GEOLOGIC MAPPING OF THE AV-15 RHEASILVIA QUADRANGLE OF ASTEROID 4 VESTA. O.L. White[1], R.A. Yingst[2], D. Berman[2], A. Frigeri[3], R. Jaumann[4], L. Le Corre[5], S. Mest[2], C.M. Pieters[6], F. Preusker[4], C.A. Raymond[7], V. Reddy[5], T. Roatsch[4], C.T. Russell[8], P.M. Schenk[1], N. Schmedemann[9], and the Dawn team, [1]Lunar and Planetary Institute, Houston, Texas, USA (white@lpi.usra.edu); [2]Planetary Science Institute, Tucson, Arizona, USA (yingst@psi.edu); [3]National Institute of Astrophysics, Rome, Italy; [4]DLR, Berlin, Germany; [5]Max Planck Inst., Katlenburg-Lindau, Germany; [6]Brown University, Providence, Rhode Island, USA; [7]NASA JPL, California Institute of Technology, Pasadena, California, USA; [8]UCLA, Los Angeles, California, USA; [9]Freie Universität, Berlin, Germany.

Introduction: NASA's *Dawn* spacecraft entered orbit of the inner main belt asteroid 4 Vesta on July 16, 2011, and is spending one year in orbit to characterize the geology, elemental and mineralogical composition, topography, shape, and internal structure of Vesta before departing to asteroid 1 Ceres in late 2012. As part of the *Dawn* data analysis the Science Team is conducting geologic mapping of the surface, in the form of 15 quadrangle maps. This abstract reports results from the mapping of quadrangle Av-15, named Rheasilvia.

Data: The base for mapping this quadrangle is a monochrome Framing Camera (FC) mosaic produced from the High Altitude Mapping Orbit (HAMO) data with a spatial resolution of ~70 m/pixel. This base is supplemented by a Digital Terrain Model (DTM) derived from Survey orbit data (Figure 1). Also used to support the mapping are FC color ratio images from the Survey orbit with a spatial resolution of ~250 m/pixel, slope and contour maps derived from the DTM, and Visible and InfraRed (VIR) hyperspectral images from the Survey and HAMO orbits with spatial resolutions of 700 and 200 m/pixel, respectively.

Geologic Setting: Av-15 Rheasilvia Quadrangle covers the southern pole of Vesta and stretches north to 21°S. This quadrangle is dominated by the central mound complex of the Rheasilvia impact basin.

The quad is heterogeneous spectrally, and in terms of color and albedo [1-4]; these heterogeneities were originally interpreted to stem from extrusive volcanic activity and impact. Imaging by the Hubble Space Telescope (HST) in 1994 and 1996 revealed a crater at the south pole that excavated ~1% of the asteroid's volume; the presence of a 1-µm absorption feature was interpreted as coarse-grained plutonic pyroxene or possibly olivine in a differentiated upper mantle [5].

Data and Mapping Procedure: We used a monochrome Framing Camera (FC) mosaic produced from the High Altitude Mapping Orbit (HAMO) data as our basemap. Images in this mosaic have an average spatial resolution of ~70 m/pixel. This base was imported into ArcGIS format, and supplemented by a Digital Terrain Model (DTM) derived from Survey orbit data. FC color ratio images from Survey orbit with a spatial resolution of ~250 m/pixel and Visible and InfraRed (VIR) hyperspectral images from the Survey and HAMO orbits with spatial resolutions of 700 and 200 m/pixel, respectively, provided information on surface composition and were used to refine unit boundaries.

Geologic Units & Features: The map of Av-15 is shown in Figure 2. Primary geologic features of this region include: (1) the Rheasilvia complex, including the central mound terrain, ridge-and-groove terrain, and smoother terrain; (2) slump material that is likely associated with formation of the basin; and (3) impact craters and associated material. The FC mosaic of the Rheasilvia basin region is shown in Figure 3, with the quad area indicated in black. Also indicated are the Rheasilvia basin (in blue) and two additional potential older basins (in red).

Rheasilvia complex. The Rheasilvia formation extends across numerous quadrangles, but is centered within this one. The formation encompasses the central mound complex, two trends of ridges and grooves, and patches of smoother, less-cratered terrain on the mound itself. The mound, which covers nearly 60% of the quadrangle area, is ~22 km high and ~180 km wide, with a discontinuous bounding scarp and low crater density. The ridge-and groove terrain consists of ridges and grooves radiating approximately 90°-270°, and ridges and troughs or ridge and groove complexes radiating arcuately from the central mound unit. Note that nearly all of these ridges, troughs and grooves lie outside the boundaries of this quadrangle.

VIR data indicates that the basin's central mound has a uniform mineralogy, while the basin floor shows more heterogeneity, though both indicate the presence of howardite-diogenite rich materials.

Slump material. Along the base of the bounding scarp occur patches of material characterized by a low crater density and smoother, somewhat granular-textured morphology. Irregularly-bounded patches of very smooth material 25-35 km across are also present, often located on slopes or topographically lower regions. We interpret most of these deposits as slump material emplaced as a result of the effects of basin formation and settling. However, some deposits may be post-impact, driven by uplift or relaxation, for example. Highest-resolution data from the Low-Altitude Mapping Orbit (LAMO) may better reveal the nature and relative stratigraphy of these deposits.

Impact craters. Most terrain in the quadrangle is heavily cratered. Secondary crater chains and fields are evident as well. The central mound is less cratered in general, and also has portions that have low crater density. Craters range from those with fresh, sharp rims, craters with degraded rims and craters that are little more than depressions. Also present are craters with rims of heterogeneous degradation; a portion is sharp and fresh-appearing, while a portion is subdued and apparently mantled with material of albedo similar to the surroundings. Higher-resolution VIR data will be an important component in determining the nature of the potential mantling material.

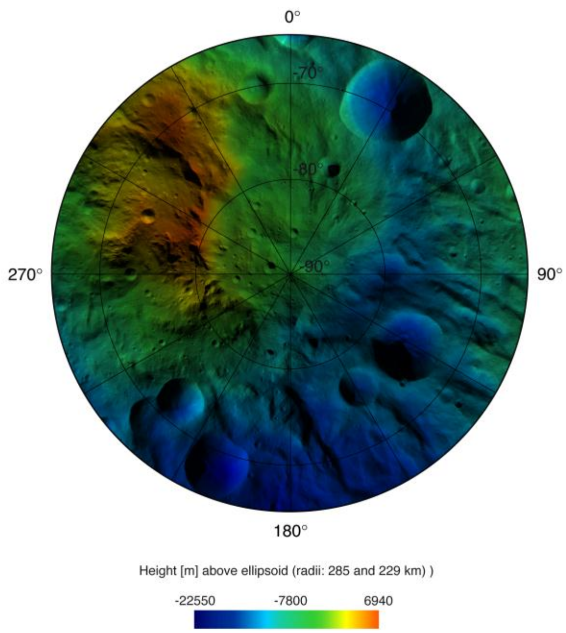

Figure 1. Color-coded Digital Terrain Model of quad Av-15, derived from NASA Dawn FC monochrome imaging.

References: [1] Binzel, R.P., et al., (1997) *Icarus*, *128*, 95-103. [2] Gaffey, M.J., (1997) *Icarus*, *127*, 130-157. [3] Drummond et al., (1998) *Icarus*, *74*, 1-14. [4] Li, J.-Y., et al., (2008) *LPSC*, *39*, 2253. [5] Thomas et al., (1998) *Icarus*, *128*, 88-94.

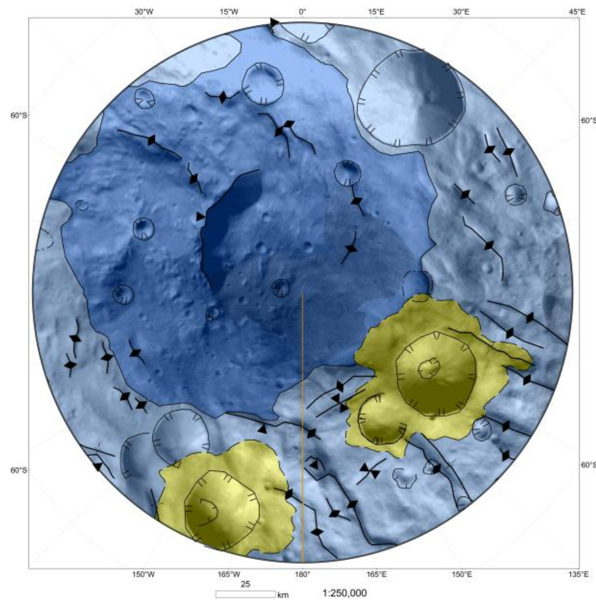

Figure 2. Geologic map of Av-15 Rheasilvia Quadrangle, Vesta.

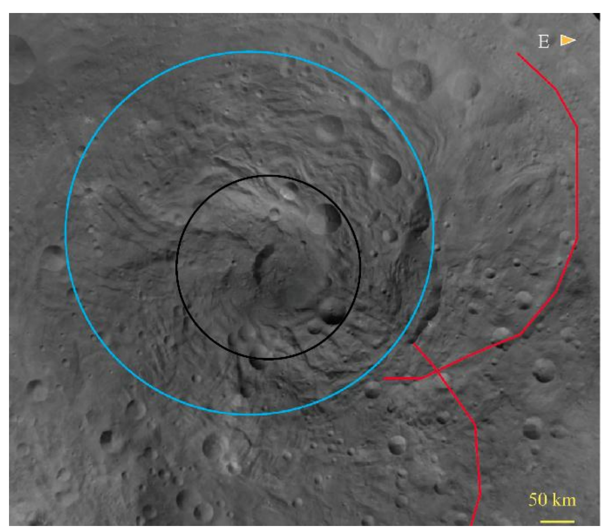

Figure 3. South pole of Vesta, with the Av-15 Rheasilvia quad (black), Rheasilvia basin (blue) and two potential older basin rims (red) shown.