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# Combining spectral and morphostratigraphic units on Mercury: A case study of the Rachmaninoff basin area

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MESSENGER-era quadrangle geological maps are primarily made by observing Mercury's geomorphology in monochrome MDIS mosaics [1], and so might more accurately be called morphostratigraphic maps. Geological maps of Earth incorporate more information, such as rock lithology, composition, and origin [2]. Until landed Mercury science begins [3], most bedrock properties will probably remain elusive, hence the convention for planetary geological maps to be descriptive and conservative. MESSENGER did collect spectroscopic data, indicative of composition, but this information has not systematically been incorporated into the planet's geological maps thus far.

Recently, [4] produced spectral unit maps of Mercury using MDIS data, including the Hokusai quadrangle. In this work, we combine the morphostratigraphic units of [5] with these spectral units. We focus on Rachmaninoff basin and its surroundings, including Nathair Facula. Our aim was to augment the descriptions and correlation of map units of [5].

We summarized the spectral unit map, originally produced as a  $\sim 450$  m/pixel raster, by digitizing new spectral contacts between regions dominated by different spectral units. We observed that these spectral contacts either closely align with morphostratigraphic contacts, indicating spectrally and geomorphically distinct units in contact with each other, or spectral contacts diverge from morphostratigraphic contacts, indicating spectral diversity within a morphostratigraphic unit. We added these diverging spectral contacts to the morphostratigraphic contacts to create a new geostratigraphic map.

By combining spectral and morphostratigraphic datasets, we have been able to distinguish impact melt and volcanic plains deposits within Rachmaninoff, which formerly had to be grouped together [5]. Our method can be applied retroactively to preexisting morphostratigraphic maps of Mercury [6] and other planetary bodies [7], and it produces similar results to maps created from the outset using color data [8]. Our approach brings planetary geologic maps closer to their Earth equivalents.

[1] Galluzzi et al. (2021) Planetary Geologic Mappers Meeting, Abstract #7027. [pdf](#)



- [2] Massironi et al. (2021) EGU21-15675. [doi](#)
- [3] Ernst et al. (2022) Planet. Sci. J., 3, 68. [doi](#)
- [4] Zambon et al. (2022) JGR Planets, 127, [doi](#)
- [5] Wright et al. (2019) J. Maps, 15, 509-520. [doi](#)
- [6] Giacomini et al. (2021) EGU21-15052. [doi](#)
- [7] Pöhler et al. (2022) 53rd LPSC, Abstract #2094. [pdf](#)
- [8] Semenzato et al. (2020) An integrated geologic map of the Rembrandt basin, on Mercury, as a starting point for stratigraphic analysis. Remote Sensing, 12. [doi](#)

