COMPOSITIONAL DIVERSITY AND EVOLUTION OF THE MARTIAN CRUST: PRELIMINARY DATA FROM THE MARS ODYSSEY GAMMA-RAY SPECTROMETER

W. V. Boynton (1) , G. J. Taylor (2) , GRS TEAM
(1) Lunar and Planetary Lab, Univ. of Arizona, Tucson, AZ 85721. (2) Hawaii Inst. of Geophys. and Planetology, Honolulu, HI 96822.

Introduction: Preliminary data on the concentrations of Si, Fe, H, K, and Th reveal that the martian surface 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. K and Th are also discussed in the context of crustal evolution and the bulk composition of Mars, as they are useful elements for determining the inventory of moderately volatile elements in planetary interiors and for deciphering the evolution of the crust and mantles of the planets. Compositional Diversity: Maps of the concentrations of Si, K and Fe reveal two important points. (1) 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 and the possibility that the pervasive dust on Mars is similar in composition everywhere. (2) 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. With respect to geographic and geologic correlations, surface type 1 (basaltic) and 2 (andesitic) regions have been identified by Bandfield et al. (2000). The type 1 region appears no different in K or Si content than the majority of the mid-latitude region, but the type 2 region appears 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 (2002) that the material is weathered basalt. Crustal Evolution: The following tentative con-
clclusions are based on K and Th data. (1) The surface materials on Mars indicate that K and Th are higher than in typical martian meteorites, consistent with suggestions that much of the crust formed early from undepleted Martian mantle. (2) K and Th are correlated. (3) The K/Th ratio is higher than on Earth, consistent with suggestions that Mars is richer in moderately-volatile elements. (4) The compositional differences between Earth and Mars favor accretion of the terrestrial planets from relatively narrow feeding zones. (5) The alteration (or salt) component on the surface of Mars does not appear to have been rich enough in either K or Th to affect the general, presumably igneous, K-Th correlation.