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Geologic Mapping of the Av-15 Rheasilvia Quadrangle of Asteroid 4 Vesta

R. A. Yingst (1), E. Ammannito (2), D. Berman (1), M. C. De Sanctis (2), F. Capaccioni (2), A. Frigeri (2), R. Jaumann (3), L. Le Corre (4), S. Mest (1), E. Palomba (2), C. M. Pieters (5), F. Preusker (3), V. Reddy (4), T. Roatsch (3), C. T. Russell (6), P. M. Schenk (7), N. Schmedemann (8), D. A. Williams (9), F. Tosi (2), and F. Zambon (2)

(1) Planetary Science Institute, Tucson, Arizona, United States (yingst@psi.edu), (2) Istituto di Astrofisica e Planetologia Spaziali, Istituto Nazionale di Astrofisica, Roma, Italy, (3) DLR, Berlin, Germany, (4) Max Planck Inst., Katlenburg-Lindau, Germany, (5) Brown University, Providence, Rhode Island, USA, (6) UCLA, Los Angeles, California, USA, (7) Lunar and Planetary Institute, Houston, Texas, USA, (8) Freie Universität, Berlin, Germany, (9) School of Earth & Space Exploration, Arizona State University, Tempe, Arizona USA

NASA's Dawn spacecraft is spending one year in orbit around 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 one global and 15 quadrangle maps. Here we report results from the mapping of Rheasilvia quadrangle Av-15. Mapping is based on a Framing Camera (FC) mosaic produced from High Altitude Mapping Orbit (HAMO) data with a spatial resolution of ∼70 m/pixel, supplemented by a Digital Terrain Model (DTM: lateral spacing of 450 m/pixel and vertical accuracy of ∼30 meters), FC color images, and Visible and InfraRed (VIR) hyperspectral images. Av-15 Rheasilvia Quadrangle covers the southern pole of Vesta and stretches north to -21°S. Vesta has three dominant terrains: A heavily-cratered northern terrain with ancient troughs and grooves, an intermediately-cratered equatorial terrain bearing prominent flat-floored, E-W-trending troughs, and the relatively lightly-cratered south polar region, containing the Rheasilvia impact basin and related terrains. This quadrangle is dominated by the central mound complex of the Rheasilvia impact basin.

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; and (3) impact craters and associated material. The Rheasilvia formation encompasses the central mound complex, two trends of ridges and grooves (only 5% of the quad area is covered by this terrain), 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 that arch or curve as they extend out from from the central mound unit. 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. 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. Most terrain in the quadrangle is heavily cratered.

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