Looking at Xanthe Terra, Mars: Structural History by Mapping Linear Features using CTX Imagery. A. Shelton[1] and C. G. Hughes[1], [1]EKU Department of Geosciences, Richmond KY Christopher.Hughes@eku.edu

Introduction: Xanthe Terra, Mars (Figure 1) is a unique area to study due to its proximity to different features. Xanthe Terra is located on the Martian Dichotomy (the boundary between the Northern lowlands and Southern highlands), which has an elevation difference of one to three kilometers (km). This allows for the study of both hemispheres simultaneously. Xanthe Terra is also located North of the equator, near Valles Marineris - a large canyon that runs 4000 km along the equator. The presence of this canyon indicates structural change in the area. Xanthe Terra is marked by many craters and linear features. The linear features are the focus for this project. This project is concerned with linear features caused by stress. Stress is a force that has acted upon Mars' crust, causing strain - the deformation of the rock [1]. Two stress types that occur are extensional stress, pulling of the rock, and compressional stress, pushing of the rock. Both stresses can be identified by the types of structural features that occur due to the resulting strain. By mapping these linear features, we want to produce a structural history for Xanthe Terra, and the possible effects of the surrounding areas on Xanthe Terra's formations. This will add to the understanding of Martian geology.

Methods: We used Context Camera (CTX) [2] imagery available within the JMars program [3] as a base to record linear features within Xanthe Terra. CTX data is collected by the Mars Reconnaissance Orbiter, and is usually used for context when viewing other data such as that from the HiRISE instrument. CTX imagery can provide views of Mars surface 30km wide and up to 40 km long. This sliver spatial resolution can be 5-6.5m/pixel [2]. These images provide a detailed vison of 99.1 percent of the surface of Mars. CTX imagery is presented as stamps within JMars. We used these stamps as a mapping surface. Linear features one km or longer are recorded within a small area of Xanthe Terra. Attributes such as length and source image were recorded. We then determined stress type, and feature type. The structural linear feature types are - Extensional: grabens, rifts, tension cracks and troughs or channels and Compressional: ridges, wrinkle ridges [4].

Results:

Preliminary Results. Over 500 linear features were mapped within an area 180 km long and 60 km wide (10,800 sq km) (Figure 2). This small area of Xanthe Terra contains both compressional and extensional features.

Future Work. We will be using ArcGIS to determine strikes of linear features. This data will be used to create rose diagrams to determine the stress fields of the area. This will result in a better understand of what the presence of these features means for the structural history of Xanthe Terra, and provide further insights into the global geologic history.

Initial Conclusions: The study of Xanthe Terra's structural features has shown a presence of several features of both the compressional and extensional stress type. This and additional information to be collected will aid in the understanding of the structural history of Xanthe Terra, Mars.

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References:

[1] van der Pluijm and Marshak (2004) *Earth Structure*

[2] Malin, M. C. et all. (2007) "Context Camera Investigation on board the Mars Reconnaissance Orbiter." Journal of Geophysical Research E: Planets.

[3] Christensen, P. R. et al. (2009) "JMARS–A Planetary GIS" American Geophysical Union 2009, Abstract #IN22A-06.

[4] Anderson. R. C. et al. (2001.) "Primary and Secondary Concentrations of Tectonic Activity through Time in the Western Hemispheres of Mars." Journal of Geophysical Research.

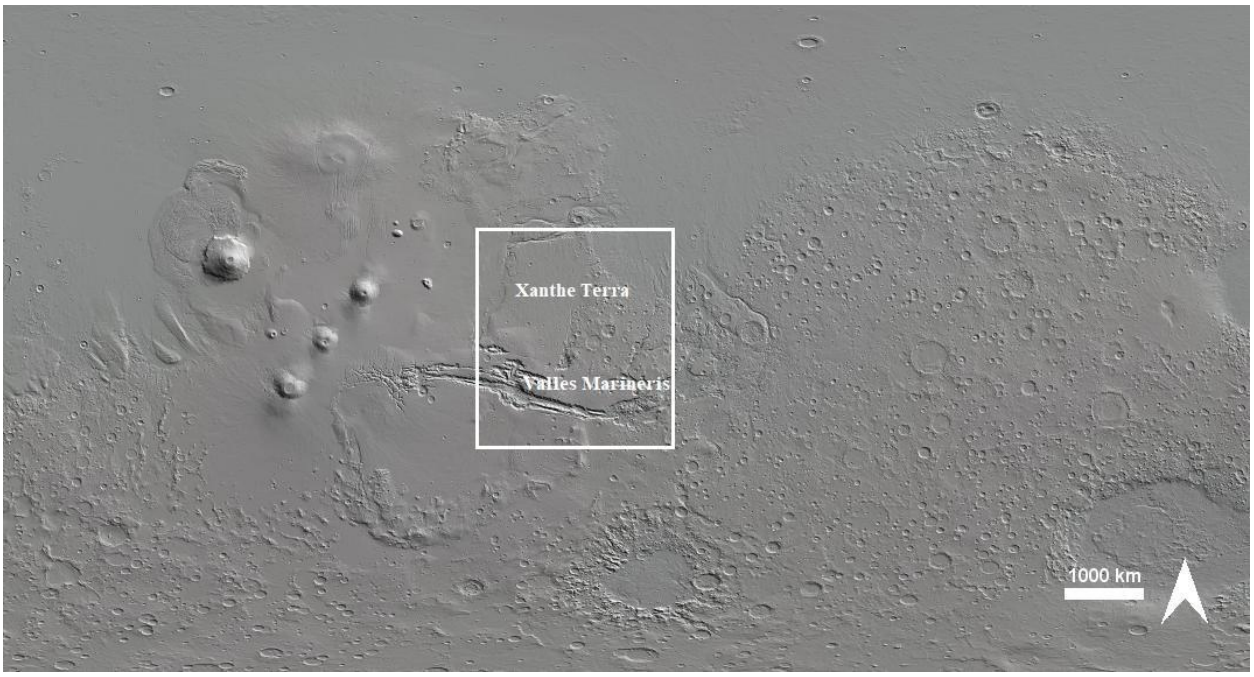

Figure 1 This is a Mars Orbiter Laser Altimeter (MOLA) shaded relief map of Mars, the topographic differences between the Northern and Southern hemisphers can be seen. The locations of the Xanthe Terra and its proximity to Valles Marineris are also featured.

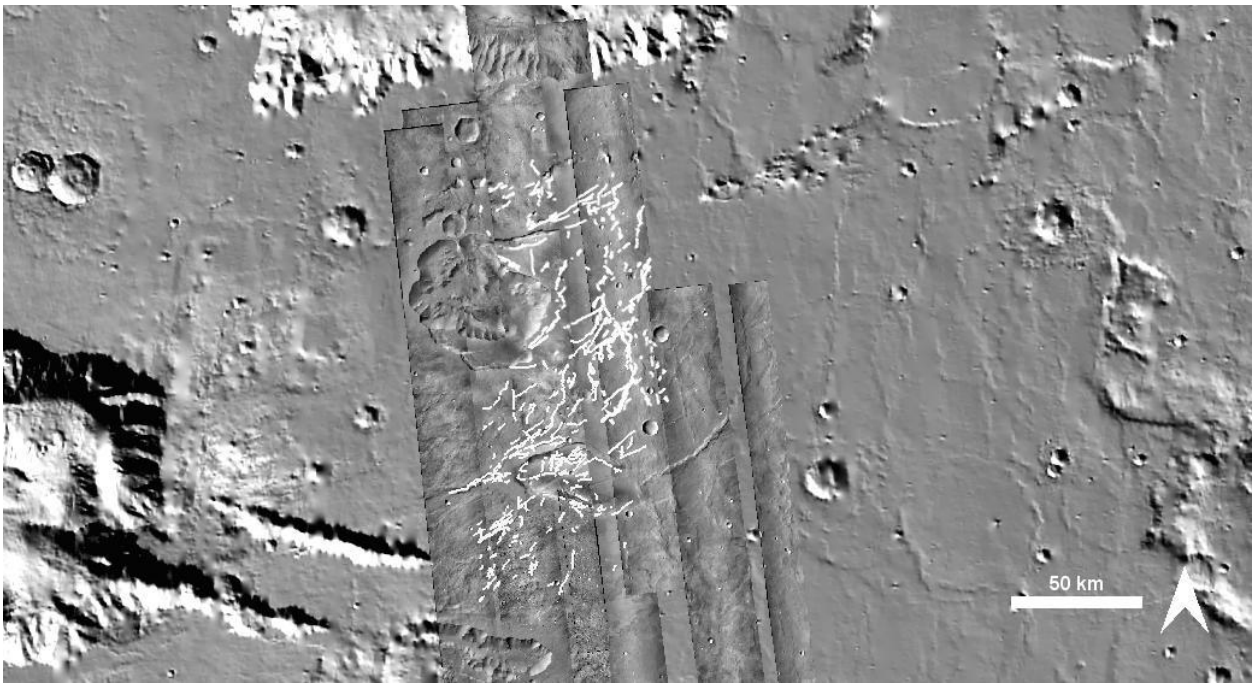

Figure 2 This map shows the CTX stamp surface used to record linear features. All recorded linear features are shown in white within this area of Xanthe Terra, Mars.