COMPOSITIONAL MAPS OF CERES SURFACE: THE AHUNA MONS REGION. A. Raponi[1], M.C. De Sanctis[1], M. Ciarniello[1], F. Zambon[1], F. Tosi[1], E. Ammannito[1,2], F. G. Carrozzo[1], A. Frigeri[1], F. Capaccioni[1], M.T. Capria[1], S. Fonte[1], M. Formisano[1], M. Giardino[1], A. Longobardo[1], G. Magni[1], E. Palomba[1], C. M. Pieters[3], C. A. Raymond[4], C. T. Russell[2] and the Dawn Science Team, [1]Istituto di Astrofisica e Planetologia Spaziali, Istituto Nazionale de Astrofisica, Rome, Italy (andrea.raponi@iaps.inaf.it), [2]University of California Los Angeles, Earth Planetary and Space Sciences, Los Angeles, CA-90095, USA, [3]Dept. Earth, Environmental, and Planetary Science, Brown University, Providence, [4]Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA-91109.

Introduction: Topic of this work is the model of the Ceres' surface composition based on the data coming from the VIR instrument [1] onboard Dawn [2].

The Dawn spacecraft reached Ceres in early 2015, starting a thorough observational campaign at three different orbital altitudes.

The Visible InfraRed (VIR) mapping spectrometer combines high spectral and spatial resolution in the VIS (0.25-1μm) and IR (1-5μm) spectral ranges.

Here we focus on the data obtained from the Ahuna Mons region, a pyramid shaped mountain, unique on the Ceres' surface, and a near hexagonal crater.

The Ahuna Mons data were acquired by VIR during the HAMO (High Altitude Mapping Orbit) with a nominal resolution of ~370 m/px.

Method: In order to model the measured spectra, we have taken into account Hapke's radiative transfer model [3], which allows one to retrieve the relative abundances of the spectral end-members. The optical constants of the spectral end-members are obtained by applying the methodology described in [4] to IR spectra reflectance obtained from the RELAB database. The observed spectra of Ceres surface are affected by thermal emission at wavelengths longward of ~3 μm which prevents a comparison with laboratory data. Thus to model the whole wavelength range measured by VIR, the thermal emission is modeled together with the reflectance, thanks to the link between emissivity (ε_λ) and the single scattering albedo (w): $\varepsilon_\lambda = H(\mu,w) \times \gamma(w)$, being μ the emission angle and H the Ambartsumian-Chandrasekhar function [3]. For further details on the method, see reference [5].

Results: The possible end-members responsible for the spectral features on Ceres are those suggested by [6]: Mg-phyllosilicate (antigorite), NH_4-montmorillonite, carbonates (mainly dolomite) and a dark material (magnetite). For each pixel, we model the reflectance spectrum as a mixture of those components. Abundances of the end-members are retrieved and projected on the Ceres surface. The Ahuna Mons presents clear differences with respect to the surrounding region, in particular more carbonates, less ammonium montmorillonite, and an asymmetric distribution of the Mg-phyllosilicate.

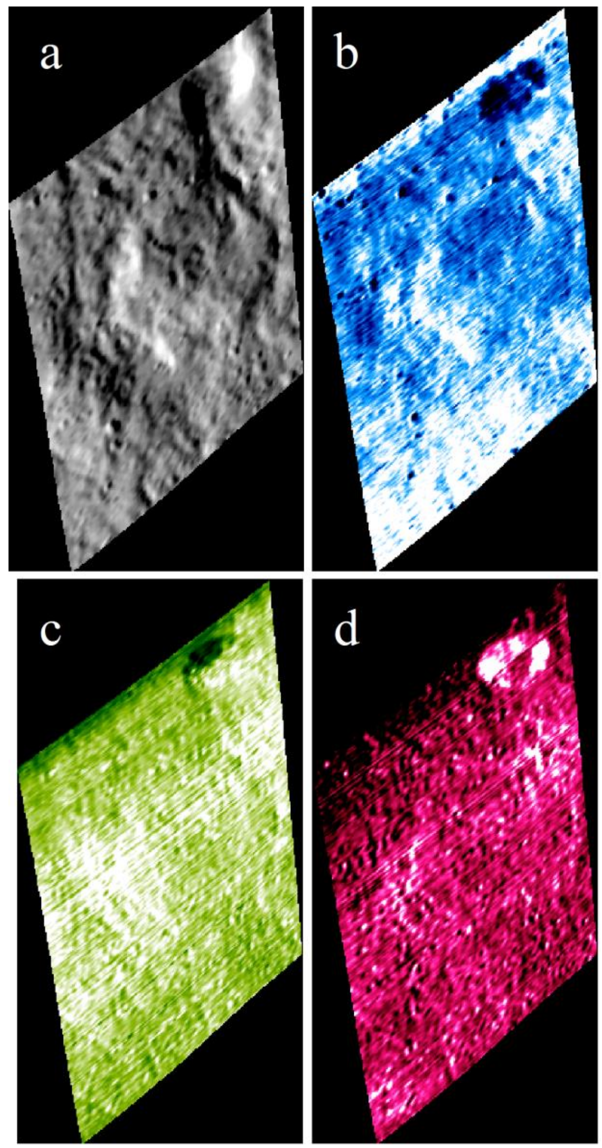

Figure. Panel a: context image at 1.7 μm. Ahuna Mons (310.5°E, 11.5°S) is on the top of the image. Panels b, c, d: abundances of the endmembers: ammonium montmorillonite (b), antigorite (c), carbonates (d). Stronger color indicates weaker abundance of the end-member. Stripes are produced by flat field artifacts.

As shown in the figure, the content of carbonates on the sides of Ahuna Mons stands out against the background, while the top of the mountain presents a composition similar to the average one.

The compositional model should not be affected by the different illumination conditions, because the model takes into account the viewing geometry information. This is confirmed by the maps of abundances of Ahuna Mons which present a similar behavior on both sides of the mountain regardless their exposure to solar radiation. However subtle contrast of abundances can be produced by a weak correlation with the viewing geometry as it could be the case of the crater rim.

References: [1] De Sanctis M.C. et al., Space Sci. Rev., DOI 10.1007/s11214-010-9668-5 , 2010.
[2] Russell, C.T. and C. A. Raymond, Space Sci. Rev., 163, 3-23, 2011.
[3] Hapke B., Cambridge Univ. Press., 1993, 2012
[4] Carli, C. et al., Icarus, 235, 207-219, 2014.
[5] Raponi, A. PhD Thesis, arXiv:1503.08172, 2015.
[6] De Sanctis, M.C. et al., 2015. Nature 242, 528.

Acknowledgements: VIR is funded by the Italian Space Agency–ASI and was developed under the leadership of INAF-Istituto di Astrofisica e Planetologia Spaziali, Rome-Italy. The instrument was built by Selex-Galileo, Florence-Italy. The authors acknowledge the support of the Dawn Science, Instrument, and Operations Teams. This work was supported by ASI and NASA. A portion of this work was performed at the JPL/NASA.