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MINERALOGICAL MAPPING OF QUADRANGLES AV-13 (TUCCIA) AND AV-14 (URBINIA)

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Abstract

The surface of Vesta, one of the largest bodies in the main asteroid belt, has been divided in 15 quadrangles (Fig. 1) [1]. Here we analyze the spectral properties of the quadrangles Av-13 Tuccia (270°-360°E; 21°-66°S), and Av-14 Urbinia (270°-360°E; 21°-66°S) located in the southwest part of the asteroid (Fig. 1).

1. Introduction

Data acquired by VIR, the Visible and Infrared spectrometer onboard the Dawn spacecraft, cover a large portion of Vesta's surface and allow for a detailed spectral analysis of the protoplanet [1]. VIR acquired data at different resolutions depending on the altitude of the spacecraft: Survey (2735 km above mean surface), High Altitude Mapping Orbit or HAMO (695 km), Low Altitude Mapping Orbit or LAMO (210 km), and HAMO-2, an extension of the mission similar to the HAMO phase [2]. The pixel scale of VIR data is 700 m for the Survey phase, 180 m for HAMO and HAMO-2, and 60 m for LAMO [1, 2]. Vesta's global mineralogy is consistent with that of the Howardite-Eucrite-Diogenite (HED) clan of meteorites, and all VIR reflectance spectra are dominated by the presence of two pyroxene absorption bands centered near 0.9 and 1.9 μm [3, 4]. At local scales, other mineralogical phases, such as olivine and opaque material, have been found mixed with pyroxenes [5, 6, 7]. Global maps of the spectral parameters have been produced for each quadrangle based on the entire VIR dataset [8]. The principal parameters that we employ for mineralogical mapping are: band center, band depth, band area ratio (BAR) and the strength of the OH-signature at 2.8 μm [9]. In addition, linear unmixing techniques can be applied to determine the composition of the principal features present on Urbinia and Tuccia quads.

2. Quadrangles description

Av-13 and Av-14, located in the southern hemisphere, contain a diversity of terrain types and several features of particular interest. Both the Tuccia and Urbinia quads include part of the Rheasilvia basin. The northern region of Av-13 covers part of Vestalia Terra and the Veneneia basin, while Av-14 contains a portion of Oppia's orange ejecta [10]. Urbinia and Tuccia are characterized by substantial topographic relief: the southern parts of the quadrangles, within the Rheasilvia basin, have some of the lowest elevations on Vesta, while the northern parts are home to the Vestalia Terra highlands, the highest areas on the entire asteroid [5]. The geologic units that have been identified include extended bright crater material (BC), Rheasilvia ridge and groove terrain (RRGT), dark lobate material (DL), and undifferetiated material [11]. Prominent impact craters include the relatively young craters (<300 Ma) Galeria and Eusebia, showing diffuse ejecta blankets [11], and the two young craters Vibidia and Antonia (10-20 Ma) [11]. Also present are many craters containing bright materials, and some dark regions [11].

3. Results

The mineralogy of quadrangles Av-13 and Av-14 is quite homogeneous and is dominated by howardite eucrite-rich compositions except in a few areas (Figs 2, 3). Band centers in the vicinity of Antonia, in the Tuccia quadrangle, are lower than the rest of the quadrangle, revealing a predominantly diogenite-like mineralogy. The ejecta blanket of Antonia shows the largest band depth in this quadrangle. Vibidia ejecta are also characterized by large band depths, but do not show compositional gradients. The Urbinia quandran-

gle has a large quantity of bright ejecta characterized by high band depths; the composition is quite uniform in general. Moreover, Av-13 and Av-14 quadrangles appear to lack the OH signature, with the exception of the dark area in Veneneia basin and the region corresponding to the orange material in Urbinia quadrangle. Investigation of the composition of the two quadrangles by linear spectral unmixing techniques allow us to determine the abundance of the different lithological components present in characteristic areas of the quadrangles.

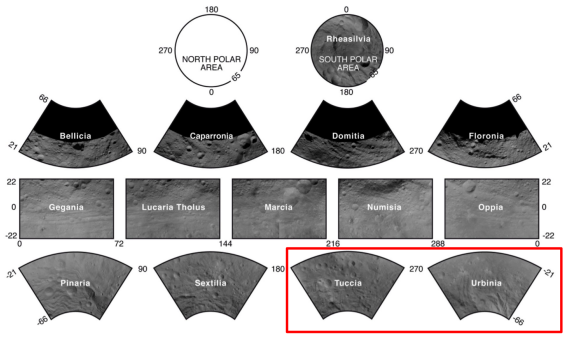

Figure 1: Vesta's quadrangle division.

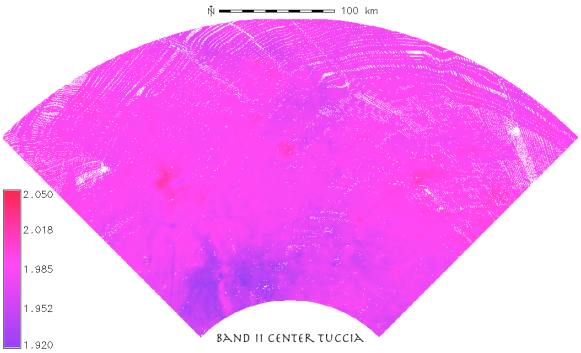

Figure 2: Band II center distribution of Tuccia quadrangle.

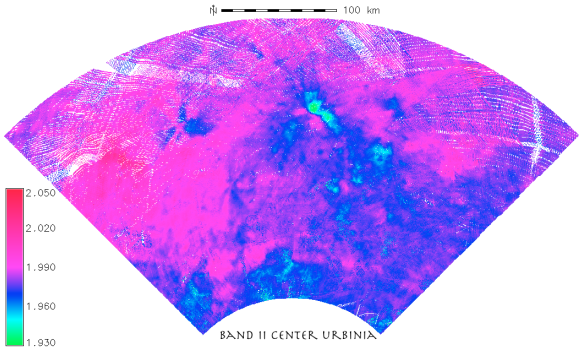

Figure 3: Band II center distribution of Urbinia quadrangle.

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