Structural Analysis, Layer Thickness Measurements and Mineralogical Investigation of the Largest Interior Layered Deposit within Ganges Chasma, Valles Marineris, Mars. A. Hore[1], F. Fueten[1], J. Flahaut[2], R. Stesky[3], A.P. Rossi[4], E. Hauber[5], C. Quantin-Nataf [6]. [1] Department of Earth Sciences, Brock University, St. Catharines, Ontario, Canada L2S 3A1 <ffueten@brocku.ca>; [2]Vrije Universiteit Amsterdam (VU), The Netherlands; [3]Pangaea Scientific, Brockville, Ontario, Canada K6V 5T5; [4]Jacobs University Bremen, 28759 Bremen, Germany; [5]Institute of Planetary Research, German Aerospace Center (DLR), Berlin, Germany; [6]Laboratoire de Géologie de Lyon, UMR CNRS 5276, Université Claude Bernard/Ecole Normale Supérieure de Lyon, France.

Introduction: Valles Marineris (VM) Chasma is thought to have been formed during a two-stage process. Early ancestral basins [1] were later linked to result in the current topography [2]. Interior Layered Deposits (ILDs) occur throughout VM, yet their origin(s) remain uncertain. Several formation mechanisms having been proposed [refs in 3].

Studies determining layer thickness and attitudes, as well as mineralogy studies provide insights into the ILD deposition mechanisms [3]. This study focuses on the largest ILD located within Ganges Chasma.

Ganges Chasma ILD: Ganges Chasma is located at the eastern end of the VM (Fig. 1A). A large ILD [4] located within the chasma ranges in elevation from approximately -4000m at the chasma floor to 250m. Sand sheets and dune fields are located to the north and south of this ILD [5].

Methodology: A CTX mosaic was used as a basemap. Two HiRISE stereo pairs PSP_006519_1730/ PSP_007020_1730 (H1) and ESP_013059_1725/ ESP_012993_1725 (H2), were used to calculate HiRISE DTMs (1m/pixel) with the NASA Ames Stereo Pipeline [6,7]. The absolute values for the HiRISE DTMs were adjusted to HRSC topography. Layer thicknesses were measured along multiple transects for each HiRISE image by recording the elevation of each layer boundary. Transect location and length varied and was dictated by layer visibility. Layer strike and dip were measured using ORION. Three CRISM data sets at or near these HiRISE locations were analyzed, adding mineralogical information.

Results: The Ganges ILD is dominated by several nearly-horizontal benches. The two HiRISE images that have been measured are located at different elevations within the ILD. Image H1 (Blue in Fig. 1E) covers elevations of -3426 m to -1340 m, from the base of the ILD to the first major bench. The majority of image H2 (Red in Fig. 1E), sits above the first bench and covers elevations of -2040 m to -900 m.

Layer attitudes for H1 indicate a consistent layer dip towards the North, with a mean dip of 9° while layer strikes in H2 are more variable and layers have a shallower mean dip of 5° (Net insets in Fig. 1E).

785 layer thicknesses were measured along 43 transects. The elevation ranges over which layering could be measured for both HiRISE images did not overlap (Fig. 1F). H1 had a range in thickness from 0.001 m to 8.76 m with an average of 0.71 m. H2 ranged from 0.003 m to 6.26 m with an average thickness of 1.15 m. The median layer thickness for H1 is 0.34 m while H2 has a median of 0.89 m.

Within the lowest elevations of H1, in 7 separate locations, layering is disrupted on the scale of approximately 100 m (Fig. 1B, C, D). In all locations a trough-like section of layering is folded, disturbing layering stratigraphically below it. In morphology, though not in scale, these features bear similarities to ball-and-pillow structures within terrestrial sediments.

CRISM analysis (Fig. 1 G, H) covers the central portion of HiRISE image H1 and the northern edge of H2 and indicates that both locations are dominated by monohydrated sulfates mixed with ferric oxides.

Discussion: The data covers approx. 2.5 km of stratigraphy. Median layer thickness is less at lower elevations, but data from both images falls within similar layer thickness ranges. The bulk of the measured stratigraphy appears to be composed of monohydrated sulfates.

Initial observations suggest that the unusual layer features were created by soft sediment deformation and are dominantly found at lower elevations.

Investigation of additional HIRISE stereo pairs and additional CRISM data is currently in progress. This work is part of a project with the aim to document stratigraphic relationships and compare layer thicknesses with other ILDs within Valles Marineris.

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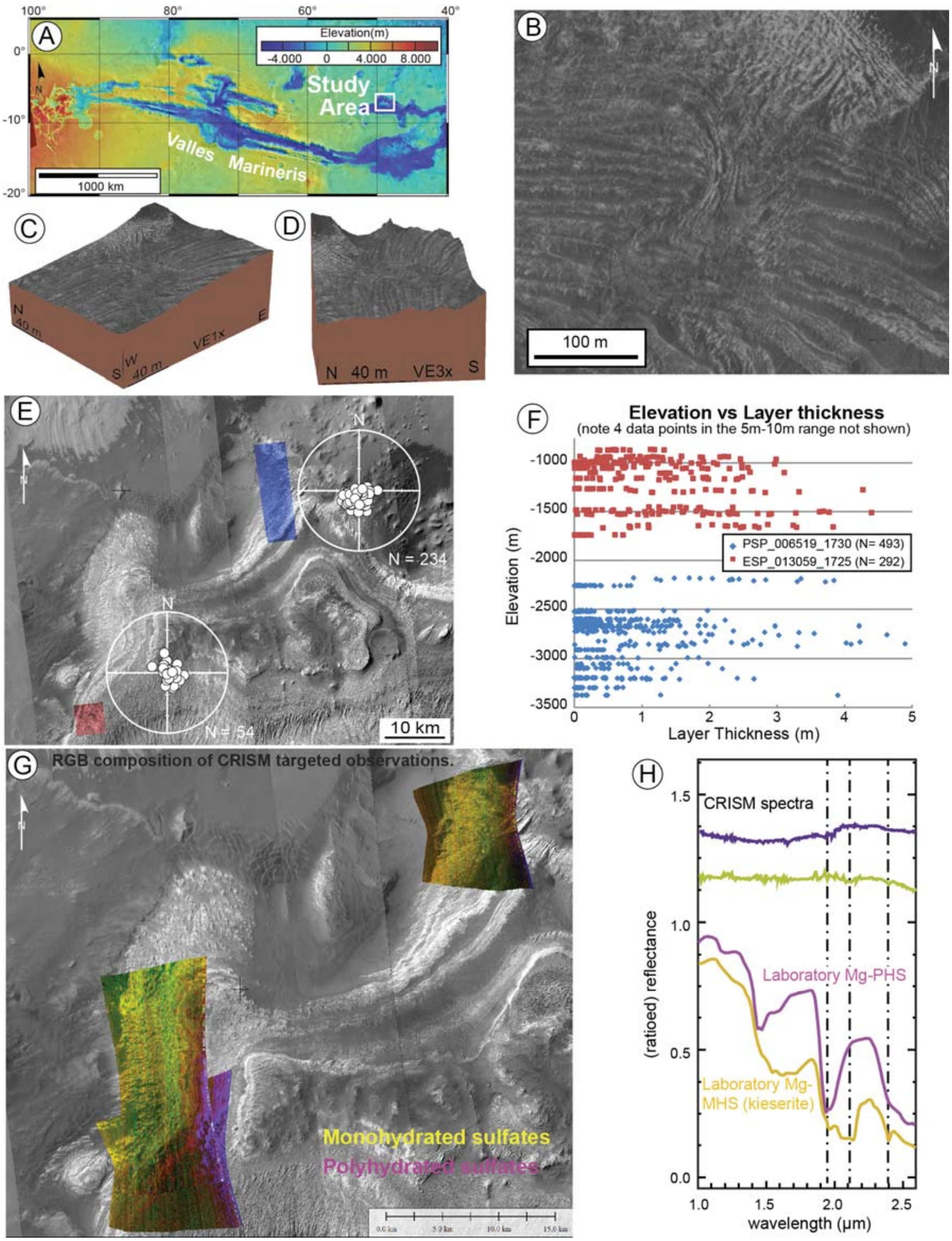

Figure 1: A) Location; B) Map view of sedimentary structures; C) 3D view of structure; D) 3D view, VE=3X; E) Location of HiRISE images with Schmid nets; F) Elevation vs Layer Thickness; G) CRISM data map; H) CRISM Spectra.