EPSC Abstracts
Vol. 9, EPSC2014-283, 2014
European Planetary Science Congress 2014

Spectral analysis of Marcia Quadrangle of Vesta: Mineralogy of the Eucritic Equatorial Region

M.C. De Sanctis (1), Combe (2), E. Ammannito (1,6), A. Frigeri (1), A. Longobardo (1), E. Palomba (1) , F.Tosi (1), F. Zambon(1), S. Marchi (3,1), R. Jaumann (4), K.Stephan (4), C.A. Raymond (5), C.T. Russell (6) , and Dawn Team.

(1) INAF, Istituto di Astrofisica e Planetologia Spaziale, Area di Ricerca di Tor Vergata, Roma, Italy, (2) Bear Fight Institute, Winthrop, WA, USA; (3) NASA Lunar Science Institute, Boulder, USA; (4) DLR, Berlin, Germany, (5) Institute of Geophysics and Planetary Physics, UCLA, USA, (6) Jet Propulsion Laboratory, NASA, Pasadena, USA ; (mariacristina.desanctis@iasf-roma.inaf.it)

Abstract

The Vestan equatorial region, containing the young and distinctive Marcia crater, displays several interesting features and terrain types. Crater Marcia is a 68 km long (N-S) by 58 km wide (E-W) crater and it is located in a howarditic – eucritic rich region on Vesta [1,2,3]. While a detailed geological investigation of Marcia region was performed [4], no detailed mineralogical analysis of Marcia region was done. Here we describe the results of the spectral analysis of Marcia quadrangle. In particular, we focus on the behavior of the main geological units identified in the quadrangle, including the dark Marcia ejecta, the divalia fossae formation and old cratered highlands.

1.Introduction

Vesta is the largest fully differentiated asteroid. It has a basaltic surface dominated by a spectral signature of the mafic silicate mineral, pyroxene [1,2,3,5,6]. Its spectra are similar to those of howardite, eucrite, and diogenite meteorites (HEDs), indicating that it has Vesta is the source of this class of meteorites [2,3,5,6,7,8]. The NASA-Dawn mission orbited the asteroid Vesta from 16 July 2011 to 25 July 2012 [9], taking multicolor and hyperspectral images by means of the Framing Camera (FC), e.g. [10], and the Visible and InfraRed spectrometer (VIR), e.g. [11], and mapping the surface elemental composition by means of the Gamma Ray and Neutron Detector (GRaND) [12]. In particular the FC and VIR data allowed us to derive mineralogical maps of the Vesta surface.

Vesta's surface has been divided into fifteen quadrangles, each one with different geologic and mineralogical characteristics.
The main geologic and mineralogical surface features in this regions are the large, relatively young craters Marcia and Calpurnia and their surrounding dark ejecta field, a hill with a dark-rayed crater named Aricia Tholus, and an unusual diffuse material surrounding the impact crater Octavia. The dark ejecta field is superposed the heavily cratered units that predate the formation of Rheasilvia and Veneneia impact basins. The major geologic units identified in the quadrangle have been analyzed to see differences and similarities need to disclose their origin and relationship.

2. Results

Large variation of reflectance is seen in the quadrangle: bright an dark materials are present as diffuse material and also concentrated spots and outcrops.
The spectral analysis of this region indicates that it is relatively uniform in distribution of the pyroxenes band centers, but it shows large differences in pyroxenes band depths and reflectance. The first analysis of pyroxenes band centers of Marcia quadrangle indicates mainly a basaltic eucritic composition, thus suggesting that this region can be a remnant of the old Vestan basaltic crust (fig.1). Nevertheless the data of Marcia quadrangle set off from the HED trend, with spectra showing centers of the 2 micron pyroxenes band at unusually long wavelengths, suggesting that the eucritic basaltic composition could be only apparent.
Different possible reasons are considered to reproduce the observed band centers distribution,

including the presence of carbonaceous chondritic material, melts and opaques. Analysis of the laboratory mixture of pyroxenes and carbonaceous chondrites, show that the spectra of the mixture have reduced reflectance, small band depths and longer centers of the second pyroxenes band, while the centers of the 1 micron band remain unaffected by the presence of carbonaceous chondrites. The mixture of pyroxenes with carbonaceous chondrites can explain the observed spectra in Marcia darkest region, clarifying the reason for the observed offset from the HED trend.

Acknowledgements

VIR is funded by the Italian Space Agency–ASI and was developed under the leadership of INAF-Istituto di Astrofisica e Planetologia Spaziali, Rome-Italy. The instrument was built by Selex-Galileo, Florence-Italy. The authors acknowledge the support of the Dawn Science, Instrument, and Operations Teams. This work was supported by ASI and NASA's. A portion of this work was performed at the JPL NASA

References

[1] De Sanctis et al. 2012, Science, 336, 697

[2] De Sanctis et al., Space Sci. Rev., DOI 10.1007/s11214-010-9668-5 , 2010;

[3] Ammannito et al., 2013, Meteorit. Planet. Sci. http://dx.doi.org/10.1111/3

[4]Williams et al., 2014, Iacrus, in press.

[5] McCord et al. 1970, Science; Science 168, 1445-1447;

[6] Gaffey 1997; Icarus, Icarus 127,130–157;

[7]Consolmagno & Drake 1977, Geochim. Cosmochim. Acta 41, 1271-1282;

[8] McSween et al., 2013, Meteorit. Planet. Sci. 48, 2090-2104

[9] Russell C.T et al. 2012, Science, 336, 684

[10] De Sanctis, M.C., et al. (2011). Space Sci. Rev. 163, 329-369.

[11] H. Sierks, et al., 2011, Space Sci. Rev. doi:10.1007/s11214-011-9745-4

[12] Prettyman, et al., 2011, , Space Sci. Rev

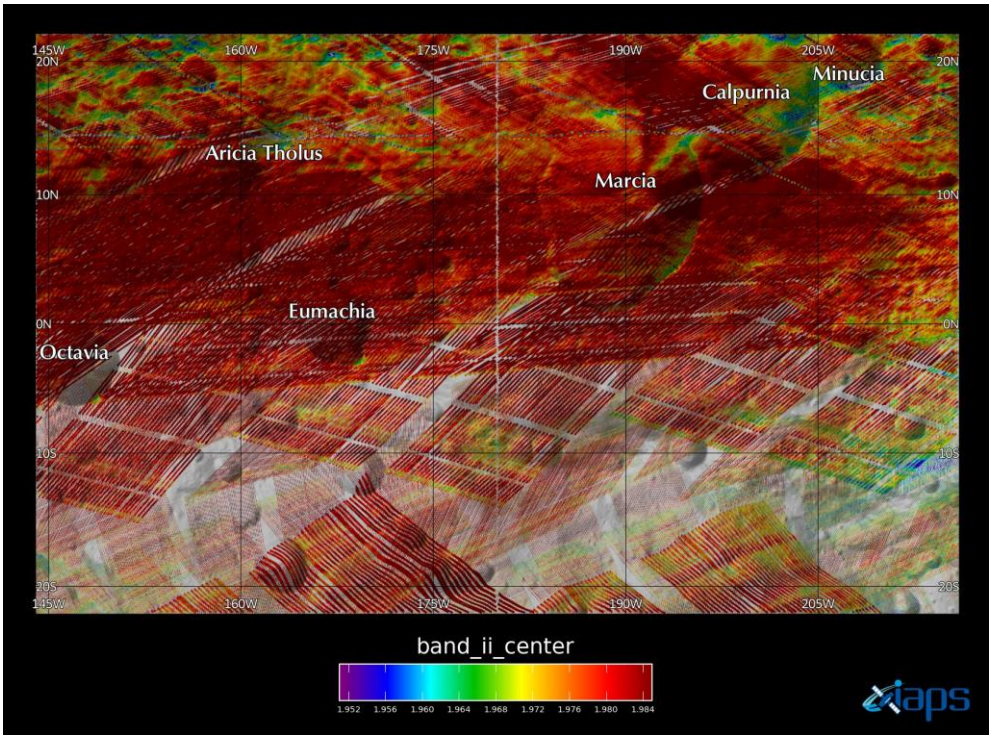

Fig. 1.Distribution of Band II centers.