TECTONICS OF THE GROOVED TERRAIN ON GANYMEDE

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Large areas of grooved terrain occur on Ganymede. These terrains are regions with a complex tectonic framework characterized by intersecting systems of grooves showing different orientation and density and by areas with barely discernable structures or totally smooth.

A statistical analysis of the azimuthal frequency distribution and of the density of the structures observed has been carried out on some of the widest Sulci. Two main types of tectonic structures have been considered: a) features with a well defined graben-like morphology with smooth floor bounded by sharp rims and b) typical grooves sets. For this study all the areas characterized by almost the same orientation of grooves have been considered as single domains. The distinction between structures (a) and (b) is only morphological and does not imply any speculation on the age of the structures.

The aim of this study is: to investigate the spatial distribution of the grooves in order to establish possible correlation between grooving and main tectonic structures of the grooved regions; to analyse the grooves density distribution in order to evaluate the major directions of stresses which determined their formation.

Figure 1 shows the azimuthal frequency distribution and the cumulative length distribution of the grooves in the Uruk Sulcus region. This region is $\sim$350 km wide, it extends for $\sim$2200 km and it covers an area of approximately 9×10^5 km^2. Two main tectonic trends are observable: the first one appears to be broadly spreaded in the NW direction and is associated with a slight decrease in grooves frequency northward;it includes more than 60% of all the measured grooves. The second is NNE oriented with a spread of about 30° and it includes about the 20% of the grooves. The first trend shows that the majority of the grooves is preferentially oriented almost parallel with the direction of the Sulcus (WNW) while the second high concentration of grooves is almost perpendicular to the global trend of the Sulcus itself. The last ones are also the longest grooves measured on the area as we can see from the cumulative length distribution in figure 1. The presence of these two directional trends indicates that probably most of the grooves domains have been subjected to the same stresses which interested the whole Sulcus.

The histogram in figure 2 represents the distribution of the number of grooves per unit length. The number on top of each column indicates the percentage area whose grooving density is indicated in the corresponding class (D). It is important to note

that the grooving density is completely concentrated within the 0-0.5 range where the highest values correspond respectively to the classes whose central values are 0.15 and 0.25. In spite of this concentration of the grooves density we observed a variation of density according to the orientation of the grooves. In fact the grooves domains which cover most of the area of Uruk Sulcus (61.5% in Fig. 2) are characterized by a relative low density and are oriented prevalently in direction perpendicular (NNE) to Uruk Sulcus main orientation. The remaining area includes grooves domains varying their orientation from NW to Uruk Sulcus direction (WNW) with increasing grooves density.

Finally, this analysis leads to interprete the tectonic framework of the Uruk Sulcus region as the result of a unique tectonic event and to consider the grooving mechanism somehow related to the formation of the main structures of the region and apparently not to local stresses.

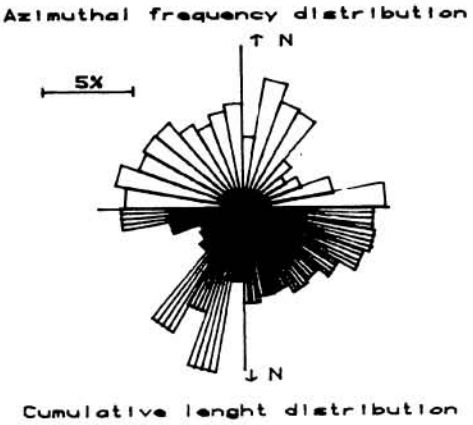

Fig. 1 - Uruk Sulcus Grooves Distribution

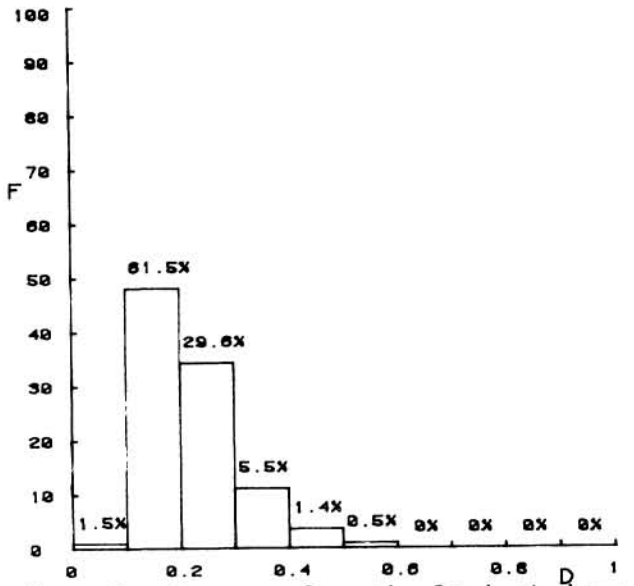

Fig. 2 - Grooves Density Distribution in the Uruk Sulcus