GEOLOGIC MAPPING OF THE AV-7 (LUCARIA) QUADRANGLE OF ASTEROID 4 VESTA.

V. Reddy[1,2], L. Le Corre[1], A. Nathues[1], D.A. Williams[3], W.B. Garry[4], R.A. Yingst[4], R. Jaumann[5], T. Roatsch[5], F. Preusker[5], C.M. Pieters[6], C.T. Russell[7], C.A. Raymond[8], [1]Max Planck Institute for Solar System Research, Katlenburg-Lindau, Germany (nathues@mps.mpg.de), [2]Dpt. of Space Studies, University of North Dakota, USA, [3]School of Earth and Space Exploration, University of Arizona, USA, [4]PSI, Tucson, USA, [5]DLR, Berlin, Germany, [6]Brown University, Providence, USA, [7]UCLA, Los Angeles, USA, [8]JPL, Pasadena, USA.

Introduction: NASA's Dawn spacecraft arrived at the asteroid 4 Vesta on July 16, 2011, and is now collecting imaging, spectroscopic, elemental abundance and radio science data during its one-year orbital mission. As part of the geological analysis of the surface, a series of 15 quadrangle maps are being produced based on multispectral Framing Camera images along with Visible and InfraRed imaging spectrometer data obtained during the High-Altitude Mapping Orbit (HAMO) and Low Altitude Mapping Orbit (LAMO). This poster presentation concentrates on our geologic analysis and mapping of quadrangle Av-7.

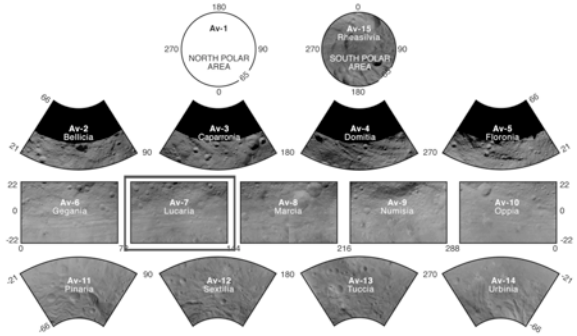


Fig.1. Location of the quadrangle Av-7 on Vesta.

Geologic setting: This quadrangle is located in the equatorial region of Vesta between 72°E and 144°E, and 22°S and 22°N. Prevailing features observed are: a 40-km long hill named Lucaria Tholus, the continuation of the set of equatorial troughs visible in the Av-6 quadrangle (parallel to the equator and spread between 15°S and 5°N), relatively fresh craters which exhibit a combination of bright and dark landslides within the crater walls, slump material within craters and a dark orange-color ejecta from a nearby crater observed in 'Clementine' color ratio images (R=750/440 nm, G=750/920 nm and B=440/750 nm filters),.

Main geologic units: By using the DEM from Survey orbit and image mosaics form HAMO and LAMO, we made a geologic map of this quadrangle and determined three main units.

1. The northern cratered trough unit in the upper part that is heavily-cratered and likely the oldest terrain.

2. The equatorial ridge and trough unit that is more widespread and is the highest terrain of the quadrangle. These giant E-W trending flat-floored troughs are separated by prominent ridges overlaid by some medium sized craters.

3. Part of a unit from the Rheasilvia formation is identified as well in the southern area of the map with a smooth lithology containing very few craters and some lineaments showing the gradual transition to the ridged and grooved terrain of the southern hemisphere.

Key geologic features: A key feature is Lucaria Tholus, which has been used to name the quadrangle. This feature corresponds to an unusual hill bearing a ridge crest which has an orientation slightly different from the set of E-W equatorial troughs (Fig.2). Dark material is visible in the form of flow-like deposits. The source appears to be the darkest spot at the top of the hill with the presence of small irregular pits. This could be a volcanic edifice or the result of a mass wasting. It is located in an area showing clusters of dark spots and curvilinear dark features. Analysis of higher resolution imagery is required to reveal its true nature.

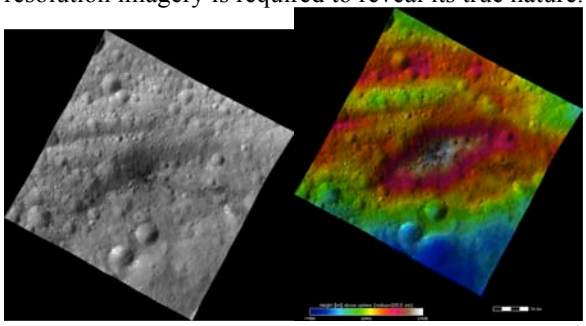
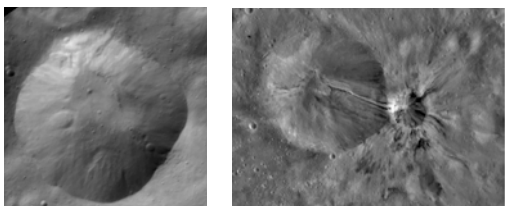


Fig.2. *Left*: Clear filter image of Lucaria Tholus during the HAMO phase. *Right*: same image overlaid by color coded elevation data in transparency.

Other interesting features include craters with slumping visible on the crater walls and/or material on the crater floor emplaced by mass-wasting (Fig.3). Some smooth texture units on the crater floor could be the result of impact melt.



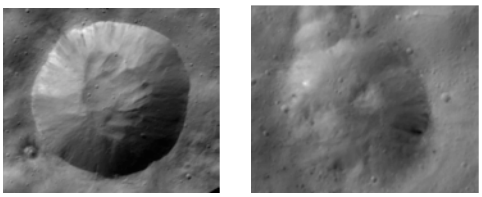


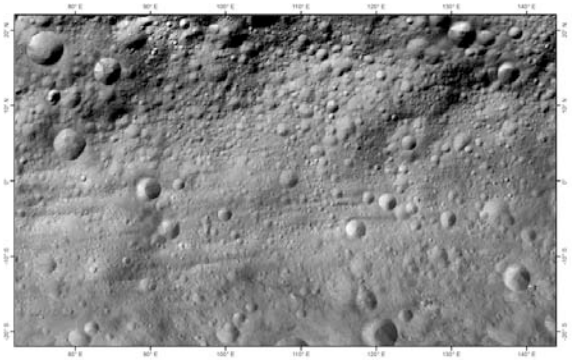
Fig.3. Close up views of several craters showing mass-wasting morphologies: slump material, landslides or smooth deposits within the craters. Images from FC clear filter HAMO data.

Discussion: Craters displays a variety of morphologies likely related to mass-wasting. In addition, dark material appears frequently as streaks on crater walls, or as clusters of spots or sinuous streaks on the surface, outside of craters. One of the major challenge is to investigate the nature of dark material on Lucaria Tholus and to assess its formation process.

Multi color images of this quadrangle also show that each geologic unit has a distinct color signature, with a) having deeper 1 micron absorption band, b) weaker 1 micron absorption band and c) having steeper visible slope.

In quasi 'Clementine' ratio maps a diffuse orange to red deposit is found around a well preserved crater (located in quadrangle Av-8). The red slope of this unit could be an indication of space weathering but it is quite localized and could rather be explained by a mixture of impactor material and excavated pre-existing lithology.

We believe that the color variations seen in this quadrant could be either due to compositional differences or surface maturity processes. We intend to use spectral information to map color-compositional units and to determine the mineralogy of the surfaces. We will use FC mosaics with clear images, false color composites and DEM (Fig.4) in order to refine the unit boundaries.



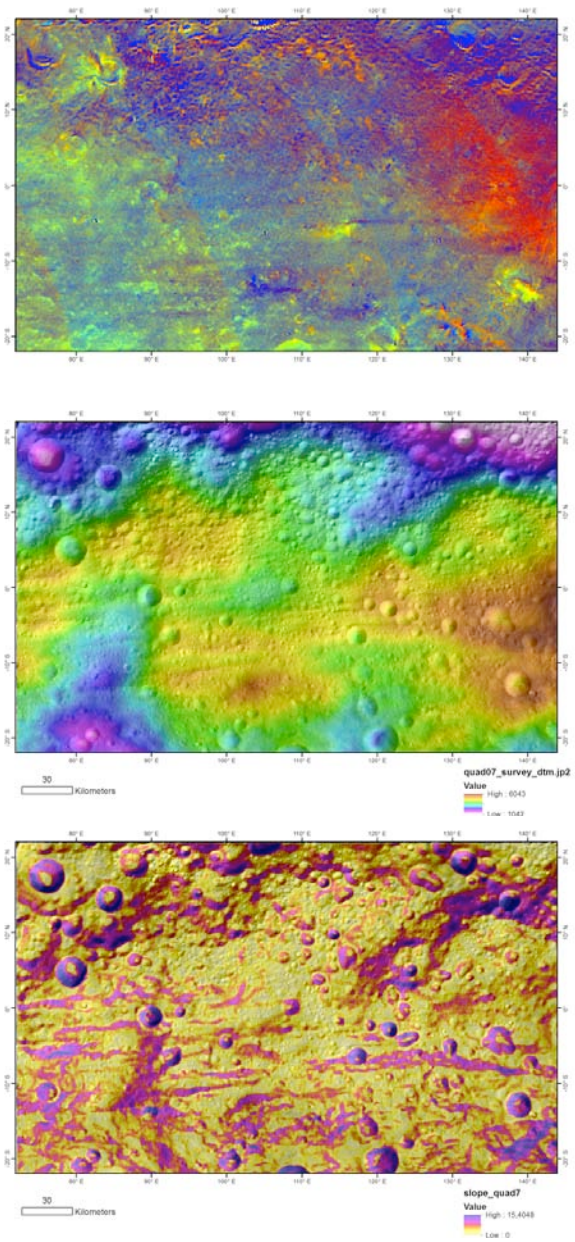


Fig.4. Mosaics used to create the geologic map of this quadrangle. The first map is a clear filter image mosaic from Survey phase data, the second map is a false color composite using Clementine color ratios of approach phase and the third map is a combination of elevation data and shaded relief derived from HAMO clear images. The last map is a slope map derived from the DEM that is helpful to identify scarps and ridges.