

Tectonic structures in Noctis Labyrinthus area based on HRSC and CTX photogeological mapping

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1. Abstract

Noctis Labyrinthus is made up by inter-connected canyons with complex branched networks of extensional faults and grabens whose origin and evolution is still debated [2,4,5,6,7,8,9]. It is located in the Northern hemisphere at the western part of Valles Marineris, and is bordered by Noctis Fossae to NE and by Syria Planum and Syria Colles to the S-SE (defined on the surface by the coordinates 6.36° S, 258.81 °E).

Our work was carried out on HRSC and CTX images and was focussed at mapping at different scales faults, scarps and grabens and identifying their cross-cutting relationship in order to assess the strain field responsible for their formation.

2. Data and Methods

As a basemap to delimit all the lineaments, we have used two orthoimages and DEM pertaining h3210_0000 and h3221_0000 datasets acquired from HRSC camera onboard Mars Express Spacecraft with 12 to 13m/Pixel of spatial resolution and a images mosaic from CTX camera of Mars Reconnaissance Orbiter with 5.2m/Pixel of spatial resolution [1,9]. We focused our work to draw at different scales faults, scarps and grabens and we have checked their orientation using rose diagrams.

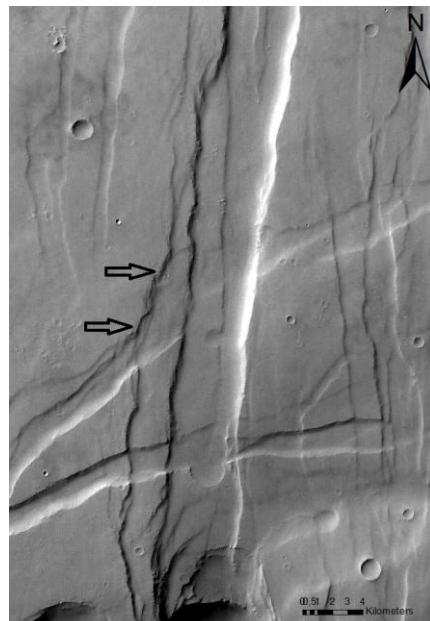


Figure 1. Interference patterns at fault intersection (4°13'43.85"S – 104°50'57.48"W), HRSC H3221_0000_ND2, orthoimage (sinusoidal projection).

3. Results and Conclusions

The resulting rose diagrams show at all scales two main trends of faults in the studied area: ENE-WSW and N-S (Fig.2). These systems do not show a preferential cross-cutting relationship of one direction over the others. This seems to support a coeval development of the two systems potentially generated in response of a bidirectional or a radial extension. The overlapping zones represented by interference patterns are interested by slump structures, steeper slopes, wrinkle ridges and concentric ring fractures (Fig.1).

Particularly relevant are also the pits which can be found within the tip and at the margin of the Noctis Labyrinthus grabens [3]. They seem due more to graben propagation than impact cratering phenomena and thus might give hints on the rheological subsurface layering which underwent the extensional deformation. We propose that the oblate strain field drove an extensional tectonism responsible of the evolution of pits chain and faults into grabens.

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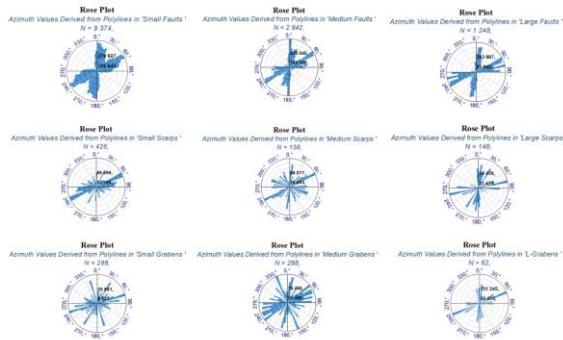


Figure.2. Rose diagrams of the faults, scarps and grabens relative to the tectonic context of the selected area (6.36° S, 258.81° E).

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Keywords : Noctis Labyrinthus, faults, grabens, rose diagrams, cross-cutting relationship, tectonic extension, pits, scarps, strike Slip, Interference patterns, mapping.

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