Preliminary GRS Measurement of Chlorine on Mars

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Significant initial results from the Gamma Ray Spectrometer (GRS) aboard Mars Odyssey include detection of near-surface water ice (1), estimates of seasonal carbon dioxide cap thickness (2), and distribution of potassium and thorium in the equatorial region (3). With continued data collection, we have also obtained preliminary measurements of chlorine at the surface of Mars. Summing all data since boom deployment and using a forward calculation model, we estimate values for chlorine concentration at 5° resolution. This data was rebinned and smoothed with a 15-degree-radius boxcar filter reveal regions of noticeable chlorine enrichment at scales larger than the original 5° resolution, allowing for preliminary comparison with previous Mars datasets. Analyzing chlorine concentrations within 30 degrees of the equator, we find a negative correlation with thermal inertia and positive correlation with albedo, indicating that chlorine is associated with fine, non-rock surface materials in brighter, lower thermal inertia regions. Although possibly a smoothing artifact, the spatial correlation is more noticeable in the region covering Tharsis and Amazonis than around Arabia and Elysium. Additionally, a noticeable region of chlorine enrichment appears west of Tharsis Montes, and chlorine concentration is estimated to vary in the equatorial region by over a factor of two. A simplified two-component model involving spatial distribution of chlorine-poor rocks and a homogenous chlorine-rich fine material requires rock abundance to vary from zero to over 50%, a result inconsistent with previous measurements and models. Rather, variations in chlorine concentration are more likely explained through substantial variations in chlorine content in various types of fine materials involving dust, sand, and duricrust. Tentative models involving variations in fine components, rock composition, distribution of rocks and fines, and formation mechanisms for Martian fines are discussed in light of this new preliminary data.

References: (1) Boynton et al, 2002, *Science* 297 (5578):81; Feldman et al, 2002, *Science* 297 (5578):75; (2) Kelly et al, 2003, 6th Intl. Mars Conference, #3244; (3) Taylor et al, 2003, *6th Intl. Mars Conference*, #3207.