GEOLOGIC MAPPING OF THE AV-9 NUMISIA QUADRANGLE OF ASTEROID 4VESTA. D.L. Buczkowski[1], D.Y. Wyrick[2], F. Capaccioni[3], J.E.C. Scully[4], D.A. Williams[5], H. Hiesinger[6], W.B. Garry[7], R.A. Yingst[7], L. Le Corre[8], A. Nathues[8], P.M. Schenk[9], R. Jaumann[10], C.A. Raymond[11], C.M. Pieters[12], T. Roatsch[10], F. Preusker[10], C.T. Russell[4]. [1]JHU-APL, Laurel, Maryland, USA; [2]SwRI®, San Antonio, Texas, USA; [3] INAF-IFSI, Roma, Italy; [4]UCLA, Los Angeles, California, USA, [5]ASU, Tempe, Arizona, USA; [6]Wilhelm Westfalisch University, Münster, Germany; [7]PSI, Tucson, Arizona, USA; [8]Max Planck Institute, Katlenburg-Lindau, Germany, [9]LPI, Houston, Texas, USA; [10]DLR, Berlin, Germany; [11]JPL, California Institute of Technology, Pasadena, California, USA; [12]Brown University, Providence, Rhode Island, USA

Introduction: NASA's Dawn spacecraft arrived at the asteroid 4Vesta on July 16, 2011, and is now collecting imaging, spectroscopic, and elemental abundance data during its one-year orbital mission. As part of the geological analysis of the surface, the Dawn Science Team has begun geologic mapping of Vesta's surface at the global scale [1,2] and as a series of 15 quadrangle maps that are being produced based on Framing Camera (FC) images , along with Visible & Infrared Spectrometer data (VIR) obtained during the High-Altitude Mapping Orbit (HAMO). We here concentrate on our geologic analysis and mapping of quadrangle Av-9 Numisia.

Geologic Setting: Av-9 Numisia quadrangle is located in the equatorial region of Vesta, extending from ±22˚ latitude and from 216º - 288º E longitude (Fig. 1). The region is dominated by Vestalia Terra, a distinct region of Vesta. Many of the impact craters in Av-9 have both bright and dark layers in their walls and also distinct ejecta lobes.

Data: Clear filter (monochrome) FC HAMO images (spatial resolution of ~70 m/pixel) were mosaicked to make a base for this quadrangle (Fig. 2a). Topography of Av-9, is observed in a colororized Digital Terrain Model (DTM) derived from Survey orbit FC data [3-5] (Fig 2b). Variations in surface composition are revealed by VIR hyperspectral images from Survey (700 m/pixel) and HAMO (200 m/pixel) orbits and FC color ratio images (250 m/pixel) from Survey orbit (Fig. 2c).

Compositional Information: FC color ratio images using standard *Clementine* ratios [Red (750/430 nm); Green (750/920 nm); Blue (430/750 nm)] [6] show compositional variations within the Numisia quadrangle (Fig. 2c). Several of the craters on Vestalia Terra have "colorful" ejecta, indicating spectral and possibly compostional diversity. Further study with VIR data is underway to investigate the significance of these color variations observed in the FC color ratio data. VIR data analysis thus far has concentrated on determining the band depth of the 1 μm and 2 μm absorptions associated with iron-bearing pyroxene minerals [7,8].

Geologic Units and Features: Three of the global geologic units are present in Av-9 Numisia: cratered highlands material (chm), northern cratered trough terrain (nctt) and cratered plains material (cpm) [1].

Vestalia Terra: Vestalia Terra is a distinct, topographically high region of Vesta bound by steep scarps (Fig.1). The region is albedo-bright in clear filter FC images, compared to surrounding terrains. The large number of craters with "colorful" ejecta on Vestalia Terra implies that the region have a diverse composition.

Numisia crater: Centrally located at 7ºS, 247ºE, the 33 km diameter Numisia crater is the largest impact crater in the Av-9 quadrangle. It has a sharp rim and shows both bright and dark layers in its walls. The object that formed Numisia impacted into an older crater to its northeast; this older crater appears to be buried by a ribbon of dark material (see description below). The dark material evident in the crater wall may thus be exposures of the "dark ribbon".

Cornelia crater: Although significantly smaller than Numisia (15 km), Cornelia crater shows greater color diversity. In clear filter FC data, Cornelia's interior shows large deposits of albedo-dark material. There are two distinct lobes of ejecta: the smaller, inner lobe albedo-dark and the larger, outer lobe albedo-bright. This two-toned ejecta is also evidenced in the FC color ratio data (Fig. 2). In addition, Cornelia displays an extensive ray system, that extends beyond the boundaries of the Av-9 quadrangle, to the south and west.

"Dark ribbon" material: The so-called "dark ribbon" is primarily evident in FC color ratio data (Fig. 2) but is also discernable in clear filter data as a roughly linear unit of albedo-dark material crossing Vestalia Terra from the northwest to the southeast. This dark material seems to fill a locally low region cutting across top of the regionally high Vestalia Terra. The ribbon is cut by Numisia crater, whose wall stratigraphy thus may display the thickness of the dark material. The origin of this material has yet to be determined, but possibilities include impact ejecta flow and/or volcanism.

Pit crater chains: While the other equatorial quadrangles on 4Vesta display the numerous wide and flat-floored troughs of the equatorial ridge and trough terrain (ertt) [1], Av-9 does not. There are, however,

three long pit crater chains. The merged pits show signs of collapse but distinct fault faces can also be observed. A strong correlation between pit crater chains and fault-bounded graben has been observed on other planetary bodies [9]. These pit crater chains are roughly aligned with the equatorial flat-floor troughs of unit ertt [10].

Elongate hill: The topography of Av-9 reveals the presence of an elongate hill in the southeast of the quadrangle (Fig. 2b). Merged pits appear in line with the elongate hill to both the west and east. FC color data shows material of a distinct composition which appears to be moving downslope on the northern flank of the hill. A crater impacted into the northern face of the hill has albedo-bright and "colorful" ejecta Other potential flow features include a linear arrangement of elongate pits.

References: [1] Yingst et al. (2011) Fall AGU, #P43B-0248. [2] Yingst et al. (2012) 43rd LPSC, this volume. [3] Preusker et al. (2011) Fall AGU, #U23B-02. [4] Jaumann et al. (2012) *Science*, in review. [5] Preusker et al. (2012) 43rd LPSC, this volume. [6] Nathues et al. (2011) Fall AGU, #U22A-01. [7] [7] De Sanctis et al., this meeting. [8] Capaccioni et al. (2012) EGU. [9] Wyrick et al (2004) JGR doi:10.1029/2004 JE002240. [10] Buczkowski et al. (2011) Fall AGU, #U21B-05.

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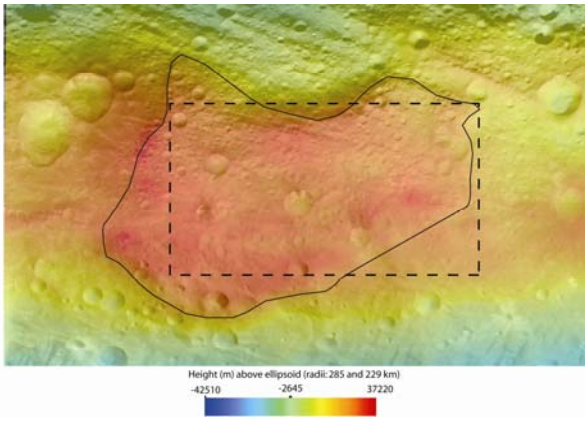

Figure 1. Global-scale topography map of 4Vesta centered on Vestalia Terra. Solid line marks outline of Vestalia Terra. Dashed line marks location of Av-9 quadrangle.

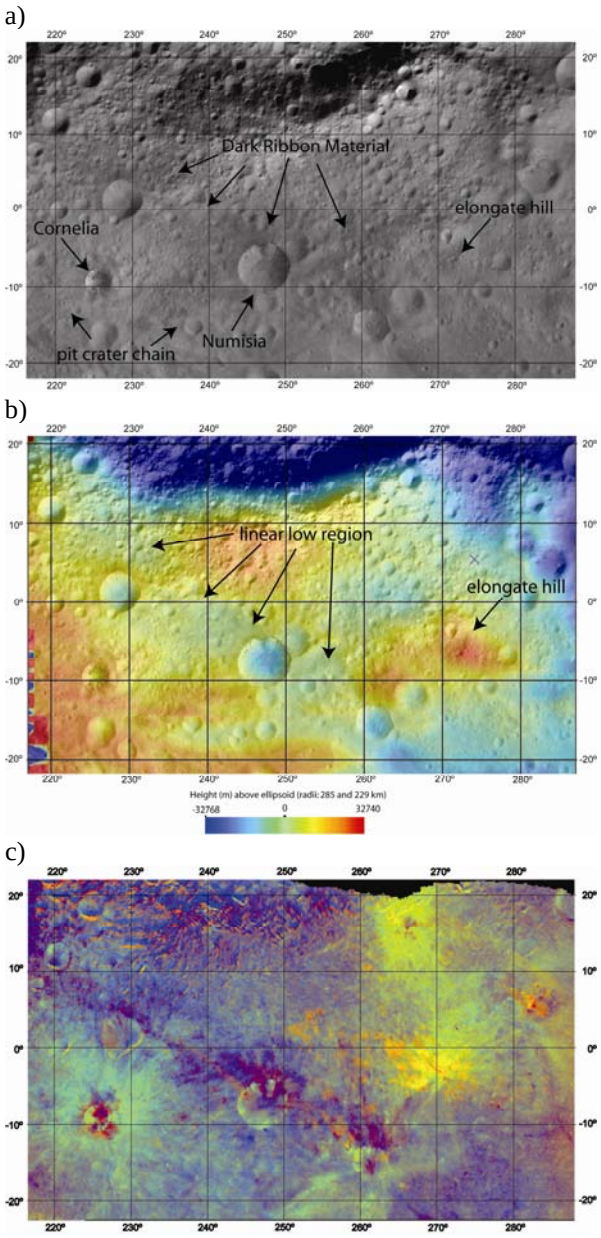

Figure 2. Data maps of Av-9 Numisia quadrangle. a) Framing Camera clear filter HAMO mosaic. Features of note are labeled. b) Topography map, scaled to Av-9 region. c) Color ratio FC data based on Survey data. Dark ribbon and "colorful" crater ejecta are easily observed. Note correspondence of dark ribbon and low region on Vestalia Terra.