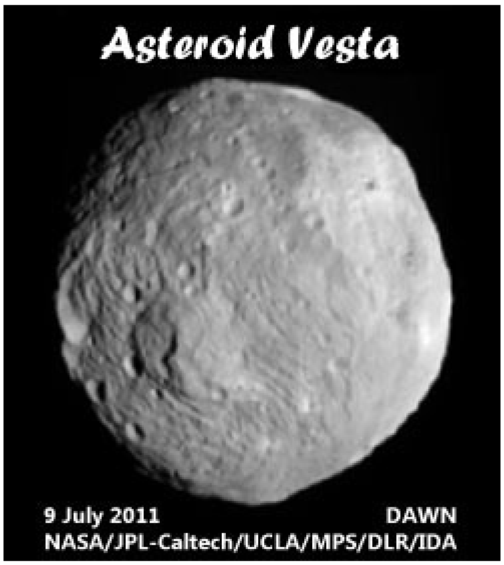
PLANETARY SCIENCE RESEARCH DISCOVERIES

CosmoSparks

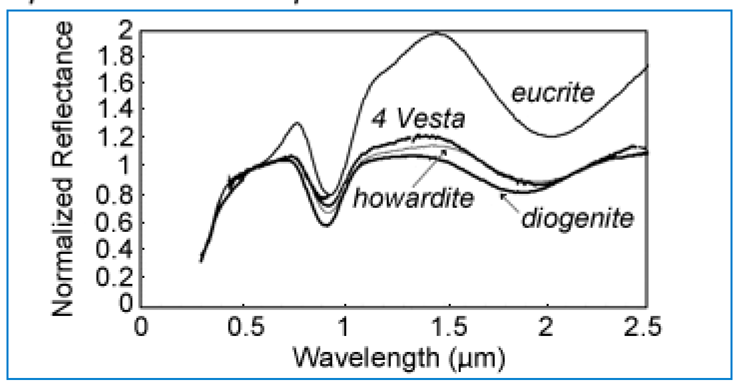
Quick Views of Big Advances

Vesta and the Vestoids

NASA's Dawn spacecraft begins to orbit asteroid 4 Vesta on July 15, 2011 for a year-long investigation, but the business of figuring out the surface composition, structure, and geologic history of this asteroid has been underway for decades. Cosmochemists, astronomers, and planetary scientists have been using laboratory analyses of meteorites and telescopic ***spectral*** data to tease out details of Vesta, vestoids (asteroids with similar spectral characteristics that could be collisional fragments of Vesta), as well as other asteroids. The 0.9 and 1.9 micrometer absorption bands for pyroxene in the spectra of Vesta match spectral markers of the HED meteorites--the three linked groups of meteorites: howardites, eucrites, and diogenites.



Spectra: Vesta Compared to three HED Meteorites



(From Burbine, *et al.* (2009) *Meteor. & Planet. Sci.*, v. 44(9), p. 1331-1341.)

Rhiannon Mayne (Texas Christian University) and colleagues compared laboratory spectra of HED meteorites to the visible and near-infrared (~0.4-2.5 µm) spectra (from telescope facilities at Kitt Peak, AZ and Maunakea, HI) of 14 vestoids and one V-type asteroid. The vestoids in this study are all over five kilometers in size. The team wanted to know if each appeared most like a eucrite (lava erupted on the asteroid's surface) or a diogenite (magma slowly crystallized below the surface), or a mixture of the two called howardite (formed by impact bombardment). Of the 15 vestoids in their study, Mayne and colleagues found seven consist entirely of only one HED meteorite type, either eucrite or diogenite, suggesting large-scale (>5 km) homogeneity both laterally and vertically on Vesta. The researchers found the other eight asteroids match a mixed spectrum, like howardites, suggesting smaller-scale (<1 km) heterogeneity. In addition, they report a new ferroan (high Fe/Mg ratio) diogenite composition for asteroid 2511 Patterson. In advance of Dawn's arrival at Vesta, the vestoids studied by Mayne and colleagues provide a way of examining the scale of compositional variability in Vesta's crust, thus offering clues to how Vesta formed. Of the two leading models for the formation of Vesta, partial melting or a magma ocean, the compositional variations reported by Mayne and coauthors seem to support the partial melting model, which predicts multiple intrusions of basaltic melts into the crust. We will know more when Dawn's instruments begin gathering science data at Vesta in early August, 2011.

See:

Mayne, R. G., Sunshine, J. M., McSween Jr., H. Y., Bus, S. J., and McCoy, T. J. (2011) The Origin of Vesta's Crust: Insights from Spectroscopy of the Vestoids. *Icarus,* v. 214, p. 147-160, doi: 10.1016/j.icarus.2011.04.013. [***NASA ADS entry***]. Also

see ***Dawn Mission Website*** and **PSRD** articles ***about Vesta***.

Written by Linda M. V. Martel, Hawai‘i Institute of Geophysics and Planetology, for ***PSRD***.

HOME

[***About PSRD*** | ***Archive*** | ***CosmoSparks*** | ***Search*** | ***Subscribe***]

[***Glossary*** | ***General Resources*** | ***Comments*** | ***Top of page***] ***Share***

July 2011

http://www.psrd.hawaii.edu

psrd@higp.hawaii.edu