INVESTIGATION OF ASTEROID 4 VESTA SPECTRAL PROPERTIES BY IMPLEMENTATION OF PHASE- AND COLOR-RATIO TECHNIQUES

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NASA space mission Dawn to asteroid 4 Vesta and dwarf planet Ceres resulted in a large amount of image data with a high spatial resolution obtained by onboard instrument Framing Camera (FC) under various observation and illumination geometry in a number of extended visual spectral bands. It provides an opportunity to implement already existing methods of analysis of the surface layer's optical roughness on the atmosphereless planetary bodies. Indirectly the optical roughness holds some information about packing density of regolith environment, average sizes of grains and shapes as well as single scattering albedo. The phase-ratio method is applied to images of the vestan surface in order to investigate local roughness, spectral slope and absorption band depth variations. To provide better understanding of chemical variations along researched areas of surface we also built maps of color-ratio distributions. These methods were developed and successfully applied to the lunar surface images obtained during Moon's remote sensing.

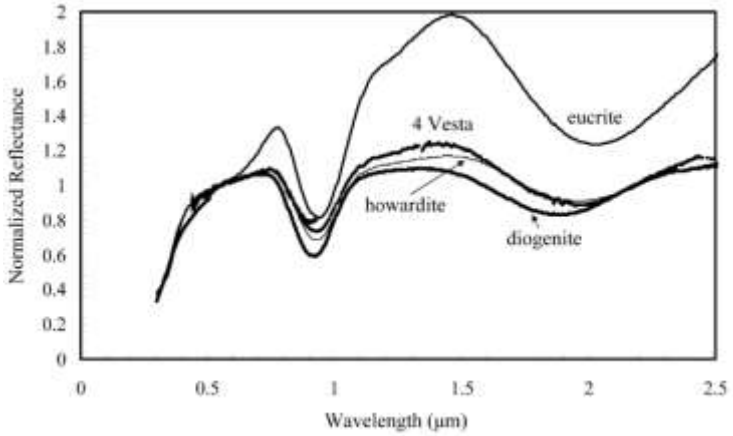

Fig 1. Vestan spectrum in comparison with spectra of eucrites, howardites and diogenites

Global colorimetric mosaics of Vesta shows significant variations of spectral properties of regolith surface layer and points to considerably greater variations comparing to those which other asteroids have [1]. Moreover, the vestan spectrum stands out in terms of the evidence of two pyroxene absorption bands at 0.9 μm and 1.9 μm and almost coincides with that of howardites (Fig 1) [2]. Narrow band-pass filters of FC instrument fit the spectrum of Vesta in such a way that it is possible to estimate the depth of pyroxene adsorption band at 0.9 μm and,

therefore, analyze abundance of pyroxene in the material of researched surface areas (Fig. 2).

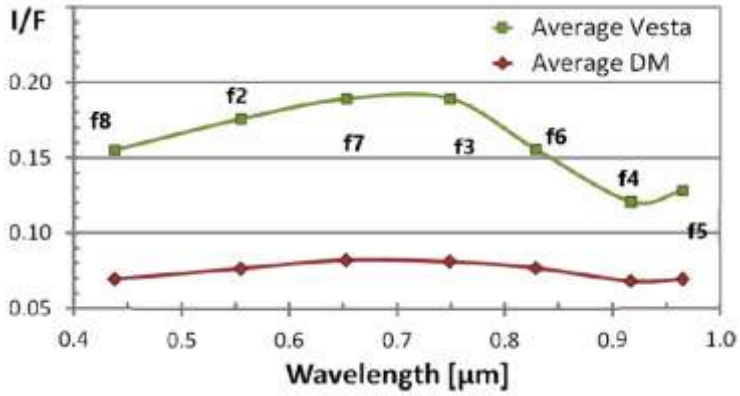

Fig 2. Coverage of the relative reflectance of Vesta and Ceres by FC filter band-passes [3]

There is a plenty of factors that cause observed albedo, color and phase ratio variations: ejecta from young fresh craters, outcrops of bedrocks due to slope processes, such as landslides and taluses, evidences of endogenic activity (cryovolcanism on the Ceres' surface). Searching of such processes of regolith surface layer renovation on Vesta is the main goal with this study.

References:

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ENVIRONMENTAL EFFICIENCY EVALUATION OF A BATTERY ELECTRIC VEHICLE

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Decision makers require accurate and detailed information regarding the life cycle environmental burdens of different passenger transport technologies to efficiently decarbonize the passenger transport sector. Much progress has already been made on this front. Previous studies have already shown that Battery Electric Vehicles(BEV) and Fuel Cell Electric Vehicles (FCEV) can provide climate benefits, though results depend strongly on several factors including the CO2