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Presentation Abstract

Title **Chemical mapping of Vesta**

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Abstract Vesta's surface mineralogy and composition have been studied for decades via telescopic spectroscopy and laboratory analyses of the howardite, eucrite, and diogenite (HED) meteorites, which are thought to originate from Vesta. Visible and infrared reflectance measurements by Dawn have broadly confirmed the paradigm established by Earth-based work, strengthening the Vesta-HED connection. The Dawn mission has achieved a milestone by completing the first chemical measurements of a main-belt asteroid using nuclear spectroscopy. Dawn's Gamma Ray and Neutron Detector (GRaND) has globally mapped the composition of Vesta, including the portions of the northern hemisphere not illuminated by solar radiation. GRaND is sensitive to the composition of the bulk regolith to depths of several decimeters. Abundances and/or detection limits for specific elements and elemental ratios, such as H, Fe, Si, Fe/O, Fe/Si, and K, have been measured. Variations in the average atomic mass and neutron macroscopic absorption cross section have been characterized. The measurements constrain the relative proportions of HED whole-rock end-members, providing measurements of the pyroxene and plagioclase content of the regolith, thereby constraining the processes underlying Vesta's differentiation and crustal evolution. The spatial resolution of GRaND is sufficient to determine basin-average compositions of Veneneia and Rheasilvia, which may contain outcrops of Vesta's olivine-rich mantle. While the elemental composition of Vesta's regolith is similar to the meteorites, there are notable departures from HED whole-rock compositions. While these differences are not sufficient to topple the Vesta-HED paradigm, they provide insight into global-scale processes that have shaped Vesta's surface. Questions addressed by the analysis of GRaND data include: (i) Is Vesta the source of the Fe-rich mesosiderites? (ii) Are evolved, igneous lithologies present on Vesta's surface? (iii) What are the origins of exogenic materials found in Vesta's regolith? (iv) Is the vestan mantle exposed within the southern basins?

