

**MERCURY QUADRANGLE GEOLOGICAL MAP SERIES ON MERCURY QUICKMAP.** V. Galluzzi<sup>1</sup>, N. L. Chabot<sup>2</sup>, D. A. Rothery<sup>3</sup>, L. Giacomini<sup>1</sup>, L. Guzzetta<sup>1</sup> and J. Wright<sup>4</sup>. <sup>1</sup>Istituto di Astrofisica e Planetologia Spaziali (IAPS), Istituto Nazionale di Astrofisica (INAF), Via del Fosso del Cavaliere 100, 00133 Rome, Italy (valentina.galluzzi@inaf.it), <sup>2</sup>Johns Hopkins Applied Physics Laboratory, Laurel, MD, USA, <sup>3</sup>School of Physical Sciences, The Open University, MK7 6AA, UK, <sup>4</sup>European Space Agency (ESA), European Space Astronomy Centre (ESAC), Camino Bajo del Castillo s/n, 28692 Villanueva de la Cañada, Madrid, Spain.

**Introduction:** A series of regional scale geological maps is being produced for each quadrangle of Mercury [1] in preparation for the ESA/JAXA BepiColombo mission to aid selection of scientific targets and to provide context for interpretation of new data [2]. The maps are compiled at an average mapping scale of 1:600,000 based on photo-interpretation of MESSENGER/MDIS basemap mosaics [3] and published with an output scale of 1:3,000,000 following USGS planetary mapping guidelines and the Horizon 2020 Planmap project standards. Seven out of fifteen quadrangles have been completed and published between 2016 and 2022 [4-10]. We checked and updated the published maps to obtain matching and consistent boundaries in order to provide a continuous digital geological map.

The merged output was prepared to be explorable in the Mercury Quickmap website where it is now hosted: <https://mercury.quickmap.io/>. Through strong funding support from NASA's MESSENGER mission, Mercury QuickMap contains the highest quality final imaging, surface composition, and topography products produced by the MESSENGER project, in a user-friendly, web-based interface. It allows multiple products to be cross-compared and explored, which aids in scientific interpretation and analysis of Mercury data. It also can be used by the BepiColombo team to inform planning operations and the selection of locations for targeted measurements. Hence, the addition of geologic mapping products into Mercury QuickMap is beneficial to both the larger Mercury science community and the BepiColombo team.

**Merging the Quadrangles:** The quadrangle maps were compiled following common guidelines and agreement among the authors. However, geological contacts and units were often mismatching at the boundaries due to the complex and varying surface texture of Mercury that often leads to different kinds of interpretation. Quadrangles with high crater density at their boundaries required an accurate review of the mapping on both sides. In some cases, such changes were done before publication (e.g., H02-H03, [6]), while others needed refinements after publication (e.g., H02-H06, [4], [9]). Due to the wide span of time through which the maps were produced, the first maps to be published (i.e., [4], [5]) underwent the most changes due to an update of the available basemaps. Classification of crater materials was done either with a 3-class system [4-10] or both 3- and 5-class system [7],

[8], [10]. Since the 3-class system was used on all publications, this unified release reports just this way of representing the morphological degradation stage of craters.

**Known Issues:** The oldest published quadrangle maps [4], [5] were compiled using older basemap versions that were uncontrolled by the currently available DEM, nor did they use the most up to date reference system that is available now. This led to a major mismatch of the mapped units onto the newer basemaps. We corrected the mismatch by spatially adjusting automatically the contacts and linear features, although not all areas were correctly adjusted. Thus, a mismatch of about 4 km might be observed in some places, especially the central area of [5]. Moreover, some quadrangles [4], [5] did not originally report *faculae*, or marked them as *bright material* [6]; we are currently working on updating such absent information.

**Conclusions and Future Work:** The current merged quadrangle maps offer a consistent and continuous view of Mercury's geological framework for about 50% coverage, as shown in Figs. 1 and 2. Completion of the other quadrangle maps is underway. Mercury QuickMap offers an opportunity to overlay such geologic information with other MESSENGER-derived products for comparison and to promote multidisciplinary studies of Mercury's surface.

**Acknowledgments:** We acknowledge funding from the Italian Space Agency (ASI) under ASI-INAF agreement 2017-47-H.0 and NASA grant 80NSSC20K0790. We thank the geological map authors [4-10] for agreeing to use and update their work.

**References:** [1] Galluzzi V. et al. (2022) *LPI Contrib. No. 2610*, Abstract #7027. [2] Rothery D. A. et al. (2020) *Space Sci. Rev.*, 216, 66. [3] Denevi, B. W. et al. (2018) *Space Sci. Rev.* 214. [4] Galluzzi V. et al. (2016), *J. Maps*, 12, 227–238. [5] Mancinelli P. et al. (2016) *J. Maps*, 12, 190–202. [6] Guzzetta L. et al. (2017) *J. Maps*, 13, 227–238. [7] Wright J. et al. (2019) *J. Maps*, 15, 509–520. [8] Pegg D. L. et al. (2021) *J. Maps*, 17(2), 718–729. [9] Giacomini L. et al. (2022) *J. Maps*, 18(2), 246–247. [10] Malliband C. C. et al. (2022) *J. Maps*, latest issue.

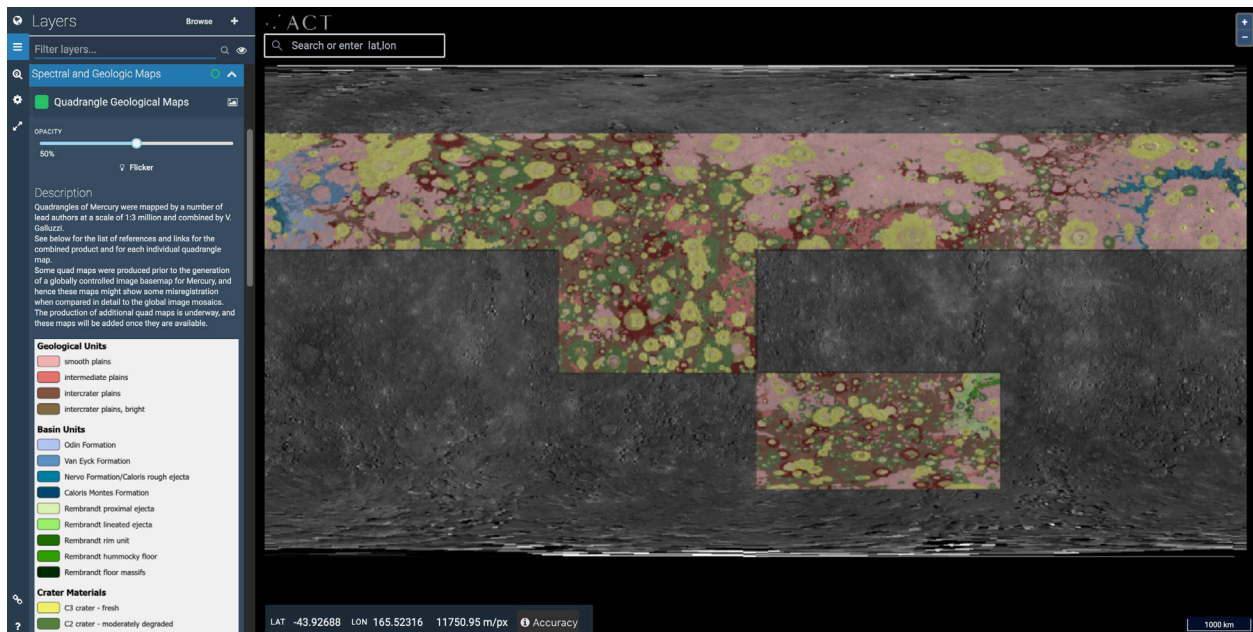


Figure 1. Merged regional quadrangle geologic maps available on Mercury QuickMap: <https://mercury.quickmap.io/>

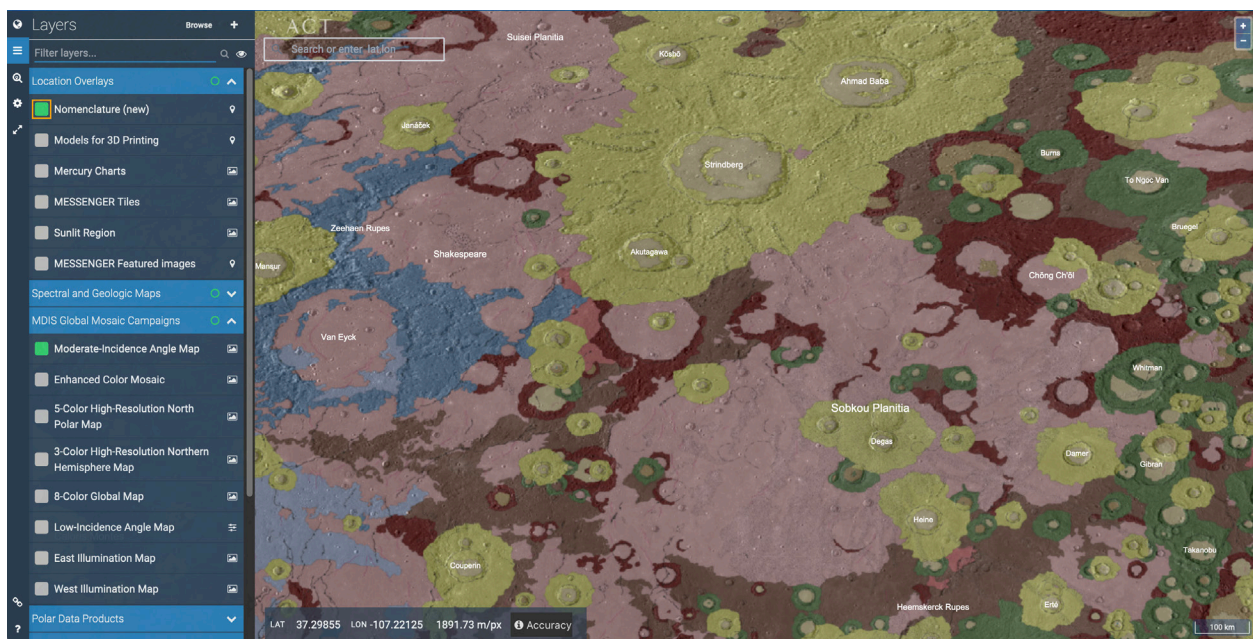


Figure 2. Close-up view of a portion of Shakespeare quadrangle (H03) [6] available on Mercury Quickmap: <https://mercury.quickmap.io/>