CONSUS CRATER ON CERES: A MULTI-COLOR LITHOLOGY IN AN OLD IMPACT FEATURE.

A. Nathues[1], R. Sarkar[1], M. Hoffmann[1], J. Hernandez[1], P. Singh[1], G. Thangjam[2], J.H. Pasckert[3], N. Schmedemann[3], K. Mengel[1], and E. Cloutis[4]

[1]Max Planck Institute for Solar System Research, Justus-von-Liebig-Weg 3, 37077 Göttingen, Germany nathues@mps.mpg.de; [2]School of Earth and Planetary Sciences, National Institute of Science Education and Research, NISER, HBNI, Bhubaneswar, India; [3]Institut für Planetologie, WWU Münster, Germany; [4]Department of Geography, University of Winnipeg, Canada

Introduction: The dwarf planet Ceres is the largest (~940 km diameter) object in the main asteroid belt, orbiting the Sun at a distance of ~2.8 AU. Ceres is a survivor of the earliest period of the Solar System and thus a detailed knowledge about its interior provides fundamental insights into the formation and evolution of volatile-rich planetary embryos.

Consus crater (diam. ~64 km) [1] is an old (Fig. 1) yet spectrally diverse impact feature on Ceres (Fig. 2). We studied Consus using color and clear filter imagery obtained by Dawn's Framing Camera [2] from different orbits. The goal is to improve our understanding of the structure of the Cerean crust by analyzing prominent impact features.

Geology: Consus is located in a geologic unit termed 'cratered terrain', slightly south-east of Hanami Planum [3]. The crater exhibits post-impact inward wall slumping and eroded terraces in the northwest (Fig. 1). On its eastern floor a 15 x 11 km impact crater formed ('large floor crater') that excavated bright materials. The brightest feature (reflectance up to ~0.13 at 0.56 µm) is a fresh ejecta field, excavated by a ~0.2 km diameter impact crater, located on the eastern rim of the large floor crater. The Consus floor, central peak, and walls, with the exception of some areas on the eastern and southern rim, do not show bright outcrops as other larger Cerean craters do.

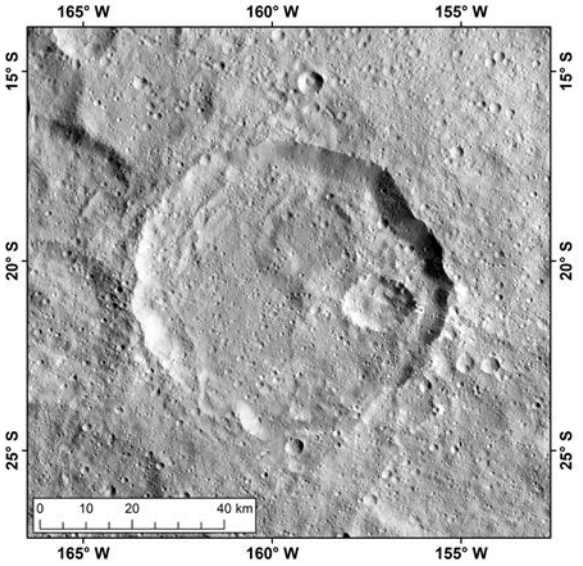

Figure 1: *Clear filter mosaic of Consus (~35 m/px).*

The floor shows different terrains caused by slumping and impact processes (Fig. 3). The ejecta field is ambiguous and heavily eroded.

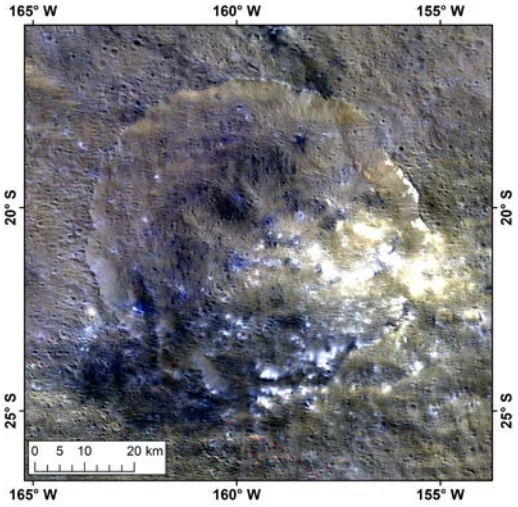

Figure 2: *Photometrically corrected color mosaic (R= 0.96, G=0.75, B=0.44 µm) at pixel scale ~140 m. Yellowish bright material covers partly the eastern rim of Consus and some parts of the inner wall of the large floor crater.*

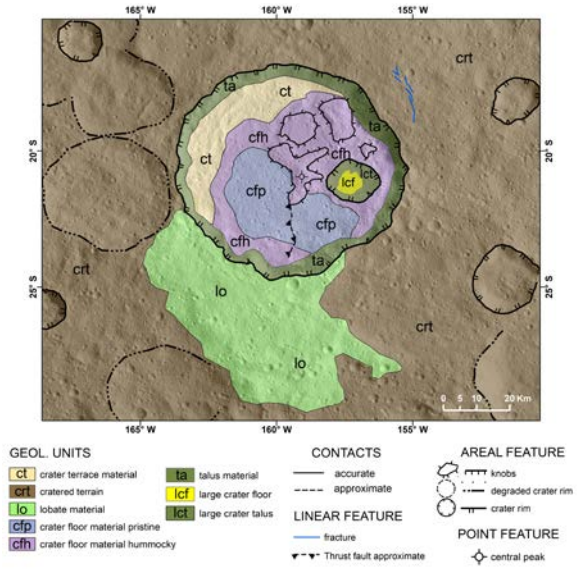

Figure 3: *Our geologic Consus map (mapping scale: 1:500,000).*

Consus' color lithologies: The crater shows a high spectral diversity (Fig. 4), significantly larger than many craters of similar size and age. We identified the following lithologies: 1) bright material (BM), 2) yellow bright material (yBM), 3) bright intermediate material (BIM), 4) bright blue material (BBM), 5) dark blue material (DBM), 6) dark reddish material (DRM), 7) dark material (DM), and 8) Consus background material (CB).

Remarkable is the appearance of three different types of bright material that exhibit different spectral shapes. These bright materials are partly ejecta of the large floor crater and are the main subject of our ongoing study.

We are exploring three main hypotheses for the causes of these color variations: (1) differences in the physical and/or compositional properties of the opaque minerals that cause the overall low albedo of Ceres and are expected to dominate reflectance spectra of carbonaceous chondrite-type materials; (2) variations in physical properties between the different terrains; and (3) space weathering. By combining FC data with compositional data derived from VIR data, geomorphology, and relative surface ages, we hope to constrain the causes of the color variations.

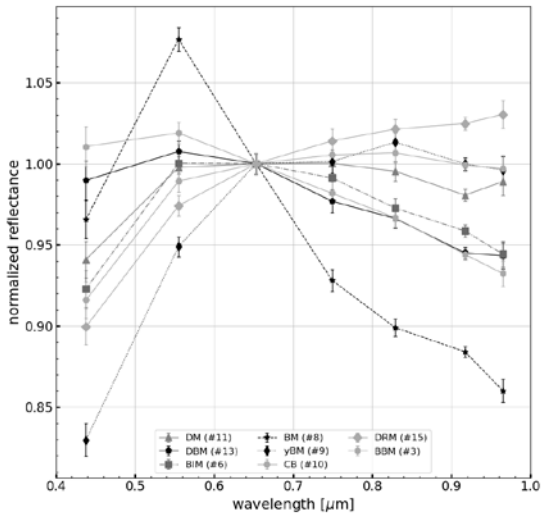

Fig. 4: *Normalized color spectra of lithologies identified in Consus. Dashed spectra belong to lithologies whose reflectance is > 0.035 at 0.56 µm, while continuous lines belong to those lithologies showing lower reflectances.*

Lower reflectance could basically be created by aromatization of the organic component of the carbonaceous Cerean material, but that would be associated with a slight reddening while the DM and DBM in Consus tends to be neutral to slightly blue sloped. A decrease of grain size, which should correlate with increasing age, would lead to a gradual reddening of spectral slope and increase in reflectance. However, if decreasing grain size leads to more effective dispersal of opaques, spectral slopes would become bluer.

Preliminary Conclusions: Consus is an interesting Cerean impact feature that, despite its old age (~1Ga) shows a multi-color lithology. Some of the observed color lithologies are rare on Ceres and thus their appearance is likely related to specific processes which acted in the Cerean crust. We intend to report new findings that help in understanding the structure and composition of the Cerean crust.

References: [1] e.g., Longobardo et al., Icarus **318**, 241 – 250 (2019); [2] Sierks et al., Space Sci Rev **163**, 263–327 (2011) ; [3] e.g., Buczkowski et al., JGR Planets **123**, 3188–3204 (2018)