GEOSPATIAL INVESTIGATION OF THE MINERALOGIC AND GEOLOGIC MAPS OF VESTA.

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Introduction: Between July 2011 and September 2012, the NASA/Dawn mission has mapped the surface of Vesta with images from the Framing Camera (FC [1]), spectral data from the Visible and Infrared Mapping Spectrometer (VIR [2]), and elemental data from the Gamma Ray and Neutron Detector (GRaND [3]).

The successful acquisition of imagery from FC and VIR allowed us to produce global image mosaics reaching 20 meters per pixel and global mineralogic maps at 100 meters per pixel.

A global geologic map of Vesta has been recently published [4,5]. Geologic units and structures have been identified and put into their stratigraphic context using FC image-mosaic and the digital terrain model derived from stereo image processing.

The VIR spectra have been synthesized into spectral parameters or indicators [6] that have been used to produce quadrangle and global maps showing the mineralogic diversity across Vesta, through the variation of the compositional and the physical state of the pyroxene-rich lithologies, which are typical of Vesta[7].

Herein we present the work done to explore the spatial correlation between the mineralogic and geologic map of Vesta (Figure 1).

Geospatial processing: We have designed a Geographic Information System (GIS) approach to spatially correlate the geologic map and the spectral parameters maps of Vesta.

For this work the mineralogic and geologic maps of Vesta have been imported into a widely-used Free Open Source GIS (the Geographic Resources Analysis Support System, or GRASS[8]) using a common coordinate reference system. The digital GIS maps are stored in a Open Gis Consortium (OGC) compatible format to facilitate interoperability between different GIS packages.

Within the GIS environment, specialized tools allow us to spatially correlate different maps, do statistical analyses and develop specific geoprocessing pipelines involving different types of geospatial data.

Discussion: This work of comparison of the geologic map of Vesta and the mosaics of spectral parameters extracted from VIR data aims to explore the level of spatial correlation between two kind of maps made with different approaches.

The geologic map is the result of an interpretative process, while the spectral parameters map is the result of an automated processing.

The basic element of a geologic map is the geologic unit. Geologic units are made up of bodies of rock that are interpreted to have been formed by a particular process or set of related processes over a discrete interval of time, so the morphology and the topography are the primary sources for the crafting of a geologic map.

Spectral parameters' maps are the result of a data reduction process made by experienced spectroscopists and allow the non-spectroscopists to focus on the spatial variation of a single aspects of a complex spectra, representing a perfect element for the study of the spatial correlation with other dataset, as the gelogic map of this study.

Figure 1 shows that although globally there is no one-to-one correlation between geologic units/structures and spectral parameters, it is still possible to identify geometric similarities between the geologic and the mineralogic map. With our work we present where spatial correlation exists between two maps, and which spectral parameters can be correlated to some aspects of the geologic unit or structures.

The availability of global geologic and mineralogic maps published in late 2014 / early 2015 represents the first opportunity to observe the spatial correlation globally for Vesta, using the most up-to-date dataset.

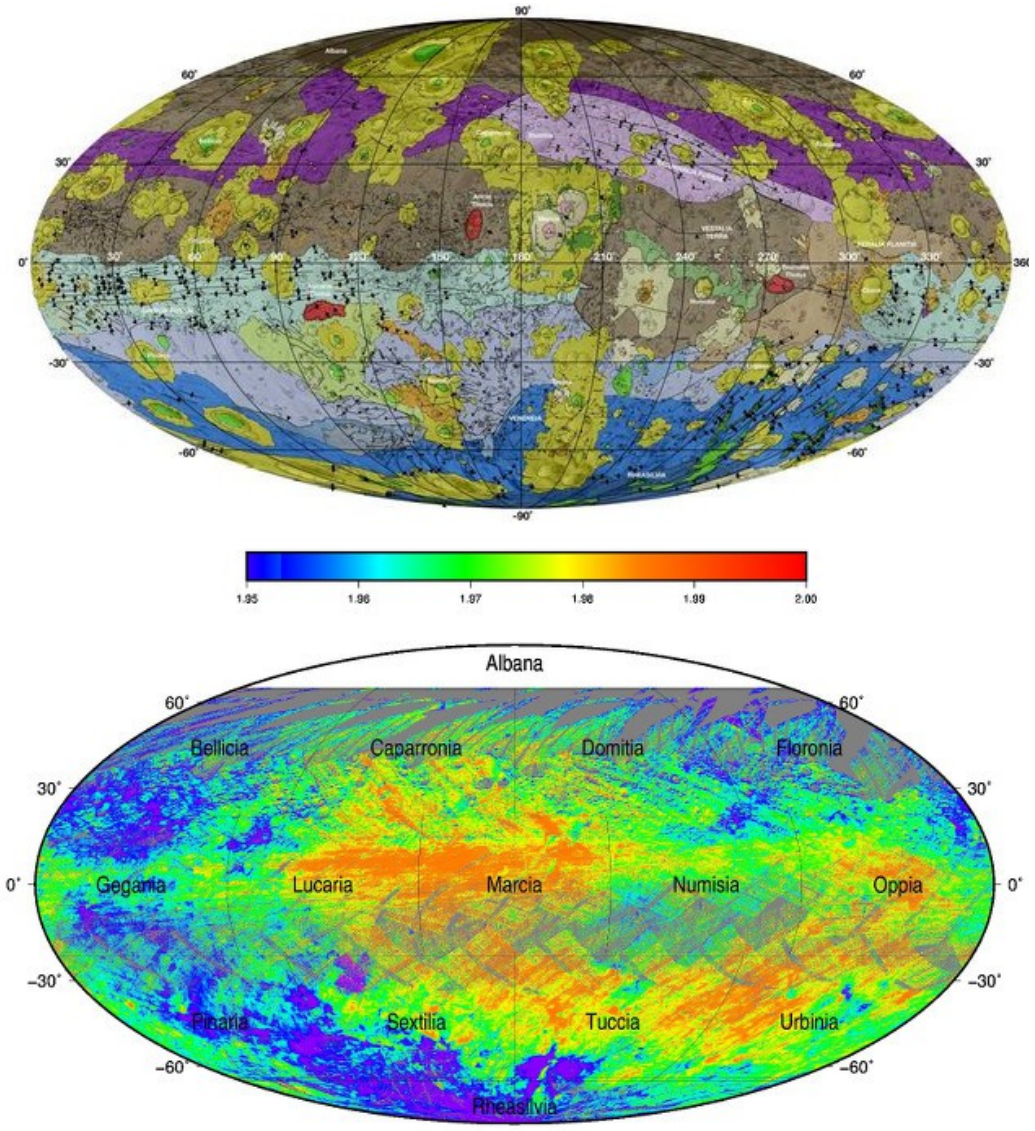

Figure 1: The global geologic map of Vesta (top, [5]) and the spectral parameter map of pyroxene Band II center (bottom).

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