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Geologic Mapping of the Av-9 Numisia Quadrangle of Asteroid 4Vesta

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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 map-ping of Vesta's surface at the global scale 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, located in the equatorial region of Vesta, extending from 22˚N - 22˚S and from 216º - 288º E. Clear filter (monochrome) FC HAMO images (∼70 m/p) were mosaicked to make a base for this quadrangle. Topography of Av-9, is observed in a colorized Digital Terrain Model (DTM) derived from Survey orbit FC data. Variations in surface composition are revealed by VIR hyperspectral images from Survey (700 m/p) and HAMO (200 m/p) orbits and FC color ratio images (250 m/p) from Survey orbit.

Av-9 Numisia is dominated by Vestalia Terra, a distinct, albedo-bright, topographically high region of Vesta bound by steep scarps and crossed by a roughly linear unit of dark material from the northwest to the southeast. This "dark ribbon" is primarily evident in FC color ratio data but is also discernable in clear filter data. The dark material appears to fill a locally low region on top of Vestalia Terra. The ribbon-like feature is cut by Numisia crater, which shows both bright and dark layers in its walls; the dark layers may thus be exposures of subsurface "dark ribbon" material. The origin of the "dark ribbon" material has yet to be determined, but possibilities include impact ejecta flow and/or volcanism.

FC color ratio images using standard Clementine ratios [Red (750/430 nm); Green (750/920 nm); Blue (430/750 nm)] show that many of the impact craters in Av-9 have "colorful" ejecta. The greatest color diversity is displayed by Cornelia crater. Cornelia's interior shows large deposits of albedo-dark material, two distinct lobes of ejecta (a smaller, albedo-dark, inner lobe and a larger, albedo-bright, outer lobe) and an extensive ray system. Just to the south of Cornelia are two long pit crater chains. The merged pits show signs of collapse but distinct fault faces can also be observed. These pit crater chains are roughly aligned with the equatorial flat-floor troughs evidenced around much of the rest of Vesta. The topography of Av-9 reveals the presence of an elongate hill in line with a third pit crater chain in the southeast of the quadrangle. FC color data shows material of a distinct composition on the northern flank of the hill, where a small crater has extensive albedo-bright and "colorful" ejecta deposits.

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