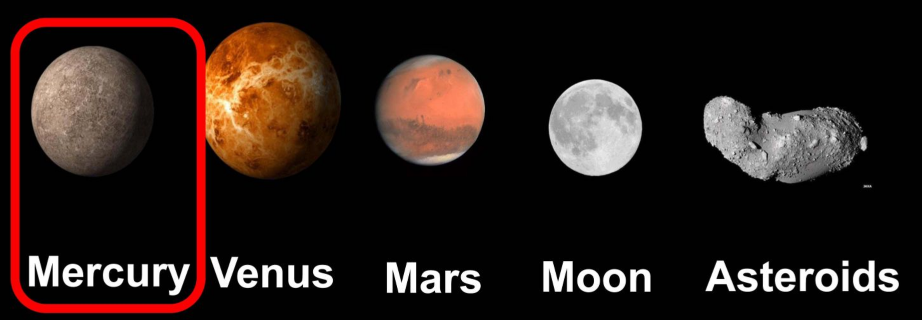

Studying the spectral characteristics of 121 impact craters on Mercury

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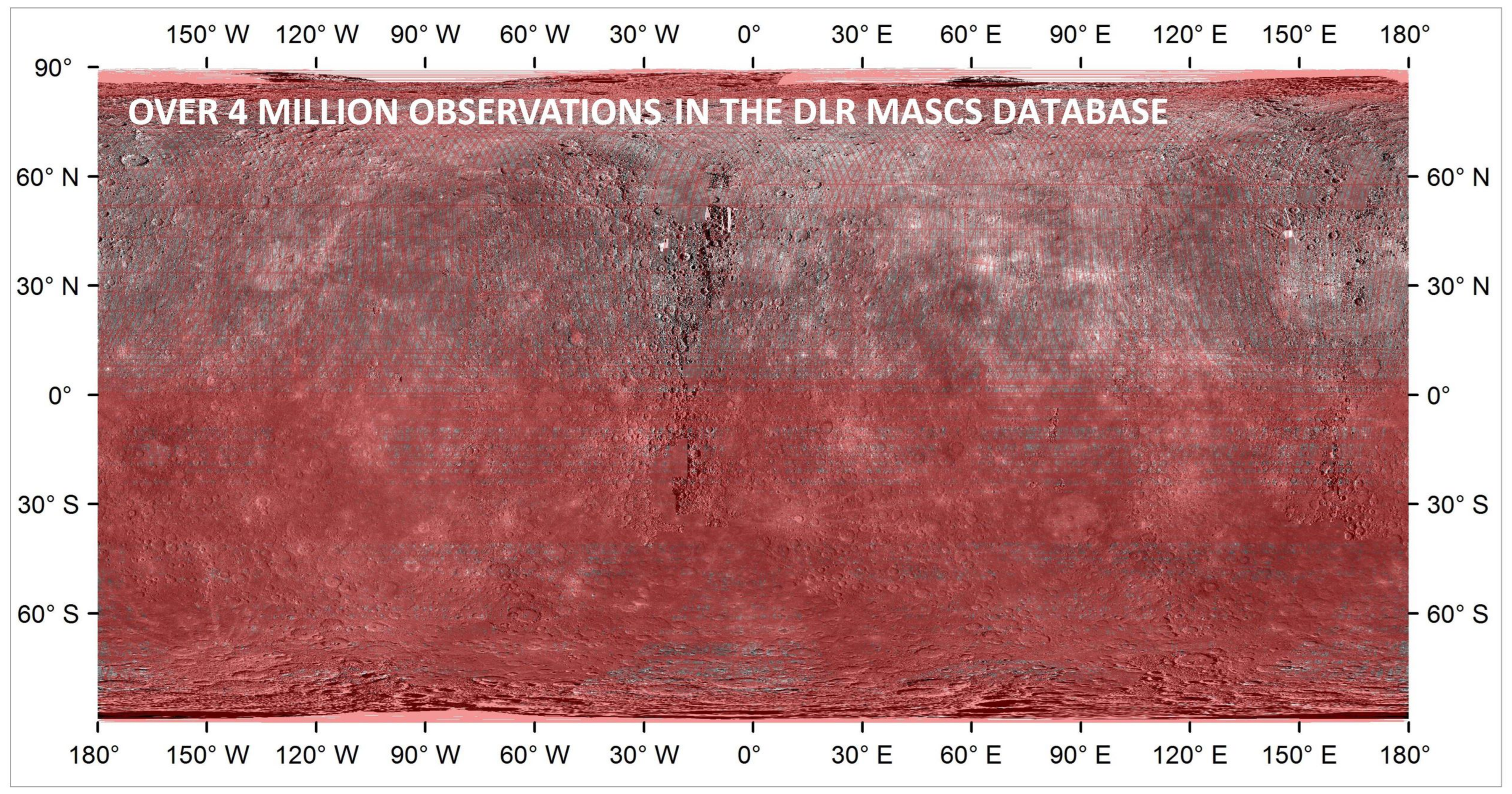
INTRODUCTION

We studied the spectral reflectance of 121 complex impact craters on Mercury, on the basis of geological and physical criteria. We combined Mercury Atmospheric and Surface Composition Spectrometer (MASCS) Visible and Infrared Spectrograph (VIRS) data with Mercury Dual Imaging System (MDIS) images, both acquired from orbit by the Mercury Surface, Space ENvironment, GEochemistry, and Ranging (MESSENGER) spacecraft. We mapped central peak (unit a), floor deposits (unit b-a), and external ejecta at distances of 1, 5 and 10 crater radii. Exploiting the DLR MASCS database [1-5, 8], we globally selected all the MASCS observations contained within each of the mapped units, following a previously tested local scale procedure [5-6]. Here we show the first of the two schemes of analysis, where we included all reflectance observations, even those shared between units. In a second scheme that we are currently studying, we excluded all spectra that are shared by multiple areas.



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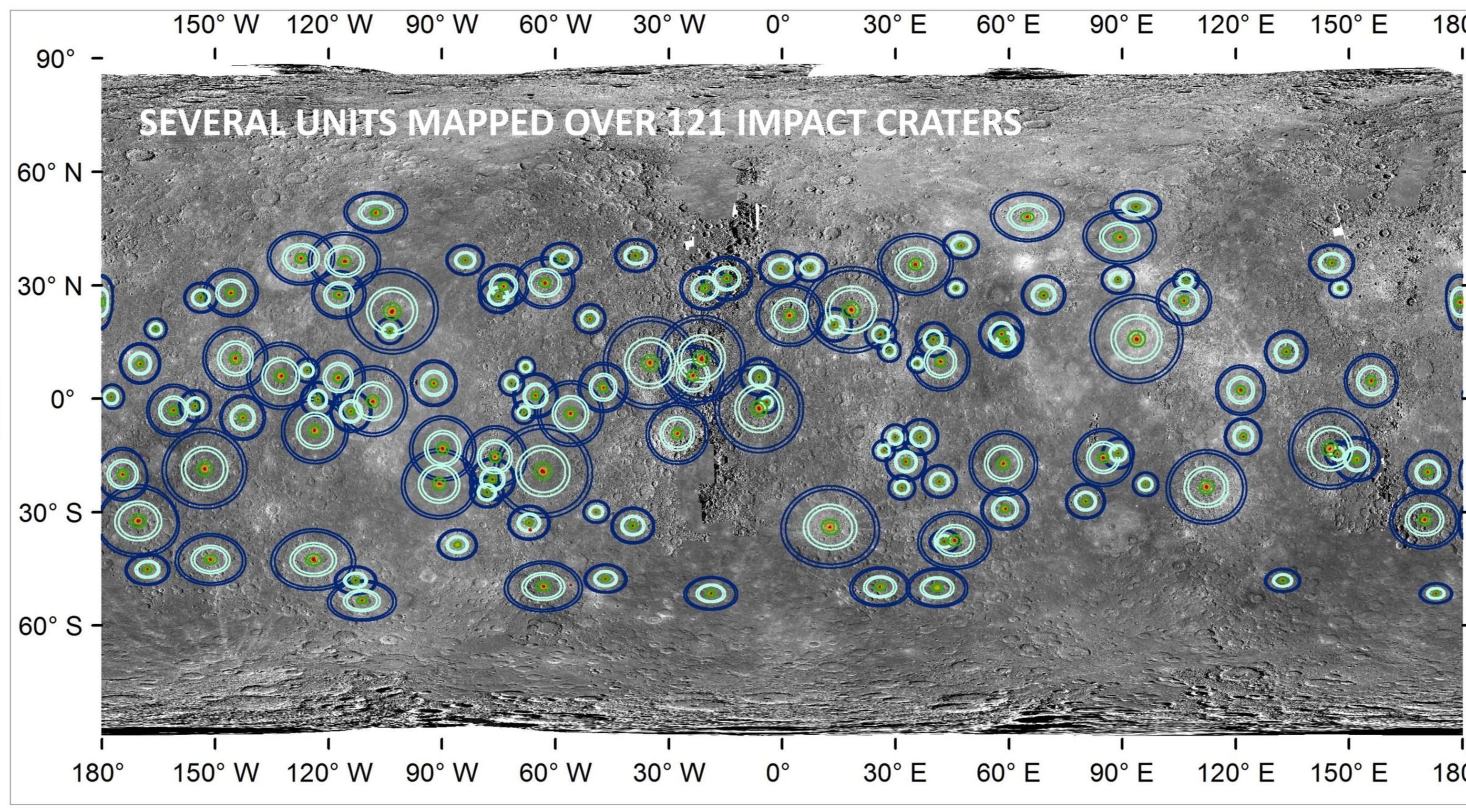

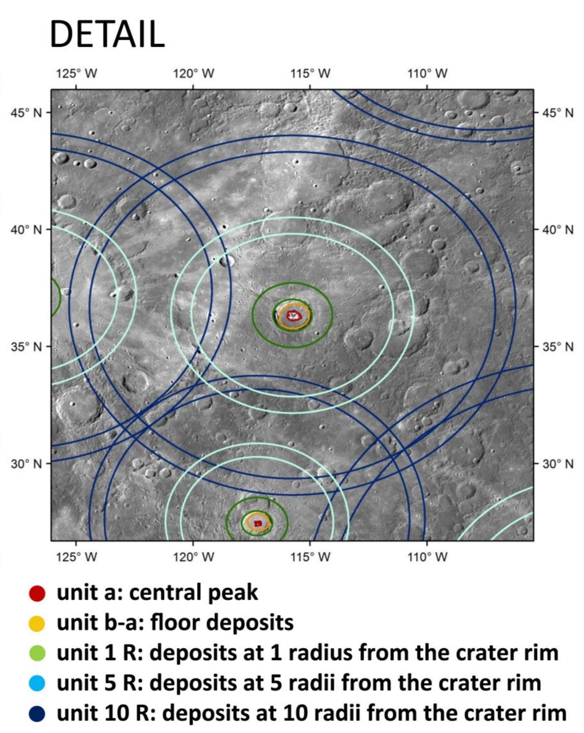

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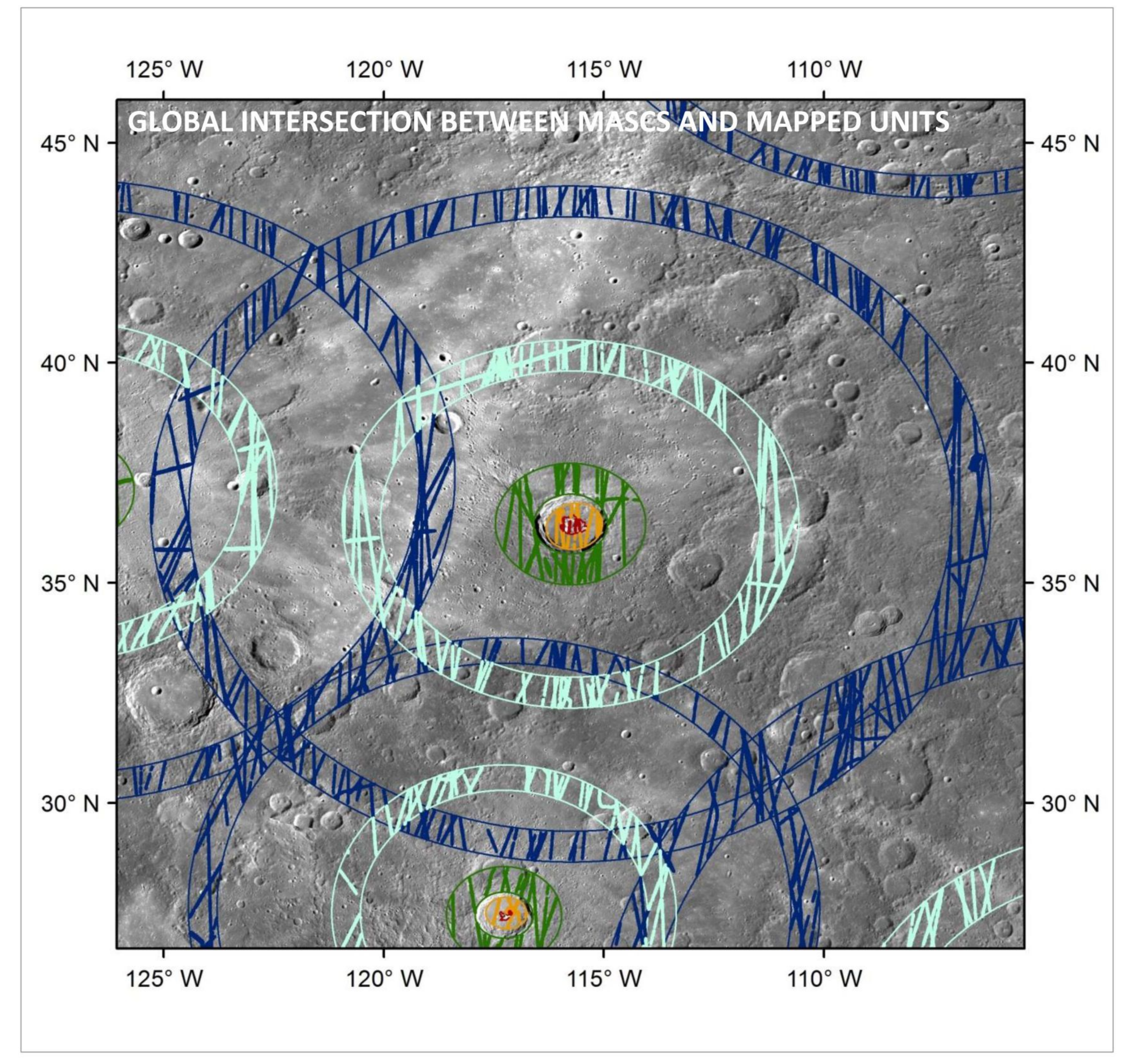
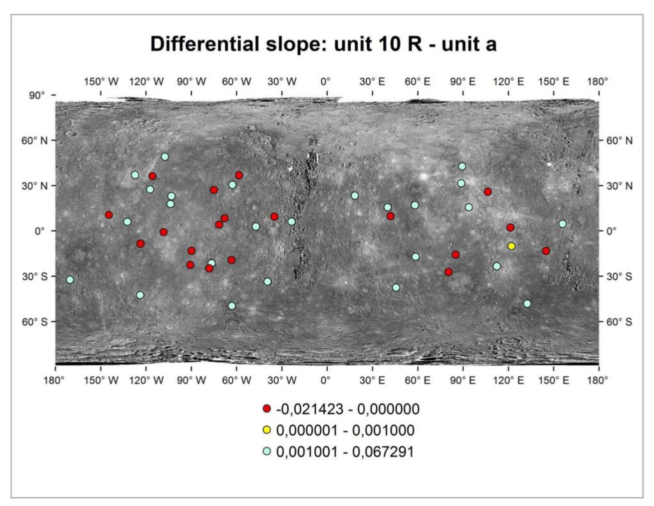
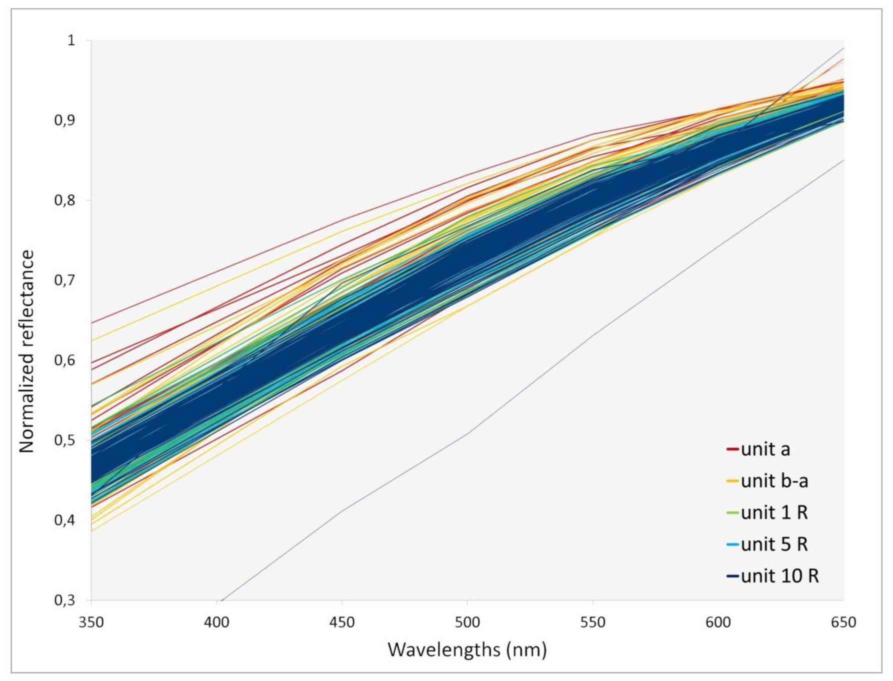
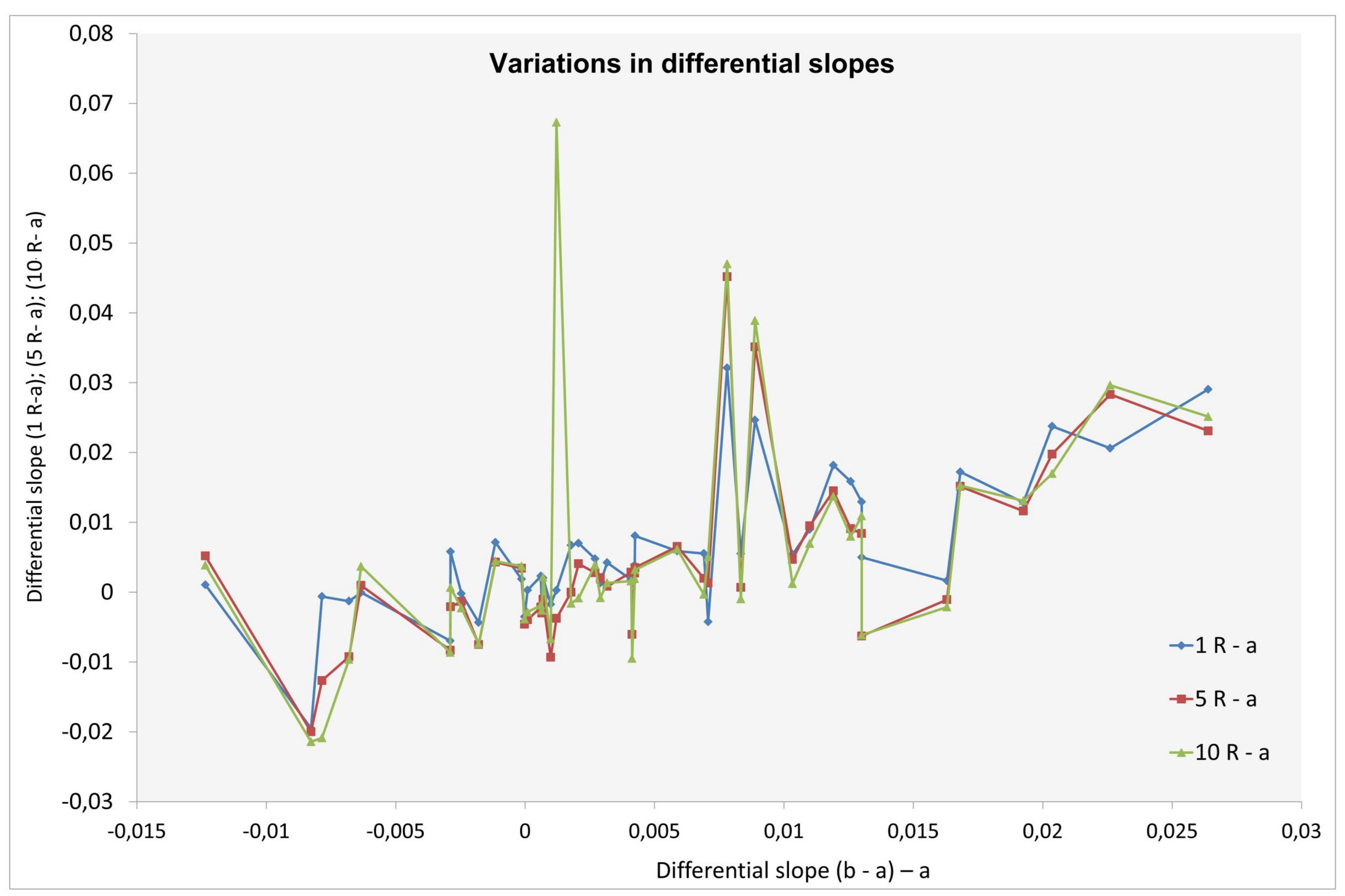
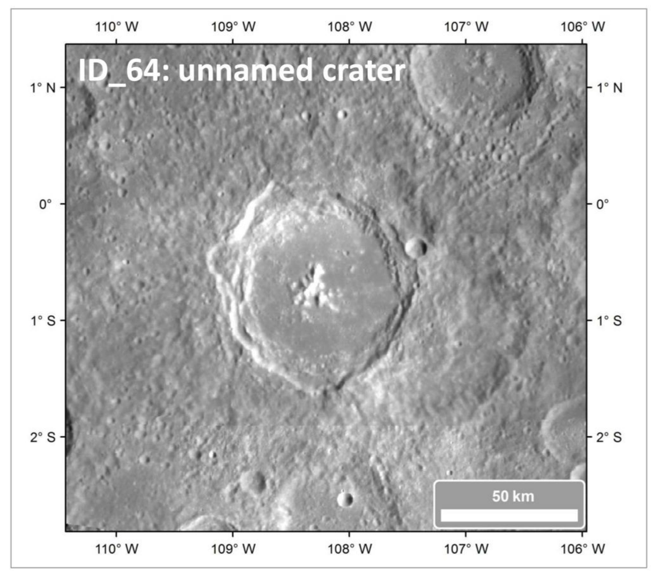


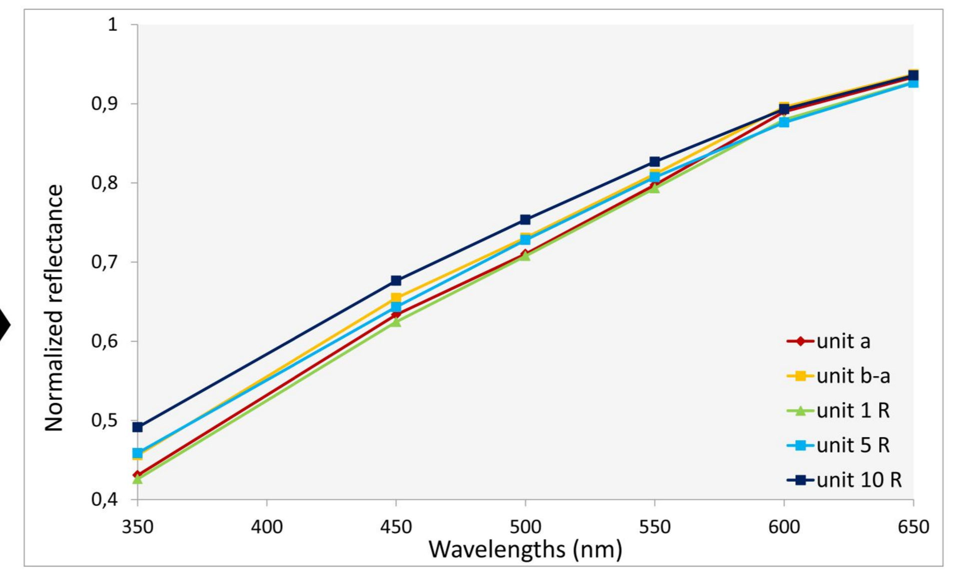
RESULTS

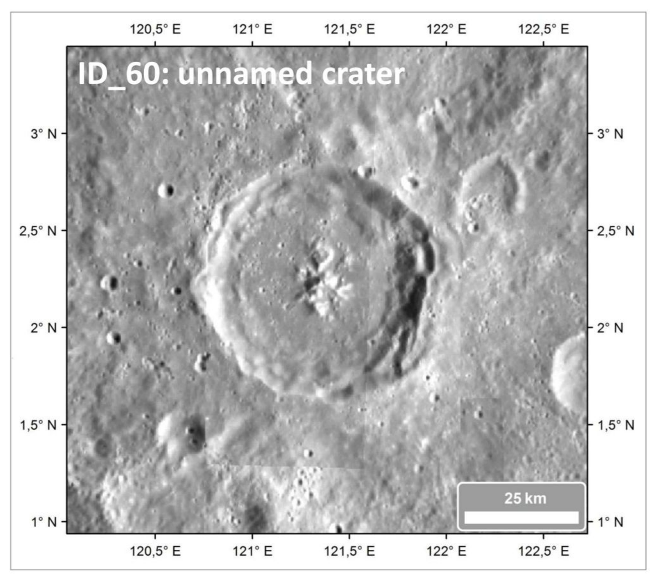


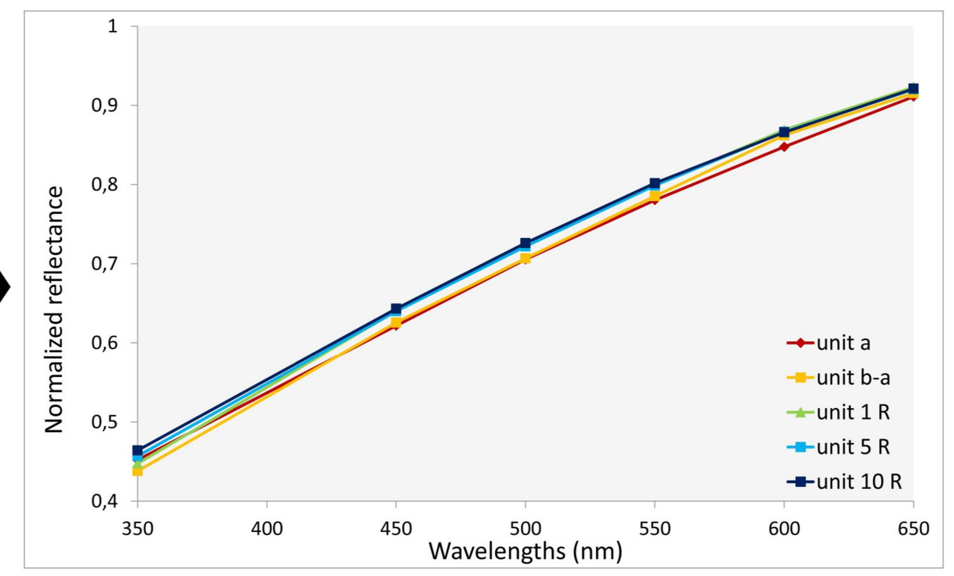


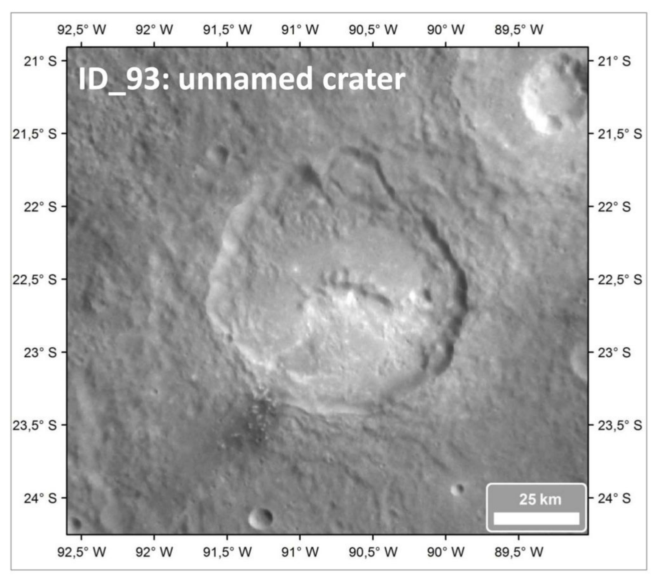


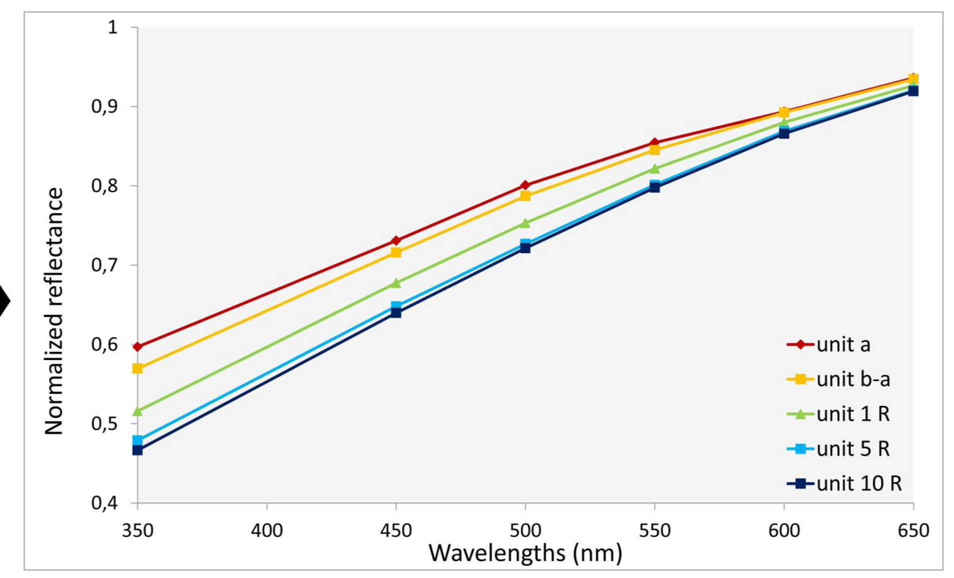










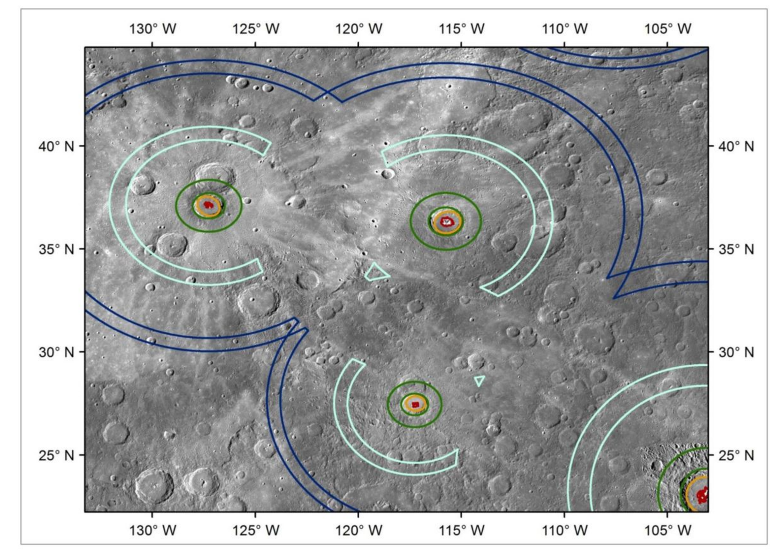


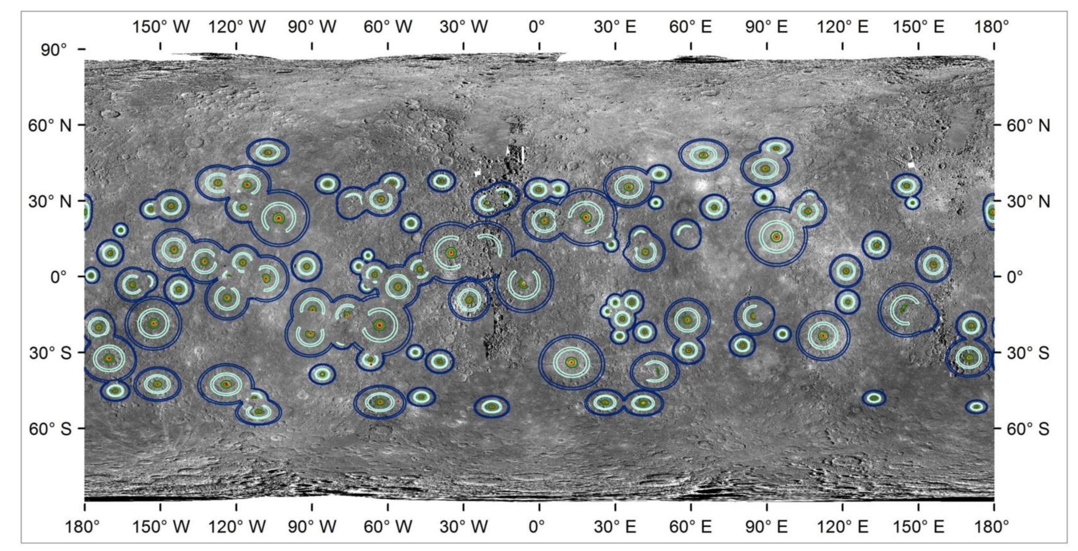
OVERVIEW

Central peaks (unit a) show a greater range of spectral slopes, while more external units are characterized by constantly decreasing slopes. We calculated a differential slope given by the difference between the slope of each external unit and that of the central peaks.

Following the idea that central peaks arise from grater depths, being plausibly characterized by material of different composition [9-10], and according to the assumption that space weathering reddens the spectra of more mature materials, we exploit the differential slope to exclude variations in slopes predominantly due to space weathering effects. If a central peak is characterized by a spectral slope greater than that of more external areas, (more mature materials), the resulting negative differential slope excludes the predominance of space weathering, possibly indicating the occurrence of compositional heterogeneities. The differential slope between the unit 10 R and the central peak show no localization over the global scale, though there is a greater concentration of negative differential slopes on the western hemisphere of Mercury. Interestingly, we observe that differential slope between floor deposits and central peaks varies proportionally with the differential slope between the more external units and the central peak. The analysis of the second scheme will be used to test the current results.

MUCH MORE IS COMING...





REFERENCES

[1] D'Amore, M., et al., 2010. Compositional units on Mercury from principal component analysis of MESSENGER reflectance spectra, 41st Lun. Plan. Sci. Conf., abstract #2016. [2] D'Amore, M., et al., 2011. Composition of surface units on Mercury from surface reflectance measurements during the first and second MESSENGER flybys, 42nd Lun. Plan. Sci. Conf., abstract #1381. [3] D'Amore, M., et al., 2012. Global classification of MESSENGER spectral reflectance data and a detailed look at Rudaki plains, 43rd Lun. Plan. Sci. Conf., abstract #1413. [4] D'Amore, M., et al. 2013a. Unsupervised clustering analysis of spectral data for the Rudaki Area on Mercury, 44th Lun. Plan. Sci. Conf., abstract #1896. [5] D'Amore, M., et al., 2013b. Exploiting the Mercury surface reflectance spectroscopy dataset from MESSENGER: making sense of three million spectra, 44th Lun. Plan. Sci. Conf., abstract #1900. [6] D'Incecco, P., et al., 2012. Kuiper crater on Mercury - An opportunity to study recent surface weathering trends with MESSENGER, 43rd Lun. Plan. Sci. Conf., abstract #1815. [7] D'Incecco, P., et al., 2013. Spectral properties and geology of two impact craters on Mercury, 44th Lun. Plan. Sci. Conf., abstract #1499. [8] Helbert, J., et al., 2013. A comparison of the spectral properties of the Caloris and Rembrandt impact basins, 44th Lun. Plan. Sci. Conf., abstract #1496. [9] Melosh, H. J., 1989. Impact cratering: a geologic process, Oxford University Press. [10] Osinski, G. R., et al., 2011. Impact ejecta emplacement on terrestrial planets, Earth and Plan. Sci. Letters, Volume 310, Issues 3–4, 15 October 2011, Pages 167–181.