The global occurrence of very smooth plains patches on Mercury and Implications for Effusive Volcanism.

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Introduction: Large-scale effusive volcanism, responsible for most of Mercury's 'smooth plains', is accepted to have ended by ca. 3.5 Ga [1]. We present local occurrences of smooth surfaces, often with the appearance of being topographically ponded (a.k.a. smooth ponded patches or very smooth plains patches). These examples are seldom larger than a few 10s of km across, and are characterised by extremely smooth surfaces with a paucity of impact craters. Some of these deposits may provide evidence for a protracted phase of waning effusive volcanism post-3.5 Ga. We aim to map the global occurrences of very smooth plains patches on Mercury and investigate their implications for the effusive volcanic evolution of the planet.

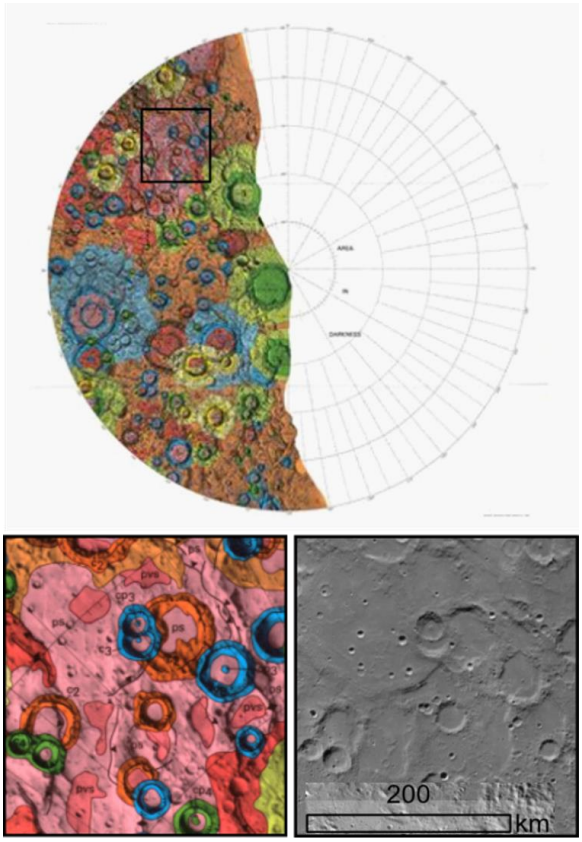

Fig 1: partial map of H15 by Strom et al. (1990). Black box and insert highlights areas of high concentration of 'very smooth plains' deposits

Occurrences at H15: During the Mariner 10 era, the partial geological map of H15 ([2]; fig. 1) included four distinct geological units. Of these, very smooth plains (pvs), has never been mapped globally and, at H15, shows a common association with craters or tectonic features. We have identified a further 4 examples of very smooth plains patches in H15. While the majority of all recorded examples in H15 can be found east of longitude 70°E, exceptions to this occur associated with Alver, Magritte and Nairne craters.

Global Occurrences and prospective origins: Similar patches have recently been identified in H10 ([3]; fig. 2). Again, an association with primarily, though not exclusively, tectonic features was discovered (e.g. Calypso, Soya and Enterprise Rupes).

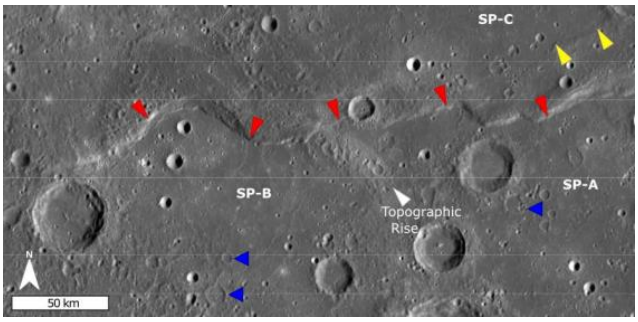

Fig. 2 (from Malliband, 2021): ponded smooth patches associated with Calypso Rupes (indicated by red arrows). Yellow arrows point to an additional fault-bounded smooth patch on the hanging wall of the Rupes. Blue arrows point to ghost craters.

Additionally, some patches of very smooth plains have been mapped in the survey of smooth plains deposits < 10^5 km of Wang et al. [4]. Previous works propose a range of origins which we will explore, namely:

- *Impact-related origin:* Either as impact melt or fluidized impact ejecta
- *Small-volume effusive volcanic origin*: where the age of such deposits are somewhat contested

Features such as the geological setting, spatial distribution, thickness of the deposit, embayment relationships and reflectance spectra may indicate origin.

Data and method: We map using NAC (single frame) and WAC (global mosaic) images obtained by MESSENDER's MDIS. Mapping is carried out using ArcGIS Pro. Each image is mapped in the projection most suited to that quadrangle. For newly discovered deposits we have assigned a degree of confidence, classifying all identifications as confident or tentative.

For H15, a point has been placed at each deposit- and a polygon drawn round to indicate the extent of the deposit. For presentation at LPSC results for deposits identified at bordering quadrangles will be revealed. Next, images that cross the polygon will be downloaded and processed with a resolution better than 166 m/pixel. These images will be used to produce a detailed map. If possible, the age of the deposit will be constrained using crater counting analysis.

Acknowledgments: The monochrome basemap, enhanced color mosaic and DEM for H15 was downloaded from the Geosciences Node of NASA's Planetary Data System archive. SJC is supported by the French Space Agency CNES.

References: [1] Byrne P. K., et al., (2016). *Geophys. Res. Letters.* [2] Strom et al., (1990). *Geologic Map of the Bach Region of Mercury*. [3] Malliband C., et al. (2022). *Journal of Maps.* [4] Wang Y., et al., (2021). *Geophys. Res. Letter.*