PYROCLASTIC DEPOSITS IN THE RUDAKI'S AREA. F. Zambon[1], M. C. De Sanctis[1], F. Capaccioni[1], G. Filacchione[1], C. Carli[1], E. Ammannito[1] and A. Frigeri[1] (francesca.zambon@iasf-roma.inaf.it)

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Introduction: Mercury Dual Imaging System (MDIS), after the first two flybys, covers large part of the Mercury surface and together with the Mariner 10 mission, mapping about 90% of the Mercury surface [1]. Thanks to the WAC (Wide Angle Camera) images it is possible to study Mercury's surface composition, combining the color bands on order to have multiband images. We applied MINIMUM DISTANCE supervised classification method to the WAC data of the Rudaki's region (FIG. 1). The aim is to classify and distinguish between different terrains in this region. Afterwards we compared this area with the pyroclastic deposits in the Lermontov (D2) and Mistral (D1) craters [2] to investigate about potential pyroclastic deposits in the Rudaki region.

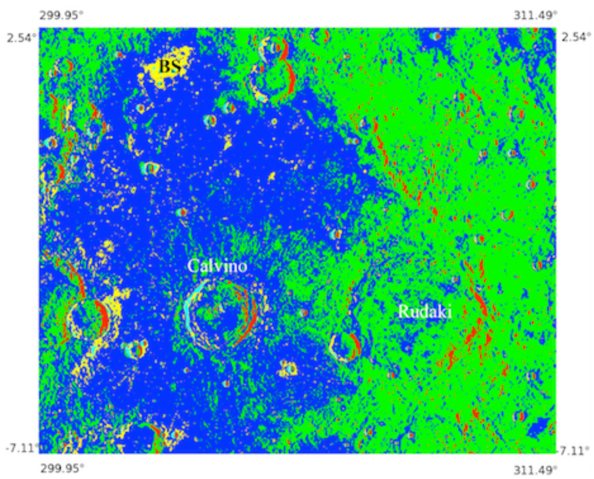
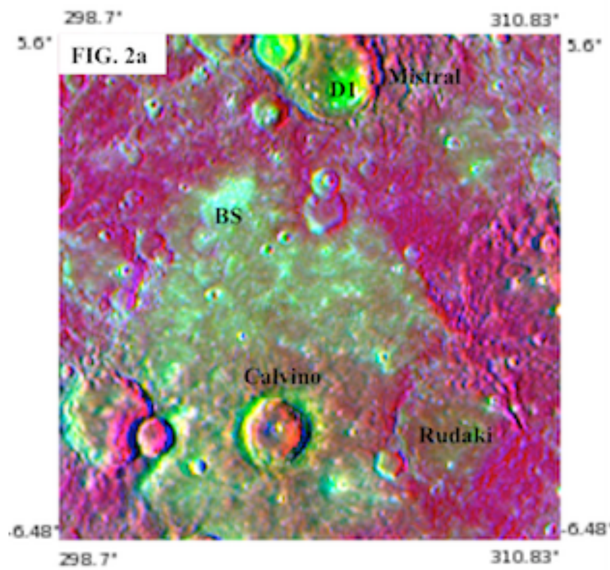


Figure 1: MINIMUM DISTANCE classification of the Rudaki Area. In the image it is possible to distinguish the different regions present on the Rudaki region associated to the three main spectral classes. The colors corresponds to: high albedo areas (yellow class), smooth planes (blue class), and rough areas (green class). In the upper part of this figure is visible a very high albedo area here classified as a yellow spot (BS).

Data set description: The data used for this analysis are the WAC calibrated data of the region near the Rudaki and Lermontov craters of the first two flybys. We applied the Hapke-Henyey-Greenstein photometric model [4] to the mercator-projected multiband cubes using the parameters described in [5]. For the bright spot (BS) (FIG.1) analysis we preliminary produced RGB color images (R: PC2, G: PC1, B: 433/1012 band ratio) of the Rudaki-Mistral and Lermontov regions (FIG. 2a-b).



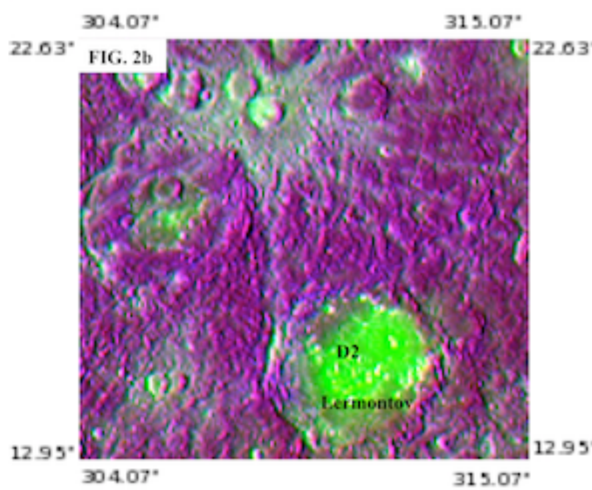


Figure 2 a-b: RGB color images (R: PC2, G: PC1, B: 433/1012 band ratio) of the Rudaki-Mistral and Lermontov craters.

Classification results: MINIMUM DISTANCE classifications detect three different type of terrains: 1) high albedo areas (yellow class), 2) smooth planes (blue class), 3) rough areas (green class) (FIG. 1). The bright spot (BS) in the north west of the Rudaki area shows a morphology similar to pyroclastic deposits. To deepen the nature of this region we compared the RGB image of the Rudaki region with the RGB image of the Lermontov and Mistral Craters (FIG 2a-b). The subsequent elaboration of this data was done using the Principal Component (PC) analysis and the band ratio that gives informations about the spectral slopes. PC analysis is useful to identify subtle variations in multispectral images. In this case the first principal component (PC1) is associated to reflectance variations, while the second principal component (PC2) is linked to color variations and maps the morphological boundaries and variations in the physical state or composition [6]. Combining PC1, PC2 and band ratio it is possible to emphasize color differences in order to produced RGB images in which the red channel represents the PC2, the green channel the PC1 and the blu channel the 433/1012 band ratio.

From this observation we see that the bright spot (BS) in the Rudaki area has different spectral characteristics than the pyroclastic deposits in Mistral and Lermontov craters. In [2] were mentioned some criteria to identify possible pyroclastic deposits: 1) the presence of an irregular center depression, 2) albedo anomaly with diffuse boundaries, 3) distinct spectral signature. The bright spot presents irregular center depression and albedo anomaly with diffuse boundaries, but to define it as a pyroclastic deposit it is necessary to do a detailed spectral analysis of this region with other area containing pyroclastic deposits.

Conclusions: The small spectral differences and the absence of clear absorptions bands, makes difficult to extrapolate mineralogy of the Rudaki Area on Mercury. The classification identifies three different types of terrains highlighting albedo and spectral slopes variations related to spectral heterogeneities on Mercury's Rudaki region. The blu class is characteristic of the smooth planes, the green class is typical of the rough areas. It is possible to notice the presence of the green class also in the smooth plane, indicating the possible presence of an older terrain inside the smooth plane. The yellow class is associated to the high reflectance regions, which show the presence of bright materials probably more recent than the others. Comparing the yellow spot (BS) inside Rudaki plains with the pyroclastic deposits in Mistral (D1) and Lermontov (D2) craters [2] we note a different color variation.

To study more in deep the spectral characteristics we will do a more define spectral analysis: comparing the mean spectra and the spectral variation of these three region we could find more differences or resemblances.

With the orbital phase of the MESSENGER and thanks to the future Bepi Colombo (SIMBIO-SYS) missions [7], it will be possible to have higher spatial and spectral resolution data and improve the results obtained [8].

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References: [1] Denevi, B. W. et al., 2009. [2] Kerber, L. te al., 2011 [3] Mamarsadeghi, N. et al., 2007. [4] Hapke, B., 1993. [5] Domingue, D. L. et al., 2010. [6] Robinson, M. S. et al., 2008 [7] Flamini, E. et al., 2010 [8] Rothery, D. et al., 2010.