RIDGE BELT -RELATED SCARPS AND TROUGHS: COMPRESSIONAL CRUSTAL BENDING ON VENUS; J. Raitala, T. Törmänen, K. Kauhanen and T. Tokkonen, Department of Astronomy, University of Oulu, Oulu, Finland; e-mail: jouko@hiisi.oulu.fi, terhi@hiisi.oulu.fi

Cytherean ridge arcs resulted in crustal shortening in places with either the strongest compression or weakest surface layers. Arcuate scarps on or close to the edge of the ridge arcs were compressional fronts formed by overthrust over or subduction of adjacent lowland.These ridge arcs became wider due to the propagation of new ridge formation close to previous one(s). As this process repeated itself with time, the crust became thicker and the foreland was bent either due to the excess load, overthrust or subduction event.

The Salme Dorsa arc measures 100 km in width and 600 km in length. It consists of a horseshoe-like set of ridges and grooves on a gently sloping lowland. The westward arcuate ridge belt indicates lateral compressional stresses and crustal deformation from SE against the southern Ishtar Terra foreland plain. The trough on the western side of the ridge belt and tensional grabens close to the crest of the bulge to the west of the trough are due to the crustal bending and indicate effects of the load and thrust. Compression and relative movement from southeast against and over the foreland planitia have resulted in ridge belt, trough and bulge formation. The load- and/or stress-induced bending of the uppermost crust allows some estimations of the uppermost elastic lithosphere thickness.

Repeated folding and thrust faulting of surface layers due to compression are indicated by four more ridge belts located close to Salme Dorsa indicate. The northeasternmost one has short ridges located in troughs. The west-opening arcuate ridge belt interlocks with the Salme Dorsa horseshoe. To the south of Salme Dorsa are the prominent N-S ridges of Ausra Dorsa. The NE-SW ridges of the northern Sigrun Fossae zone parallel the border of Ishtar Terra just to the south of Salme Dorsa. In addition to the distinct ridge belts, there are numerous small mare ridges in the planitia areas.

The eastern ridge annulus of Tusholi Corona has topographically high compressional ridges and a deep scarp along the eastern edge. The eastward facing Tusholi scarp gives an impression that the movement of the ridge belt relative to the lowlands has been to the east. Compressional overthrust, subduction or a mere surface load by the weight of the Tusholi massif as the crust thickened during compression have resulted in trough formation in front of the eastern scarp. This trough has been partly filled by the flows from the crater Lafayette. This eastern trough together with adjoining crustal bulge bending closely resembles that of Salme Dorsa.

To the north of Lakshmi Planum the scarps (Uorsar Rupes) are described to have been caused by series of repetitive overthrusts (Head, 1990, Head et al. 1990). They parallel the highland edge rising stepwise from the low northern planitia up to Freya Montes. Similar structures are also found to the north of Maxwell Montes. Their formation mechanism may be

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roughly the same as that of the ridges in the Salme and Tusholi areas. A foreland trough is found in front of the northward scarps which thus display the compression and load edges of the topographically high terrains over northern lowlands.

Sel-anya Dorsa is cross-cut by Fortuna Tessera terrain at 75°N, 80°E. It presents an another example of movements of northern Ishtar Terra where an edge scarp cuts through the N-S ridges of Sel-anya Dorsa. The ridge belt has some parallel lineaments on the tessera indicating the relative northward movement of tessera or tessera formation.

Audra Planitia is bordered in the south and southwest by a 1200 km long and up to 200 km wide arcuate ridge belt, which has a low-lying eye-shaped small plain between two ridge belt branches. The ridge belt formation has postdated formation of the ridges within Audra Planitia (Törmänen and Raitala, 1992). The ridge belt has a steep north-facing scarp rising 1 to 1.6 km higher than Audra Planitia. The eye-shaped plain is bounded by two similar scarps the southern scarp being steeper and higher than the northern one. Its surface continues exactly the topographic trend of Audra Planitia and there is a linear foredeep just north of the southern scarp as is also the case within the larger plain. Compression, crustal shortening and under/overthrusting have been important deformation events. The main ridge belt structures have formed in underthrusting and crustal shortening in NE-SW direction. Underthrusting has moved to the NE resulting in formation of the remnant eye-shaped plain. The ridge belt, being a deformed compressional zone, has also bent the crust in its deformation direction either due to the load and/or overthrust.

Ridge belt -related scarps presented above have resulted in crustal compression. Arcuate scarps may thus be seen as compressional fronts formed by overthrust over adjacent lowland or by lowland subduction in places where crustal plates moved against or over each other. Overthrust-subduction and load bent the uppermost surface layers of the lowland. The foredeep trough became wider due to the propagation of the process. The trough can be seen as a synclinal depression next to the compressional massif load. As the process proceeded with time the foreland crust was bent more and resulted in tensional graben formation along or on an adjacent anticlinal bulge on lowland side of the trough.

References: Head, J.W., 1990, Geology 18:99-102. Head, J.W. et al. 1990, GRL 17: 1337-1340. Törmänen, T. and Raitala, J., 1992, LPSC XXIII: 1441-1442.