101-10 - Booth No. 36: ANALYSIS OF SEGMENTED NORMAL FAULTING IN THE NORTHERN THARSIS REGION OF MARS

Monday, September 23, 2024

8:00 AM - 5:30 PM

Hall D (Anaheim Convention Center)

Booth No. 36

Abstract

Exploring the geometric characteristics and long-term evolution of segmented normal fault systems is vital for seismic hazard assessment and advancements in natural resource development. Complex fault geometries are better preserved on Mars relative to Earth because of low rates of erosion and deposition on the red planet. In addition, newly available (2023), high-resolution (5 m/pixel) imagery of the Mars CTX Mosaic permits us to examine fully exposed fault networks in more detail than anywhere in the solar system.

In this study, we investigate characteristics of segmented normal faulting in the Northern Tharsis region on the west flank of the volcano Alba Mons. This circumferential fault network begins at the northernmost flank of Alba Mons, where these faults interact with a linear, north-striking fault network that extends northward from the volcano. The circumferential faulting spans several hundred kilometers along the western flank to the southernmost flank of the volcano, where faulting interacts with a linear system that extends southward from the volcano. Previous researchers suggest that the circumferential fault network evolved over four stages, with initiation beginning in the Early and Middle Noachian (3.92-3.85 Ga).

We developed a workflow to analyze this normal fault network in more detail than in previous studies. In Google Mars, we defined a series of sampling windows that capture different sections of the circumferential fault system. We used high-resolution images captured from the CTX Mosaic to analyze fault segment relationships in map-view. From the CTX imagery, we documented fault segment lengths, stepover distances, displacements, linking geometries, and total extension across the fault network for each model. Changes in the magnitudes and orientations of many of these variables allow us to relate changes in the local and regional stress fields and magnitudes of extension as faults propagated and accumulated displacement within the circumferential fault network. We can apply our findings of this complex normal fault network on Mars to less well-exposed segmented normal fault systems on Earth.

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