Geophysical Research Abstracts
Vol. 14, EGU2012-6225, 2012
EGU General Assembly 2012

A Global Geologic Map of Vesta Based on High-Altitude Mapping Orbit Data

R. A. Yingst (1), E. Ammannito (2), D. Berman (1), M. C. De Sanctis (2), F. Capaccioni (2), A. Frigeri (2), W. B. Garry (1), R. Jaumann (3), L. Le Corre (4), S. Mest (1), A. Nathues (4), E. Palomba (2), C. M. Pieters (5), F. Preusker (3), V. Reddy (4), T. Roatsch (3), C. T. Russell (6), D. A. Williams (7), 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) School of Earth & Space Exploration, Arizona State University, Tempe, Arizona USA

The Dawn spacecraft has acquired images of Vesta at resolutions up to 500x higher than previously available, allowing us to advance from simple identification of the largest spatial and spectral features to complex geologic mapping of morphologic units and features, including stratigraphic and structural relationships. We here report on a 1:500,000-scale preliminary global map of Vesta, based on data from the High-Altitude Mapping Orbit (HAMO). This map is part of an iterative mapping effort; the geologic map is refined with each improvement in resolution.

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 scale of ∼70 m/pixel. This base was supplemented by a Digital Terrain Model (DTM) derived from Survey orbit image data. FC color ratio images from Survey orbit with a spatial scale of ∼250 m/pixel and Visible and InfraRed (VIR) hyperspectral images from the Survey and HAMO orbits with spatial scales of 700 and 200 m/pixel, respectively, provided information on surface composition and were used to refine unit boundaries.

Vesta can be divided into three terrain types: heavily-cratered terrain; ridge-and-trough terrain (equatorial and northern); and terrain associated with the Rheasilvia basin. Smaller features include bright and dark material and ejecta (some defined specifically by color); and mass-wasting materials. The Rheasilvia formation is characterized by (a) bounding arcuate scarps; (b) a central mound with smoother, less cratered regions; (c) a linear set of ridges and troughs running through either side of the central mound; and (d) a more arcuate set swirling out from and around the central mound. Rheasilvia basin, centered at approximately the asteroid's south pole, stretches 60-120 degrees of latitude, and its formation undoubtedly influenced most of the geologic features on the surface and the overall shape of Vesta.

Large-scale global troughs that occur at the equator cover an impressive percentage of the asteroid's 1765 km circumference and are 19 to 380 km long and up to 20 km wide. An older set of large-scale troughs is present in the northern hemisphere. Mineralogical signatures of the troughs suggest the presence of howardite-eucrite, but the signatures are not homogeneous.

Impact structures dominate Vesta's surface. Small fresh craters have sharp-crested, narrow rims and bowl shapes; larger fresh craters have flat floors and may display slumping of rim walls, some finer-textured floor fill, or visible ejecta material. All fresh craters are interpreted to be the youngest impact features on Vesta. Degraded craters, interpreted to be older, have subdued but distinct, continuous rims and varying internal shapes. Enclosed sub-circular or ovoid regions of lower topography also exist; many of these are interpreted to be the oldest craters. Basins like Rheasilvia are characterized by high-topography rugged hills and arcuate scarps forming partial rings.

The authors gratefully acknowledge the support of the Dawn Instrument, Operations, and Science Teams. This work is supported by NASA through Dawn at Vesta Participating Scientist grant #NNX10AR19G.