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Global properties of hollows on the surface of Mercury

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1. Introduction

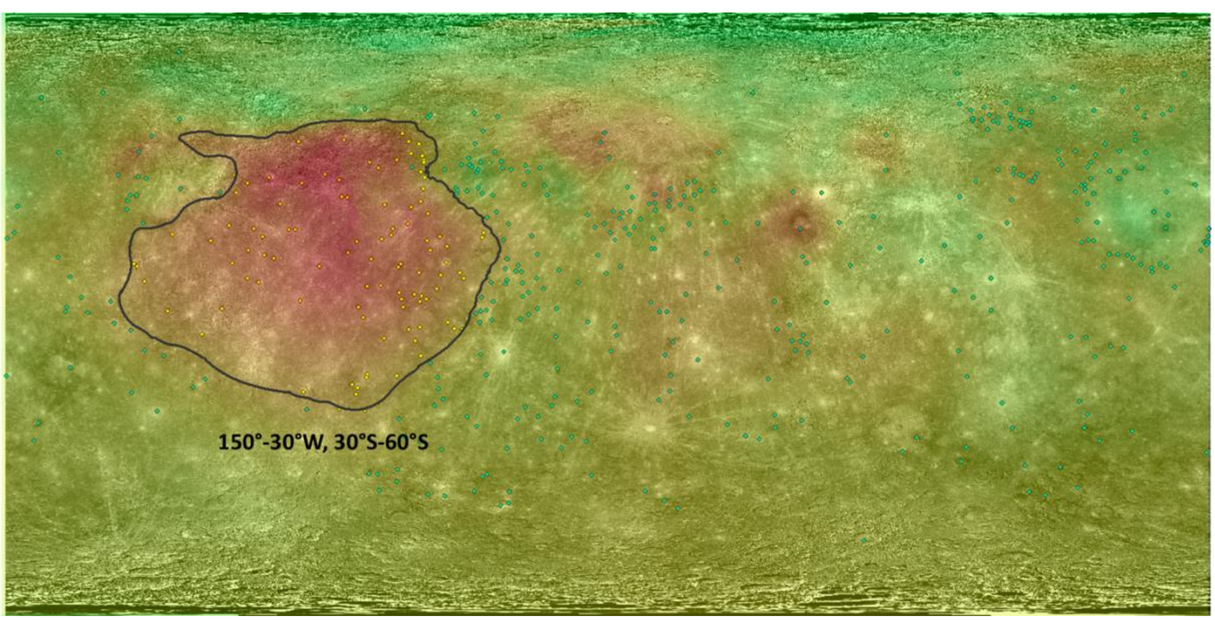
Hollows were revealed for the first time on the surface of Mercury as shallow irregular and rimless flat-floored depressions with bright interiors and halos, often found on crater walls, rims, floors and central peak [1,2,3]. Hollows features are located everywhere on the surface of the planet [3] and since they are fresh in appearance, they may be actively forming today via a mechanism that could involve depletion of subsurface volatiles [1], whose nature is still under debated [4,5].

In this work, combining different data acquired by the MESSENGER ((Mercury Surface, Space, Environment, Geochemistry, and Ranging) mission, we investigate the global properties of hollows located in different geochemical terrains of the planet. We analyze the distribution of hollows with respect to elevation data, gravity data, craters distribution and crustal thickness mainly focusing our work on the high Mg-region of Mercury.

2. Dataset and Methods

We considered the database of hollows previously published [2,4] and selected those one located on the high Mg-region of the surface of Mercury. From the data available we found about 90 hollows in that region, as shown in Figure 1. To perform a statistical distribution of these features, we consider the geological setting in which they originated making use of the available published geological map of the Mercury quadrangles. Combining the information coming from the geological maps and the MDIS (Mercury Dual Imaging System, [7]) images covering hollows, we divided the geological setting in which these features formed in the following categories: crater floor, crater rim, central peak and peak ring structures. We then mapped the area covered by hollows on high resolution MDIS images to achieve their mean size and area in order to find any differences or similarities between the hosting geological setting (Figure 2).

Figure 1: Hollows are shown by dots on the Mg/Si map from XRS instrument onboard MESSENGER. The black contour defines the high-Mg region [6] in which there are about 90 hollows (yellow dots).



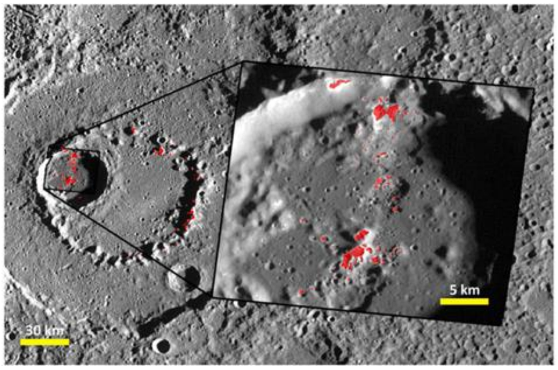


Figure 2: An example of hollows mapping to determine size and areas.

In order to constrain the distribution of hollows with physical data, we also considered the Mercury crater database [10] showing the crater density of the area under study. In addition, we associated to each hollow field the elevation value derived from the USGS Digital Elevation model [11] (Figure 3).

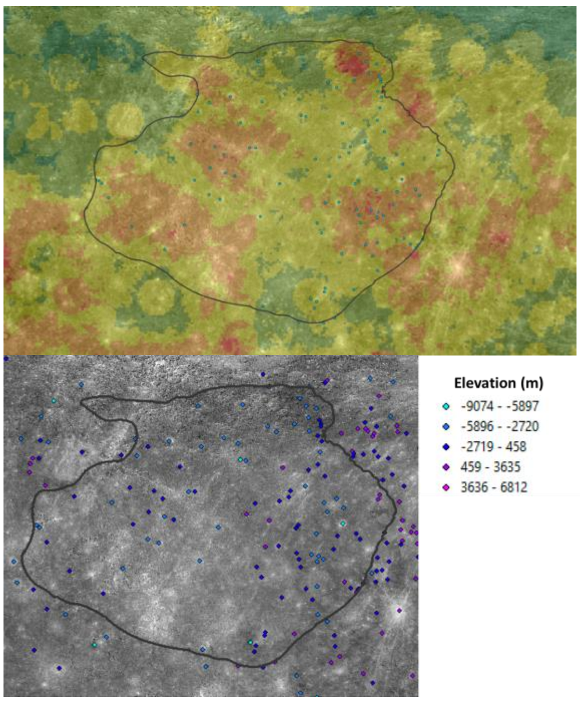


Figure 3: Above: Crater density (red high density, green low density) from Mercury's crater database. Below: Elevation values of hollows derived from the USGS DEM.

3. Preliminary results and future works

From the preliminary analysis of some hollows located in different geological setting of the high-Mg region, we found no difference in terms of size and areas. This could imply that the formation mechanism is the same for all these structures. However, the detailed mapping of these features has to be still completed. In addition, looking at the elevation values of hollows' location, we do not derive a common trend. Indeed, hollows are located at different elevation values suggesting that the source of their volatile material does not stand at the same depth for all cases. These are preliminary results that have to be refined ending the mapping of hollows and comparing the behaviour of these structures with other measurements such as gravity and crustal thickness ones.

Acknowledgements

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