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Geologic Mapping of the Av-4 Domitia Quadrangle of Asteroid 4 Vesta

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NASA's Dawn spacecraft is spending one year in orbit of asteroid 4 Vesta to characterize its geology, chemical and mineralogical composition, topography, shape, and internal structure. The Dawn Team is conducting geological mapping of the surface in the form of 15 quadrangle maps, and here we report results from the mapping of Domitia quadrangle Av-4. Mapping is based on a Framing Camera (FC) mosaic produced from High Altitude Mapping Orbit (HAMO) data (spatial resolution (s.r.) of $\sim$70 m/pixel), supplemented by Digital Terrain Models (DTMs) derived from HAMO and Survey orbit data; Visible and InfraRed (VIR) hyperspectral spectrometer images from the Survey and HAMO orbits (s.r. of $\sim$700 m/pixel and $\sim$200 m/pixel) and FC color ratio images from the Survey orbit (s.r. of $\sim$250 m/pixel). Initial data interpretations of the recently acquired Low Altitude Mapping Data (LAMO) from the FC (s.r. of $\sim$20 m/pixel), VIR (s.r. of $\sim$100 m/pixel), and compositional data from the Gamma Ray and Neutron Detector (GRaND) are also included. Av-4 Domitia quadrangle is situated from 21-66°N and 180-270°E in Vesta's northern hemisphere. Due to its location in the northern hemisphere the upper portion of this quadrangle has yet to be illuminated by the Sun and consequently studied. The northern tip of Vesta's high relief terrain, called Vestalia Terra, extends into the southern portion of Domitia quadrangle. The heavily cratered landscape of Domitia quadrangle is typical of Vesta's northern hemisphere and these craters are classified into four types. Domitia quadrangle is located in Vesta's Northern Cratered Trough Terrain, which is a heavily cratered area with a NW-SE trending trough system. Saturnalia Fossa is the dominant trough and is $\sim$25 km wide on average, with a center latitude and longitude located at $\sim$32°N, 257°E. This system of troughs, and the ridges between them, appear to influence the smaller scale structures: grooves, pit crater chains and lineaments are mostly roughly sub-perpendicular to the trough system and the remaining grooves, pit crater chains and lineaments are sub-parallel to the trough system. All of these structures may be part of, and evidence for, extension. The poles to the trough system were found to cluster at $\sim$60$\pm$10°S, 165°E, which is near the center of the older of Vesta's two southern basins. This indicates a likely connection between the formation of this basin and the trough system. LAMO data will help to determine whether possible thrusts and contractional structures are formed by a tectonic, regolithic or another process. Dark material occurs as lobate features and as material cropping out of and slumping into the interior of an impact crater. The composition and origin of Vesta's dark material is currently being studied. The average values of the centers of the 1μm and 2μm pyroxene bands suggest a mixed howarditic-eucritic-like composition for this quadrangle. The quantity of pyroxene minerals and physical properties, such as grain size, are reasonably constant throughout Domitia quadrangle. However there is some variability, which is under investigation.