STRUCTURAL MAPPING OF CUSUS VALLES, MARS. M. Chinnamuthu and S. Anbazhagan, Centre for Geoinformatics and Planetary Studies, Periyar University, Salem-636011, Tamil Nadu, India. (chinnamtech@gmail.com, anbu02@gmail.com).

Introduction: Mars has several tectonic imprints on its surface. Several studies were conducted on tectonic evolution, formation of graben structure, fault topography and tectonics associated with volcanism [1, 2, 3 & 4]. Graben structures on Martian surface might have developed due to isostatic stresses in the volcanic region, flexural bending stresses and deformation, surface expression of giant dykes and magmatic processes [5,6, 7, 8 & 9]. Borraccini et al (2007) have conducted detailed tectonic evolution study in the eastern regions of the Thaumasia plateau. They related the orientation of lineaments and graben structures with different time period. In the present study, we have done structural mapping of Cusus Valles and inferred that the valles formation controlled by graben structure. Cusus Valles located in the south east of Cassini crater at 14.34^0 N 50.5^0 E on Mars. Cusus valles and its channels were probably carved out along structural discontinuities by flooding during the Noachian period. The channel system originated from the south western part of Antoniadi crater.

Methodology: The structural features and topography of Cusus Valles is studied with help of Mars Odyssey Thermal Emission Imaging System (THEMIS) data. MGS Mars Orbiter Laser Altimeter (MOLA) data in 463m spatial resolution is used for plotting profiles of wrinkle ridges in association with THEMIS image. ArcGIS 10.4 and ENVI 5.2 software were used for mapping.

Results and Discussion: Mars Odyssey THEMIS image as well as MOLA data were used for interpretation of structural features of Cusus Valles. It is interesting to note that Cusus Valles is bounded by two wrinkle ridges running northwest to southeast direction **(Figure 1)**. In addition to the two prominent wrinkle ridges in the boundary, small ridges were also interpreted from the image. The structural parameter interpreted from remotely sensed data has clearly indicated that the Cusus Valles is controlled by tectonic phenomena. Lobate scarp, buried crater rim crest, lineation, depression and small channels were interpreted and shown in the image (Figure 1). The arrows indicate the direction of channel flow. Wrinkle ridges are common feature found on Lunar Maria and also in Mars. It forms low and sinuous ridges on the surface and extended up to several hundred kilometers.

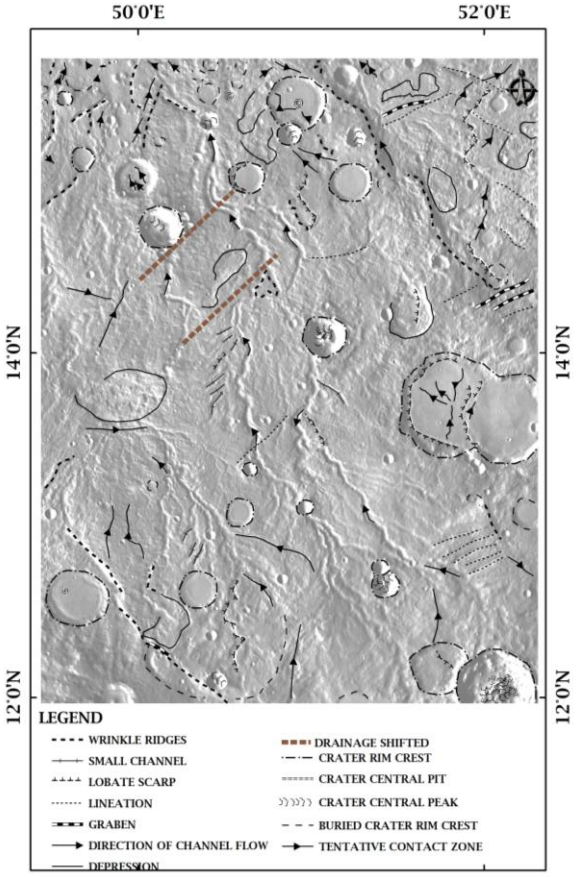

Figure 1 Structural features in Cusus Valles interpreted from THEMIS image. The Valles bounded by wrinkle ridges running in the NE and SW boundary of the basin. Lobate scarp, buried crater rim crest, lineations, depression and small channels are marked in the image.

Wrinkle ridges are named with the Latin designation as dorsum (plural dorsa). Several hypotheses proposed for development of wrinkle ridges on Martian surface, it generally considered as tectonic feature, formed due to folding and faulting [10]. They are evidences of compressional stress in Mars crust and created fault [11]. Theories also supported for development of wrinkle ridges due to surface loading and internal shrinking in the lithosphere, crustal tectonics and large-scale global volume decrease within Martian interiors [12]. Lobate scarps are generally one-sided and occur in linear or arcuate segments. They are morphologically similar to lobate scarps observed on Mercury [13 & 14].

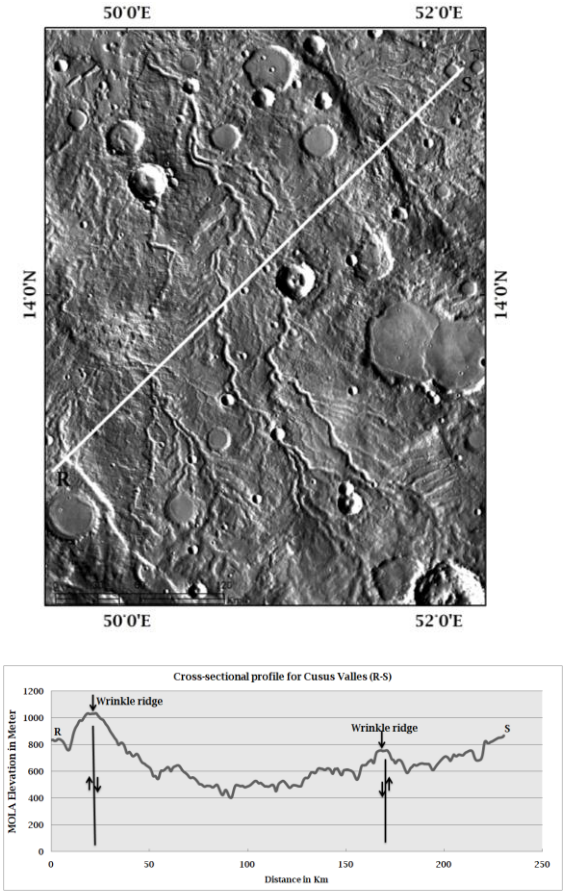

Figure 2 The THEMIS image of Cusus Valles show section profile drawn across the wrinkle ridges. Cross-sectional profile show the Cusus Valles bounded by wrinkle ridges indicates graben structure.

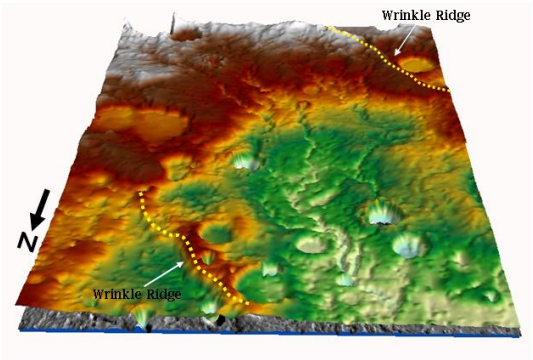

Figure 3 Mars Odyssey THEMIS image superimposed over the MGS MOLA data show Cusus Valles. The Valles boundary marked as wrinkle ridges in the Digital Elevation Model.

The crater rim is the edge of the crater, typically elevated above the original ground surface. The buried crater rim is structurally elevated bedrock [15] overlaid by a thick layer of overturned ejecta materials. Lineations are the linear structural features criss-crossed mostly NE-SW direction in the Cusus Valles. Such lineations are controlled by fractures and faulting. The lineations were interpreted based on tonal contrast, changes in topography and shift in the drainage course. Depressions are landforms located below the surrounding plain area. The Valles networks developed between two wrinkles ridges. The entire Cusus Valles might have developed in a graben structure. The profile drawn (R-S) across the wrinkle ridges, indicated the sharp break in the topography (Figure 2).

The wrinkle ridges in the Cusus Valles most probably controlled by graben like structure bounded by parallel normal faults. The profile drawn across the valles in the NE-SW direction indicates the graben structure (Figure 2). The THEMIS image superimposed over the MOLA elevation model has clearly shown the wrinkle ridges (Figure 3).The presence of wrinkle ridges might be formed due to compressional stress or internal shrinking in the lithosphere. They are three set of lineaments running in NE-SW, EW and ESE-WNW directions interpreted from THEMIS data. The lineations might have developed to compressional forces in the center valles region. The EW lineaments at few locations shifted drainage course probably controlled by fault and pre-date the fluvial origin.

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