Layer Attitudes and Unconformities within the Interior Layered Deposit, Ophir Chasma, Mars. A. Van Patter[1], F. Fueten[1], R. Stesky[2], J. Flahaut[3], E.Hauber[4],. [1] Department of Earth Science, Brock University, St. Catharines, Ontario, Canada L2S 3A1 ffueten@brocku.ca; [2] Pangea Scientific, Brockville, Ontario, Canada K6V 5T5; [3]CRPG, CNRS/UL, 54501 Vandœuvre-lès-Nancy; [4] Institute of Planetary Research, German Aerospace Canter (DLR), Berlin, Germany

Introduction: Many of the chasms within Valles Marineris (VM) are partially filled with enigmatic sedimentary deposits referred to as Interior Layered Deposits (ILDs) [1]. Many formation mechanisms have been proposed (see references in [2]). Most recently it has been suggested that current ILD topography is due to anticompensational stacking [3]. Sulfates are associated with ILDs, indicating the presence of liquid water during ILD formation [4]. Ophir Chasma is the northern most chasma connected to VM and previous work has identified several layer packages within Ophir's ILD. It has been suggested that the central valley through the ILDs of Ophir Chasma formed by large-scale erosion due to the catastrophic release of water [5]. A chasm-wide study focussed on mineralogy identified the presence of ferric oxides and sulfates within the ILD [5]. Monohydrated sulfate (MHS) signatures, suggestive of kieserite, are commonly found in the exposed lower units, along with ferric oxides whereas weak polyhydrated sulfates (PHS) signatures are associated with dustier outcrops [5].

A detailed study focussing on three HiRISE stereo pairs found that the ILD within western Ophir contains at least two units. An upper unit has thin layers while a lower unit has thicker layers and is associated with the kieserite signature. [6].

In this study HiRISE and CTX images were used to measure layer attitudes throughout Ophir (Fig. 1A) to obtain a better regional understanding.

Methodology: Digital Elevation Models (DEMs) were computed from three HiRISE and eleven CTX stereo pairs using the NASA Ames Stereo Pipeline [7, 8]. Layer attitudes were measured using Orion. Where CTX DEMs were not available HRSC DEMs and CTX images were used. Three HRSC DEMs and CTX image pairs as well as two HiRISE images with CTX DEM's were used. Layer attitudes were remeasured in CTX and HiRISE where stereo pair coverage existed in both formats.

Results: A total of 396 ILD layer measurements were taken throughout Ophir Chasma. Where layers were measured in both HiRISE and CTX DEMs, measurements generally agree. Layers within the chasma commonly dip outwards (Fig. 1A). Several units and unconformities can locally be identified in different areas of the chasma (Fig. 1A). Generally, the upper units have an average dip of 10°, while lower units have a mean dip of 7°. The northern edge of Ophir Mensa generally has steeper dips with a mean dip value of ~16°. We describe three locations with different types of contact relationships (Fig. 1C-E) here.

(1) Along the northern slope of Ophir Mensa (Fig. 1D), a layered unit with a 19° mean northward dip sits on top of a non-layered unit. In addition to the presence and absence of layering, the two units can be distinguished by subtle albedo differences. Non-layered units were identified in several locations, and are always near the base of the visible strata

(2) Along the southern edge of Ophir Mensa, a package of layered material dipping approximately 9° appears to be unconformably on top of the unit composing the bulk of the mound (Fig. 1E). The eroded top of this unit is flat, while the underlying unconformity appears to appears to mimic the rounded topography. Layering in the older unit has an average dip of 18°. Additionally a significant truncation can be observed in the lower unit.

(3) In west Ophir (Fig. 1C) an unconformity is observed between the two units. The upper unit has a mean dip of 12° while the lower unit is 7°. The lower unit contains a previously recorded dip reversal [6] which has been confirmed here and which indicates that the deposition of the lower unit is complex.

Discussion: Ophir Mensa reveals a complicated sedimentary record, illustrated by several truncations and unconformities between units, which include units that show no visible layering. We acknowledge that these units may well possess layering that is not visible in the 5m/pixel resolution of CTX imagery. Our referring to lower and upper units is restricted to the localities in which they were observed. At this stage it is not possible to correlate units across Ophir Mensa. Future work in Ophir will attempt to link units in attempt to explain the history of the Chasma.

References: [1] Lucchitta, B. et al. (1994), *JGR*., 99, 3783-3798. [2] Fueten, F. et al. (2017), *JGR*., doi: 10.1002/2017J E005334. [3] Kite, E. et al. (2016), *JGR.*, doi: 10.1002/2016JE005135. [4] Flahaut, J. et al. (2010), *JGR*., doi: 10.1029/ 2009JE003566. [5] Wendt, L. et al. (2011), *Icarus.*, 213, 86-103, dio: 10.1016/j.icarus.2011. [6] Peralta, J. et al. (2014), *LPS XLVI*, Abstract # 1153. [7] Moratto, Z.M. et al. (2010), *LPS XLI*, Abstract # 2364. [8] Broxton, M.J. and Edwards, L.J. (2008), *LPS XXXIX*, Abstract #2419.

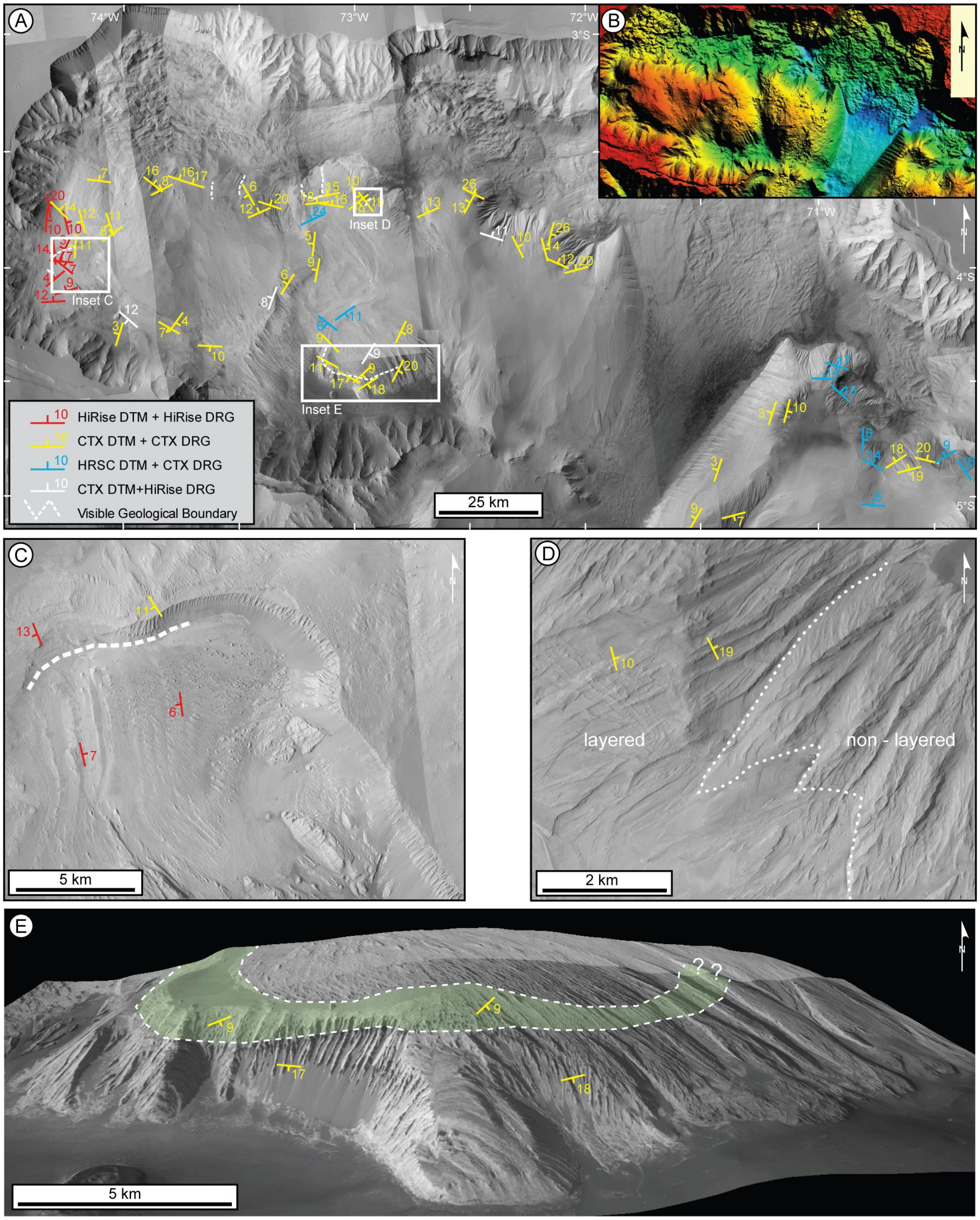

Figure 1 A) General layer attitudes across Ophir Chasma; B) HRSC DTM of Ophir Chasma C) Layer attitude measurements in West Ophir. The dashed white line is the unconformity between the lower and upper units; D) Unconformity between the layered and non-layered unit is displayed along the white dashed line. The general dip of the layered unit is 19° in the lower elevations and shallows to 10°on top of Ophir Mensa; E) An unconformable upper unit (shaded green) is emplaced on a lower unit. The lower unit shows truncations and a mean dip of 18°, while the upper unit is and has a dip of 9°.