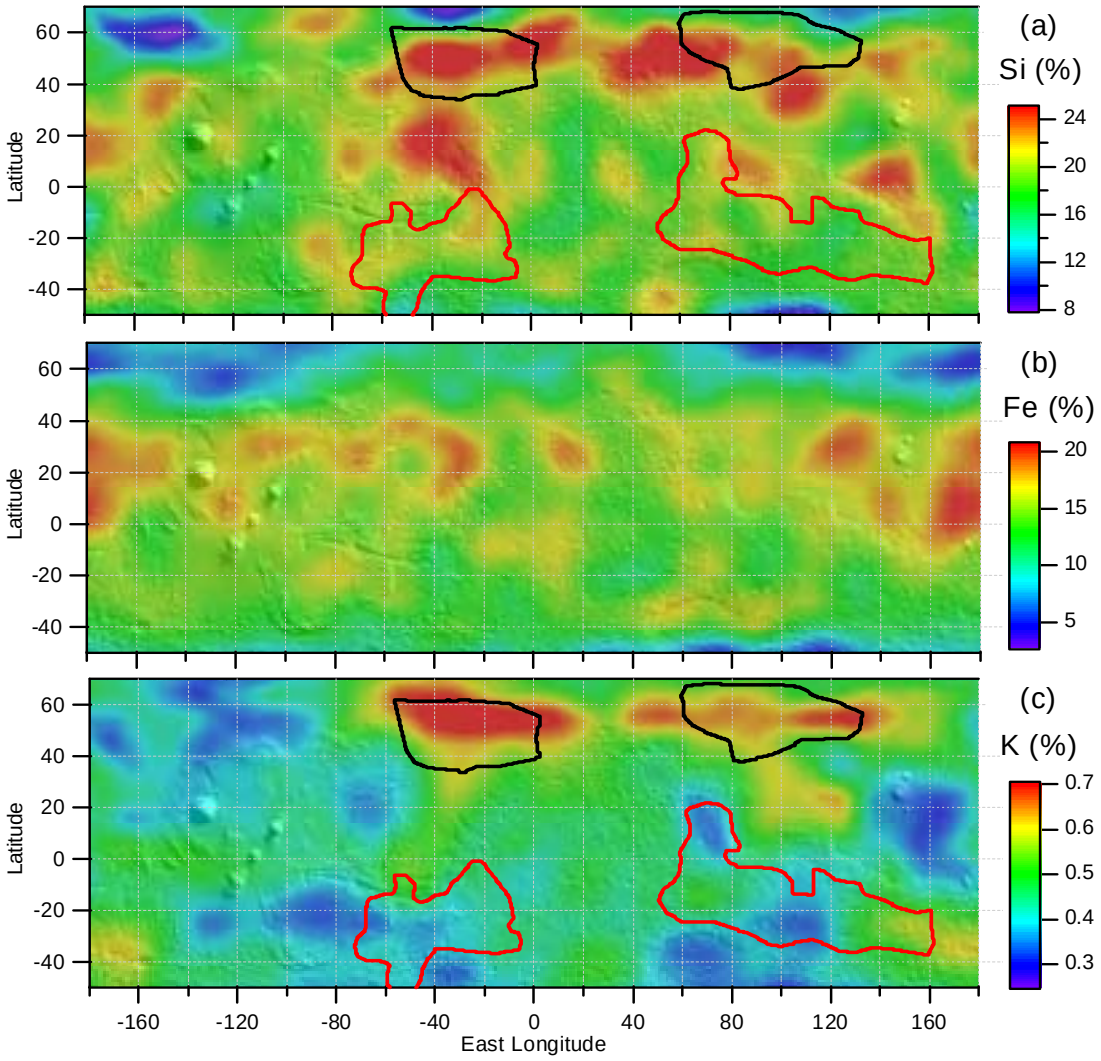

Figure 1. Maps of Si, Fe, and K determined with the Mars Odyssey Gamma-Ray Spectrometer. The data have been scaled to Mars Pathfinder and/or Viking-1 soils (see text). On figures 1a and 1c we have added rough outlines of the regions defined by Bandfield et al. [#] and Hamilton et al. [#] of surface type-1 (red) and surface type-2 (black). The type-2 region overlaps significantly with the areas with greatest concentration in Si and K, but the type-1 region does not appear to be significantly different from the rest of the mid-latitude region. Fe is clearly enriched in the northern hemisphere, but otherwise it does not appear related to either of the two regions.

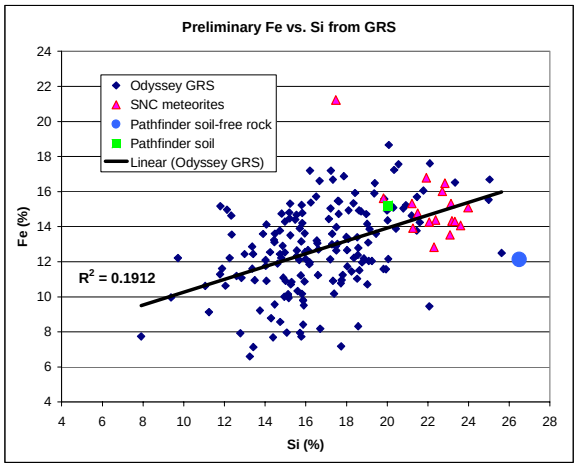

Figure 2. Scatter plot of Fe vs. Si based on 15-deg binned GRS data. Fe is significantly correlated with Si, but there is significant scatter. The scatter in large part may be due to the high statistical uncertainty associated with the data. As time goes on, the statistical uncertainty will decrease, but already it is likely that some of the scatter is real. This scatter indicates that the data cannot be described as a simple mixing of two components, e.g. rocks and dust.