**GANYMEDE'S IMPACT CRATER MELKART: AN EXAMPLE FOR A COMBINATION OF HIGH-RESOLUTION SPECTRAL AND GEOLOGICAL ANALYSES IN THE OUTER SOLAR SYSTEM.** K. Stephan[1], R. Wagner[1], C.A. Hibbitts[2], G.B. Hansen[3], R. Jaumann[1], [1] DLR, Inst. for Planet. Res. Rutherfordstrasse 2, 12489 Berlin, Germany, [2]Applied Physics Laboratory, Laurel, MD, USA, [3] Planetary Science Institute, 22 Fiddler's Rd., Winthrop WA 98862-0667, USA (Katrin.Stephan@dlr.de).

**Introduction:** Despite the identification of the spectral, i.e. the chemical and physical properties of an icy satellite's surface it is essential to know their spatial distribution in order to identify the source of specific compounds or physical properties. Since the Galileo mission hyperspectral mapping spectrometers have been produced so-called "image cubes" that relate individual spectra to specific areas on the planetary surface in the outer solar system with sufficient pixel ground resolution. They allow attributing surface properties to specific points on the planetary surface e.g. geological and morphological surface features.

The Jovian satellite Ganymede is a unique object to study relationships between chemical and physical surface properties and geological and/or morphological surface features. Esp. geological features like impact craters of various surface composition, sizes, morphologies and crater retention ages as well as tectonic surface features (e.g. Sulci) are of special interest. Additionally, Ganymede's magnetic field offers the exclusive opportunity to study the effects of incoming energetic particles from Jupiters' magnetosphere upon the surface properties.

However, spatial highly-resolved spectral (and imaging) data are very rare and concentrated more or less completely on the anti-Jovian hemisphere up to now. Only two local regions were simultaneously observed by the Near Infrared Mapping spectrometer (NIMS) [1], acquiring spectra between 0.7 and 5.2 µm, and the Galileo Solid State Imaging (SSI) camera [2] with relatively high spatial resolution. We chose the NIMS observation of the impact crater Melkart at 10°S/ 186°W, illustrating the potential to combine high resolution data to investigate its spectral properties as well as the stratigraphic position, morphology, and relative and absolute crater retention age.

**Geological and spectral characteristics of Melkart:** Melkart is one of Ganymede's central dome craters with a diameter of 105 km. It is partly located within the dark ancient cratered terrain of Marius Regio and within the younger bright grooved and smoothed terrain (small area extending from southern Sippar Sulcus). A linear tectonic feature characterizes the transition between the two different substrates across the crater area. Figures 1 and 2 show results of analyzing the NIMS observation G8GNMELKART (spatial resolution of ~5 km per pixel) with respect to the simultaneously acquired Galileo SSI image (global context is provided by Voyager images). In general, the NIMS spectra of the crater deposits show a mixture of water ice and rocky non-ice contaminant (including the absorption of $CO_2$ at 4.25µm. Two spectral endmembers could be defined in the observed area. Spectra with a relatively high amount of water ice and weak absorptions of $CO_2$ (band depth of about 10%) characterizes the impact crater itself and the region of the bright grooved and smoothed terrain, whereas Marius Regio exhibits a distinct higher spectral influence of the dark rocky contaminant(s) and a deeper $CO_2$ absorption (band depth of max. 26%). No spectral variations occur that distinctly separate the impact crater itself from its substrate (i.e. the bright grooved terrain). This is consistent with Melkart's relatively high crater retention age of max. 3.77 Gyr (3.85 Gyr on the crater floor) [3, 4]. This corresponds to the crater retention age derived for the grooved and smoothed terrain in general of about 3.6 - 3.9 Gyr [5] and an advanced equalization of the spectral properties between impact crater and substrate due to space weathering processes including impacts of micrometeoroids and thermal sublimation processes.

In addition, there are no variations between the crater material and the dome material. Only towards the crater rim which is located within Marius Regio the abundance of water ice is decreasing. However, this does not correspond exactly with the tectonic border between the younger bright grooved and the ancient dark terrain. Darker material within the impact crater is supposed to be the result of later mass wasting processes of darker material originating in Marius Regio into the crater area rather than of the impact itself. This indicates that in deeper regions (<10km) no distinct variations between the two major terrain types of Ganymede occur supporting the results of [6] that the dark material only represents a thin veneer of dark material over an icy crust.

Sizes of the water ice particles do not vary distinctly within the entire observed region. All spectra exhibit particle radii of ~ 200 µm distinctly larger than measured for fresh impact craters (~10µm) [7]. Melkart's particle radii correspond to the global distribution of particle radii derived for the anti-Jovian hemisphere at latitudes of ~ 10°S [7] and are supposed to be caused by sublimation processes that dominate the equatorial region of Ganymede.

**Conclusions:** The impact crater Melkart represents an example for the combined analysis of high-resolution spectra and imaging data. These data make it possible to map spectral variations not only of the impact crater correlation to the specific substrate but also within the impact crater itself. Comparable data of impact craters on Ganymede could give more inside into the impact process itself. Especially, observations of fresh impact craters could reveal the source of volatiles in the surface material on Ganymede like $CO_2$.

**References:** [1] Carlson, R. W. et al., *SSR*., 60, 457-502, 1992; [2] Belton, M. J. S. et al., *SSR*, 60, 413-455, 1992, [3] Stephan, K. et al., *LPSC XXXIV*, abstract No. 1687, 2003; [4] Wagner, R. et al., *LPSC XXIX*, abstract No. 1818, 1999; [5] Neukum, G. et al., *LPSC XXX*, abstract No. 1742, 1998; [6] Stephan, K. et al., *LPSC XXXVI*, abstract No. 2061, 2005 [7] Prockter, L. M. et al., *Icarus*, 135, 317-344, 1998.

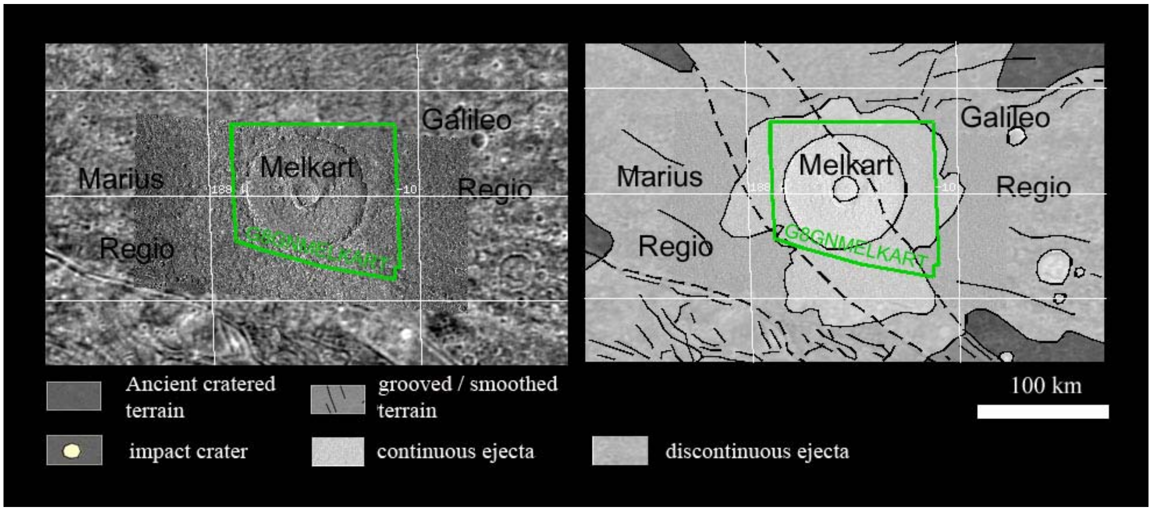


Figure 1: Geological context of the NIMS observation G8GNMELKART

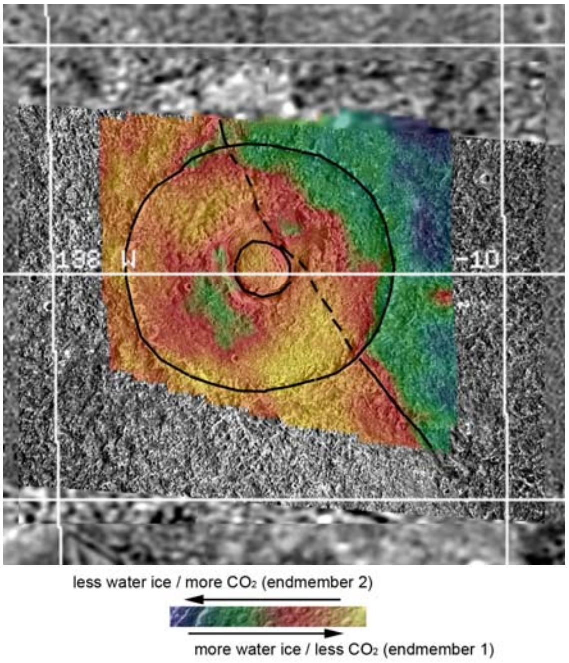


Figure 2: Distribution of the two spectral endmembers (see text) in the observed region.