CLASSIFICATION OF DAWN VIR HYPERSPECTRAL DATA OF VESTA. F. Zambon[1], M. C. De Sanctis[1], E. Ammannito[1], M. T. Capria[1], F. Capaccioni[1], F. Carraro[1], S. Fonte[1], A. Frigeri[1], G. Magni[1], S. Marchi, E. Palomba[1], F. Tosi[1], D. T. Blewett[2], C. A. Raymond[3], C.T. Russell[4], T.N. Titus[5] and the Dawn Team.

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Introduction: On May 2011 Dawn spacecraft started observations of 4 Vesta [1]. The Dawn VIR-MS (VIS and IR Mapping Spectrometer) mapped most of Vesta's surface in the spectral range of wavelengths 0.255 - 1.07 μm for the visible (VIS) and 1.02 - 5.097 μm for the infrared (IR), generating hyperspectral cubes of 432 bands for each channel [2]. Vesta has a basaltic surface: its spectrum has similar characteristics to the HED (howardite, eucrite and diogenite) meteorites and presents strong absorption bands centered near 0.9 μm and 1.9 μm, indicating the presence of iron-bearing pyroxenes [3]. By analyzing the whole disk of Vesta as observed during the approach phase, it is possible to have a global overview of its surface.

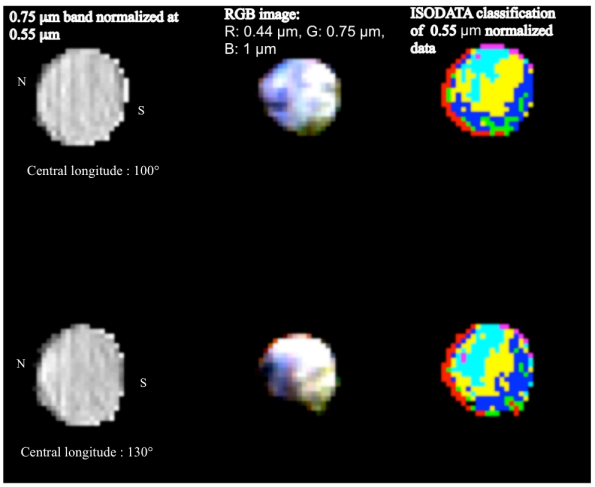

Figure 1: *Left column:* Images of two different view of Vesta whole disk at 0.75 μm. *Middle:* RGB images of Vesta (R: 0.44 μm, G: 0.75 μm, B: 1 μm). *Right:* The result of the ISODATA classification of the Vesta full disk image cube (0.44 μm to 2.1 μm, normalized to 1 at 0.55 μm).

Data set description and analysis: For a preliminary study, it possible to classify the whole disk image of Vesta obtained during the approach phase. The VIS and IR channel were connected together and for this analysis it was selected the spectral range between 0.44 μm and 2.1 μm. All the reflectance spectra are normalized to 1 at 0.55 μm. The normalization reduces the albedo differences and emphasizes the spectral differences, as slopes and absorption bands. The ISODATA unsupervised classification method [4], together with an RGB image (R: 0.44 μm, G: 0.75 μm, B: 1 μm), can be useful in developing a global view of Vesta's major spectral variation. ISODATA is a commonly used clustering algorithm [5]. The parameters explored here are the following: limited number of classes (interval between 3 and 10 classes), a single iteration and a threshold of 5%. Future work will build upon this result by using higher resolution data and selecting the end-members for a supervised classification.

Classification results: A comparison of the RBG image and ISODATA classification method gives consistent results. There is a good correspondence between the four ISODATA useful classes (yellow, cyan, green and blue classes) and the regions emphasized in the RGB image. The mean spectra obtained from ISODATA classification are presented in Fig. 2. The spectra exhibit slopes variations and are characterized by two pyroxene features at 0.9 μm and 1.9 μm that have different band depths and band widths that can be associated to the grain size distribution, the abundance of the absorbing minerals and the presence of opaques materials [6].

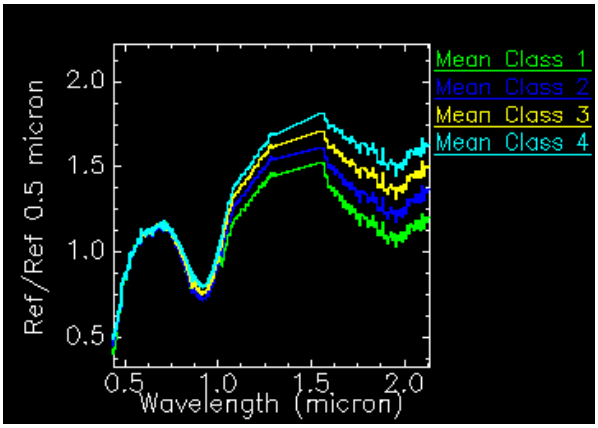

Figure 2: Mean spectra of the classes obtained with ISODATA classification. The bands from 1.31 μm to 1.56 μm were removed because of calibration residue.

Discussion and conclusions: The results of the ISODATA classifier are in agreement with the RGB image and show the presence of four major spectral types. The Cyan class (#4 in Fig. 2) dominates the north-east region, the yellow class (#3) is found in the

equatorial area, the blue class (#2) in the southern mid-latitude while the green class (#1) is concentrated in the south-west region. The mean spectra reveal slopes variations and two distinct spectral features near 0.9 μm and 1.9 μm characteristic of pyroxenes. More detailed studies can be done by applying a suitable photometric correction [7] and using the survey and HAMO data.

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References: [1] Russel, SSR, 163, (2012). [2] Russel et al. 2004. [3] De Sanctis et al. LPSC 2012. [4] Adams, J. B., Gillespie, A. R. (2006). [5] Mamarsadeghi, et al., 2007. [6] De Sanctis et al, (2012). [7] Li et al., (2012).