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The Surface Features of Vesta: First Results from Dawn's Survey Orbit

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Abstract

As NASA's Dawn spacecraft is performing its survey orbit of asteroid (4) Vesta, the framing camera on board ([1]) delivers high resolution images of the surface. We report here on the most prominent features observed and describe the physical characteristics and properties of the craters on the largest asteroid ever visited by a spacecraft. Understanding the geomorphological features observed is essential to characterize the evolution of the surface since its creation. Vesta shows a strong dichotomy between the northern and southern hemisphere. The southern hemisphere is characterized by a very complex morphology with the presence of many grooves, cliffs, and a topographic feature which appears to be the signature of a large impact. The northern hemisphere is saturated with craters and is more typical of an old planetary surface as observed on other celestial bodies, the lunar highlands for instance. Both hemispheres seem to be separated by a set of quasi-equatorial grooves.

This dichotomy is also present in the physical properties of the surface as derived from the study of craters depth-to-diameter ratios. Craters on the northern hemisphere have a typical d/D distribution comparable to all other asteroids visited so far, whereas the southern craters appear deeper than expected and show a distinct profile in the cumulative distribution. This may be an indication for a higher strength material on the surface, or a regolith layer not as thick as the one in the northern hemisphere. We will present here a first estimation of the thickness based on the study of buried craters.

References

[1] Sierks et al, The Dawn Framing Camera, Space Sci. Rev., February 2011

Figures

Asteroid Vesta. NASA's Dawn spacecraft obtained this image with its framing camera on July 23, 2011. It was taken from a distance of about 3,200 miles (5,200 kilometers) away from the protoplanet Vesta. The pixel scale is about 500 m. Vesta is 530 km in diameter and the second most massive object in the asteroid belt.
(Credits: NASA/JPL-Caltech/UCLA/MPS/DLR/IDA)