Layer Attitude and Thickness Measurements in Western Portion of the Ophir Chasma Interior Layered Deposit, Valles Marineris, Mars. J. Peralta[1], F. Fueten[1], R. Cheel[1], R. Stesky[2,] J. Flahaut[3], E. Hauber[4],. [1]Department of Earth Sciences, Brock University, St. Catharines, Ontario,Canada L2S 3A1 <ffueten@brocku.ca>; [2]Pangaea Scientific, Brockville, Ontario, Canada K6V 5T5; [3]Vrije Universiteit Amsterdam (VU), The Netherlands; [4]Institute of Planetary Research, German Aerospace Center (DLR), Berlin, Germany;.

Introduction: The formation of Valles Marineris (VM) is known to involve a combination of tectonic extension and subsequent erosion. Isolated ancestral basins [1] were later linked by further extension [2, 3]. Interior layered deposits (ILDs) occur throughout VM. While the exact method of their deposition is unknown, several processes have been proposed [refs in 4]. Detailed examination of the layering can lead to a better understanding of their geological histories. A detailed study of layering on Candor Mensa, within West Candor Chasma [4] documented two units which are separated by an unconformity. A lower unit, associated with monohydrated sulfates with thicker layers is overlain by the upper unit with thinner layer and polyhydrated sulfate signatures. A study primarily aimed at the identification of the mineralogy within Ophir Chasma [5], located immediately north of Candor Mensa, indicates that the western portion of the Ophir ILD shows a strong kieserite signature [5, their Fig 3], while a polyhydrated sulfate signature is attributed to the dust cover. In this study we used three HiRISE images located within the western ILD of Ophir (Fig. 1A) to measure layer attitudes, layer thicknesses and to investigate stratigraphic relationships.

Methodology: HiRISE and CTX DTMs were calculated with the NASA Ames Stereo Pipeline [6, 7]. Layer attitude and thickness were measured in three HiRISE stereo pairs: PSP_008458_1760, PSP_008893_1760 (H1); ESP_015974_1760, ESP_020220_1760 (H2); ESP_034738_1760, ESP_034949_1760 (H3). To provide a more regional context and link the separated HiRISE image locations, additional layer attitudes were measured in a CTX stereo pair (B21_017886_1763_XN_03S074W, G22_026879_1764_XN_03S074W) (Fig. 1B). Layer thicknesses in HiRISE images were calculated by measuring a package of individual layers along a transect perpendicular to the slope.

Results: Layer attitude measurements indicate the existence of at least two units. Layers in the lower unit have a mean dip of 6º, with layers generally dipping to the north (Fig 1, C). Layering within this unit is parallel with three distinct benches. Dip direction appears to change by ~110° across the stratigraphically highest bench. Layers in the upper unit have a mean dip of 13º, and dip generally towards the west. Truncated layers were observed within this unit at several localities (Fig. 1E, 1F). The presumed contact between the units is obscured by debris, but must cut across layering of the lower unit. Hence it must be unconformable.

In total, 820 layer thicknesses were measured along 183 transects. Layer thickness data was compiled into three data sets (Fig. 1D). Layer thicknesses from the lower unit measured in both, H1 and H2, was separated from the upper unit. Data from H3 was presented separately because it is not continuous with the others. The majority of layer thicknesses in the lower unit were between 2 m and 8 m, with a mean thickness of 6.38 m. No thickness variations were found to be associated with the benches. The majority of thicknesses in the upper unit and in H3 were less than 2 m, with mean thicknesses of 1.30 m and 1.63 m respectively.

Discussion: There are at least two units. Layer dips in the lower unit are shallower than in the upper unit. Layer thicknesses in the lower unit are thicker than those in the upper unit. Layers in H3 most likely belong to the upper unit**.** Multiple benches within the lower unit indicate variations in the competency within this package. The lower unit shows a kieserite signature [5]. The data suggest a complex deposition history with some similarity to observations for Candor Mensa [4]. In both settings a thicker lower unit is associated with monohydrated sulfates. In both settings a thinner bedded upper unit is unconformably emplaced [4]. The prevailing theory is that the chasmata were initially filled with ILDs while they were isolated [1-4], though it has been proposed that the upper unit of Candor Mensa was deposited after basin-linking [4]. The similarities between the Ophir ILD and Candor Mensa suggest that at least these two adjacent chasms experienced similar depositional histories.

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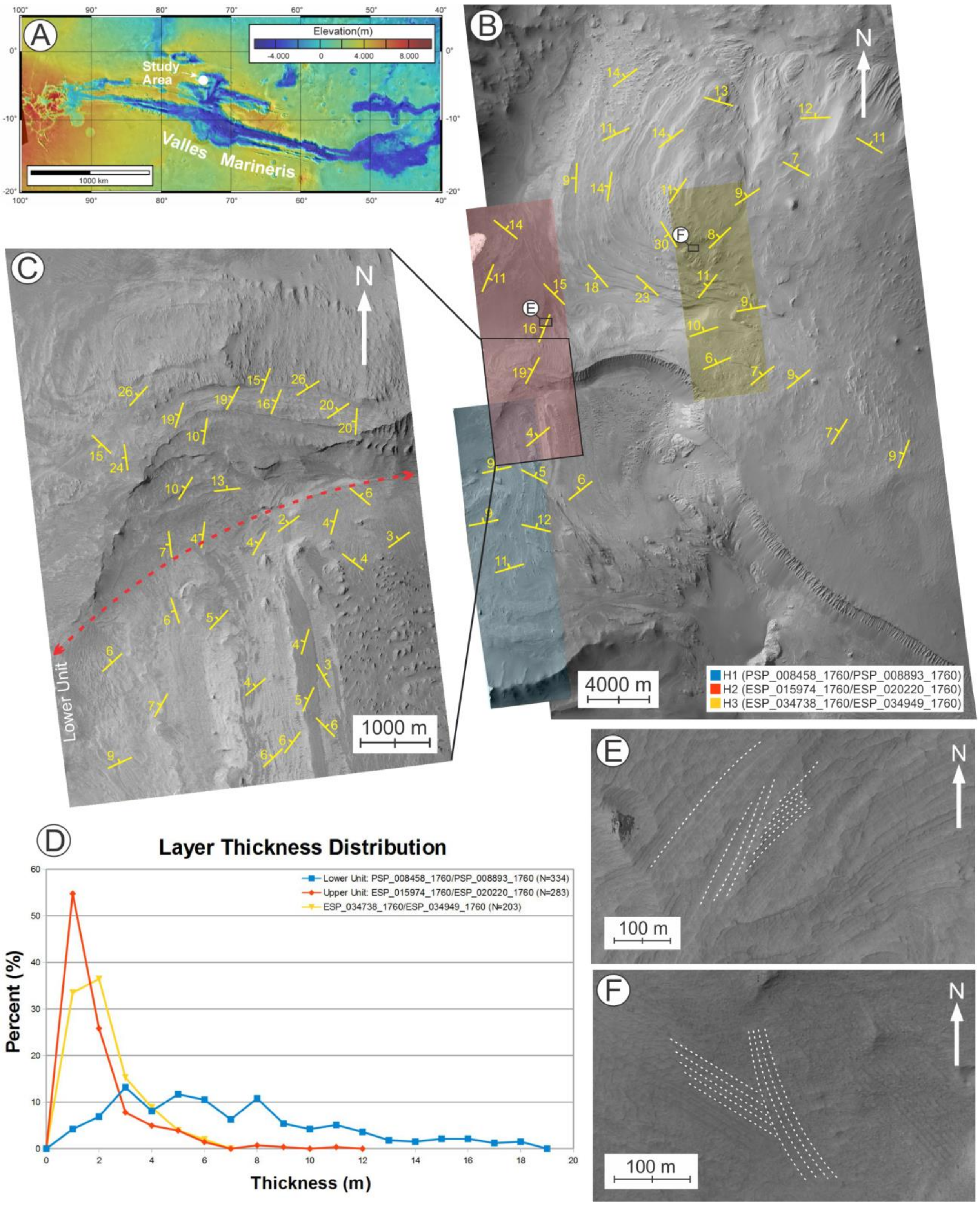

Figure 1: A) Location of study area; B) Location of HiRISE images H1, H2, and H3 on base CTX image (B21_017886_1763_XN_03S074W/G22_026879_1764_XN_03S074W). Layer attitudes measured from cumulative HiRISE and CTX data; C) Close up of layer attitudes in H2. Dashed red line shows boundary between lower and upper unit; D) Layer thickness histogram of cumulative HiRISE data; E) View of truncations in H2; F) View of truncations in H3.