EPSC Abstracts
Vol. 12, EPSC2018-850, 2018
European Planetary Science Congress 2018

Spectral and lithological heterogeneities in the Shakespeare (H-03) quadrangle of Mercury

N. Bott (1), A. Doressoundiram (1), D. Perna (1,2), F. Zambon (3), C. Carli (3) and F. Capaccioni (3)
(1) LESIA - Observatoire de Paris - CNRS - Sorbonne Université - Université Paris-Diderot, 5 place Jules Janssen, 92195 Meudon, France, (2) Osservatorio Astronomico di Roma - INAF, Monte Porzio Catone, Italy, (3) Istituto di Astrofisica e Planetologia Spaziali - INAF, Roma, Italy (nicolas.Bott@obspm.fr)

Abstract

We analysed the spectral properties of the surface of Mercury in the H-03 quadrangle to define its compositional variability and identify units constrained by relevant spectral parameters.

1. Introduction

Mercury mapping campaign started to support the observational strategy of the SYMBIO-SYS instrument onboard the future BepiColombo spacecraft. A goal is to integrate the color variations due to differences in composition to the photo-interpreted geology of the innermost planet. The used data are image mosaics from the Mercury Dual Imaging System (MDIS) Wide Angle Camera (WAC) onboard MESSENGER spacecraft. Authors identified three major color units (high-reflectance plains, intermediate terrains and low-reflectance material) and two minor color units (red spots and hollows) [1].

2. Data set

The surface of Mercury is subdivided into 15 quadrangles. Some have already been mapped [2,3], others are in progress [4]. Here we focus on the H-03 quadrangle, Shakespeare, with 22.5° < latitude < 65° and 180° < longitude < 270°. We used the data of the 8 following filters: 433.2, 479.9, 558.9, 628.8, 748.7, 828.4, 898.8 and 996.2 nm. The other filters (698.8, 947.0 and 1012.6 nm) are used because they can not ensure the coverage of the quadrangle.

3. Method

To produce the color map, we used the software ISIS (USGS) and proceeded as follows: 1) Importation of raw data into ISIS (Integrated Software for Imagers and Spectrometers) format; 2) Georeferencing using SPICE kernels and a DEM of Shakespeare produced at DLR [5]; 3) Radiometric calibration; 4) Equirectangular projection; 5) Kaasalainen-Shkuratov photometric correction [6, Table 9] to report the data at standard illumination conditions (incidence i=30°, emission e=0°); 6) Coregistration of images to obtain the mosaic of Shakespeare.

4. Results

4.1 Color mapping

We applied techniques of image analysis, such as RGB color combinations (Figure 1) and Principal Component Analysis [7], to emphasize differences in spectral properties which can be correlated to differences in composition. We will expose and discuss the last updates.

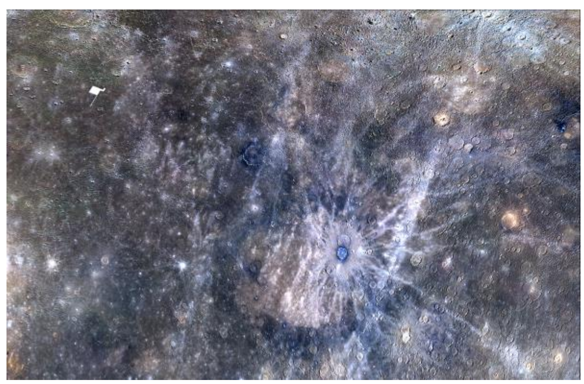

Fig. 1. RGB map of the Shakespeare quadrangle (R= 996.2 nm, G=748.7 nm and B=433.2 nm)

4.2 Spectral mapping

From the global 8-color mapping, it is possible to infer interesting spectral parameters to identify units associated to specific terrains. Considering a thresholding of the values of a spectral parameters (reflectance at 750 nm, PC2...), we obtained indications of units, showing different terrains with probable differences in composition (Figure 2).

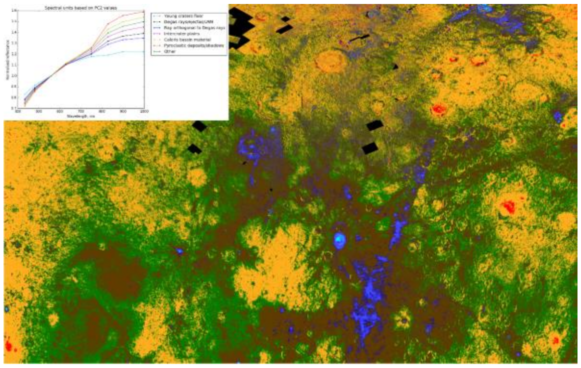

Fig. 2. Example of spectral parameter map of the Shakespeare quadrangle using a thresholding of PC2 values.

For example, it appears on the above spectral map that the floor of Degas crater (cyan) is clearly distinct from other terrains (Sobkou planitia, in yellow on the left) in term of values of PC2. As PC2 highlights the spectral slope variations, this means that the floor of this young crater has a spectral slope distinct from the rest of the quadrangle. This is confirmed on the plot of the averaged spectra of each unit defined by the threshold of this parameter (embedded graph, Figure 2). More analyses of spectral parameters will be presented.

5. Future works

This work on spectral properties of the surface material present in the Shakespeare quadrangle will be integrated to the geological map of the Shakespeare quadrangle produced by [8], and aims to define higher level units to produce a more accurate map of this quadrangle.

Acknowledgements

This work is partly supported by the Centre National d'Etudes Spatiales. D. Perna received funding from the European Union's Horizon 2020 research and innovation program under the Marie Sklodowska-Curie grant agreement n.664931.

References

[1] Blewett, D. T. et al.: Multispectral images of Mercury from the first MESSENGER flyby: Analysis of global and regional color trends, Earth and Planetary Science Letters, Vol. 285, pp. 272-282, 2009.

[2] Galluzzi, V. et al.: Geology of the Victoria quadrangle (H02), Mercury, Journal of Maps, Vol. 12, pp. 227-238, 2016.

[3] Zambon, F. et al.: Mercury compositional units inferred by MDIS. A comparison with the geology in support to the BepiColombo mission, Geophysical Research Abstracts, Vol. 18, EGU2016-16909, 2016.

[4] Giacomini, L. et al.: Geological mapping of the Kuiper quadrangle (H06) of Mercury, Geophysical Research Abstracts, Vol. 19, EGU2017-14574, 2017.

[5] Preusker, F. et al.: High-Resolution Topography from MESSENGER Orbital Stereo Imaging - The H3 Quadrangle "Shakespeare", LPS XLVIII, abstract #1441, 2017.

[6] Domingue, D. L. et al.: Application of multiple photometric models to disk-resolved measurements of Mercury's surface: Insights into Mercury's regolith characteristics, Icarus, Vol. 268, pp. 172-203.

[5] Denevi, B. W. et al.: The Evolution of Mercury's Crust: A Global Perspective from MESSENGER, Science, Vol. 324, pp. 613-618, 2009.

[7] Guzzetta, L. et al.: Geology of the Shakespeare quadrangle (H03), Mercury, Journal of Maps, Vol. 13, pp. 227-238, 2017.