PETROCHEMICAL COMPARISON OF THE ANCIENT AND RECENT (SNC) MARTIAN CRUST. H. Y. McSween, Jr.[1], T. L. Grove[2] and M B. Wyatt [3], [1]Dept of Geological Sciences, University of Tennessee, Knoxville, TN, [2]Dept of Earth, Atmospheric and Planetary Sciences, MIT, Cambridge, MA 02139, [3]Dept of Geology, Arizona State University, Tempe, AZ 85287.

Introduction: The chemical composition of the martian crust, and even of Mars itself, has been inferred from SNC meteorites. However, with one exception, SNCs sample young volcanic centers and are not necessarily chemical proxies for the thick, ancient crust. Until Mars Odyssey GRS data are available, the only compositional information for the Noachian crust is Mars Pathfinder APXS analyses or chemical data calculated from deconvolutions of spectra from Mars Global Surveyor TES. In making this comparison, we will distinguish TES surface types 1 and 2 (ST1, ST2), previously interpreted as basalt and either andesite [1] or partly weathered basalt [2].

Method: By combining the compositions of spectral endmembers in proportion to their modes, we have estimated ST1 and ST2 chemical compostions from TES data [3]. The fitting was constrained to the 1301 to 233 cm^{-1} region. Compositions were calculated on a water and CO_2-free basis to facilitate comparisons.

Results: We have classified ST1 and ST2 using two widely used schemes for volcanic rocks. On a wt % alkalis versus silica diagram [4], ST1 plots as basaltic andesite and ST2 as andesite (near the Pathfinder rock). Using the molecular normative plagioclase composition versus color index classification [5], both ST1 and ST2 plot within the basalt field. However, oxidation of Fe can shift the ST2 composition closer to andesite. Both types of ancient crust are clearly resolvable from basaltic shergottites and nakhlites.

Both ST1 and ST2 plot within the calc-alkaline field on a FeO*/MgO versus silica diagram. The only geochemically similar terrestrial rocks form by hydrous melting and fractional crystallization in subduction zones. If these compositions represent igneous rocks, they imply a much wetter martian interior than previously envisioned. SNCs plot within the tholeiite field, as appropriate for dry magmas. The ST1 and ST2 compositions appear to have high Al contents (more like the Earth's crust than SNCs), although the uncertainties preclude a firm conclusion.

Alternatively, both ST1 and ST2 compositions could be partly weathered volcanic rocks, as suggested by their positions on diagrams used to understand chemical weathering of basalts [6]. In this case, weathering must produce silica enrichment, as well as depletion in soluble elements. This scenario is more consistent with spectroscopic properties and the ~2 wt % water in alpha-mode APXS analyses [7] of Pathfinder rocks and could account for the high Al. Weathering is also consistent with the inferred sedimentary depositional history of the ST2 terrain in the northern plains.

If ST1 and ST2 are igneous, the chemical composition of the ancient martian crust is distinct from SNCs, which must represent remelting of a relatively dry mantle source that was previously depleted by formation of the early crust. If these compositions represent weathered materials, we do not know how their volcanic protoliths compare to SNCs.

References: [1] Bandfield J. L. et al. (2000) *Science 287*, 1626-1630. [2] Wyatt M. B. and McSween H. Y. (2002) *Nature 417*, 263-266. [3] McSween H. Y. et al. (2003) LPSC XXX!V, 1189. [4] Le Bas M. J. et al. (1986) *J. Petrol. 27,* 745-750. [5] Irvine T. N. and Baragar W. R. A. (1971) *Canad. J. Earth Sci. 8,* 523-548. [6] Nesbitt H. W. and Wilson R. E. (1992) *AJS 292*, 740-777. [7] Foley C. N. et al. (2003) *JGR*, submitted.