ODYSSEY GRS AND SNC METEORITE EVIDENCE FOR MULTIPLE LIL-ENRICHED RESERVOIRS ON MARS S. M. McLennan[1], B. C. Hahn[1], W. V. Boynton[2] and G. J. Taylor[3]. [1]Dept. of Geosciences, SUNY, Stony Brook, NY, 11794-2100, USA. E-mail: Scott.McLennan@sunysb.edu. [2]Lunar and Planetary Lab., Univ. of Arizona, Tucson, AZ, 85721. [3]Hawaii Inst. Geophysics and Planetology, Honolulu, HI, 96822.

Introduction: Based on SNC meteorite geochemistry, the bulk composition of Mars generally is thought to be enriched in moderately volatile elements (*e.g.* K, Rb) compared to Earth [1]. This enrichment leads to K/U and K/Th ratios thought to be about double those of terrestrial primitive mantle. McLennan [2] questioned the degree of volatile enrichment in the martian primitive mantle on the basis of more recently obtained SNC analyses and suggested that the martian crust may constitute a LIL-enriched, low K/Th and low K/U reservoir that is not well-sampled by SNC meteorites. However, recent results from Mars Odyssey gamma ray spectrometer [3] confirm high K/Th ratios for the martian surface. This paper discusses some of the implications of this result.

SNC Meteorites: Many SNC meteorites posses high K/U (>15,000) and K/Th (>4000) ratios [1] compared to most terrestrial basalts (K/U~10,000; K/Th~2700). However, the young basaltic shergottites, comprising the majority of SNCs, are variably depleted in LREE and thus likely were derived in part from highly depleted mantle [2,4]. K/U and K/Th ratios decrease systematically with both K abundances and La/Sm ratios in basaltic shergottites [2]. These relationships suggest that a LIL-enriched, low K/Th reservoir forms a second component being sampled by basaltic shergottites.

Odyssey GRS K-Th Relationships: Odyssey GRS data suggest that the average martian surface is characterized by high K_2O abundances (0.40%) and high K/Th ratios (5500). Regional variations from these averages among geologically distinct terrains are only on the order of ±25% for K and ±10% for K/Th [3]. If representative of the entire crust, these values would imply that the martian crustal reservoir constitutes roughly half of the planet's complement of K and Th [3,5]. The high K/Th ratio would preclude this crustal reservoir from being the LIL-enriched component sampled by basaltic shergottites.

Discussion: There are several ways to explain the combined GRS and SNC meteorite K-Th systematics. GRS data may not be representative of the entire crust due either to crustal differentiation and/or stratification or to surficial processes fractionating K from Th. Although these possibilities cannot be excluded, the simplest interpretation is that GRS data are indeed representative of at least a significant fraction of the upper martian crust. If so, an additional LIL-enriched reservoir must exist, in either the mantle or crust, that is characterized by relatively low K/Th ratios (≤3000) and presumably low K/U ratios (≤12000). The size of the reservoir cannot be constrained but would be approximately proportional to the size of the depleted mantle reservoir sampled by basaltic shergottites.

References: [1] Wänke, H. and Dreibus, G. 1988. *Philosophical Transactions of the Royal Society of London* A325: 545-557. [2] McLennan, S. M. 2003. *Meteoritics and Planetary Science* 38: 895-904. [3] Taylor, G. J., Boynton, W. and 21 others. 2005. *Journal of Geophysical Research* (submitted). [4] Jones, J. H. 2003. *Meteoritics and Planetary Science* 38: 1807-1814. [5] McLennan, S. M. 2001. *Geophysical Research Letters* 28: 4019-4022.