KEY FEATURES OF THE LUCARIA QUADRANGLE OF ASTEROID VESTA. A. Longobardo[1], M.C. De Sanctis[1], E. Palomba[1], V. Reddy[2], A. Nathues[3], E. Ammannito[2], C. Raymond[4] and C.T. Russell[5], [1]IAPS-INAF, via Fosso del Cavaliere 100, 00133 Rome (andrea.longobardo@iaps.inaf.it), [2]Planetary Science Institute, 1700 East Fort Lowell, Suite 106, Tucson, AZ, [3]Max Planck-Institute für Sonnensystemforschung, 37191 Katlenburg-Lindau, Germany, [4]JPL, California Inst. Techn., Pasadena, CA, USA, [5]UCLA, Institute of Geophysics, CA, USA.

Introduction: The NASA-Dawn mission orbited the asteroid (4) Vesta from 16 July 2011 to 25 July 2012 [1], taking multicolor and hyperspectral images by means of the Framing Camera (FC), e.g. [2], and the Visible and InfraRed spectrometer (VIR), e.g. [3], and mapping the surface elemental composition by means of the Gamma Ray and Neutron Detector (GRaND) [4]. In particular the FC and VIR data allowed us to derive mineralogical maps of the Vesta surface (e.g. [5]).

Vesta's surface has been divided into fifteen quadrangles (four for northern and southern latitudes, five at equatorial latitudes, and the two poles), each one with different geologic and mineralogical characteristics.

Ths work focuses on the most important features observed in the Lucaria quadrangle. Our study takes into account the Lucaria maps derived from VIR data, i.e. albedo, photometrically corrected band depths, temperature-corrected band centers [6], and by DEM, i.e. topographic and slope maps [7], respectively.

The Lucaria quadrangle as a whole: The Lucaria quadrangle extends from 22°S to 22°N latitudes and from 72°E to 144°E longitudes. We identified three macro-regions (MR) inside the quadrangle [7]:

- the northern terrains, heavily craterised and probably the oldest ones (henceforth MR1);
- the central region, dominated by the equatorial troughs (henceforth MR3);
- the southern terrain, part of the Rheasilvia basin [8], smoother, less craterised and younger (henceforth MR3).

The most interesting features in our quadrangle are the Publicia crater and ejecta, located in MR1; Lucaria tholus, located in MR2, close to the equatorial troughs; and the Aelia crater and ejecta, located in MR3. In the following, the results of a preliminary analysis of these features are summarised.

Publicia region: The Publicia crater is centered at 14°N 84°E. In its surroundings, a low-topography region is present, whose maximum depth is reached in another (unnamed) crater, centered at 18°N 76°E (Figure 1).

Seven dark units are present in the Publicia region [9], corresponding to ejecta presumably originated by the impact which generated the Publicia crater (Figure 2). The composition of these dark ejecta is mostly howarditic, as suggested by the lithological map obtained by band center analysis [5], with contamination of carbonaceuous chondritic material (CCs), supplied on Vesta by one or more low-velocity impacts with primitive asteroids (e.g. [10, 11]). The presence of CC material is indicated by a deeper 2.8 μm absorption band (due to OH) [9], as well as by a significant lower albedo. No CC contamination is present in the diogenitic rim of the low-topography region (Figure 2 and [5]).

The dark ejecta are located both inside and outside the low-topography region, suggesting that the impact generating the Publicia crater is more recent than that generating the low-topography region.

Equatorial troughs: The equatorial troughs extend from 72°E to 120°E longitudes, and are spread between latitudes 15°S and 5°N. Their orientation is parallel to the rims of Rheasilvia and Veneneia basins (located in the Southern hemisphere of Vesta and formed by large impacts), suggesting a common origin.

On other asteroids, large impact form surface fractures (e.g. [12]). However, the band center analysis does not reveal lithological discontinuities in correspondence of troughs [5], since the troughs composition is howarditic as in the surroundings. This suggests that troughs are more probably graben rather than fractures, in agreement with results obtained by fault-displacement analysis [13].

Lucaria Tholus: The Lucaria tholus is centered at 12°S 107°E and is one of the two tholi which have been identified on Vesta's surface. The other tholus is the Aricia hill (12°N 166°E), located in the Marcia quadrangle. The VIR spectral data analysis suggests that both tholi are composed of howardites mixed with CCs, as evidenced by low albedo, shallower pyroxene (1 μm and 2 μm) band depth and deeper OH band. Even if the two tholi show a similar albedo ([9]), i.e. 0.185-0.190 at 1.2 μm, the Lucaria tholus show deeper pyroxene bands and a shallower OH band. This suggests that the CC material content on the Aricia tholus is higher, whereas the Lucaria tholus formed in a more homogeneous terrain (i.e. lower amount of CC materials and lower albedo difference between the dark and the bright endmember).

Aelia region: The Aelia region includes two close craters, located at 13°S 139°E and 14°S 140°E respectively. The craters' ejecta are made of bright and dark

materials intimately mixed [9, 14]. Band center analysis show a certain correspondence between albedo and composition: in particular diogenites correspond to bright ejecta, whereas dark ejecta are mainly howarditic. The investigation of this correspondence is still in progress.

Preliminary conclusions: The present analysis has led to the following preliminary conclusions:

- The impact originating the Publicia crater followed that originating the low-topography region centered at 18°N 76°E. This would be confirmed by the presence of dark, carbonaceous ejecta both inside and outside this region.
- The equatorial troughs have the same compositions of the surroundings, in agreement to their graben nature.
- The Lucaria tholus should be similar to the Aricia tholus, from a compositional point of view. However, the two tholi formed in a different mineralogical context.
- The mixing of bright and dark material observed in the Aelia region corresponds to an intimate mixture of howardites and diogenites.

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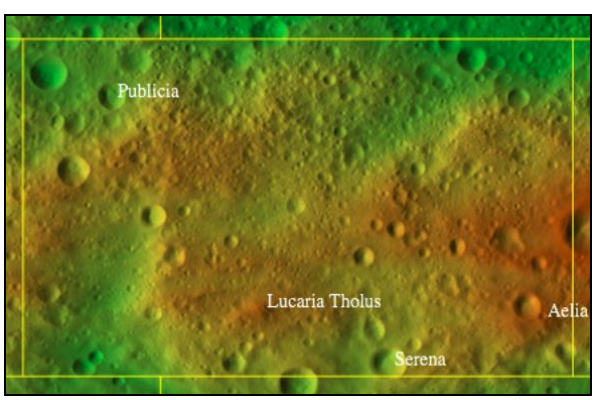

Figure 1: Topographic map of the Lucaria quadrangle. Elevation increases from green to red.

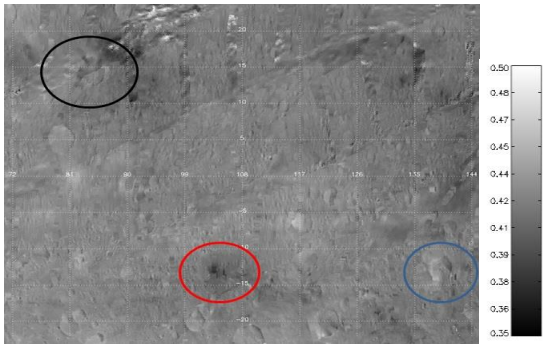

Figure 2: Gray-scale map of the albedo at 1.2 μm of the Lucaria quadrangle. The black, red and blue circles mark the Publicia, Lucaria tholus and Aelia region, respectively. No particular albedo features are associated to the equatorial troughs.

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