EXTENSIVE PHYLLOSILICATE-BEARING LAYER EXPOSED BY VALLEY SYSTEMS IN NORTH-WEST NOACHIS TERRA. D. L. Buczkowski[1], K. Seelos[1], S. Murchie[1], F. Seelos[1], E. Malaret[2], C. Hash[2] and the CRISM Team, [1]Johns Hopkins University Applied Physics Lab, Laurel, MD 20723, Debra.Buczkowski@jhuapl.edu, [2] Applied Coherent Technology, Herndon, VA 20170

Summary: Evidence for a widespread phyllosilicate-bearing layer has been identified in a distinct region in northwest Noachis Terra.

Introduction: Noachis Terra is a highland cratered plain on Mars, extending from 20º to 80ºS latitude and 55ºW to 30ºE longitude. The region we refer to as northwest Noachis Terra (Fig. 1) is bound by Coprates and Eos Chasma to the north, Thaumasia Planum to the west and the Argyre basin to the south. Uzboi Vallis, a major Martian valley system, cuts through greater Noachis Terra and is the eastern boundary of our region of interest.

Two small valley systems incise NW Noachis Terra: Her Desher Vallis and Nirgal Vallis. Nirgal Vallis is a tributary of Uzboi Vallis, joining the larger system to the south of Holden crater. Her Desher Vallis is an isolated valley that does not seem to connect to any craters or larger valleys.

Observations: Mosaicked CRISM multispectral mapping observations (~230 m/pixel) suggest that a phyllosilicate-bearing layer outcrops along the length of both valley systems and in the interior rims of many craters in the region (Fig. 2). Further inspection of high resolution CRISM hyperspectral targeted observations (20-40 m/pixel) of the walls of Her Desher Valles and Nirgal Vallis confirm the presence of phyllosilicates. Spectral analyses indicate that these phyllosilicates are iron-magnesium smectites, and that the mineralogy of the layer is generally consistent along the length of both valleys, a total distance of ~600 kilometers. This distinct phyllosilicate-bearing layer is located only a few meters below the surface cap material and is laterally contiguous with a consistent apparent thickness of ~10 meters. HiRISE observations of these layers show the materials are polygonally fractured, which is morphologically similar to other Fe-Mg clays identified on Mars [e.g. 1].

Several high resolution hyperspectral CRISM observations of craters near the valley systems also show a phyllosilicate-bearing layer of similar composition. As in the valleys, these phyllosilicates extend laterally and are located a comparable distance below the surface. HiRISE images indicate that the crater phyllosilicates have the same polygonal morphology as those in the valleys. CRISM multispectral mapping observations imply that the phyllosilicates are in multiple other craters in the same region (Fig. 2). Fe-Mg smectites have also been identified in Ritchey crater, located ~200 km southwest of Her Desher Vallis [2].

Discussion: To the south of the study region in northwest Argyre, a similar phyllosilicate-bearing deposit has been identified located directly below a thin cap-rock [3]. A layer of comparable mineralogy has also been identified to the north in the walls of eastern Coprates Chasma, although at significantly greater depth [4]. It has been suggested that the Argyre and Coprates outcrops may represent a single, horizontally contiguous material [3]. If this hypothesis is correct, then Her Descher Vallis, Nirgal Vallis, and surrounding impact craters are also sampling this spatially extensive phyllosilicate-bearing layer.

However, the much greater depth of the phyllosilicate outcrops in Coprates Chasma implies an overall northward dip to the layer. Premliminary evaluation of craters in NW Noachis to the north of Her Desher and Nirgal Valles, and more proximate to Coprates and Eos Chasma, show evidence of phyllosilicates in their central peaks but not their walls. This is consistent with the putative phyllosilicate-bearing layer being exhumed from greater depth [5], and the idea of a single northward-dipping, phyllosilicate-bearing unit extending from Argyre to Coprates Chasma.

Conclusions: We have observed evidence for a widespread phyllosilicate-bearing layer in northwest Noachis Terra. This layer is exposed by both Her Desher and Nirgal Valles is also seen in nearby impact craters, delineating an area at least 600 km long and up to 150 km wide. There is preliminary evidence that this layer may be part of an even more extensive unit stretching from the Argyre basin north to Valles Marineris.

References: [1] McKeown N.K. et al. (2009) AGU Fall Mtg. Abs. P43D_1458. [2] Milliken R. (2007) *2nd MSL Landing Site Wkshp*. [3] Buczkowski D.L. et al. (2010) *JGR, in revision*. [4] Murchie S. et al. (2010) *JGR, in press*. [5] Ernst et al. (2009) AGU Fall Mtg. Abs. P23D-04.

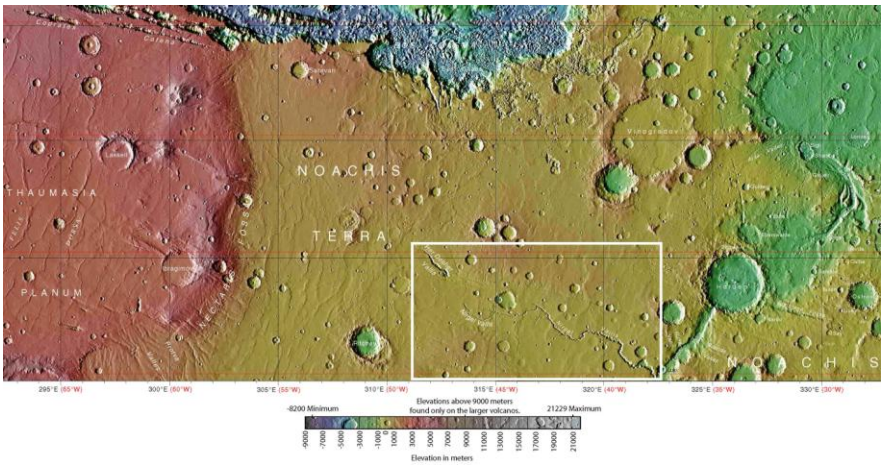

Figure 1. Northwest Noachis Terra. White box indicates location of Her Desher and Nirgal Valles.

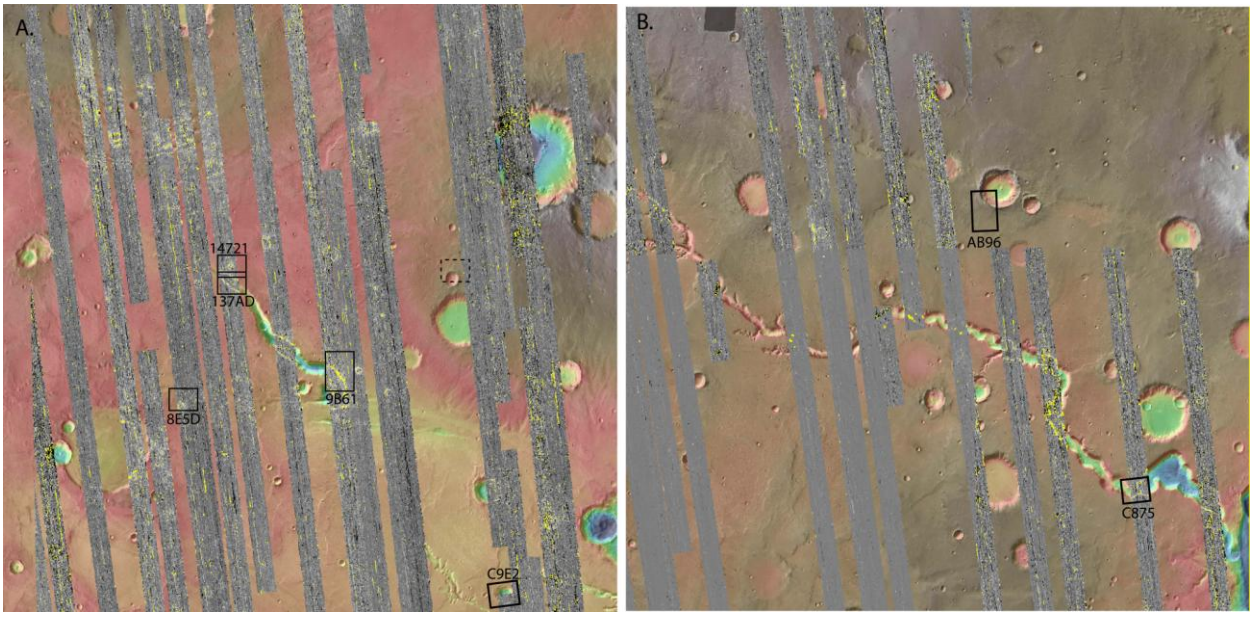

Figure 2. MOLA topography draped over THEMIS imagery of a) Her Desher Vallis and b) eastern Nirgal Vallis. Grey strips are CRISM mapping strips; yellow indicates location of probable presence of Fe-Mg phyllosilicates. Labeled boxes indicate location of high-resolution CRISM imagery.

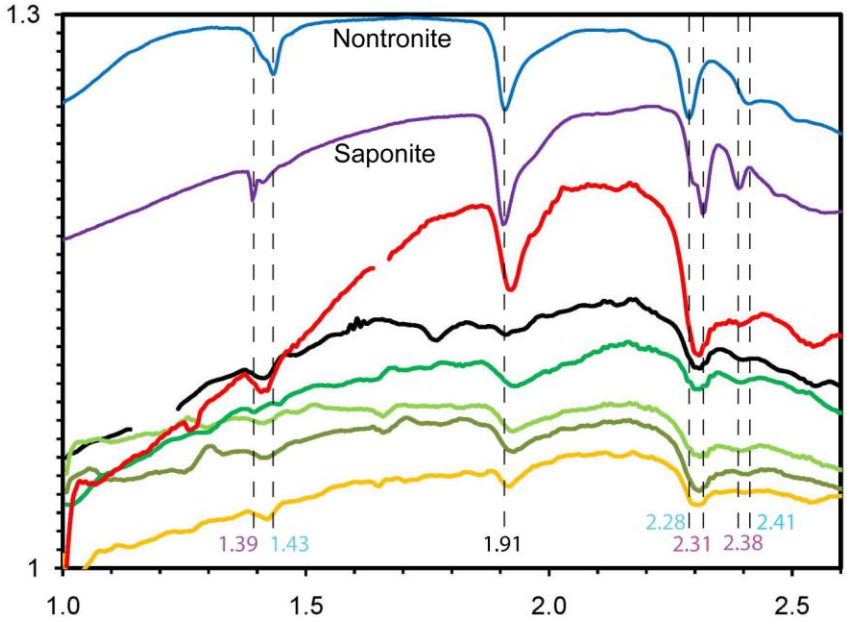

Figure 3. Spectra of phyllosilicate layer from four different CRISM hyperspectral images, compared to library spectra of Fe-smectite (nontronite) and Mg-smectite (saponite).