VNIR SPECTRAL VARIABILITY OF HED SLABs. C. Carli[1], V. Moggi Cecchi[2], G. Pratesi[2,3], and F. Capaccioni[1] [1]IAPS-INAF (Via Fosso del Cavaliere 100, 00133, Roma, Italy; cristian.carli@iaps.inaf.it), [2]Museo di Storia Naturale, Università di Firenze, Via La Pira, 4, I-50121, Firenze, Italy; [3]Dipartimento di Scienze della Terra, Università di Firenze, Via La Pira, 4, I-50121, Firenze, Italy.

Introduction: Howardite, Eucrite and Diogenite (HED) meteorites are related to 4Vesta asteroid, their parental body. These achondrites show igneous-like characteristics (e.g. composition, texture) and display visible and near-infrared (VNIR) spectra analogue to those of Vesta's asteroid family (e.g. [1]). Recently, the Dawn Mission (NASA) has investigated 4Vesta from the orbit, producing a first detailed global mapping. This mission has confirmed the relationship between 4Vesta and HEDs by their spectral properties [2], revealing the two dominating pyroxenes absorptions, around 0.9 and 1.9 μm [3]. In particular, spectral characteristics are within the Howardites field, and, partially, within those of Eucrites and Diogenites [4]. Moreover, bright and dark materials are visible, which are supposed to be fresher excavated [5] and CC-like materials-rich regions [6], respectively. [7] identified areas where the olivine could be present in significant amounts in two craters of the north hemisphere, and [8] indicated that olivine could be present also in other regions.

Here we present spectral characteristics of several eucrites, diogenites, and some howardites, belonging to the Museo di Storia Naturale dell'Università di Firenze. We considered the variability in reflectance and absorptions of slab (fresh-cut surface) comparing these data with the mineralogy and in particular the composition of mafic phases. We analyzed how absorptions change on different area, discussing the spectral heterogeneity of sample. Moreover we will discuss how absorption parameters varies between the different samples and we will relate trends with mineralogical variations. In addition, we considered in our analysis for three different eucrite, with an evident variation in reflectance, and an olivine diogenite powders from a representative portion of samples. This will be usefull to deep investigate also the influence of size on spectral shape and on absorption band parameters.

Methods: Reflectance spectra were measured on a slab sample. The measured surface was cut but not mirror-like polished. The bidirectional reflectance spectra were measured with a Fieldspec-Pro spectrophotometer mounted on a goniometer in use at the SLAB (Spectroscopy LABoratory) at IAPS-INAF, Rome. The spectra were acquired with 1 nm spectral sampling between 0.35 and 2.50 μm with i=30° and e=0°. The source used was a QTH lamp. The calibration was performed with Spectralon optical standard (registered trademark of Labsphere, Inc.). The illuminated spot was ca. 0.6 mm in diameter. The mineral chemistry of the most diagnostic mineral phases for spectral properties (e.g. pyroxenes, olivine) were considered (e.g. ferrosilte mol% (fs%), fayalite mol%) to correlate with the position and depth of HED absorptions.

Results: Spectra show bidirectional reflectance between 0.05-0.45 (Fig.1), and mafic minerals are clearly indicated by the presence of Fe^{2+} crystal field absorptions around 0.9 (band I) and 1.9 μm (band II). In general, both the mafic absorptions indicative of pyroxenes are clearly present in the spectra with a variation in spectral contrast. Spectra show also a clear variability between 1.1 and 1.5 μm (see Fig.1), whit an asymmetric absorption present in eucrites or in olivine abundant region.

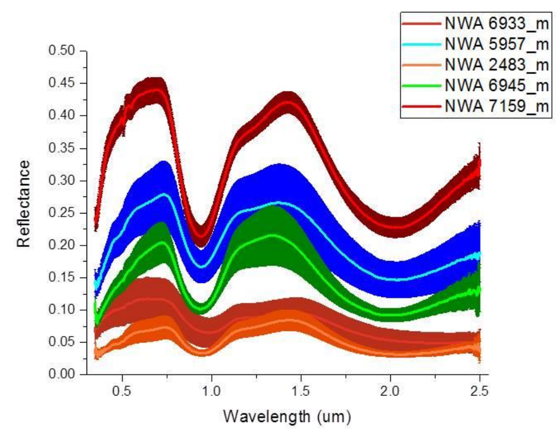

Figure 1 - Different bidirectional reflectance slab spectra from some of measured samples. Mean spectra and standard deviations are plotted.

In this first step we analyzed spectral parameters with a particular attention to the depth and the center of the two absorptions. These parameters were acquired for each averaged spectrum representative of a spectraly homogenous sample or portion of sample after the removal of continuum performed according to the approach described in [9]. Figure 2 shows the position of the Band Center I vs. the Band Center II characteristics of some selected samples after continuum removal. The variability between the position of the two bands show a trend similar to the one already observed in the literature for powders spectra. The Band Center shifts from lower to higher wavelength in agreement with the variation in pyroxene composition. Low-iron and low-calcium pyroxene present in diogenite have absorptions at lower wavelength, where relative high-iron and/or high-calcium pyroxene in eucrite are shifted at 1.0 and 2.1 μm, respectively.

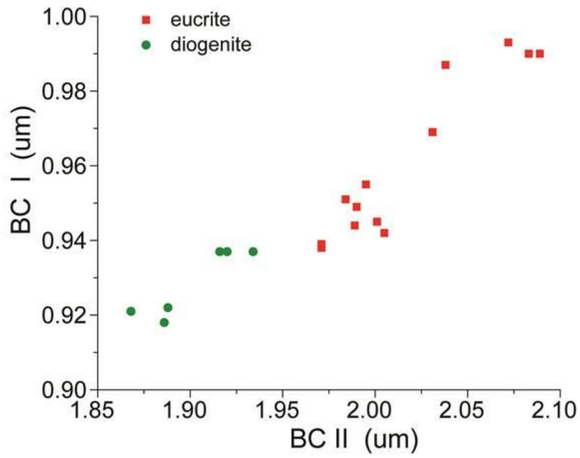

Figure 2 - Selected continuum removed band center I (BCI) and II (BCII) for eucrite (red) and diogenite (green).

Considering the samples where both slab and powder spectra are measured, we can clearly evidence how the band position show a similar trend for slab and powders (not shown here), with a slight shift towards lower wavelength for the band II.

In Figure 3 we have related the Band Center I for those samples (3 eucrite and an olivine diogenite) with the fs% of pyroxene. We considered also parameters for synthetic pyroxene from [10, 11]. We can see a very good corrispondance with the dominating pyroxene phase, while the shifts are in accordance with the presence of olivine for the diogenite and the exolution lamelle of high-calcium pyroxene for the eucrites.

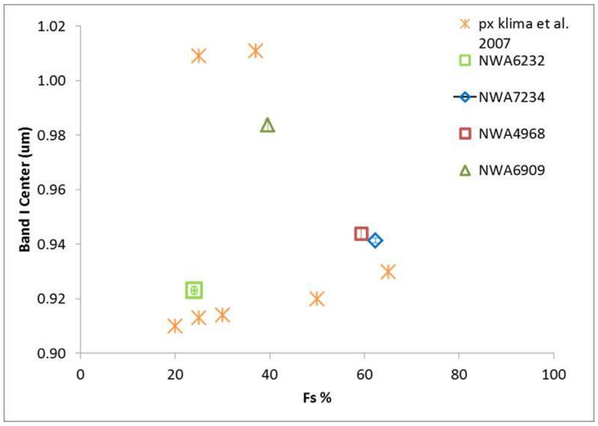

Figure 3 – Band Center I vs. fs%. of four investigated samples are plotted with repect to synthetic pyroxene (from [10] and [11]) parameters with composition analogues to those present in these HED.

Future Works: The variation of the Band Center seems to have closer values for slab and powder spectra. Working with absorption parameters acquired for slab spectra of HED will permit to enlarge the studied number of samples: 1) to better investigate the spectral properties of this meteorite family, and 2) relating them with the mineral chemistry. Discussing them will improve our capability to separate samples dominated by differences in mineral and/or rock composition. Moreover, we can investigate, at the illuminated spot scale, the hetereogenity of several samples, which is unsuitable for powders.

References:

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