CYCLIC DEFORMATION EVENTS IN THE REGION OF GULA AND ACHELOUS CRATERS, GANYMEDE. C. Rossi[1], L. Penasa[1], A. Lucchetti[1], F. Tusberti[1], J. Beccarelli[1], R. Pozzobon[2], M. Pajola[1], G. Munaretto[1], M. Massironi[2]. [1]INAF - Astronomical Observatory of Padova, Padova, Italy (costanza.rossi@inaf.it); [2]University of Padova, Department of Geoscience, Padova, Italy.

Introduction: Ganymede is the largest satellite in the Solar System and, among the icy satellites of Jupiter, it represents a fully differentiated body with the lowest moment of Inertia of 0.3115. Its icy crust covers a subsurface ocean at depth around 100-130 km [1], where an internal conducting layer rich in electrolytes such as salts and acids (or convection in a viscous iron core) allows the generation of an intrinsic magnetic field [2], also evidenced by auroral emissions [3]. Its surface is subdivided into two main terrains, i.e. the oldest dark terrain and the youngest light that is deformed by tectonic landforms [4]. Such structures are the grooves [5] and are mostly formed by extensional and strike-slip regimes [6, 7]. However, the tectonic processes responsible for such strong deformation are still unclear, although tidal heating in the crust in response to dynamical resonance with the neighborough Io and Europa is assumed to as one of the main sources of stress [8].

Moreover, impact cratering has also shaped Ganymede surface that shows large variety of crater units, ranging from degraded to fresh [4]. Located at approximately NE of Perrine Regio and N of Aquarius Sulcus (62°N, 12°W), Gula and Achelous craters represent the type locality of such units, at Galileo high resolution of 178 m/pixel. These craters show similar diameter of approximately 40 km and a close proximity of approximately 50 km of distance.

Gula is a partially degraded crater with a lower albedo than the surrounding material, lack of rays and a deposit of continuous ejecta surrounding its rim. Further south, Achelous is a fresh crater characterized by high albedo and continuous double-layer ejecta that surround its rim [4]. It has been classified as rampart crater accompanied by distinctive ejecta features fluidized during their emplacement [9].

Both craters overlap a light terrain that shows sets of grooves with an apparently chaotic crosscutting relationship.

In this contribution we explore the geology and the structural setting of Gula/Achelous region in order to understand i) its evolution and ii) the cause of the occurrence of close craters with same dimension and different degradation level.

Methods: We investigated the Gula/Achelous region by performing geological and structural mapping on GIS environment.

Geostatistical analysis has been performed to quantify the azimuthal distribution of the identified structures and their crosscutting relationships.

Moreover, numerical modeling through SatStress code [10] has been computed to achieve the diurnal tidal stress tensor (available at https://code.google.com/archive/p/satstress/).

Results and discussion: We obtained preliminary results that allow to recognize a total of 6 sets of grooves mainly trending N-S and E-W, whose origin is ascribed to 7/8 main deformation events. Morphological and geometrical analyses allow to determine both extensional and strike-slip structures belonging to such sets. Moreover, crosscutting relationships allow to assume a periodic alternation of the N-S groove sets with the E-W ones that follow a 'crisscross' pattern. Such sequence of latitudinal (N-S) vs longitudinal (E-W) deformation is evidence of cyclical events that have affected Ganymede's surace and are responsible for the formation of the identified groove sets, which follow two main directions. Therefore, a process that hardly allows defined crosscutting relationship between groove sets since systematically follow the same directions that form new generation of structures with similar azimuth and characteristics. This is consistent with tidal stresses which have periodically modified the surface of the satellite.

Ongoing work is carried on to unravel open issues concerning crosscutting relationship between the groove sets, their relationship with the geological units, the crater locations and their ejecta deposits.

Conclusions: The region of Gula/Achelous craters is characterized by structural sets with two main orientations trending N-S and E-W and faint crosscutting relationship showing that cyclical deformation events have been responsible for their formation. Ongoing work by using numerical modeling is carried on to validate tidal heating as the main process that affected the study area.

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