DETERMINING THE PYROXENE MINERALOGIES OF NEAR-EARTH, MIDDLE-BELT, AND OUTER-BELT VESTOIDS. Thomas H. Burbine[1], Paul C.Buchanan[2], and Richard P. Binzel[3], [1]Department of Astronomy, Mount Holyoke College, South Hadley, MA 01075, USA (tburbine@mtholyoke.edu), [2]Kilgore College, 1100 Broadway, Kilgore, TX 75662, USA (pbuchanan@kilgore.edu), [3]Department of Earth, Atmospheric, and Planetary Sciences, Massachusetts Institute of Technology, Cambridge, MA 02139, USA (rpb@mit.edu).

Introduction: Asteroids with reflectance spectra similar to howardites, eucrites, and diogenites (HEDs) are found throughout the asteroid belt and near-Earth asteroid population. These objects are commonly called Vestoids. Asteroid 4 Vesta at a semi-major axis (*a*) of 2.36 AU is the largest (~500 km in diameter) of these bodies and also a member of the Vesta dynamical family. Vesta is generally assumed to be the parent body of almost all HED meteorites.

However, a number of eucrites have oxygen isotopic compositions significantly different from most other measured HEDs, implying that other differentiated bodies besides Vesta formed in the asteroid belt. Vestoids in the inner main-belt (~2.1-2.5 AU) are most likely fragments of Vesta; however, Vestoids located in the near-Earth asteroid population, the middle-belt (~2.5-2.8 AU), and the outer-belt (~2.8-3.3 AU) may or may not be related to Vesta.

We present initial results of an ongoing mineralogical study of near-Earth, middle-belt, and outer-belt Vestoids. Different types of HEDs have contrasting ranges of average pyroxene compositions: noncumulate eucrites ($Fs_{43-55}Wo_{9-15}$), cumulate eucrites ($Fs_{30-44}Wo_{6-10}$), howardites ($Fs_{31-42}Wo_{4-8}$), and diogenites ($Fs_{20-30}Wo_{1-3}$). We currently have near-infrared spectra of nine near-Earth, one middle-belt, and two outer-belt Vestoids. We hope to determine whether these Vestoids have distinctive pyroxene mineralogies and how these mineralogies relate to HEDs.

Vestoid Spectra: The Vestoids were observed in the near-infrared using SpeX. SpeX is a medium-resolution near-infrared spectrograph [1] located at the NASA Infrared Telescope Facility (IRTF) on Mauna Kea. Observing procedures are discussed in Binzel et al. [2].

Band Centers: To determine the pyroxene mineralogies of the Vestoids, we first calculated band centers. Band centers for the asteroid spectra were calculated using the method of Storm et al [3]. A linear slope derived from a straight line tangent to the two reflectance peaks on each side of the band was divided out. A second-degree polynomial was then fit over the bottom third of the band and the band center was calculated. Each reflectance value was randomly resampled using a Gaussian distribution and then fit using another second-degree polynomial. Each spectrum was resampled ninety-nine times. The derived one-hundred band centers were averaged and the sample standard deviation calculated.

Band centers move to shorter wavelengths as the temperature of the surface decreases [4]. To do the temperature corrections, we use the results of Moroz et al. [5] who measured the movement of the band centers for two pyroxenes at different temperatures.

Outer-Belt Vestoids: We have near-infrared spectra of 1459 Magnya (*a=3.14 AU*) and 7472 Kumakiri (*a=3.01 AU*). Both of these objects are dynamically difficult to derive from Vesta. Magnya has a temperature-corrected Band I center of 0.934±0.002 µm and a temperature-corrected Band II center of 1.985±0.030 µm. From these band centers, the interpreted pyroxene mineralogy of Magnya is consistent with a noncumulate eucrite or a cumulate eucrite, depending on which formulas are used. This result is consistent with the observation that eucrites with "anomalous" oxygen isotopic compositions have Fs and Wo contents indistinguishable from eucrites with "normal" oxygen isotopic values. We are still analyzing the Kumakiri spectrum.

Middle-Belt Vestoid: We have near-infrared spectra taken at two different times (2006 and 2007) of 21238 1995 WV7 (*a=2.54 AU*), which is located just outside the 3:1 resonance. Calculated temperature-corrected average pyroxene mineralogies for 1995 WV7 are consistent with a cumulate eucrite, howardite, or a diogenite depending on the formulas that are used and whether data from 2006 or 2007 is used. Since the pyroxene mineralogy of 1995 WV7 is consistent with HEDs, we argue that this object could be a fragment of Vesta.

Near-Earth Vestoids: We currently have spectra of nine near-Earth Vestoids (3361 Orpheus, 3908 Nyx, 4055 Magellan, 5604 1992 FE, 6611 1993 VW, 52750 1998 KK17, 88188 2000 XH44, 2003 FT3, 2005 WX). We are still analyzing the spectra of the near-Earth Vestoids.

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