Displacement-Length Ratios and Contractional Strains of Wrinkle Ridges in Thaumasia Minor and Solis Planum, Mars

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Statistical analyses of the planetary tectonic structures such as faults, joints and dikes are established means to comprehend stress-strain conditions throughout the history of planetary bodies. The geometric properties of the tectonic structures have been used by earlier workers to infer the rudimentary mechanical controls that helped in their origin and evolution [1]. Studies confirm that within the fault on terrestrial and planetary surfaces the maximum displacement (D_{max}) is proportional to its length (L). The D_{max}-L ratios are therefore utilized to delineate an average long-term equilibrium stress field [2, 3]. Wrinkle ridges, formed above to blind thrust faults, are compressional structures found abundantly on Mars [4]. Wrinkle Ridges in Thaumasia Minor and Solis Planum were studied using MOLA/HRSC Blended DEMs. Topographic profiles, across trends, were extracted for each wrinkle ridge near their midpoints [cf. 2] to evaluate their height and maximum displacement (D_{max}). Displacement and length values of the wrinkle ridges were plotted on a graph. The D_{max}-L ratios (γ) for wrinkle ridges of both the regions are calculated by a linear fit method [cf. 2, 5]. The γ value of ridges in Thaumasia Minor was found to be (2×10^{-3}) while that in Solis Planum is found to be (1.2×10^{-3}). The contractional strains (ε) in Thaumasia Minor and Solis Planum are estimated to be ~0.14% and ~0.1% respectively (fault plane dip θ is assumed to be 25°). These estimated values indicate that the Thaumasia Minor is more affected by compressional tectonics than the adjacent Solis planum.

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Reference

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