EPSC Abstracts
Vol. 7 EPSC2012-553-1 2012
European Planetary Science Congress 2012

Investigation of HEDs using Dawn VIR spectral indicators

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1. Introduction

Most extraterrestrial samples come from small bodies of the Solar System; however the correlation between specific meteorites and asteroids is a longstanding problem: the best known of them seems to be between Howardite, Diogenite, Eucrite (HED) meteorites and Vesta [1,2]. HEDs represent five percent of all meteorites found on Earth; they consist of material similar to terrestrial basalts and plutonic rocks. 4 Vesta, recently visited by the Dawn mission, is an asteroid that apparently was formed, melted and differentiated very early in the history of Solar System and survived intact through 4.5 billion years while suffering many impacts. Radiometric ages of the HED meteorites are close to that of Solar System itself. For this reason we believe that Vesta and the HED meteorites preserve retrievable information on the physical and chemical conditions during the planetary formation epoch [2]. The aim of this work is to support Dawn Mission, by contributing to an improved interpretation Vesta reflectance spectra acquired by the Dawn VIR imaging spectrometer, mapping Vesta's surface in the range between (0.25-5.00) µm [3] .

2. Data Sets

In our laboratory at INAF (Rome), we are building a library of reflectance spectra of HED slabs in the wavelengths between (0.35–2.50) µm. Spectra are acquired using the Fieldspec spectrometer, taking spots of about 5 mm, in standard condition, on the surface of the slabs [4]. The reflectance spectra of meteorites are classified by seven parameters: band minimum, slope, band center, bandwidth, band depth, band area and asymmetry, similar to the analysis of the Dawn VIR data.
To date we have mapped the spectra of 19 samples, including eight Howardites, nine Eucries and two Diogenites.
For all samples we produce coloured maps of the parameters mentioned above to characterize the spectral heterogeneity within each sample and the spectral variability between samples representing the different types of HEDs.

Figure 1: NWA 047, a monomict eucrite, found during 2000; it weighs 85.4 g .

Here we show, for example, the results relative to band minima position for Eucrite NWA 047.
Maps relative to this parameter are represented in following Figure 2 and Figure 3.

Figure 2: the positions map of band I minima and relative colored scale for NWA 047; values are in microns.

The Band minima of NWA 047 indicate a compositional variation of pyroxenes from possibly pigeonite to augite with a quite high variation in Ca and Fe.

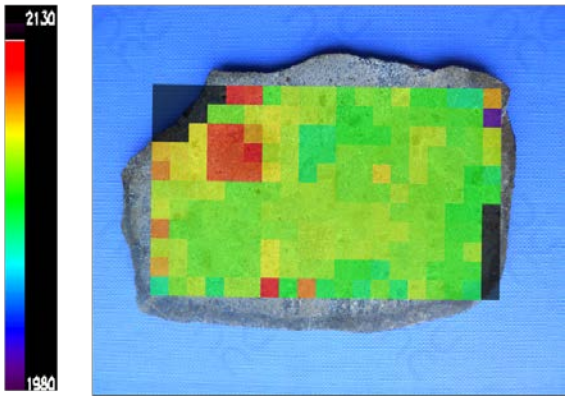

Figure 3 : the positions map of band II minima and relative colored scale for NWA 047; values are in microns.

We will discuss the spectral properties of our set of HED slabs obtained by reflectance spectroscopy, looking for correlations between all parameters. This kind of analysis should permit us to derive significant information about mineralogy of Vesta surfaces. Subsequently we will then be able to compare these results for HED samples with the reflectance spectra of Vesta's surface measured by Dawn.

Acknowledgements

The spectral data catalogue of the HEDs meteorites has been assembled using meteorites from the Vatican Observatory and the Museo di Scienze Planetarie della Provincia di Prato. The authors wish to thank the Italian Space Agency (ASI) for supporting this work.

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