THE STRUCTURE OF INTERIOR LAYERED DEPOSITS IN SOUTHWESTERN CANDOR CHASMA FROM HRSC IMAGE DATA AND STEREO-DERIVED DTM. F. Fueten[1] R. Stesky[2], P. MacKinnon[1], E. Hauber[3], K. Gwinner[3], F. Scholten[3], T. Zegers[4], G. Neukum[5] and the HRSC Co-Investigator Team, [1]Department of Earth Sciences, Brock University, St. Catharines, Ontario, Canada L2S 3A1, FFueten@Brocku.ca, [2]Pangaea Scientific, Brockville, Ontario, Canada, [3]Institute of Planetary Research, German Aerospace Center (DLR), Berlin, Germany, [4]ESTEC, ESA, Noordwijk, The Netherlands, [5]Institute of Geological Sciences, Free University, Berlin, Germany.

Introduction: Layered deposits occur widely within the chasmata of Valles Marineris, but their origin and mechanism of formation are uncertain. Several hypotheses for their formation have been proposed, including lacustrine [1] and eolian [2] deposition, as well as pyroclastic volcanism in subaerial [3, 4, 5, 6] or subglacial [7, 8] environments. Other work [9] suggests that the ILD are ancient deposits exhumed from below the material forming the trough walls. Variability in layer characteristics suggests that no single mechanism can unambiguously explain all the properties of all ILDs. Geochemical data results from the OMEGA instrument on Mars Express show that sulfates are associated with many of the ILDs [10].

A 25m/pixel panchromatic orthoimage and a DTM with a grid spacing of 150m, obtained from the High Resolution Stereo Camera of the Mars Express mission and the software ORION were used to measure the attitude of ILD layering [11] to use its geometry to place constraints on ILD formation. It was suggested that the geometry of the layering is compatible with a simple drape morphology over rotated basement blocks [11] and one angular unconformity was identified. New work using higher resolution data indicates a more complex geology in this area.

Geological Setting: The study area lies within southwestern Candor Chasma (Fig. 1A). Mapping by Lucchitta [12] defined a number of units of Hesperian or Amazonian age, based on their morphology and surface appearance, including mottled, layered and resistant. The previously identified unconformity [11] consists of a cap of resistant dark unit, which unconformably overlies strongly layered material.

Data and Methodology: The multispectral image and DTM were calculated from HRSC data collected during orbit 2116. The image has a spatial resolution of 12.5 m and the DTM, 50 m. Pangaea Scientific's software ORION was used to sample the image and calculate the layering attitudes. The method was described in detail by Fueten et al. [13].

Measurements and Results: Overall, the attitudes of layers measured using higher and lower resolution data sets agree. In addition to confirming earlier measurements, the higher resolution data also made it possible to distinguish a number of features that could not be resolved or reliably measured using the lower resolution data. Analysis of the new data indicates:

1) A series of massive competent units is identified that appear to underlie thinner layered packages of ILD material, or exist as isolated competent mounds. Earlier [11] we suggested that two of these mounds are basement material. Reexamining one in higher resolution causes us to reinterpret the structure as a competent ILD unit. Unfortunately the other mound is outside the high resolution image. Attitudes of layering in the massive units dip fairly consistently at about 10° to the E-SE (Fig. 1B). The exception is a linear outcropping of units in the northern portion of the area in which units dip towards the NE.

2) These massive layered units are unconformably overlain by thinner, less competent units. Fueten et al [11] describe an elliptical feature within a package of finely layered material, with the geometry of a gentle fold (Fig. 1C). Measurements using the new data confirm this geometry. However, the higher resolution image shows that the eastern limb of the finely layered material is unconformable over a massive layered unit which dips approximately 10° E (Figure 1D).

3) As observed earlier [11], the finely layered units vary in dip direction and dip angle throughout the area, but tend to dip approximately in the same direction as does the topography.

4) The previously documented unconformity between the finely layered material and the overlying more resistant dark unit capping the mound is confirmed (Fig.1C).

Discussion: Measurements using two independent data sets agree confirming that the methodology is robust and that layer attitudes can treated with a good degree of confidence. Massive layered units, which appear to underlie finer layered units, have regionally consistent trends. The true extent of the regional consistency will have to be explored using data that has been acquired but not yet processed. The massive units appear to be offset along faults. Finely layered units unconformably overlie the massive units, having attitudes consistent with draping. The simplest explanation for the observed features is that most of the topography is formed by competent basal layered units and the finely layered units drape over them. The consistent attitude of the massive units suggests it once was a single unit covering the entire area which later suffered erosion and possibly faulting to form isolated buttes and mounds. Later deposition of finer material covered and smoothed this earlier topography. Another younger competent unit was deposited over the erosional remnant of the fine units forming a second angular unconformity, suggesting an episodic nature to the deposition of the ILD material.

Analysis of the higher resolution data suggests that the history of Chandor Chasma was more complex than previous data revealed.

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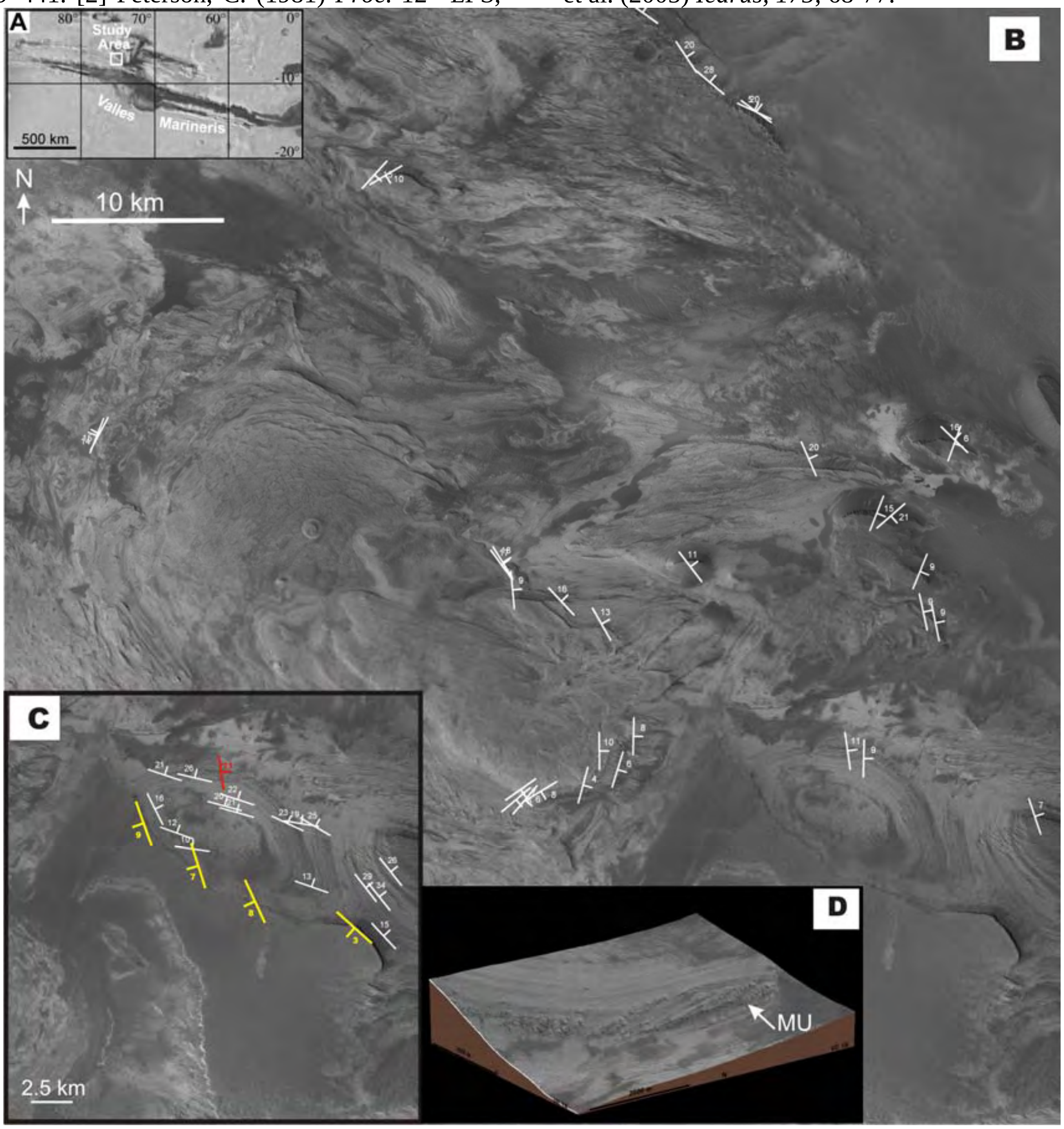

Figure 1: **A** - location map; **B** – attitudes of massive units. **C** – Detail of elliptical feature: Symbols for massive unit in Red, gentle fold in finer layered unit are White and resistant capping unit in Yellow; **D** – 3D view of angular unconformity between massive unit (MU) and finer layered material.