Coupled OMEGA-CRISM Observations of Marwth Vallis: J-P. Bibring[1], D. Loizeau[2], S.M. Pelkey[3], S. Murchie[4], J.F. Mustard[3], J. Bishop[5], B. L. Ehlmann[3], B. Gondet[1], N. Mangold[2], F. Poulet[1], L.H. Roach[3], F. Seelos[4], and the OMEGA and CRISM Science teams, [1]IAS, Université Paris-Sud, 91405 Orsay, France, [2]IDES, Orsay, France, [3]Brown University, Providence, USA, [4] The Johns Hopkins University Applied Physics Laboratory, Laurel, MD, [4]SETI Institute/NASA-ARC, Mountain View, CA, bibring@ias.u-psud.fr.

Introduction: One of the major discoveries of the Mars Express/OMEGA imaging spectrometer is that of hydrated phyllosilicates in the oldest Martian terrains, exhumed by either impact or erosion [1,2,3]. In particular, in the Marwth Vallis area, a variety of Al- and Mg/Fe- rich smectites have been identified and localized, along the flanks of the outflow channel and within the surrounding plateau. These findings have important implications for the early evolution of Mars, as these minerals record a moist environment that persisted on Mars over geological time scales. The MRO/CRISM imaging spectrometer, with its 20-fold higher spatial sampling, targeted phyllosilicate-rich spots during its early science operations [4]. We will present combined results, that highlight the enormous potential of coupling these two investigations to identify diagnostic minerals and derive the early geologic history of Mars.

Datasets: OMEGA has covered most of the Marwth Vallis area from altitudes 300-4000 km, leading to a variety of spatial sampling from 0.35-3 km/px (see Figure 1 for high-resolution coverage). Thus far, CRISM has acquired two observations at 36 m/px in the region, HRL0000285A_07, the location of which is shown in Figure 2, and HRS0000307A_07, centered at 22.75N, 341.7E . OMEGA acquires spectra in 352 contiguous spectral channels from 0.35 to 5.1 µm, while the CRISM spectral range, 0.362-3.920 µm, is covered in 544 channels at 6.55 nm/channel .

Standard processing approaches have been used to convert both OMEGA and CRISM data to I/F. Simple corrections for photometric and atmospheric effects were applied to both datasets following the method of [5].

Results: In both the OMEGA and CRISM data, hydrated phyllosilicates are identified through their diagnostic hydration feature at 1.93 µm and their metal-OH absorptions in the 2.2 – 2.35 µm range, the accurate position of which indicates the dominant cation involved. Specifically, both Al-rich (e.g. montmorillonite, but no Al-pure species such as kaolinite) and Mg-rich and Fe-rich smectites (e.g. nontronite) have been identified by OMEGA [1,2,3] and confirmed with CRISM.

Figure 2 shows a map of hydrated phyllosilicates as derived from the OMEGA data. Analyses show these hydrated regions correspond to bright outcrops of lower Noachian-aged material that have been exposed through erosion [1,2,3]. By mapping areas that display enhanced absorptions at mineralogically distinguishing wavelengths, we also see spatial variability in the hydrated mineralogy across the region (Fig. 2). High resolution mapping of similar spectral parameters derived from the CRISM data show that the spatial distinction between Al-rich and the Mg/Fe-rich species extends to much smaller spatial scales (Fig. 3).

Discussion: Hydrated phyllosilicates have been identified in terrains where no pyroxene is detected, indicating a thorough alteration of the primordial crust. However, the composition of the phyllosilicates indicates a low level of leaching, a low temperature (<300C), and a non-acidic environment.

We will present the results of the on-going combined analyses of OMEGA and CRISM data. Emphasis will be given on their outcomes in terms of formation processes of these hydrated phases, and their derived constraints on the global environment of Mars in its early evolutionary stages, during the era that might have seen Mars harboring sustained liquid water.

References: [1] Poulet F. et al. (2005), *Nature 438*, 623-627. [2] Bibring J-P. et al. (2006) *Science 312*, 400-404. [3] Loizeau D. et al. (2007), submitted to *JGR-Planet*. [4] Murchie S. et al. (2007), this conference. [5] Bibring, J.-P., et al. (2005) *Science*, **307**, 1576-1581. [6] Malin, M.C. (2006) Eos Trans. AGU, Fall Meet., P33A-03.

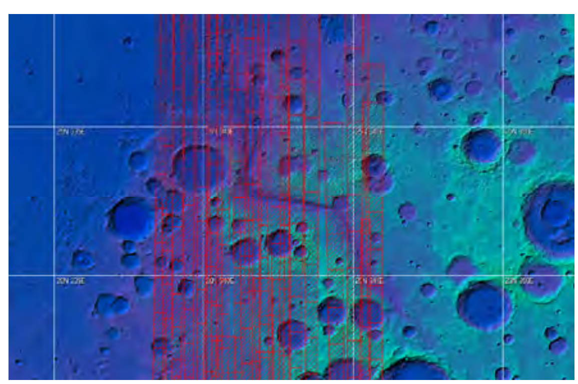

Figure 1: High resolution (300 m/px to 500 m/px) OMEGA coverage of the Marwth vallis area. OMEGA ground tracks are shown in red.

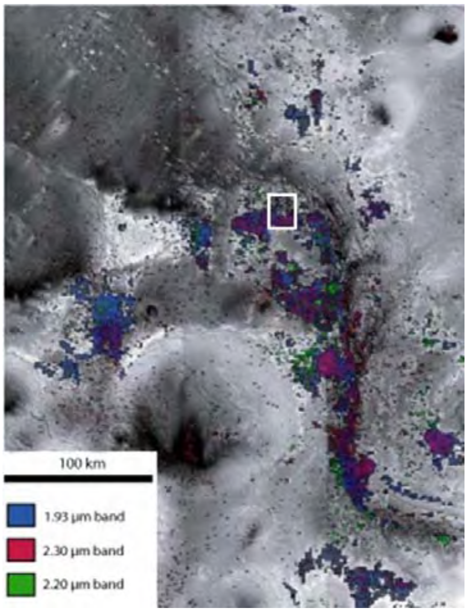

Figure 2: HRSC mosaic overlain with the distribution of hydrated phyllosilicates mapped by areas displaying enhanced absorptions at characteristic wavelengths as seen in the OMEGA data [3]. White box indicates location of the CRISM image discussed in Figure 3.

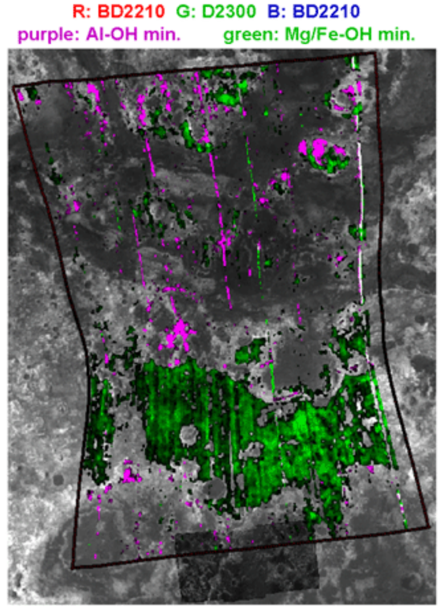

Figure 3: Distribution of the Al-rich (purple) and Mg-rich/Fe-rich (green) phyllosilicates as mapped by spectral parameters derived from the CRISM observation HRL0000285A_07 overlain, on a Context Imager observation [6]. The black outline indicates the extent of the CRISM observation.