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

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]. Hebes Chasma is unique to VM in that unlike other chasmata, it has remained isolated and lacks an out-wash channel. Hebes Chasma is 314 km across, 126 km wide and over 8 km deep. Interior layered deposits (ILDs) occur throughout VM. While the exact method of their deposition is unknown, some processes have been proposed [refs in 3]. Examination of layer thickness and attitudes of ILDs within Hebes Chasma help to define their structure and sequence of deposition. This study focuses on Hebes Mensa, the chasma's main ILD mound and several outlying ILDs.

Hebes Chasma ILD: Hebes Chasma is the northernmost extent of Valles Marineris (Fig. 1A). A massive 120 km across and 43 km wide ILD mound is located within the chasma. It ranges in elevation from 2,011 m to 3,822 m. ILDs are also present to the north, east and south of the mound amongst numerous large scale landslides.

Methodology: A CTX mosaic registered to a HRSC composite DTM (orbits 5142, 5160, 5178) formed the base data for the study. Multiple HiRISE and CTX DTMs were calculated with the NASA Ames Stereo Pipeline [4, 5]. Layer attitudes and thicknesses were measured directly in three HiRISE stereo pairs: ESP_021565_1790, ESP_016462_1785, ESP_014418 _1790. Two HiRISE images (PSP_005808_1790, PSP_006520 _1790) were registered to a CTX DTM. Additional layer attitudes were measured using the HRSC DTM. Layer thicknesses for HiRISE images registered to CTX DTMs were obtained by measuring the number of layers along a slope-parallel transect and calculating the mean thickness for each transect.

Results: Layer attitudes measurements using HiRISE , CTX and HRSC DTMs were compiled into four regions (Fig. 1B). The layers generally show an outward dip around the ILD, with mean dips of 9°, 9°, 12° and 7° to the north, south, east and west, respectively. East of the central mound, at elevations of approximately -2000 m, well below all other measured layers, a package of layers have attitudes with a consistent layer dip towards the west, with a mean dip of 6˚.

The five HiRISE images used to measure layer thickness cover a significant range of elevations (Fig. 1C, 1D). Four images, located on the main mound, H1- H4 (Fig. 1B) cover a relatively continuous range of elevations from -1,140 m to 3,680 m. Image H5 (orange in Fig. 1B) is located 20 km east of the ILD mound and covers elevations from -1,552 m to -3,302 m.

In total, 116 layer thicknesses were measured along 32 transects. Elevations of measured layers within the central mound overlap frequently (Fig. 1E). H1-H4 covers a range of thicknesses from 0.13 m to 12.44 m with an average of 1.86 m to 5.41 m. H5 ranges from 5.78 m to 65.47 m with an average of 32.28 m.

Discussion: Layer attitudes on the mound are generally shallow and dip in the direction of slope. This confirms previous measurements in Hebes and is consistent with observations of ILDs elsewhere in VM [6]**.**

The layer thickness data covers approximately 6 km of stratigraphy. Layers in the central mound show no apparent change in mean thickness with elevation. Mean layer thicknesses of several meters are similar to other measurements of ILDs within VM [7].

The layers measured east of the mound, approximately 3 km lower in absolute elevation than the layers in the main mound, are significantly thicker than the main mound's layers and their attitudes do not follow the general pattern of dipping in the direction of topography. These layers may represent a separate, possibly later stage of deposition [8]

Analysis of CRISM data is currently ongoing. This work is part of a continuing project to record and compare stratigraphic relationships, compositions, and layer thicknesses of ILDs throughout Valles Marineris.

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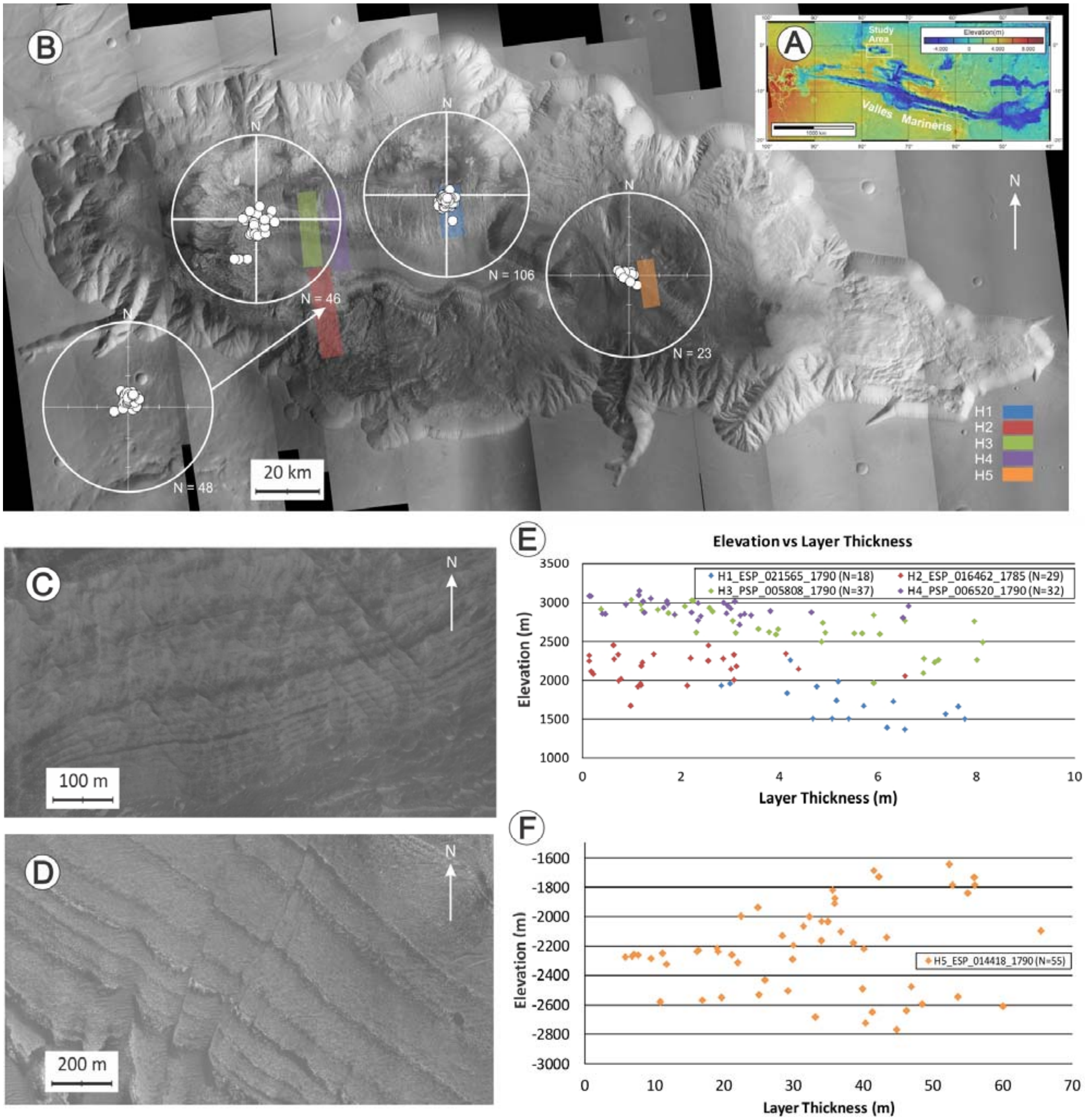

Figure 1: A) Location of study area; B) Hebes Chasma with stereonets of layer attitudes and location of HiRISE images H1 (ESP_0121565_1790), H2 (ESP_016462_1785), H3 (PSP_005808_1790), H4 (PSP_006520_1790), and H5 (ESP_014418_1790). Lower hemisphere nets with poles to bedding as measured from cumulative HiRISE, CTX, and HRSC data; C) View of layers in H1; D) View of layers in H5; E) Elevation vs layer thickness graph of layers in H1, H2, H3, and H4; F) Elevation vs layer thickness graph of layers in H5.