AZIMUTHAL DISTRIBUTION OF THE GROOVES ON GANYMEDE

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Grooved terrain on Ganymede is one of the most puzzling feature among those characterizing the surfaces of the solid bodies of the Solar System. Many authors have studied this peculiar tectonic feature to determine the thickness of the ice layer in which they formed (1) or to evaluate the expansion of the lithosphere of Ganymede, assuming the grooved areas as the result of extensive tectonics (2).

The origin of the grooves is another unsolved problem in interpreting the geology of Ganymede. Grooves occur in peculiar patterns: they form belts of changing width or areas characterized by several grooves domains with different geometric patterns (3). A statistical analysis of the azimuthal frequency distribution and of the density of the grooves has been performed on some of the widest Sulci (4). This analysis was focused mostly on the Uruk Sulcus region and the results obtained suggested the hypothesis that grooves formed due to regional tectonic regimes rather than to local stresses. This conclusion was carried out considering globally the grooves azimuthal distribution for all Uruk Sulcus. We have now extended the study of the grooved areas in order to follow the variations of the grooves orientation in greater detail.

In fig. 1 is shown an example of the preliminary results concerning an area of Ganymede surface between 110°-180° longitude and 30°N-40°S latitude. The area includes the Uruk Sulcus region and other areas east and south of Uruk Sulcus. Grooves azimuthal frequency distribution have been computed in 10° x 10° geographical grids. The upper part of each graph represents the azimuthal distribution, the lower part is the cumulative length distribution. The bar in the upper left of each plot is the 10% of the grooves in each grid; in the lower left is also indicated the total number of grooves. This representation indicates the distribution of the grooves in different portions of the area under study.

The analysis of the rose diagrams of fig. 1 shows that the extension of Uruk Sulcus is characterized by azimuthal distributions of the grooves different than those of the adjacent areas. To emphasize the main grooves trends belonging to each Sulcus we selected from each rose diagram the most representative orientation by means of histograms, two examples of which are given in fig. 2. In the histograms each class is the sum of three consecutives classes of the corresponding rose diagram (for a total range of 30°); the step between two adjacent classes is 10° (the number of grooves in each class is also given). In this way we can select the pref-

erential azimuthal orientation for each grid, represented by the peaks of the distributions of fig. 2.

By means of this method it is possible to describe the main grooves trends across all the grooved areas of Ganymede. In particular the method is very useful for those areas with complex grooves domains patterns.

Extending the analysis to the whole satellite we are able to reconstruct the main trends of the tectonic regimes that acted on Ganymede surface determining the formation of the grooved terrain.

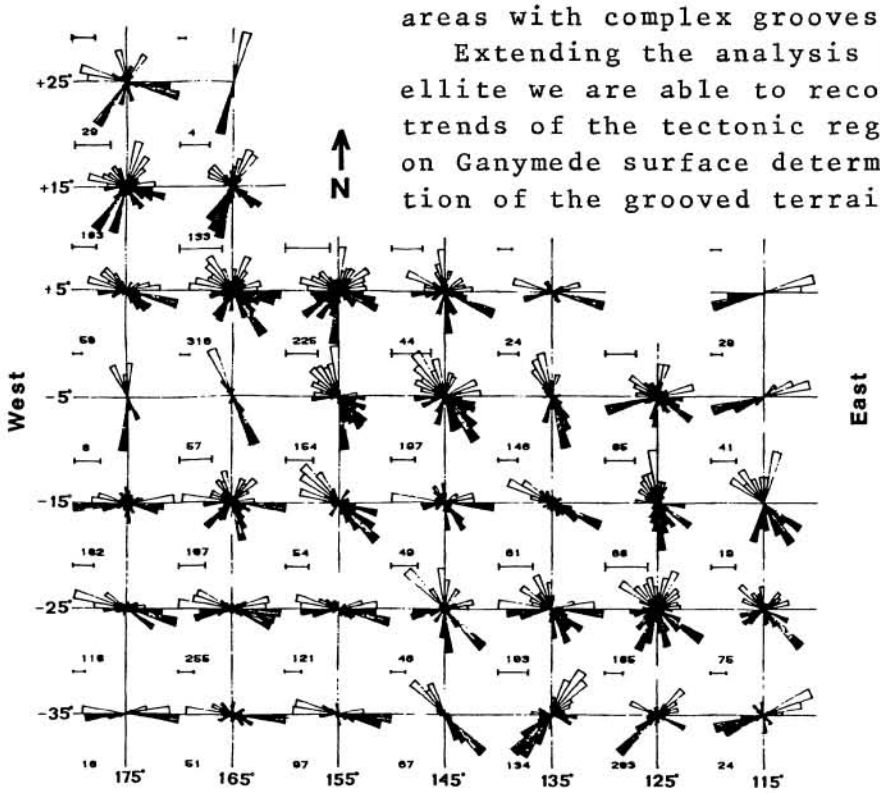

Fig. 1

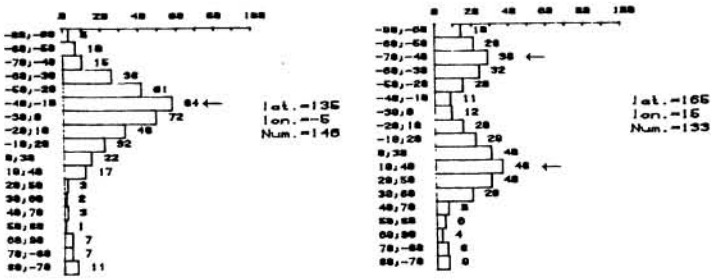

Fig. 2

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