**WRINKLE RIDGES IN AEOLIS DORSA, MARS: PRELIMINARY MAPPING.** R. M. Borden[1] and D. M. Burr[1], [1]University of Tennessee, Knoxville, TN USA 37996 (Rborden4@vols.utk.edu and dburr1@utk.edu).

**Introduction:** The global geology of Mars shows many interesting tectonic features. Whereas the largest-scale features are related to Olympus Mons and the Tharsis Montes [1], smaller tectonic features may relate more to local deformation, enabling the interpretation of local stratigraphic relationships and localized past tectonic stress histories. As part of a funded mapping project, we are applying this approach in the Aeolis Dorsa (AD) region, where prior work has already identified fluvial deposits, mainly inverted fluvial features [2]; impact craters, some with rampart ejecta blankets; dunes from Aeolian deposition [3]; and yardangs from Aeolian erosion. The Aeolis Dorsa are located within the Medusa Fossae formation, which is hypothesized to be comprised of a volcanic ignimbrite [4].

The AD region of Mars exhibits tectonic features at both global and local scales. First, the shape of the global dichotomy boundary in this region has been modeled as suggestive of lower crustal flow [5]. At the same time, deformed surficial fluvial deposits are most consistent with lithospheric flexure [6]. The Medusa Fossae Formation also has rectilinear troughs, potentially formed by tectonic fractures [7], which appear in the southwest part of the AD mapping area. Other tectonic features in the area include possible extension along the dichotomy boundary between the northern lowlands and southern highlands. More locally, several small-scale tectonic features have been observed, including wrinkle ridges [8]. This work focuses on mapping and analysis of these smaller features and using these features to derive a better understanding of the regional geologic relationships and history of localized stresses in the region. The wrinkle ridges are distributed throughout the mapping area. Local stratigraphic relationships can be inferred using cross-cutting relationships of wrinkle ridges and fractures with fluvial and Aeolian deposits.

**Background:** *Wrinkle ridges in the Solar System:* Wrinkle ridges consist of three major geomorphologic parts: an underlying rise with relatively low relief, a broad arch, and a narrow ridge (see Figure 1). The wrinkle ridge overall is asymmetric. Wrinkle ridges also commonly have en echelon lobes with curvilinear geometry [1]. Wrinkle ridges are found on terrestrial planetary bodies, including Mercury, Venus, Earth, Mars, and the Moon [9,10]. Their morphology has been extensively studied and described in the literature. Plescia and Golombek described wrinkle ridge morphology and compared several potential terrestrial analogs to Lunar and Martian wrinkle ridges [9]. Wrinkle ridges have also been analyzed more recently to infer the magnitude of crustal shortening and the geometry of the underlying thrust faults [11-13].

Wrinkle ridges are interpreted as evidence of contraction by blind thrust faults that do not break the ground surface. Wrinkle ridges are thought to be the topographic expression of fault-related folds developed with the thrusts, for which the motion along the fault decreases to zero at the tip of the fault some distance below the surface. This displacement gradient along the thrust fault results in fold formation in the hangingwall, creating the wrinkle ridge [14].

*Wrinkle ridges in AD:* Wrinkle ridges are found throughout the mapping area in AD. For example, Kite et al. identified several wrinkle ridges interacting with alluvial fan deposits [8]. Several more have been identified and mapped for this work (see Figure 2).

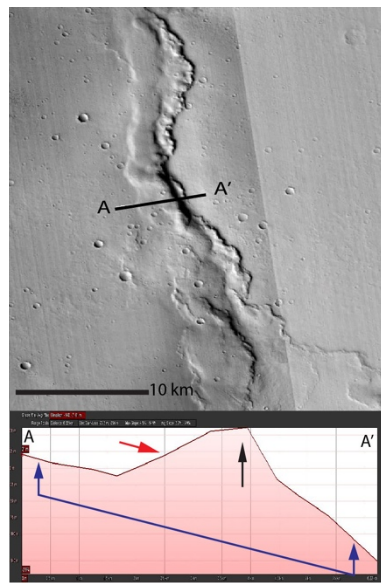


**Figure 1**: Example of a wrinkle ridge located at ~22.16 N, 79.30 W (outside study area). Elevation profile is from A to A'. Blue arrows and line denote edges of topographic rise, red arrow denotes broad arch, black arrow denotes narrow ridge.

**Hypothesis:** Based on the observations of wrinkle ridges in the AD, we hypothesize that the AD episodically underwent local contraction.

**Data and Methods:** ESRI ArcMap software for GIS analysis is used for the mapping and analyses for this project. The base map is a mosaic from the Context Camera (CTX) [15]. This layer is overlain with Mars Orbiter Laser Altimeter (MOLA) [16] topographic data to get elevations for various features. General mapping of wrinkle ridges in AD is accomplished at the 1:85,000 scale and wrinkle ridge lines are created as polyline shapefiles.

We are mapping wrinkle ridges using three classifications: certain, probable, and possible. Criteria used for mapping are that wrinkle ridges include: a topographic rise, a broad arch, a narrow ridge, en echelon lobes, curvilinear overall shape, and asymmetry [adapted from 10]. For a wrinkle ridge to be classified as certain, it must have clearly visible at least four of the six criteria. To be classified as probable it must have at least three of the criteria. To be classified as possible it needs only to have two of the criteria.

**Analyses and Preliminary Results:** Preliminary mapping in the study area has identified a number of wrinkle ridges with the certainty levels defined by the morphologic criteria. These wrinkle ridges appear to be scattered throughout the AD region, instead of concentrated in one particular area (see Figure 2). This scattered distribution suggests that contraction was widely distributed spatially.

**Future Work:** Continued detailed mapping of wrinkle ridges will be completed in the AD, followed by various analyses. The geographic orientation of each of the wrinkle ridges will be recorded and collectively analyzed to infer any directionality of the former compressional stresses that gave rise to the wrinkle ridges. Topographic profiles for each wrinkle ridge will also be obtained from DEMs, where stereo pairs are available [17], and used to infer the amount of crustal shortening in the AD. Lastly, analysis of the elevation and stratigraphic context of these wrinkle ridges will be done to infer information on their distribution in time.

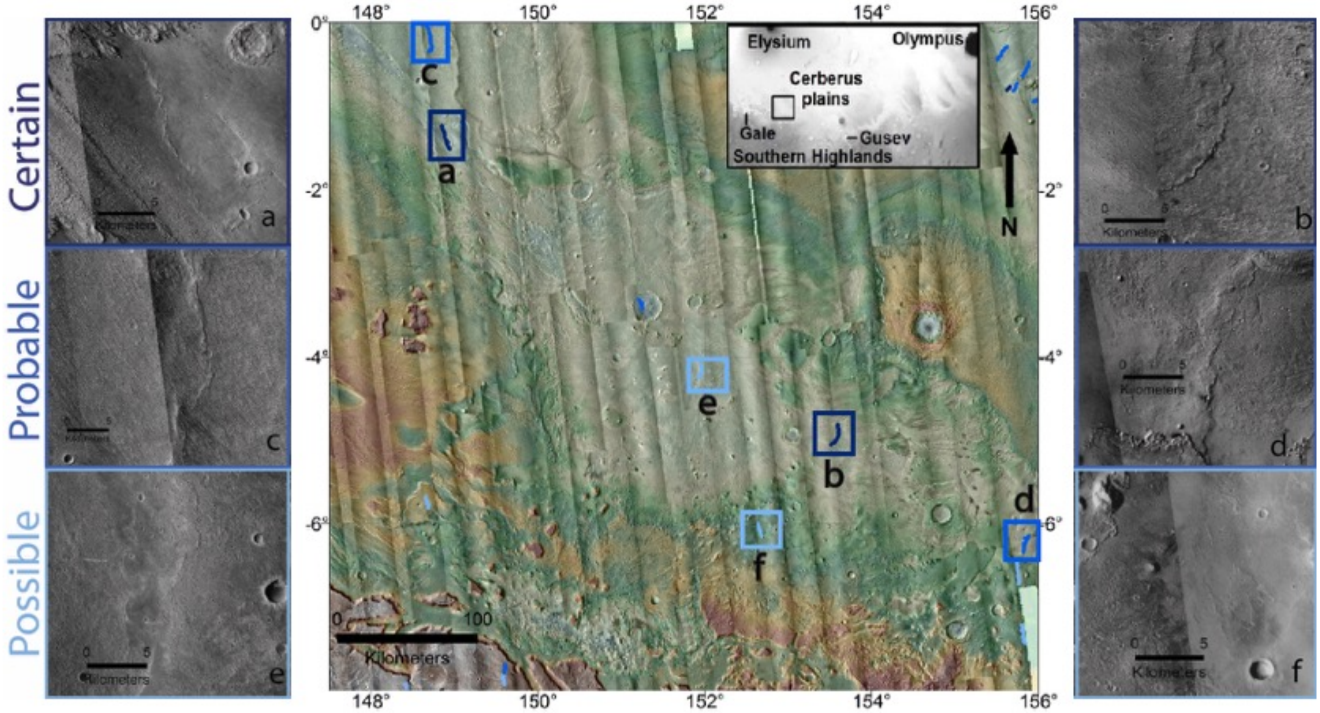


**Figure 2**: MOLA data on CTX images with mapped wrinkle ridges and context map in upper right. Boxes indicate the locations of the wrinkle ridges shown in the side images. Dark blue lines are classified as certain, medium blue as probable, and light blue as possible.

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