Meshkenet Tessera structures were mapped from Magellan data and several resemblances to chocolate tablet boudinage were found. The complex fault sets display polyphase tectonic sequences of a few main deformation phases. Shear and tension have contributed to the areal deformation. Main faults cut the 1600 km long Meshkenet Tessera highland into bar-like blocks which have ridge and groove patterns oriented along or at high angles to the faults. The first approach to the surface block deformation is an assumption of initial parallel shear faulting followed by a chocolate tablet boudinage. Major faults (a) which cut Meshkenet Tessera into rectangular blocks have been active repetitively while two progressive or superposed boudinage set formations (b, c) have taken place at high angles during the relaxation or flattening type deformation of the area.

Chocolate tablet boudinage is caused by a layer-parallel two-dimensional extension resulting in fracturing of the competent layer. Such structures, defined by two sets of boudin neck lines at right angles to each other, have been described by a number of authors (e.g. Ramberg, 1955; Ramsay, 1967; Casey et al., 1983; Ghosh, 1988). They develop in a flattening type of bulk deformation or during superposed deformations where the rock is elongated in two dimensions parallel to the surface. This is an attempt to describe and understand the formation and development of structures of Meshkenet Tessera which has complex fault structures.

Western Meshkenet Tessera has several parallel and conjugate fault directions. Offsets along NW-SE faults indicate their deformation by conjugate NE-SW faults. In the south faults have also a N-S orientation while the eastern faults have both conjugate NE-SW and NW-SE orientations. Middle Meshkenet Tessera is cut into few blocks offsetted along the faults. Some arcuate faults have parallel ridge-groove counterparts indicating horizontal displacements. In places young ridges cross main fault troughs. Western N to NNE ridges cross NW-SE faults. Gabie Rupes is paralleled by long NW-SE ridges and faults. Eastern Meshkenet Tessera is cut by fault systems. The NW, WNW and ENE faults and ridges characterize wedge-shaped tessera blocks which are bordered by wide E-W troughs in the south. Ridges also cross major troughs, bend beside the trough or match on opposite sides of the trough. While connected ridges indicate late ridge development the bending ridges display strike-slip faulting.

The surface at Meshkenet is sandwich-like and displays two-dimensional structures, possibly formed in a suitably oriented brittle layer with a relaxation of flattening bulk deformation from tensional strain in the underlying matrix. Primary main faults may have been generated by independent faulting. The ductile flow in the underlayer may then have been caused either by layer-normal compression or gravity relaxation of the topographic height. The boudinaging of Meshkenet Tessera could have taken place by action of viscous force acting from below. Tessera areas represent elevated surface units on a planet the surface temperature of which is close to the Curie point. The high surface temperature together with high lithospheric temperature gradient results in thin brittle crustal or lithospheric units over mobile layers, or asthenosphere. The brittle plate units may have floated on the underlying viscous matrix layers which have stucked firmly to the plate and caused effective viscous drag to it. The initiation and evolution of resulted fractures lets us trace evidences of the fracturing mechanism, the viscous drag and make comparisons to the laboratory experiments (Ghosh, 1988).

A certain fracture set may be formed perpendicular to the long axis of a bar-like plate independent to the orientation of the maximum extension. This set is entirely controlled by the plate geometry, not by the actual stress direction. The matrix flow opens caps between the parallel boudins and breaks them into rectangular fragments along the development of fractures perpendicular to the bars. With progressive deformation tensional...
CHOCOLATE TABLET OF MESHKENET TESSERA: Raitala, J.

Fractures are later formed at perpendicular to the first set. In relaxational or flattening deformation this second set is independent of extensional direction but at right angles to the first faults. Along superposed deformation of chocolate tablet boudinage long, narrow first boudins are cut by second generation boudinage structures despite of the orientation of the strain directions, resulting in two sequences of orthogonal fractures (Ghosh, 1988).

Previous faults cause parallel and perpendicular fractures, i.e. longitudinal and transverse boudins. With lineation roughly parallel to the maximum tensile stress the longitudinal fractures are generated first. With lineation roughly perpendicular to the maximum tensile stress the first fractures are either longitudinal or transverse ones depending on the strength of the plate and the ratio of the two tensile stresses (Ghosh, 1988).

The crossing boudinage sets may have generated either during a progressive deformation or unrelated superposed deformations. Progressive deformation allows some analysis of the stress field while in the second case only some aspects of stresses are evident. All previous or additional structures further complicate the situation and make the interpretation more difficult. Boudinage in narrow oblique rectangular plates with uniaxial extension produces secondary boudins perpendicular to the first boudin axis. In the case of previous faults the final geometry may even be independent on the deformation axis.

The two fracture sets on the Meshkenet Tessera blocks may indicate that the surface-parallel strain rates have been rather directed than equal in all directions. The long dividing and shorter perpendicular faults are necessary not simultaneous but may display either progressive faulting or superposed deformation (Ghosh, 1988): With continuing tension and long first boudins the local medium tensile stress along the bars may become large enough to break long boudins and the two fractures form in successive alternative steps resulting in a complex boudinage faulting in two cross-cutting directions. A pre-existing lineation may also modify the boudinage development by decreasing the strength of the surface plate and resulting in the first extension fracture set while the second fracture set develops at right angles to it. Successive unrelated deformation phases may cause that neither of the sets are indicative for the strain even if the produced two fault boudin axis are at right angles to each other. This is the case with first long and narrow bars or a uniform second phase over the whole area. The second faults are mostly defined by the first set. Simultaneous fracturing might play a role within an individual block with a large underlayer deformation before any fracturing.

Meshkenet Tessera has cross-cutting faults similar to the chocolate tablet boudinage modified by pre-existing faults. The development of the fractures has been caused by two-dimensional boudinage with certain pre-boudinage faulting. Meshkenet Tessera was originally faulted with the boudin axes running parallel to the faults and the neck lines at a high angle to the faultsm The strain rate may have been different parallel and perpendicular to the faults. Relaxation or flattening deformation was able to produce tensional fractures in one direction while the ductile flow across caused alternative compression-extension structures. Pre-existing faults and fault-induced lineation may have favoured boudins along the lineation over those across it, even if the maximum extension is not normal to the lineation. Although Meshkenet Tessera has effective fault-parallel fractures also perpendicular ones are well-developed indicating at least a two-phase boudinage formation.