RELATIVE AGES OF WRINKLE RIDGES IN SYRTIS MAJOR, MARS. Christian S. Venturino[1] and Tracy K. P. Gregg[1], [1]Department of Geology, 126 Cooke Hall, University at Buffalo, Buffalo, NY, 14260 (csv@buffalo.edu).

Introduction: Wrinkle ridges are complex landforms commonly consisting of a broad (~1-20 km wide), low-relief (~20-300 m tall) arch with a narrow (<1 km wide) superimposed, sinuous crest, and are interpreted to be formed by a combination of folding and thrust faulting [e.g., 1]. Wrinkle ridges observed on Mars are widely accepted to be compressional features [2,3], but their precise development and underlying structure remains unclear. Syrtis Major, Mars (Fig. 1), contains wrinkle ridges displaying various orientations surrounding Nili Patera (9.09°N, 67.03°E), interpreted to be a volcanic caldera [e.g., 5]. To the east of Syrtis Major is the Isidis impact basin (~1200 km in diameter), which may have affected the local stress-field(s). The trends and relative ages of wrinkle ridges within Syrtis Major suggests that there have been multiple stress-field orientations over time. Detailed examination of the wrinkle ridges within Syrtis Major allows the relative ages of these stress orientations to be constrained, thereby providing information about the volcano-tectonic evolution of Syrtis Major. Here, we discuss our preliminary investigation into the western portion of Syrtis Major.

Methodology: This investigation consists of 2 principal tasks: mapping wrinkle ridges in western Syrtis Major, and determining relative ages of intersecting ridges through cross-cutting and superposition relationships. A combination of visible and thermal datasets were used. Thermal Emissions Imaging System (THEMIS) daytime infrared images were used as a base map because of its combination of widespread coverage and high resolution (100 meters per pixel) [4]. Mars Orbiter Laser Altimeter (MOLA) [6] data were also referenced to help reveal the notable broad rise, low-relief arch, and sinuous ridges [cf. 5]. Data were imported and analyzed in ArcGIS 10.1 software.

Determining Relative Ages: To date, 12 wrinkle ridge intersections have been analyzed within western Syrtis Major to determine relative ages. Relative ages were identified using the following criteria. 1) If "Ridge A" clearly offsets the trend of "Ridge B", then "Ridge A" is younger. 2) Ridge superposition and topography can also be used. If "Ridge A" has uplifted "Ridge B" parallel to the trend of "Ridge A" then, in accordance to fault superposition, "Ridge A" is younger. 3) Ridge continuity through adjacent intersections can be used to aid in determining overall relative age. If a continuous ridge shows a consistent trend through multiple intersections, then it likely from the same event and time. If none of the above criteria apply, then that particular ridge intersection is classified as "undetermined."

Results and Discussion: Out of the twelve wrinkle ridge intersections analyzed in western Syrtis Major (Fig. 2), 11 ridges radial to Nili Patera were observed to be younger than the intersecting circumferential ridges (Fig. 3). This trend suggests that there are multiple stress origins that likely formed through at least 2 events.

For example, ridges with radial trends may have been formed by patera-radial compression as a volcanic evacuation or collapse event took place [5]. In contrast, concentric ridges are consistent with formation by volcanic loading [5]. Further investigations are needed to constrain the relative timing of these events so that an overall evolutionary history of Syrtis Major and Nili Patera can be inferred.

Future Work: A continuation of this investigation is ongoing using the methods and guidelines found here. Future work includes mapping the Syrtis Major wrinkle ridges in their entirety, determining relative ridge ages for the region, defining the orientation(s) and origin(s) of stress field(s) through time, and comparing the results to previous studies in Syrtis Major [5] and Hesperia Planum, Mars [7].

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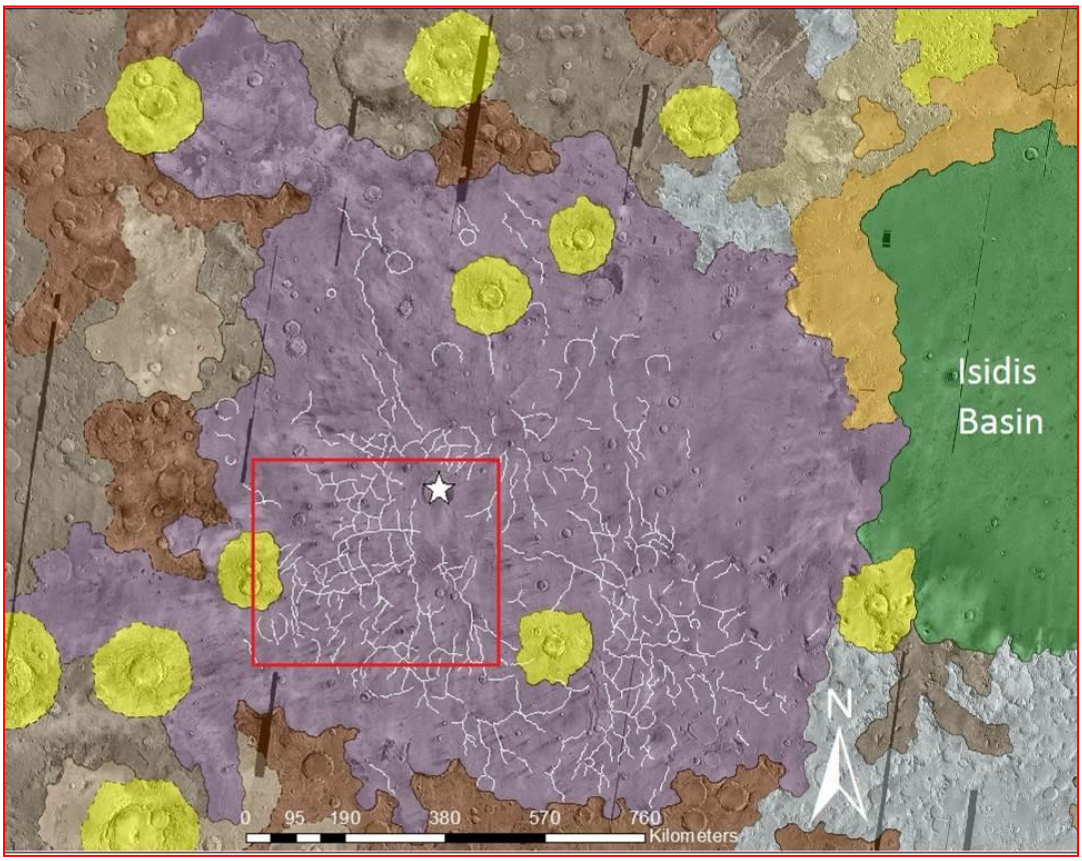

Figure 1. *Daytime infrared THEMIS mosaic of Syrtis Major, Mars overlain by a geologic map of the region, where the Syrtis Major unit is represented in purple [8]. Wrinkle ridge positions are mapped in white. Note the approximate radial and concentric orientations of the ridges relative to Nili Patera (centered at 9.09°N, 67.03°E and indicated by the white star). Area highlighted by the red box is the primary focus of this investigation and can be seen in further detail in Figure 2. Image courtesy of NASA/JPL/ASU.*

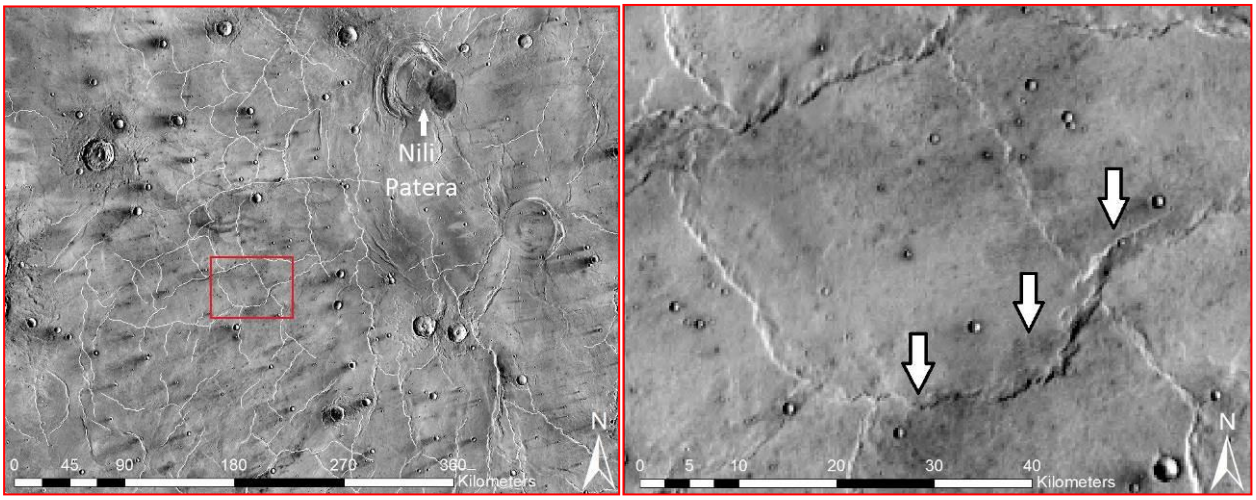

Figure 2 (Left). *Daytime infrared THEMIS mosaic of Syrtis Major, Mars illustrating the region of this investigation. Wrinkle ridge positions are mapped in white. Red box highlights in-depth image of a ridge intersection shown in figure 3.* ***Figure 3 (Right).*** *An individual ridge investigated in this study. White arrows denote a radial wrinkle ridge that's cross-cutting a concentric ridge, making it younger based on the criteria used in this study. Images courtesy of NASA/JPL/ASU.*