CORRELATION BETWEEN PRELIMINARY MINERALOGIC AND GEOLOGIC MAPS OF VESTA.

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Introduction The Dawn mission to Vesta has greatly improved the quality and resolution of data available to explore the asteroid. Prior to the Dawn mission the best data available was the one from Hubble Space Telescope [1-6] with a maximum resolution of 50 km per pixel. The *survey phase* of the mission has pushed spatial resolution up to about 100 meters per pixel by the Framing Camera (FC, [7]) on-board Dawn, and 700 meters per pixel for the VIR spectrometer, spanning the spectral range from the visible to infrared at $0.25 - 1\ \mu\mathrm{m}$ and $1 - 5\ \mu\mathrm{m}$ [8]. The frames of the FC and VIR have been processed and mosaicked. A preliminary Geologic map has been produced by mapping units and structures over the FC mosaic and the DTM derived from stereo processing of visible imagery [9]. Herein we will present some examples of correlation between the preliminary geologic and VIR-derived mineralogic maps.

Mapping in the digital domain The Dawn mission team is using Geographic Information System tools for locating frames and for data exchange among the team. The use of GIS tools and data formats significantly improves our ability to create and interpret geologic maps, and also improves the interoperability of high level data products among the instruments' team. VIR data have been synthesized into a series of spectral indicators that give indications on the mineralogical composition and the physical state of the surface.

This way we imported into a GIS the preliminary geologic map as units and structures and we projected the mosaics of spectral indicators in a common coordinate reference system.

Correlation of Maps The location map of our study is depicted in Figure 1a, while Figure 1b, 1c and 1d show respectively the image mosaic from the Framing Camera, the Band Depth computed on pyroxene Band II ($2.0\ \mu\mathrm{m}$) and the Band Center also computed on Band II. The Band Depth expresses the abundance of a mineral and the grain size of the material, while the Band Center indicates the mineral type [10,11]. Over the spectral parameters map we projected the boundaries of the preliminary geologic map of Vesta based on Dawn data [9]. The Bright Crater Ray Material (*bcrm*) unit has been mapped on impact areas characterized by high albedo, as shown in Figure 1b. In Figure 1c, in the topmost *bcrm* we see that the local maximum of Band Depth value is distributed along the unit's boundary, while in the lower *bcrm* unit, an area of very high values of Band Depth are internal to the mapped unit. The Band Center of Figure 1d follow a sligthly different geometric pattern. In the lowermost *bcrm* of Figure 1c this time we have a local minimum in Band Center, in correspondence of a small crater, while in the uppermost *bcrm*, we have a local minimum of Band Center that is limited along the upper geologic boundary.

Discussion The comparison of the preliminary geologic map and the mosaics of spectral indicators extracted from VIR data show promising aspects on both the geologic and mineralogic aspects. 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. Mineralogy as interpreted from spectroscopy provides unique information in interpreting unit boundaries and the processes that formed those units. In particular, spectral indicators synthesize the complex methods of data reduction, making mineralogic measurements accessible to non-spectroscopists. This way, within a digital mapping context in GIS, including the spectral indicators in the stack of imagery and topographic layers enriches the observation possibilities of the geologic mapper. However, caution must be used to ensure that surface mineralogic expression are not misinterpreted as geologic units, and only the combined effort of geologic mappers and spectroscopists will develop good practices in the use of spectral indicators.

We believe that the combined observation of image mosaics, topography and mineralogic parameters will greatly improve the interpretative process of geologic

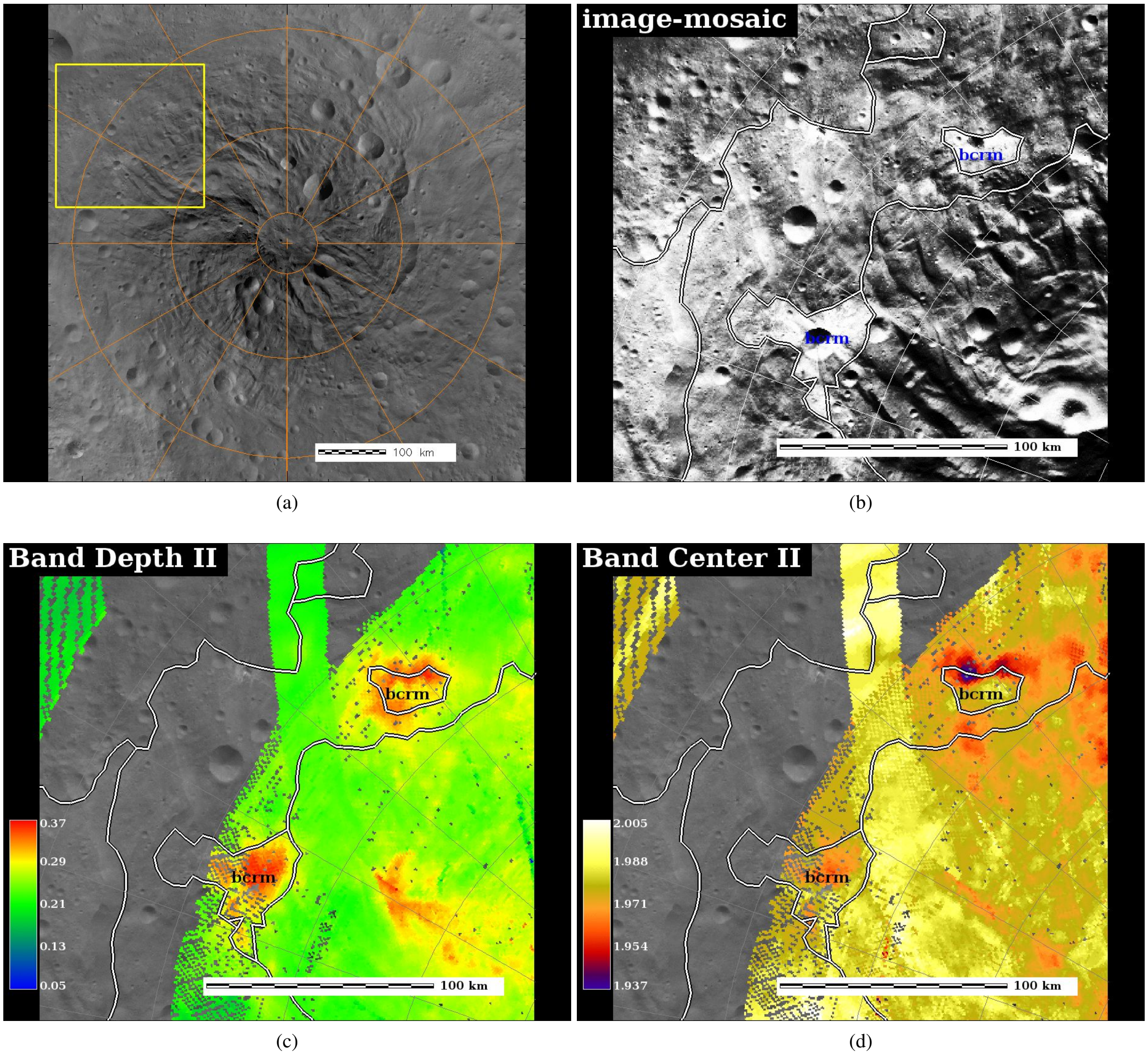

Figure 1: The study area is highlighted by the yellow frame in the context map (a). High-contrast enhanced Framing Camera mosaic (b) , VIR Band Depth (c) and Band Center (d) spectral indicators. The (b)(c) and (d) maps are overlayed by geologic unit's boundaries extracted from the preliminary geologic map of Vesta.

mapping and thus the quality of the next series of forthcoming geologic maps of Vesta.

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