PHYLLOSILICATE AND HYDRATED SULFATE DEPOSITS IN MERIDIANI. S. M. Wiseman¹, R. E. Avidson¹, S. Murchie², F. Poulet¹, J. C. Andrews-Hanna¹, R. V. Morris², F. P. Seelos², and the CRISM Team. ¹Dept of Earth and Planetary Sciences, Washington University, St. Louis, MO (sandraw@levee.wustl.edu), ²Applied Physics Laboratory, Laurel, MD, ³Institut d' Astrophysique Spatiale (IAS), Orsay, France, ⁴Dept of Earth, Atmospheric, and Planetary Sciences, MIT, Cambridge, MA, ⁵NASA Johnson Space Center, Houston, TX.

Introduction: Several phyllosilicate and hydrated sulfate deposits in Meridiani have been mapped in detail with high resolution MRO CRISM [1] data. Previous studies have documented extensive exposures of outcrop in Meridiani (fig 1), or ‘etched terrain’ (ET), that has been interpreted to be sedimentary in origin [e.g., 2,3]. These deposits have been mapped at a regional scale with OMEGA data and show enhanced hydration (1.9µm absorption) in several areas [4]. However, hydrated sulfate detections were restricted to valley exposures in northern Meridiani ET [5]. New high resolution CRISM images show that hydrated sulfates are present in several spatially isolated exposures throughout the ET (fig 1). The hydrated sulfate deposits in the valley are vertically heterogeneous with layers of mono and polyhydrated sulfates and are morphologically distinct from other areas of the ET. We are currently mapping the detailed spatial distribution of sulfates and searching for distinct geochemical horizons that may be traced back to differential groundwater recharge and/or evaporative loss rates.

The high resolution CRISM data has allowed us to map out several phyllosilicate deposits within the fluvially dissected Noachian cratered terrain (DCT) to the south and west of the hematite-bearing plains (Ph) and ET (fig 1). In Miyamoto crater, phyllosilicates are located within ~30km of the edge of Ph, which is presumably underlain by acid sulfate deposits similar to those explored by the Opportunity rover. The deposits within this crater may record the transition from fluvial conditions which produced and/or preserved phyllosilicates deposits to a progressively acid sulfate dominated groundwater system in which large accumulations of sulfate-rich evaporites were deposited.

Phyllosilicates: Phyllosilicates have been previously detected using OMEGA data within a large crater in northern Meridiani as well as in a portion of the ET to the east [4] (fig 1). However, the geologic context of these deposits was difficult to decipher. Using CRISM and other orbital data, we have defined a lateral transition from phyllosilicate bearing material to layered terrain that occurs within the heavily modified ~130km diameter Miyamoto crater. Phyllosilicates (fig 2a) are present within crater deposits ~30km from the edge of the layered terrain explored by the Opportunity rover at the landing site ~150km to the northeast (fig 1). Phyllosilicate exposures exhibit spectral features resulting from Fe/Mg-OH vibrations at 2.3µm and bound H₂O at 1.9µm. The band center and shape of the ~2.3µm absorption feature indicates the presence of saponite, a smectite clay (fig 2d).

A geologic cross section of this area shows that Miyamoto crater was heavily infilled prior to the emplacement of the layered deposits (fig 2e). Analysis of HRSC data show that phyllosilicate exposures occur in areas where a capping unit has been stripped away (fig 2b). This capping unit appears to unconformably overlie the phyllosilicate bearing material and extends to the edge of and underlies the layered terrain to the east. This relationship indicates that the phyllosilicates predate the emplacement of the layered terrain. The phyllosilicate deposits within the crater in northern Meridiani, which are spectrally similar to those within Miyamoto, may also predate the emplacement of ET.

Figure 1. Regional map of Meridiani. Phyllosilicate detections are shown in green and hydrated sulfates in red.

The lack of sulfate detection in CRISM data may be explained by the presence of coatings thick enough to obscure reflectance signatures of underlying sulfates, but thin enough to be transparent to the gamma radiation used by the MB, and/or the fine grain size of the sulfates precludes detection using VIS/SWIR data.

**Discussion:** The deposits in Meridiani record the waning of the hydrologic cycle on Mars. High energy erosive conditions which degraded and dissected the Noachian cratered terrain transitioned to a ground water dominated regime in which evaporation and aeolian reworking dominated to produce thick accumulations of layered outcrop (ET). Phyllosilicate deposits appear to be associated with the most ancient rocks on Mars [15] and hydrated sulfate deposits are present in some of the late Noachian or early Hesperian layered terrain in Valles Marineris and Meridiani. The transition in hydrologic regimes on Mars to an acid sulfate ground water system may be recorded in the phyllosilicate and layered deposits within Miyamoto crater.

Several distinct mineral assemblages are present within the layered outcrop material in Meridiani that have been grouped together as ET. Acid sulfate conditions are suggested by the presence of jarosite within the outcrop measured by the Opportunity rover. The hematitic spherules are derived from the outcrop, and the presence of the laterally extensive Ph indicates that much of the outcrop underlying this unit is similar in nature to the deposits explored by the rover. Areas of the ET that exhibit hydrated sulfate signatures experienced distinct geochemical conditions during deposition and/or diagenesis that preserved these minerals in measurable quantities. Active erosion may contribute to the orbital detection of these deposits.

The geochemical conditions experienced by ET at various locations were driven by ground water recharge and evaporative loss rates, both of which influence the water to rock ratio and therefore the fluid chemistry. Hydrologic modeling [6] predicts regions of groundwater upwelling and variation in evaporative loss rates throughout the Meridiani region. Continued high resolution spectral and geomorphic mapping of distinct terrains, including phyllosilicates and sulfates, within Meridiani will lead to a better understanding of the local and global scale hydrologic regime on Mars.