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Geologic Mapping of the Av-13 Tuccia Quadrangle of Asteroid 4 Vesta

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NASA's Dawn spacecraft is spending one year in orbit around asteroid 4Vesta 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, and here we report results from the mapping of Tuccia quadrangle Av-13. 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.

The Av-13 Quadrangle covers the region between 21°-66°S latitude and 180°-270°E longitude. It shows mainly three different terrains: Vestalia Terra located in the north of the quadrangle, the Equatorial Cratered Terrain, and the Ridge-and-Groove Terrain which is part of the Rheasilvia Formation.

The Tuccia impact crater which names quadrangle Av-13 is located at 40°S and 197°E and has a diameter of about 16 km. The bright-rayed crater on its rim has a diameter of ∼3.4 km. The crater Vibidia is located at 27.9°S and 220.3°E and has a diameter of ∼7.5 km. It is a bright-rayed crater, which, however, also excavated dark material visible on the crater floor and at the eastern crater rim. Outcrops of dark material are also located at the eastern crater wall of a 25km-diameter crater at 30.0°S and 228.0°E.

Another interesting crater is located at 60°S and 200°E on a steep slope on the Rheasilvia ridge-and-groove terrain. This crater has a diameter of approximately 15 km and shows a sharp, undegraded crater rim in the north and a highly degraded/mantled crater rim in the south. Proposed formation processes for this irregular crater rim are: ballistic ejecta coverage of the southern rim, incomplete formation of the rim, as well as mass-wasting processes like slumping and landslides. A definitive interpretation of this and other features in the Tuccia quadrangle requires the analysis of the higher spatial resolution FC and VIR data from the Low Altitude Mapping Orbit (LAMO), which is currently being acquired.

Compositional differences in the Tuccia quadrangle have been analyzed using FC color-ratio images and VIR data. The FC color-ratio mosaic shows color differences at the two bright-rayed craters (Vibidia crater and the crater on the rim of Tuccia), at several small-scale occurrences of dark material, and the surroundings of the 15 km-diameter crater at 60°S and 200°E showing the irregular crater rim.

The analysis of VIR data has concentrated on variations of the depths of the 1 μm and 2 μm absorption bands. Compositional differences detected in VIR data correlate well with color differences detected in FC color data.