PHOTOGEOLOGIC UNITS AND FRACTURE SYSTEMS IN THE EQUATORIAL AND MIDLATITUDE REGIONS OF CALLISTO. Wagner, R., and Neukum, G. DLR Oberpfaffenhofen, Inst. for Optoelectronics, Planetary Remote Sensing Section, 8031 Wessling, F.R.G.

Introduction. The surface of the least geologically evolved Galilean satellite Callisto has been the subject to geologic and tectonic investigations. Callisto's surface is characterized by densely cratered terrains (materials) and major impact basins such as Valhalla *(1, 2)*. It has been attempted to determine geologic units different in origin as well as crater retention ages. Two test areas were selected located in the equatorial and midlatitude regions of Callisto. Both test sites are not in the nearest vicinity of impact basins, hence fracture systems unrelated to major impact events may be discovered.
Image processing. The investigations are based on image mosaics from the Voyager 1 and 2 encounters with Jupiter in 1979 *(1, 2)*. The image data have been radiometrically and geometrically corrected. The Voyager 1 data have been photometrically corrected using the model presented by Squyres and Veverka *(3)*. Both Voyager 1 and 2 data sets have been projected to a Mercator grid using improved C-matrices and S-vectors supplied by Davies et al. (1989). To enhance high frequency details such as crater rims, lineaments and fractures, a highpass filter or a scene dependent filter have been applied. The filter box size has been 3x3 pixels to enhance even smallest details, and each filtered image has been added to the unfiltered version to keep the tonal characteristics of darker and brighter parts of the surface.
Photogeologic mapping of surface units is based on the Voyager 1 and 2 image mosaics shown in *figs. 1a,b*. The investigated areas are restricted to regions with sufficient image quality. Photogeologic units are identified in terms of albedo variations and apparent differences in crater density. For each unit, crater retention ages have been measured using a previously determined transformation factor of 2.4 for the lunar standard curve in the case of Callisto *(4, 5)*. No dependence of crater densities on latitude and longitude has been found *(4, 5)*, which is consistent with measurements performed by Croft et al. *(6)*. Crater densities also show no dependence on angular distance to the apex and antapex points of orbital motion, indicating a primarily planetocentric origin of impactors *(4, 5, 7)*. Five surface units may be distinguished (see *figs. 1a,b)*. Heavily cratered materials are subdivided in three subunits: ***HCT1*** is the most densely cratered and hence oldest unit. Craters have sharp rims, many crater floors contain central pits, some of these with raised rims. Unit ***HCT2*** is similar to HCT1, but HCT2 is less densely cratered and thus younger. Unit ***HCT3*** (unlabeled in *figs 1a,b)* occurs as isolated patches within units HCT2 and DCT. The craters are surrounded by ejecta blankets somewhat brighter than the underlaying units. Unit ***DCT (dark cratered material)*** shows a relatively dark intercrater surface less densely cratered than those of HCT1-3. Unit ***CT1 (cratered material, 1)*** is characterized by large craters (more than 30 km in diameter) and a lack of smaller craters. Some of the larger craters show subdued rims. Cumulative crater size frequency distribution for the diameter range 25 to about 60 km suggests a former heavily cratered unit resurfaced by some viscous fluids.
Lineaments and fractures: Mapping of lineaments and fractures has been carried out using image mosaics in a scale of 1:10,000,000 to outline the tectonic framework in the test areas. The maps (reduced in size) of both regions are shown in *figs. 2a,b*. Most of the tectonic features are dark albedo lineaments, fractures are subordinate in number. No concentric or radial fracture systems may be observed, therefore the fracture pattern may not be due to impact events. As the surface of Callisto has not undergone much resurfacing since the end of early heavy bombardment, the tectonic framework shown in the maps reflects strain that has occurred early in Callistos history. The major trend is an orthogonal lineament system with directions of 70° and 160°, and minor trends of 0 – 10° and about 110°. The major directions slightly differ from those found by Thomas and Masson *(8)*. They may best be correlated with a global grid caused by tidal effects *(9, 10)*. As Callisto has preserved most of its surface features since the time of the early heavy bombardment and does not experience tidal flexure sufficient for fracturing its lithosphere, the global trend of lineaments and fractures presented in this study is very likely caused by tidal despinning early in the history of Callisto.

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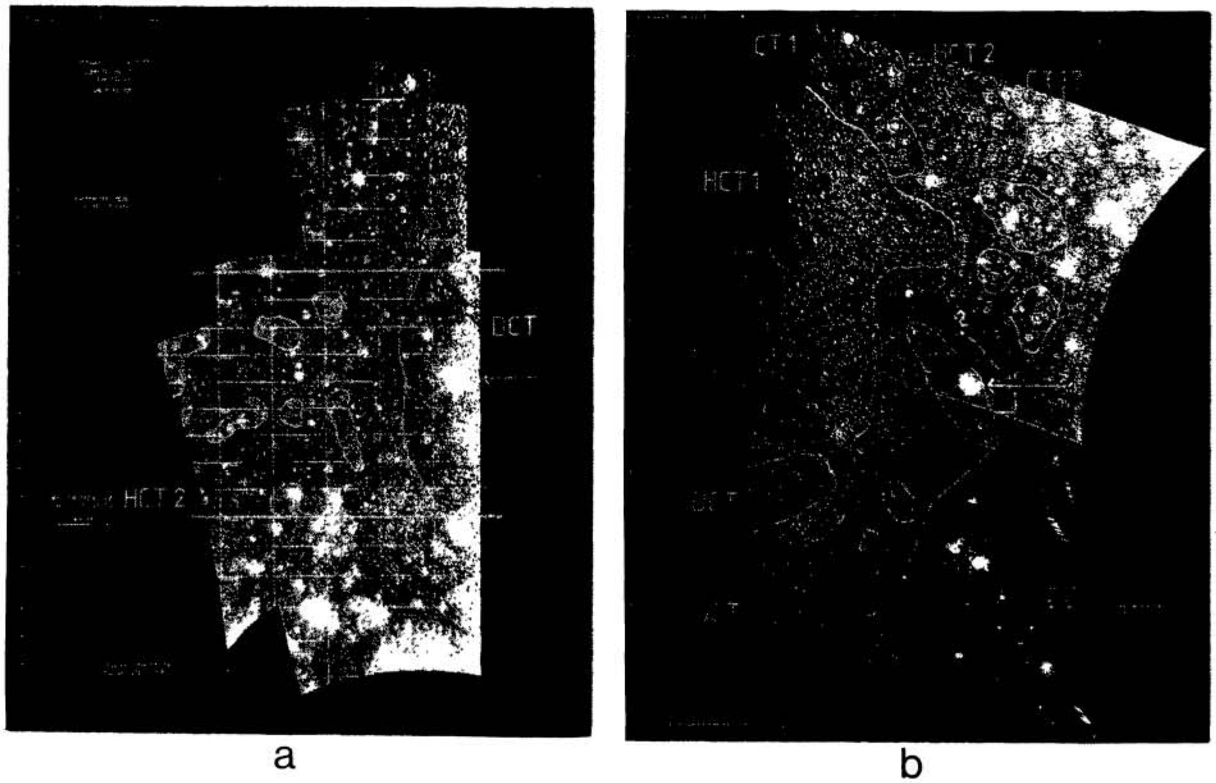

Figure 1. Image mosaics and photogeological units of the Igaluk (Voyager 1; fig. 1a) and Valfodr (Voyager 2; fig. 1b) regions (craters Igaluk and Valfodr indicated by arrows); (unlabeled unit: HCT3)

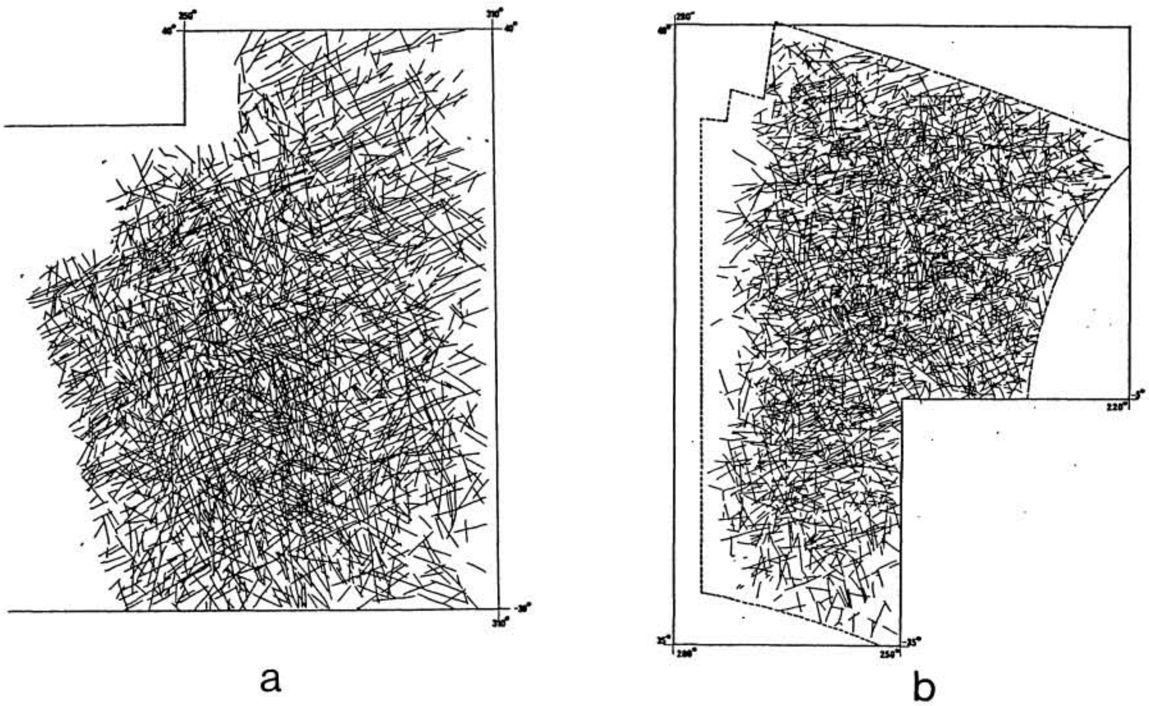

Figure 2. Lineament and fracture maps of the Igaluk (fig. 2a) and Valfodr (fig. 2b) regions