PALEO-FLUVIAL FEATURES IN THE WESTERN MEDUSAE FOSSAE FORMATION, AEOLIS AND ZEPHYRIA PLANA, MARS: ELEVATIONS AND IMPLICATIONS. R. E. Jacobsen[1] and D. M. Burr[1], [1]Earth and Planetary Sciences Department, University of Tennessee, Knoxville, TN (RJacobsen@utk.edu).

Background: The Medusae Fossae Formation (MFF) is a widespread equatorial deposit located along the Martian global dichotomy boundary [e.g., 1 and refs. therein]. Observations of yardangs and mesas support previous hypotheses that the MFF is a fine-grained friable deposit of ash fall or ignimbrite origins [e.g., 2,3,4]. Crater size-frequency distributions [2] and superposition relationships [5] suggest an Amazonian to Hesperian formation age [2,5, and refs. therein].

The western-most lobes of the MFF, between Aeolis and Zephyria Plana (AZP), host a dense collection of sinuous ridge (SR) features (Fig. 1) [6,7,8,9]. SRs are curvilinear in planform, maintain positive relief, and generally have consistent widths along their lengths. SR morphologies include flat, rounded, or crest-shaped tops, and edges that vary from gentle slopes to scarps. Many SRs organize as interconnected networks with large areal coverage suggesting formation by precipitation run-off. SRs predominantly occur in the lowest of the three stratigraphic members of the MFF [6,8,9].

Most SRs are thought to be inverted fluvial channels or scrolled floodplains [e.g., 6,7,9,10]. From their morphology, distribution, and regional stratigraphic occurrence, we interpret SRs to be remnants of active fluvial processes during early MFF formation. An investigation of the relative stratigraphy of SRs could reveal information about the environmental and temporal nature of fluvial activity in the lower MFF.

Hypothesis: We take as our null hypothesis that SRs outcrop at a single stratigraphic layer across the AZP. To begin testing this hypothesis, we report the first order data collection of SR classification, delineation, and elevation measurements. Variation in SR elevations could indicate time-transgressive (continuous or episodic) formation and/or SR formation at multiple paleo-surface elevations.

Methods: SRs were classified and delineated from Context Camera (CTX) images [11] and their elevations were derived using Mars Orbiter Laser Altimeter (MOLA) data points [12]. In our detailed observations with high resolution CTX images (~6 m/px), we focused on the region of greatest SR density in the AZP (Fig. 1), which is a spatial subset of the area studied by [6, their Fig. 9]. To keep data manageable, SRs must have an arbitrary length to width ratio of ≥10:1 to be delineated. Width measurements were taken every kilometer of SR length and were used to construct polygons covering individual SRs. All MOLA data points (spot radii of ~80 m [12]) in contact with the SR polygons were used to calculate average elevations for that SR.

The SR classification scheme used by [6,7] was reduced from 5 to 4 possible SR classes, in part as a result of using higher resolution data. ‘Thin’ SRs are narrow in plan view with sharp or slightly rounded medial crests, and tend to include both thin and wispy SRs as previously defined [6]. ‘Flat’ SRs have wider horizontal tops with scarp sides. ‘Rounded’ SRs have smooth edges with curved to flat upper surfaces. SRs classified as ‘other’ are too inconsistent along their lengths to be assigned one class. Groups of SRs were defined with association types, which incorporated previously defined [6] network patterns and associations with impact craters and fan-shaped forms. ‘Networked’ SRs describe any interconnected SRs, and include branched, parallel, and random networks as previously defined [6]. ‘Disordered’ SRs form within the distance of their lengths to other SRs, but are not interconnected with other SRs. ‘Isolated’ SRs are separated from other SRs by a distance that is greater than their length. ‘Fan-shaped’ SRs, like networked SRs, have interconnected ridges, but only cover a few km^2 and superpose a raised sloping surface. ‘Crater’ SRs are superposed by or subpose craters or ejecta.

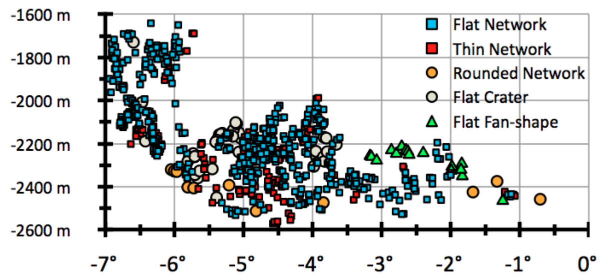
SRs were described individually with 5 attributes. (i) Observational confidence (confident or unconfident) describes certainty or uncertainty regarding SR identification, delineation, or width measurement. (ii) Multilevel attribute describes any stacked assemblage of SRs (i.e., a thin SR superposed onto a flat SR), and replaces the previous multilevel SR classification [6]. Attributes of (iii) scrollbar-like forms, (iv) layering, and (v) craters, were documented when found on SRs.

Results: 890 SRs were classified, attributed, and delineated, with elevational data collected for all SRs attributed as ‘confident’ (Fig. 1). Flat SRs were the majority (71%), with fewer thin (24%), rounded (2%), and other class (3%). Elevations for SRs were clustered within ~1000 vertical meters (Plot A), ranging from -2789 m to -1641 m. All SRs generally decrease in elevation closer to the equator. Flat networked (class and assoc.) SRs appear throughout the AZP and have some of the highest elevations. Thin networked SRs behave similarly, except their abundance decreases above -4ºS latitude. Flat fan-shaped SRs do not appear below -3ºS; they have the highest elevations (-2200 m) at this latitude. Rounded SRs are clearly the longest SRs [6,9,10] and extend further north than other SRs (Fig. 1).

Discussion: Although the range of observed SR elevations is consistent with [6], the total number SRs and classification percentages differ. This difference is likely due to i) higher resolution images enabling SR reclassifications], ii) changes to the classification, association, and attribute schema, described above, and iii) sampling every SR within networks. Flat fan-shaped SRs have a uniform elevation, which may indicate a former subareal base level for sediment deposition and/or fluvially erosion during a climate producing flashy hydrology.

Addressing our hypothesis with SR elevations alone is difficult. Atmospherically derived strata (e.g., ignimbrites) can drape over topography. Thus, higher elevation SRs found at higher latitudes could conceivably be in the same stratum/time interval as lower elevation SRs to the north. Future work will observe elevations of other paleo-environmental indicators, like yardangs, and superpositional relationship with SRs to build comparable stratigraphies of MFF features across the AZP.

References: [1] Bradley B. et al. (2002) *JGR 107 (E8)*, 5058. [2] Scott D.H. and Tanaka K.L. (1982) *JGR 87(B2)*, 1179–1190. [3] Hynek B. M. et al. (2003) *JGR 108(E9)*, 5111. [4] Mandt K. et al. (2008) *JGR 113*, E12011. [5] Kerber L. and Head J. W. (2010) *Icarus 206*, 669-684. [6] Burr, D.M. et al. (2009) *Icarus 200*, 52-76. [7] Burr, D.M. et al. (2010) *JGR 115*, E07011. [8] Greely and Guest (1987) USGS Map I-1802-B. [9] Zimbelman and Griffin (2010) *Icarus 205*, 198-210. [10] Lefort A. et al. (2012) *JGR* in revision. [11] Malin M.C. et al. (2007) *JGR 112*, E05S04. [12] Smith D.E., et al. (2001) *Science 284*, 1495-1503. [13] Christensen P.R. et al. (2004) *Space Sci. Rev. 110*, 85-130.



Plot A (above): SR elevations in the study area shown in meters below Mars datum (vertical axis) and latitudinal degrees below Mars equator (horizontal axis). **Fig. 1 (below):** Delineation of SRs in the AZP region overlying THEMIS day time IR mosaic [13] with MOLA elevation color scheme. SR study area is a spatial subset of area studied in [6, their Fig. 9].