CHEMICAL MIXING MODEL AND K-TH-TI SYSTEMATICS OF HED METEORITES FOR THE DAWN MISSION. T. Usui[1], H. Y. McSween Jr.[1], D. W. Mittlefehldt[2] and T. H. Prettyman[3]. [1]Department of Earth and Planetary Sciences, University of Tennessee, Knoxville. E-mail: tusui@utk.edu. [2]NASA Johnson Space Center, [3]Planetary Science Institute.

Introduction: The Dawn mission will explore 4 Vesta, a large differentiated asteroid believed to be the parent body of the howardite, eucrite and diogenite (HED) meteorite suite. The Dawn spacecraft carries a gamma-ray and neutron detector (GRaND), which will measure the abundances of selected elements on the surface of Vesta. This study provides ways to leverage the large geochemical database on HED meteorites as a tool for interpreting chemical analyses by GRaND of mapped units on the surface of Vesta.

Three-component mixing model: Because the spatial resolution of GRaND is coarser than spectral heterogeneity on Vesta's surface, we propose a three-component mixing model for interpretation of GRaND spectra based on whole-rock compositions of HED meteorites. The mixing model uses abundances of K, Ti, Fe and Mg that will be analyzed more accurately than other prospective GRaND-analyzed elements. The surface of Vesta is predicted to reflect the mixture of at least three rock types: diogenite, cumulate eucrite and basaltic eucrite [1]. The mixing relations for these three rock types can be displayed on two-dimensional diagrams of K vs. [Fe+Mg] and Ti vs. [Fe+Mg]. By selecting specific meteorites as end-member components, we can delineate mixing lines and quantitatively evaluate the contribution of the three rock types to GRaND spectra. Moreover, we examine propagated errors due to GRaND analytical uncertainties and intrinsic errors that stem from an assumption introduced into the mixing model. The error investigation suggests that the mixing model can adequately estimate the mixing ratios of the three end-member components as well as the abundances of most major and minor elements for the GRaND-analyzed surface.

K-Th-Ti systematics: HEDs are not the only achondrites representing asteroid crusts. Moreover, clustering of cosmic-ray exposure age distributions for HEDs suggests that the HED suite might have sampled only selected localized geologic terranes [e.g. 2]. This might imply that there may be lithologic types on the surface that have not been sampled and/or are related to other achondrite suites. We examine the variability of moderately volatile/refractory incompatible element ratios (K/Th and K/Ti) in HED meteorites, and compare those with other achondrite suites that represent asteroidal crusts; these ratios are expected to be determined accurately by GRaND. The whole-rock K-Th-Ti data of the HED suite were carefully screened because these data can be affected by sample heterogeneity and disturbed by terrestrial alteration. The K-Th-Ti systematics study indicates that the K/Th and K/Ti variations can differentiate HED meteorites from angrites and some unique eucrite-like lithologies, but not mesosiderites. These latter can be distinguished by their higher Fe contents. The results suggest that K, Th and Ti data obtained by GRaND will not only confirm that Vesta is the parent body of HED meteorites but may also allow recognition of as-yet unsampled compositional terranes on Vesta.

References: [1] Usui T. and McSween H. Y. 2007. *Meteoritics & Planetary Science* 42:255-269. [2] Eugster O. and Michel T. 1995. *Geochim. Cosmochim. Acta* 59:177-199.