GEOLOGICAL ANALYSIS OF WESTERN ISHTAR TERRA MARGINS, VENUS L. Marinangeli, Dipartimento di Scienze, Universita' d'Annunzio, Viale Pindaro 42, 65127 Pescara, Italy - e-mail:luciam@sci.unich.it

Introduction

This study is focused on the western portion of Ishtar Terra (fig.1), a highland of the northern hemisphere of Venus. The study area consists of highly deformed areas, Tesserae, Atropos, Clotho and Itzpapalotl Tessera that are associated with three mountain belts, Akna, Danu and Freyja respectively. The three Tesserae compose outer plateaus on the back of each mountain belt. Each mountain belt and associated Tessera, forms a closely related deformative system. Clues to understand the geological evolution of this area, comprise tectonic relationships between Tessera and relative mountain belt to establish timing relations of deformational event and geological recognition of pre-orogeny basements presence. In this work, the three orogen-Tessera systems have been analyzed in terms of geological and structural characteristics.

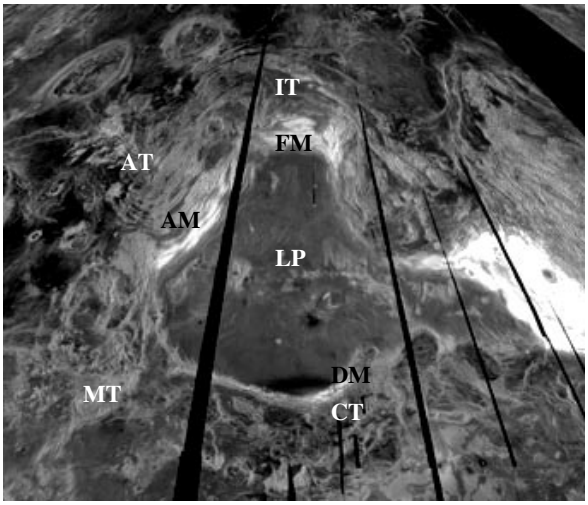

Fig. 1. SAR image of Western Ishtar Terra (portion of C2-60N333). LP:Lakshmi Planum; AM: Akna Montes; AT: Atropos Tessera; DM: Danu Montes; CT: Clotho Tessera; MT: Moira Tessera; FM: Freyja Montes; IT: Itzpapalotl Tessera.

Akna Montes-Atropos Tessera System

The geological texture of Atropos Tessera is represented by a very radar bright surface with fine-scale texture made by closely spaced ridges arranged in an *en-echelon* pattern. This pattern can be recognized elsewhere in Atropos and is interpreted to have characterized a pre-orogeny basement that composed a proto-Atropos Tessera. This unit has been subsequently deformed by shortening relative to Akna formation. The Akna Montes-Atropos Tessera region shows a similarity in structural orientation. Broad ridges generally trending NE compose the structural trend of the Akna mountain belt. This orientation is maintained by structures in Atropos, but they are less in number and length. On the basis of their radar variation across strike, both these features have been interpreted as compressional in origin. Several transversal lineaments trending NW cut the NE trending ridges. NW trending lineaments display evidence for strike-slip movement, coeval with the compressional event. These lineaments parallel the southern margin, that is represented by a linear scarp that merges to East with Vesta Rupes. Extension in this region is represented by several lava-filled basins elongated across the main structural trend, and interpreted as due to topographic relaxation of this area. As shown on fig.2, the altimetric profile across this region shows that Atropos Tessera slightly decreases toward West where it is embayed by surrounding plains.

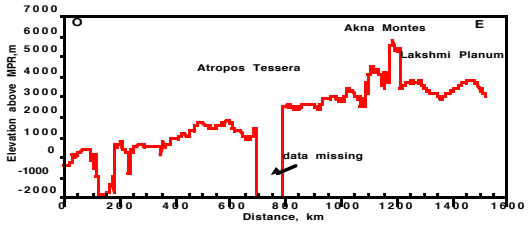

Fig.2. Altimetric profile across Akna-Atropos region.

Freyja Montes-Itzpapalotl Tessera System

This region shows a variety of geological and structural textures. The older unit seems to be represented by a fine scale texture similar to the Atropos'one. This suggests that Atropos and Itzpapalotl Tesserae formed a whole block of crust before mountain belt formation. The inner portion of Itzpapalotl, close to Freyja, has been deformed by compressional stress that have obscured the original geological textures. Chevron-like folds can be also observed in this portion. The outer portion of Itzpapalotl appears to be even younger and characterized by an S-C pattern caused by shear deformation [1,2]. Large plain emplacements are present within the Tessera, generally along the possible shear planes. The northern margin is marked by the steep and 2 km deep scarp of Uorsar Rupes (fig.3) that once acted as shear planes, but now evidently represents a normal fault.

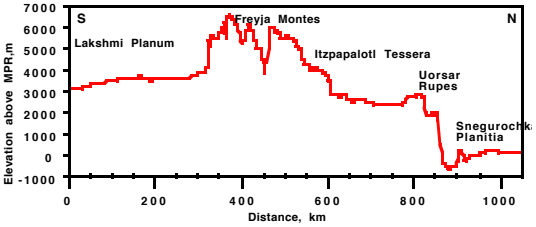

Fig.3. Altimetric profile across Freyja-Itzpapalotl region.

Danu Montes-Clotho/Moira Tessera System

Clotho and Moira Tesserae display a more complex deformation compared to Atropos and Itzpapalotl Tesserae. The radar appearance is variable, ranging from very dark to bright. Throughout a detailed observation and altimetric analysis, the darker areas appear to be depressed and, thus, are probably intra-Tessera plains that have been subsequently deformed. Three main orientations of structural systems can be seen: NE and WNW trending ridges and NW trending fractures and graben. These features intersect each other with no consistent cross-cutting relationships. Close to the Danu mountain belt, the Tessera is deformed by NE to NS trending and sigmoidal ridges composing the mountain structural domain. The shape and arrangement of the ridges may suggest that strike-slip activity acted during their formation. Another evidence of strike-slip activity along the lineament that actually forms Vesta Rupes, is that two portions of Tessera with similar morphological texture are actually, Clotho and Moira Tesserae, have been shifted apart. The overall Clotho Tessera is subjected by a strong extension, consisting in NW oriented pit chain and other collapse features. The altimetric profile (fig.4) shows that the Tessera rapidly changes elevation toward Sedna Planitia, and is disrupted by several valleys correspondent to tectonic lineaments. This area shows the higher concentration of extensional deformation of Ishtar Terra [1, 3].

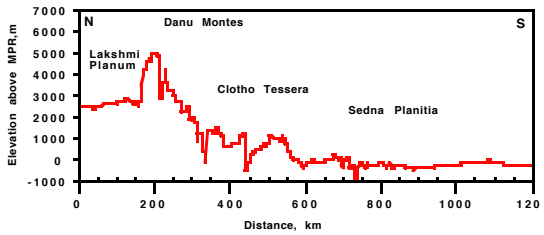

Fig.4. Altimetric profile across Danu-Clotho region.

Conclusion

Two different types of basements pre-orogenies can be envisage to compose the margin of Western Ishtar Terra. The first one compose the Atropos and Itzpapalotl range and is characterized by fine-scale texture made by closely spaced ridges arranged in an *en-echelon* pattern. It can still be seen in Atropos and eastern Itzpapalotl Tesserae. The second one characterizes Clotho and Moira, the southern margin of Ishtar Terra. It is characterized by a more complex deformational pattern; intra-Tessera plains have also been involved in the Tessera deformation. These basements have been subsequently folded and thrusted close the mountain belts.

In summary, compression, shear and extensional are found, although with different intensity and settings, in each of the three mountain belt-Tessera systems composing the margin of Ishtar. Compared to terrestrial high plateau associated with mountain belt, this sequence is related to variation of crustal stresses during crustal during shortening. The extensional phase appears to have reactivated pre-existing structural features. probably shear planes, as extensional structures and generating the northern and southern scarp of Uorsar and Vesta Rupes.

References

[1] Kaula et al., JGR-Planets, 97, 16,085-16,120, 1992 [2] Hansen and Willis, Icarus, 123, 296-312, 1996 [3] Solomon et. al., JGR-Planets, 97, 13,199-13,255, 1992