ROTATIONAL, STRIKE-SLIP AND COMPRESSIONAL ASPECTS OF THE TECTONICS OF MESHKENET TESSERA ON VENUS; J. Raitala and T. Törmänen, Department of Astronomy, University of Oulu, 90570 Oulu, Finland.

Introduction. Meshkenet Tessera (1, 2) of the Plains-Corona-Tessera Assemblage (3) is a highly elongated E-W oriented parquet terrain area on Tethys Regio between 65° to 68° N and 92° to 128° E (4, 5). It is located 480 to 800 km E and SE of easternmost Fortuna Tessera and its steep, eastward-facing arcuate scarps (6). Earhart and Nightingale Coronae, Melia Mons, and Pakahotu and Vacuna Coronae border Meshkenet Tessera as an arc in the east, southeast and south, respectively, while Ops and Tusholi Coronae on the Ishtar Terra side (7) are connected to its distinct eastward-facing scarps (4).

The 1600 km long, but only 50-340 km wide Meshkenet Tessera highland can be divided into three main subareas on the basis of differences in topography, ridge and fault orientations and distinct separating areas. Its westernmost part (from 92° to 104° E) has the highest topography of Meshkenet Tessera. The western tip of the roughly triangular middle part is located at 66° N, 104° E. This middle part is separated from the eastern area by NW-SE oriented Gabie Rupes and a younger ridge belt. The eastern part from 112° to 128° E is the largest one in area and is also topographically lowest (1.0-1.5 km). Each major tessera part has its own distinctive overall appearance and is cut into smaller subparts by large faults. Individual parts may have the same basic morphology of subparallel ridges and troughs, but ridge orientations vary markedly in different areas.

In western Meshkenet Tessera there are two fault sets with different orientations. Several NW facing scarps defining the NW border of the area strike to NE-ENE. A linear NE-directed fault situated ~5-7 km southeast of the arcuate scarp at 66° N, 97° E could be a strike-slip fault. Several tessera ridges and a major trough-like NW-striking fault seem to be slightly offset by this fault. The trough-like fault cuts through the tessera and divides it into two parts with different ridge orientations and surface morphologies. This ~5 km wide fault is quite fresh-looking, but evidently older than the NE-directed fault near the tessera border.

Two arcuate almost parallel faults with a NW orientation locate to the east of the trough-like fault. These structures are characterized by distinct NE-facing walls. Some N-NNE-striking ridges cross the faults almost undisturbed indicating that the ridges could be younger than the faults or the movement along the faults has been mostly vertical, although the strike-slip component can not be completely ruled out. On the plain south of western Meshkenet there is a zone of ridges which seem to follow the curving edge of the tessera.

The middle Meshkenet Tessera has a main set of northeastward concave NW faults which become more concave from NE to SW. The faults at 105°-107° E and 106.5°-108.5° E divide the tessera area into three blocks with an en echelon arrangement. The easternmost of these arcuate faults widens from 5 km in the NW to 25 km in the SE forming a trough between the tessera blocks. In the SW part of middle Meshkenet majority of the ridges have a N or NE orientation, but there are also ridges following the NW trend of the faults. Ridges on the block between large trough-like faults become longer and more sinuous from the NW to the SE mostly turning to NNW paralleling the large arcuate fault.

The faults east of the 107th longitude do not quite cut through the whole tessera block and several long ridges near the western tessera border cross them undisturbed. A few ridges near the NW corner seem to be displaced to the right by two narrow faults paralleling Gabie Rupes.

The en echelon arrangement of the tessera blocks indicates that the faults of middle Meshkenet are anticlockwise rotational right-handed faults. Rotation has been accompanied by dextral strike-slip faulting. Ridge orientations differ in each block so that pure strike-slip faulting would not produce observed block geometries and the widening of the largest trough-like fault. A small (~15 km across) triangle-shaped depression at 67° N, 109° E in an intersection of two faults could be a pull-apart basin formed in the area between two dextral strike-slip faults. The sinuous NWW-turning of ridges on the block between large arcuate faults resemble fault-related drag folding indicating possible sinistral movement after the initial block rotation and right-handed faulting. The ridge belt in the trough between middle and eastern Meshkenet Tessera constitutes of linear or dextral en echelon ridges with a NW orientation. This area could have been formed when the middle and eastern Meshkenet blocks moved apart but it could also be a shear zone between the two tessera blocks.

Eastern Meshkenet Tessera is cut by two cross-cutting fault systems. The ENE-trending faults are very narrow and sharp, fresh looking features. The WNW-oriented faults are wider, subdued and older looking. The angle between the fault systems is 40° to 60°. In the middle of the tessera there is a fault-bordered wedge-shaped tessera block with distinct parallel ridges. These ridges are discontinued by the southern bordering fault. If the wedge-shaped block is moved back about 20 km eastward along the ENE fault, there is a place where the ridges...
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on the block have clear continuations on the southern side of the fault. This indicates that the ENE fault is a left-handed strike-slip fault with an observed displacement of 20 km. The strike-slip nature of the other ENE-trending faults is also probable. Horizontal displacement along the WNW-oriented faults is not so evident. Majority of the ridges in eastern Meshkenet Tessera are very linear and long with N/NNE direction. On the plain north of eastern Meshkenet there are two ridge sets: sinuous NE-trending and long E-W directed arcuate ridges.

Conclusions. Rotational and strike-slip faulting, and compressional stresses all influenced the tectonics of Meshkenet Tessera. Three major tectonic phases contributed to the deformation of Meshkenet Tessera: (1) N-S directed compression, (2) E-W oriented compression and (3) horizontal forces resulting from the formation of the major volcanic/volcano-tectonic structures of the area.

The N-S compression is indicated by the E-W oriented ridge arches situated on plains north of Meshkenet Tessera between 68°-72°N. The conjugate faults and tessera blocks of middle and eastern Meshkenet also support the idea of a N-S compressional force. Beside conjugate fault sets this compression could have caused the observed offset of the wedge-shaped block along the ENE fault. This block movement is not possible in a tensional environment.

The en echelon configuration of middle Meshkenet Tessera could have been formed by anticlockwise rotation and dextral faulting in strong N-S compression. A 'bookshelf'-type mechanism could be possible if E-W directed shear was also involved in the area. The lateral faulting and accompanying block rotations could explain the observed fault features and are also known to have occurred widely on Earth (e.g. 8,9,10).

Prominent arcuate scarps connected to Ops and Tusholi Coronae seem to be thrust-like features resulting from E-W compression. The tectonic forces originating from volcanic areas around the tessera would contribute to this compression. There are also proof of N-S, NNE-SSW and E-W compressions in northern Fortuna Tessera (6) and in Audra Planitia (11). The origin of Meshkenet Tessera is difficult to trace. We, however, do not see any indication of the 'slide-like' tectonic development of Meshkenet Tessera proposed by Sukhanov in (12). The three tessera parts were earlier more closely connected to each other, possibly forming a single tessera unit, allowing the observed differences in lineament strike distributions to indicate the disruption and deformation by fracturing, lateral faulting and rotation.


Meshkenet Tessera consists of bookself-like set of parquet terrain blocks displaying various phenomena of rotational and strike-slip fault tectonics.