**LITHIFIED AEOLIAN BEDFORMS AS EVIDENCE FOR ANCIENT WATER CIRCULATION IN WEST CANDOR CHASMA, MARS.** C. Birnie[1], F. Fueten[1], R. Stesky[2], R. Cheel[1], A. P. Rossi[3]. [1]Department of Earth Sciences, Brock University, St. Catharines, Ontario, Canada <colin.birnie@brocku.ca>; [2]Pangaea Scientific, Brockville, Ontario, Canada; [3]Jacobs University Bremen, Bremen, Germany.

**Introduction:** In West Candor Chasma (Fig. 1A), on the slopes of the eroded ILD remnant Ceti Mensa [1], large fields of curvilinear, corrugated features (CCF) are present and display many characteristics of linear aeolian dunes. CCF are found in regions where erosion, not deposition, currently dominates and they display evidence of deformation in a brittle manner.

**Methodology:** Thirteen HiRISE images [2], including three stereo image pairs were examined for this study. High-resolution digital terrain models (DTM) were derived from four HiRISE stereo image pairs using the NASA Stereo Pipeline Automated Stereogrammetry Software [3]. Utilizing the HiRISE DTM, the slopes of the CCF were determined using Orion structural analysis software.

**Observations and Discussion:** CCF are present in two areas around Ceti Mensa: the northern corner of Ceti Mensa and on the intermediate plateau below (Fig. 1B; 1&2). Both locations contain large numbers of CCF that have uniform characteristics but are separated by more than 300 m in elevation and do not appear to represent the same stratigraphic unit. Hydrated sulfates are also present in the area surrounding the CCF on the intermediate plateau [4, 5].

CCF are defined by two distinct, exposed surfaces that intersect at the crest and are uniformly aligned approximately northeast-southwest, roughly parallel to the crestlines of active dunes. The slopes facing the northwest are smooth with a thin covering of dark mantling material. The slopes facing the southeast are uncovered and display vertical to inclined lineations, producing the corrugated texture. The two surfaces have unequal slopes, giving the CCF a slightly asymmetric profile, similar to linear dunes. The morphology of active dunes in the area is most consistent with linear dunes, as is the morphology of the CCF. CCF bifurcate and merge in a manner similar to that of active dunes in the surrounding area and display the same spacing range (10-130 m crest-to-crest).

Superimposed dunes are commonly observed on active dunes, generally on the SE-facing slopes (Fig. 1C). The corrugated texture of the CCF (Fig. 1D) is exclusively found on the SE-facing slopes and may be the expression of internal structures such as cross-strata, exposed and accentuated by erosion.

Cross-strata generated by the downwind migration of linear dunes dips away from the crest in opposite directions (Fig. 1E) [6]. Cross-strata can also result from superimposed transverse dune migration along the flanks of the linear dunes and dips in the same direction as lateral migration (Fig. 1F) [7, 8]. The orientation and regular spacing of the corrugations appear consistent with the cross-strata produced by one or both methods.

The exposure of corrugations exclusively on the SE-facing slopes of CCF may be due to deposits of mantling material on the NW-facing slopes covering any corrugation that may be present, or the tendency of superimposed dunes to form on the SE-facing slopes only of active dunes. Exposure of internal structures by either method suggests that CCF are lithified.

CCF are differentiated from active dunes by the presence of planar truncations, offsetting faults and small fractures that transect the CCF, further indicating the CCF are lithified (Figs. 1G and 1H). The thermal inertia of the CCF is also very low (THEMIS Nighttime IR) (Fig. 1B) compared to active dunes, assuming they are comprised similar materials (i.e. similar mineralogy, density and caloric capacity). The low thermal inertial of the CCF is unusual, as thermal inertia usually increases with increasing induration. The material properties of the CCF determine their thermal inertia but cannot be conclusively resolved at the resolution of the current instrumentation.

**Conclusions:** Given the similarities between the CCF and active dune morphology, along with the evidence for brittle deformation, it is reasonable to suggest the CCF originated as aeolian bedforms but have subsequently been lithified by fluids in several possible environments (e.g. hydrothermal, sedimentary) [9]. The thermal inertia of the CCF and active dunes in THEMIS night-time infrared imagery further suggest a disparity in the material properties of the two deposits which could be the result of diagenesis.

As the CCF form on the eroded flanks of Ceti Mensa, indicating they formed well after, it can be stated that fluids were present at the surface or circulating in the subsurface in the relatively recent past.

**References:** [1] Lucchitta, B.K. (2010) Lakes on Mars. *Elsevier*, 111-162. [2] McEwen, A.S. et al. (2007) *JGR*, 112, E05S02. [3] Moratto, Z. M. et al. (2010) *LPS XXXXI* Abstract #2364. [4] Murchie, S. et al. (2009) *J. Geophys. Res*., 114, E00D05. [5] Mangold, N. et al. (2008) *Icarus*, 194, 519– 543. [6] Bagnold, R. A. (1973) *Chapman and Hall*, London, 265. [7] Rubin, D. M. & Hunter, R. E. (1985) *Sedimentology*, 32, 147–157. [8] Hesp, P. et al (1989) *Earth Surf. Process. Landforms*, 14, 447–451. [9] Bibring, J.-P. et al. (2007) *Science*, 317, 1206–1210. [10] Bridge, J. S. & Demicco, R. V. (2008) *Cambridge University Press*, 830pp. [11] Tsoar, H. (1983) *Sedimentology* 30, 567–578.

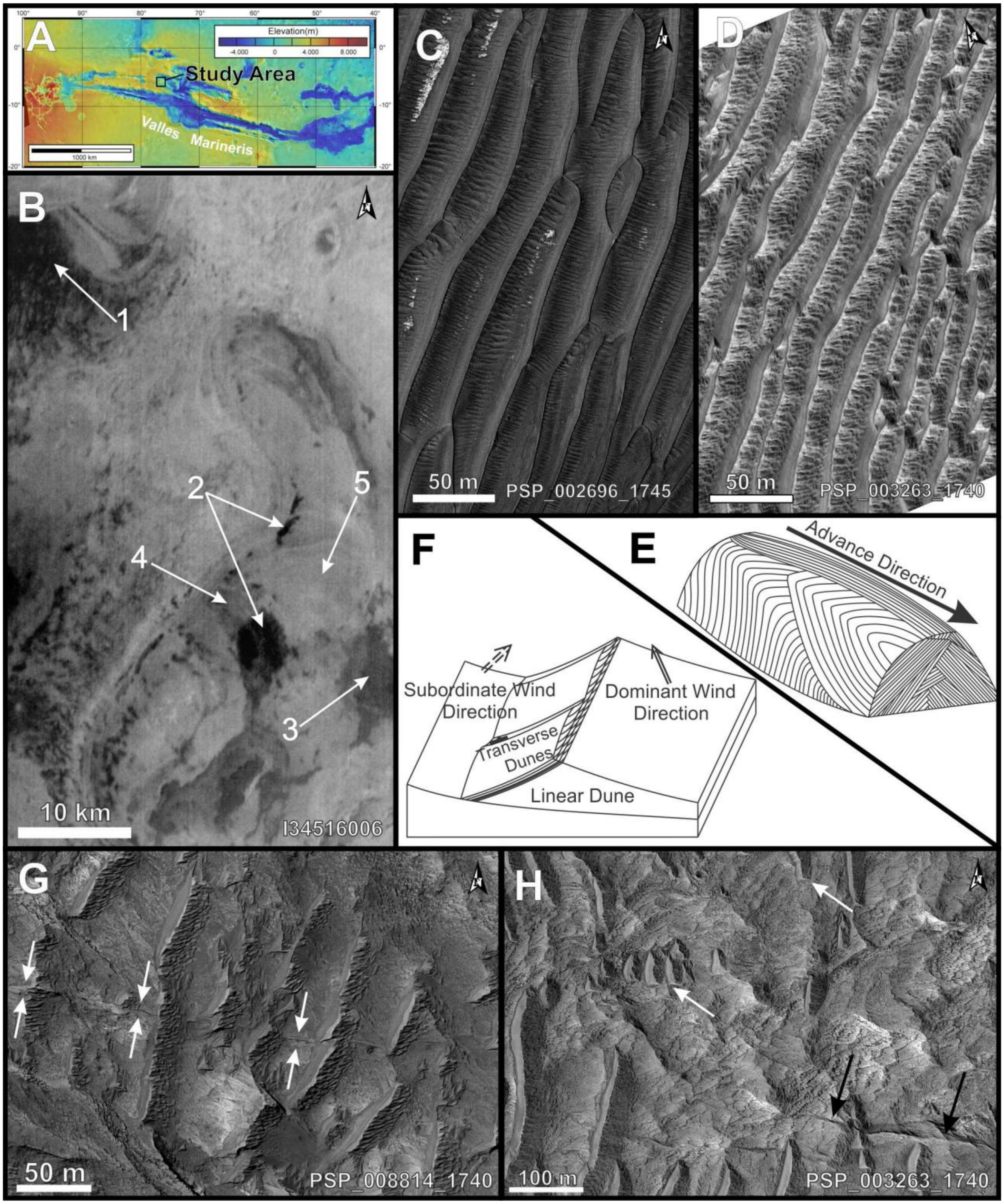


**Figure 1. A** – Location map. **B** – Nighttime infrared THEMIS image of Ceti Mensa. (1) Region of CCF on the northern corner of Ceti Mensa. (2) Region of CCF on the intermediate plateau. (3) Region dominated by active aeolian sediments (at least a few centimeters thick). (4) Area dominated by polyhydrated sulfates. (5) Area dominated by monohydrated sulfates. **C** – Active dunes with superimposed dunes on the SW-facing slopes. **D** – CCF on the intermediate plateau with corrugations on the SE-facing slope. **E** – Model from Tsoar [1982], illustrating the attitudes of cross-strata within linear dunes produced by downwind migration. **F** – Hypothetical model illustrating the cross-strata produced by climbing transverse dunes (lateral migration) on the lee slope of a linear dune [7], modified from Bridge and Demmico [2008]. **G** – CCF offset by a fault (between arrows). **H** – Planar truncations of CCF (white arrows) and a transecting curved fracture (between black arrows).