Structural Analysis of Very High-Resolution Galileo Images of Europa: Implications for Surface Evolution

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Introduction

The Galileo Solid State Imager (SSI) obtained nine very high-resolution frames (eight at 12 m/pixel and one at 6 m/pixel) during the E12 flyby of Europa in Dec. 1997. To understand the implications for the formation of small-scale structures and surface evolution of Europa, we mosaicked these frames (observations 12ESMOTTLE01 and 02, incidence =18°, emission =77°) into their regional context (part of observation 11ESREGMAP01, 220 m/pixel, incidence =74°, emission =23°), despite their very different viewing and lighting conditions (“Image Mosaic”, below). Additionally, to gain a better understanding of Europa’s resurfacing processes, we created both a morpho-geological map and a structural map of the region (“Geomorphological Map” and “Structural Map”), expanding and modifying previous work in this area [1 and 2].

Image Mosaic

Geomorphological Map

Structural Map

Possible Evolution

Conclusions and Implications

The proposed evolutionary sequence is non-unique, but is a plausible option for how this area may have developed. The progression of this region from small-scale folding to larger-scale normal faulting and then to tensile cracking could be indicative of the ice-shell thickening over time. By further refining the classification of Europa’s structures at high-resolution, we can continue to refine the inferred stages of surface evolution on the icy satellite. Resurfacing processes and the surface evolution in this region have possible implications for the different suggested models for chaos formation [e.g., 4, 5 and 6] which depend on ice-shell thickness, and thus have implications for the interaction of the surface and the ocean.

Future Work

1) Further investigate plausibility of folding as a mechanism for ridge-trench formation on Europa (i.e.: calculate required stresses and physical analogue modeling)
2) Test candidate evolution model by comparing this area to other high-resolution regions of Europa.

References