Poster Caption

Dawn Mission to Vesta, 10th Anniversary

On July 16, 2011, NASA's Dawn spacecraft entered orbit around asteroid Vesta, the first of two objects it would explore in the Main Asteroid Belt between the orbits of Mars and Jupiter. Vesta, which is about the size of the states of Arizona or New Mexico, was the fourth asteroid discovered by telescope in 1807. It was of interest because the reflected light telescopic spectrum of the asteroid matched a family of meteorites found on Earth, the HED Family (for howardite-eucrite-diogenite), as well as a family of smaller asteroids in similar orbits as Vesta around the Sun. The minerals in the HED meteorites suggested that they formed by ancient basaltic (Hawaii-like) volcanism, indicative of planet-like internal heating and separation of the interior into a crust, a mantle, and a dense core. The similar spectra of the "Vesta family" of asteroids suggested that Vesta may have been struck by a giant impactor, probably another asteroid, that ejected rocks to produce its asteroid family. Thus, the goals of the Dawn mission were to study Vesta, confirm it as the source of the HED meteorite family, and to confirm it was struck by a larger impactor.

This poster shows multiple views of asteroid Vesta, obtained by the Dawn spacecraft's German-built Framing Camera. The large central grayscale image shows an equatorial view centered on the hemisphere that shows a series of ridges and grooves that run parallel to its equator, which are named the Divalia Fossae. The image also shows that Vesta is not spherical, but rather is irregular, resulting from two large impacts that struck near the south pole. The largest south polar impact, which produced a large crater named Rheasilvia (seen in the enhanced color image at lower right), excavated crust and mantle materials, which were ejected from Vesta to form its family of smaller asteroids. The Rheasilvia impact also produced seismic waves that travel along Vesta's surface, forming the equatorial ridge-and-trough system over a billion years ago.

What about the HED meteorites? In the enhanced color image at lower left, notice the purple-colored materials around the three impact craters called the 'Snowman craters'. This material, as analyzed by Dawn's Italian-built Visible and Infrared Spectrometer (VIR) and USA-built Gamma Ray and Neutron Detector (GRaND) is rich in minerals found in eucrites. The yellow and green colors in the image at lower right, in the Rheasilvia basin floor, are rich in minerals found in diogenites (from Vesta's upper mantle). Thus, Dawn demonstrated Vesta is the indeed the home of the HED meteorites, and that it had enough internal heat to differentiate (separate) into a crust-mantle-core configuration, just like the Earth. The grayscale images of Vesta were obtained during the Low-Altitude Mapping Orbit at a resolution of 25 meters/pixel. The enhanced color images of Vesta, processed to show differences in composition, were obtained during the High-Altitude Mapping Orbit at a resolution of 70 meters/pixel.

Launched in 2007, the Dawn spacecraft used solar-electric ion propulsion to reach Vesta in 2011. It departed Vesta in 2012 and arrived at dwarf planet Ceres in 2015, where it remains in orbit since the mission ended in 2019. The Dawn mission was operated and managed by the NASA Jet Propulsion Laboratory in Pasadena, California.