# DEXTRAL SHEAR DEFORMATION BELT ON SOUTHERN MARGIN OF CENTRAL OVDA REGIO, VENUS: PRELIMINARY RESULTS.

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**Introduction:** Crustal plateaus are a major class of tectonic features on Venus surface, and its study is essential in order to understand the geological evolution previous to the global resurfacing process. These regional units are flat topped highlands formed by tessera terrain, characterized by superposition of cross-cutting structures [1-2], with complex tectonic patterns; also intratessera volcanic plains with diferent roughness appear flooding depressions. There are two principal and opposite hypothesis explaining the origin of crustal plateaus. One of them advocates a mantle downwelling process as the driving mechanism, producing thikening and shortening of the lower ductile crust above mantle downwelling flows [3], but some other authors point out that crustal plateau formation is controlled by plumes in a thin crust geodinamic regime where crustal thikening is produced by flood volcanism [4]. The greatest crustal plateau is Ovda Regio (western Aphrodite Terra), with three major groups of structures, folds, ribbons and grabens, and a history of contractional and extensional tectonic stages which understanding is highly significant for getting a genetic model. Strike-Slip tectonism has not been described in Ovda Regio, though it has been found in other areas of Aphrodite Terra [5,6]. In this paper we describe a zone with brittle strike-slip faults at Ovda Regio southern margin and discuss its implications in crustal plateaus tectonic evolution.

**Structures:** A detailed mapping between 78º-86º E longitude and 6º-16º S latitude, based on F-MIDR left-looking radar images, has provided us with significant relative chronological succession of volcanic and tectonic process. We have found a complex deformation domain formed by two different elongated belts (fig.2a), trending N100-110º, and surrounding a central zone characterized by cross structures with a basin and dome structural pattern.

The northern inner deformation belt (200 km width) develops a set of *en échelon* anticlines, with N77 axial trend and 20-120 km wavelength, sometimes associated to probable reverse faults. These folds are crosscut by perpendicular extensional structures that we classified as the so called shear-fracture ribbons [7]. The geometrical relationships with folds show that ribbons are probably synchronous with the folds or postdate them [8]. Some ribbons are wider at fold crest than at fold flanks, which is indicative that folding was simultneous or previous to ribbon formation, because the normal faults in ribbon boundaries deep towards the interior of the (graben) trough (fig.1).

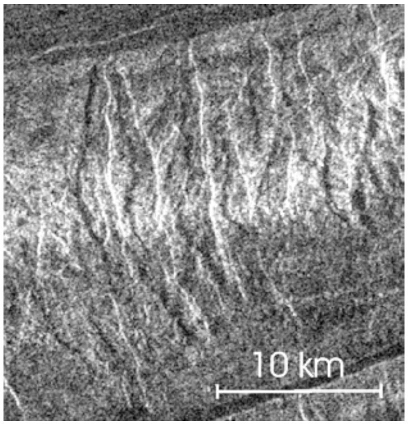

**Figure 1** Ribbons crossing an anticline from around 80.9ºE – 10.1ºS. Magellan left-looking image.

There exists a clear obliquity (30º) between the fold axial traces and the Ovda margin, with a right stepping pattern implicating a distributed dextral shearing, with the regional shortening axis trending N167º and a N57º extensional axis. This shortening orientation is coherent with both folds and ribbons and it is significant that it is perpendicular to Ovda Regio northern marginal fold belt, which has been interpreted as a collisional belt [10,11]. The fold and ribbon geometry and kinematics allow to determine the contribution of these structures to the horizontal dextral regional shearing along the inner belt, which has been calculated in a minimum amount of 5-20 km.

The general deformation pattern in the outer (southern) belt is also coherent with the same regional strain field but in this case different structures accomplish the dextral shear deformation. In this belt there is a deformation zone, 200-260 km wide, defined by several structures with very straight traces trending subparallel to the plateau margin and more than 600 km long. Detailed geometry shows R and P Riedel-like fractures with an anastomosing geometry (Fig.2b) equivalent to the patterns described in brittle strike-slip faults , both in experimental works and in a number of field examples on the Earth. The geometry of this fracture pattern indicates moderate offset. Completing the structural pattern in this external belt there is a set of *en échelon* ridges with sigmoidal geometry (s-shape) and N60-90 dominant direction that can be interpreted as folds with 2-5 km wavelength. Ridges became asymptotic to the large strike-slip faults. The spatial assostiation to fault traces and the sigmoidal shape of ridges suggest that the development of this structures is determined by shearing along large strike-slip faults. This tectonic design represents a shear zone with displacement concentrated along brittle strike-slip faults, and it must be distinguished from the S-C terrains described in Ishtar Terra [9,4] which correspond to a more ductile crustal behavior. Minimum bulk horizontal displacement along this external deformation belt has been estimated from the geometrical relations (displacement of a previous linear structure) in almost 12 km.

Between the inner and outer shear belts, appears a quite diferent tectonic pattern characterized by a set of fracturelike lineal structures trending N120º that is placed among three large N100-110º strike-slip faults. This new structures can be interpreted as R-type Riedel fractures providing a dextral shear movement criterion.

The development of this non-coaxial dextral deformation belt began before the emplacement of regional volcanic plains because this units cover some structures of the external shear belt, but shearing continues after this moment developping the strike-slip faults at the outer belt on Aino planitia volcanic plains. Therefor strike-slip tectonics took place before, during and immediately after the global resurfacing process.

**Geodinamic Implications:** The structural observations in these two shear belts in southern margin of Central Ovda Regio significantly agree with a stress field transmitted from the advocated collision in the northern margin [10,11], with the shortening axis oriented along N167º. In the other hand this strike-slip tectonic regime parallel to the margin and the evidence that some ribbons postdate folds seems to contradict the upwelling geodynamic model [7].

[1] Hansen V. L. et al. (1999) Geology, 27, 1075-1078. [2] Hansen V. L. and Willis J. J. (1995) Icarus, 123, 296-312. [3] Bindschadler D. L. et al. (1992) JGR, 97, 13459-13532. [4] Phillips R. J. and V. L. Hansen (1998) Science, 279, 1492-1497. [5] Davis A. M. and Ghail R. C. (1999) LPS XXX, Abstract#1330. [6] Tuckwell G. W. & Ghail R. C. (2001) LPS XXXII, Abstract#1562 [7] Ghent R. R. & Hansen V. L. (1999) Icarus, 139, 116-136. [8] Gilmore M.S. et al. (1998) JGR, 103, 16813-16840. [9] Hansen V. L. (1992) LPS XXIII, 478-479. [10] Tuckwell G. W. and Ghail R. C. (2002) LPS XXXIII, Abstract#1566. [11] King R. L. et al. (1998). LPS XXIX, Abstract#1209.

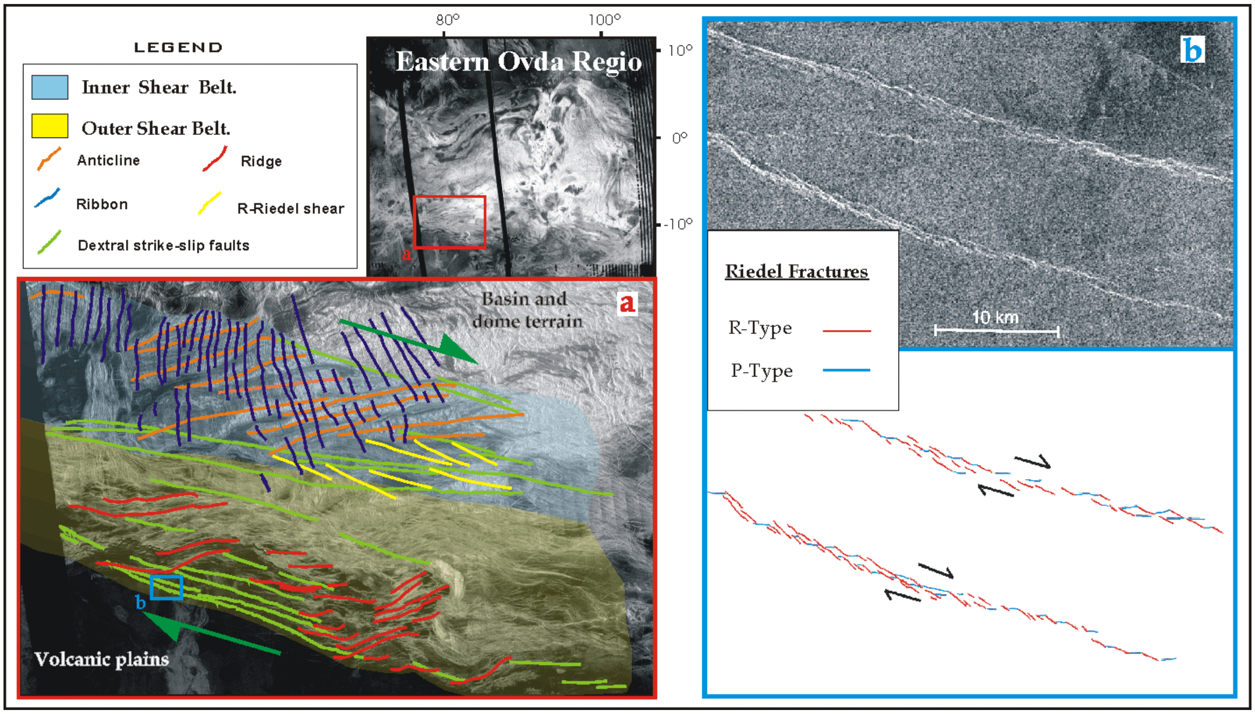

**Figure 2.** a) Schematic structural map of Central Ovda Regio suthern margin showing evidence of a dextral shear kinematic. b) R-P Riedel fracture pattern at fault zones of the large dextral strike-slip faults, full Magellan resolution image and interpretation.