Geological Mapping of the Derain (H-10) Quadrangle of Mercury

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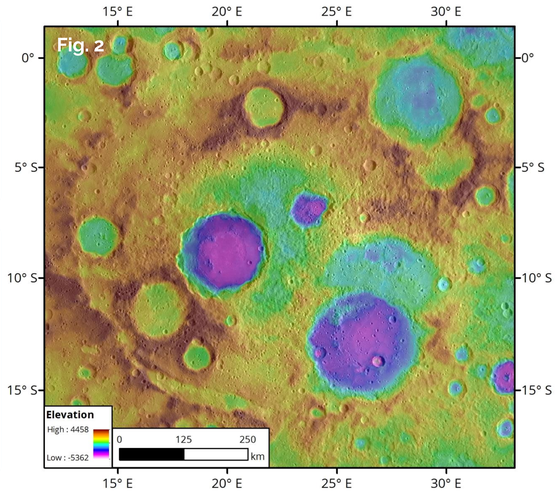
1 Summary

- We are geologically mapping the Derain quadrangle of Mercury as part of a co-ordinated mapping program.
- We have completed crater mapping.
- We have identified a range of notable of features in the quadrangle.

2 Introduction

We are currently geologically mapping the Derain (H-10) quadrangle of Mercury. The location of Derain in relation to other quadrangles is shown in Figure 1. Derain was not imaged by Mariner 10, and so this MESSENGER based work is the first detailed geological mapping of the quadrangle. This is part of the European mapping effort (Galluzzi *et. al.*, 2016) as part of preparation for the ESA BepiColombo Mission. We have finished initial crater mapping and are now beginning to start classification of craters with diameters greater than 20km.

This poster showcases some of the notable features we have begun to examine so far.

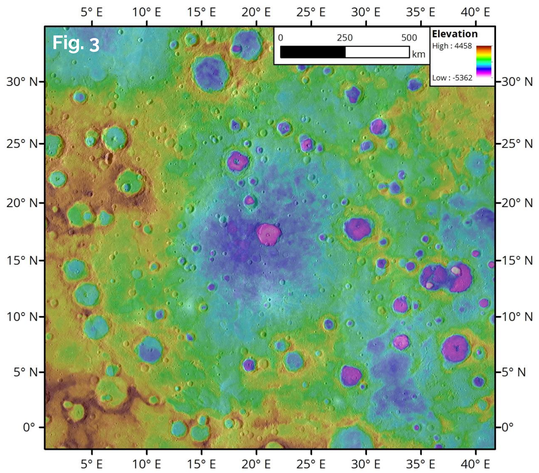


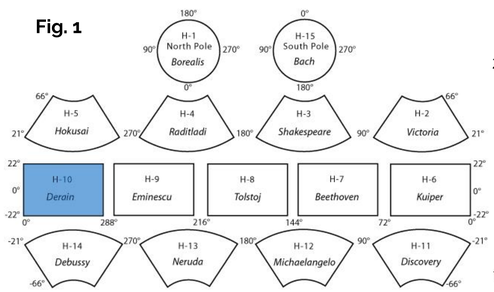
3 Ancient Basins

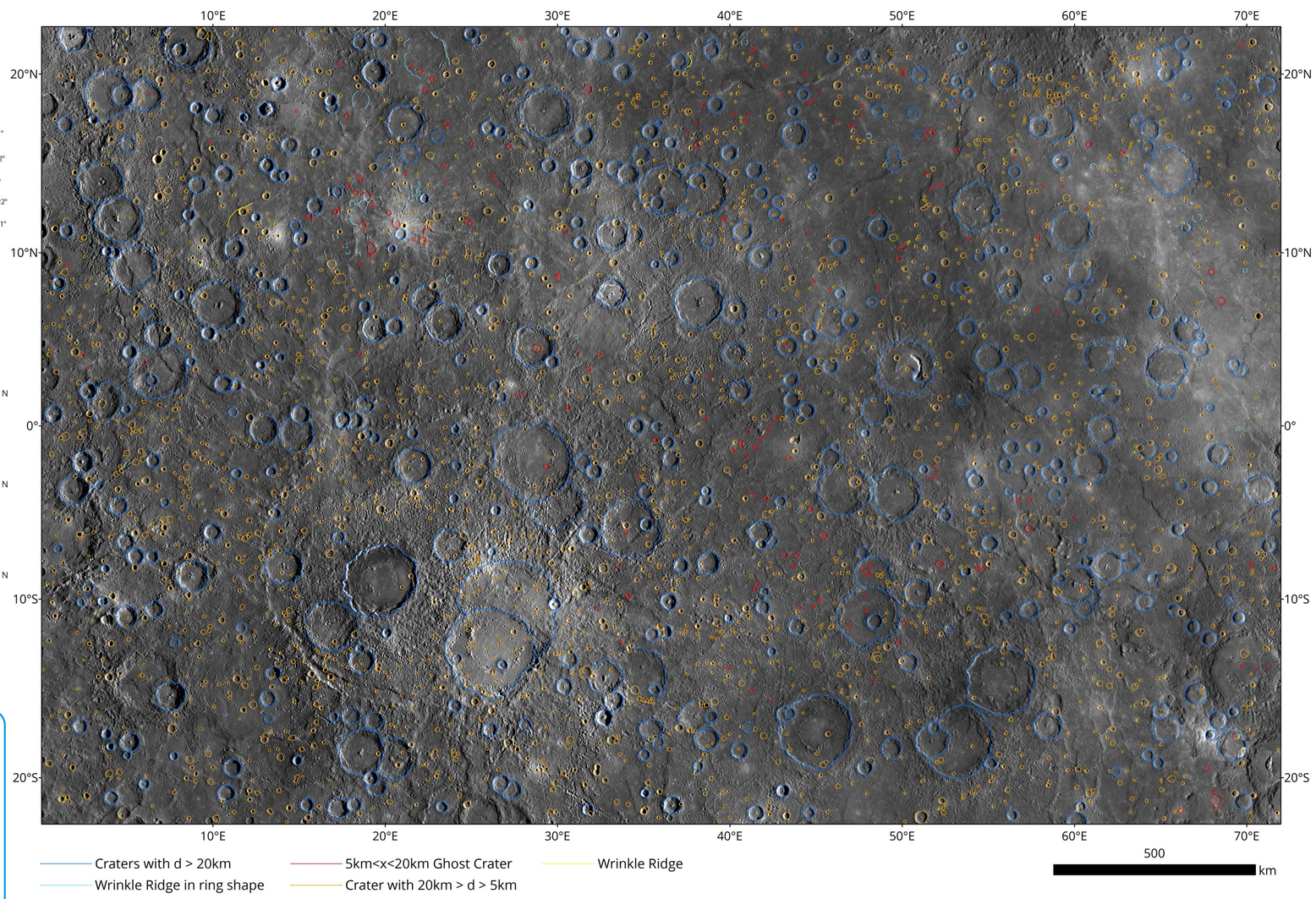
There are two possible basins identified and catalogued as B30 and B36 by Fasset *et. al.* (2012).

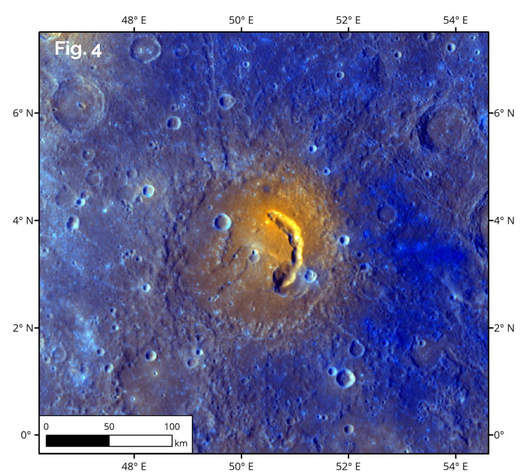
B36 is easily visible in topography (Fig 2) and MDIS mosaic with a clear, partially complete western rim. The eastern boundary has been obscured by later impacts. We have identified impacts here of at least Calorian age. Unlike other pre-Calorian basins (eg Tolstoj) there is no visible evidence of later volcanic resurfacing.

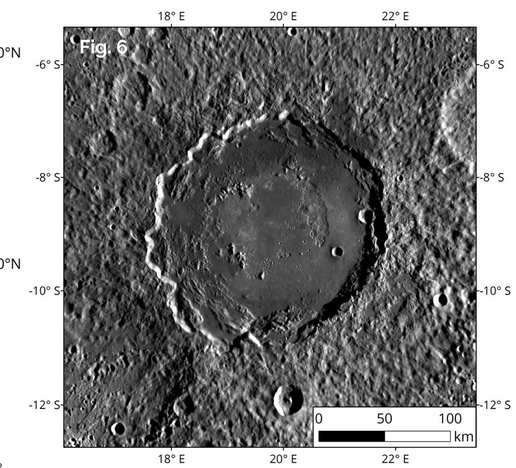
B30 is in the north west of the quadrangle, and extends north into the Hokusai quadrangle. It is more evident in elevation (as shown in fig. 3) than the MDIS mosaic. The reported diameter of 1390km (Fasset *et. al.* 2012) . would make it the second largest basin on Mercury. B36 is Pre-Tolstojan, and so one the oldest basins on Mercury. The SW boundary is marked by a later lobate scarp. This is notable for a change in vergence between segments.









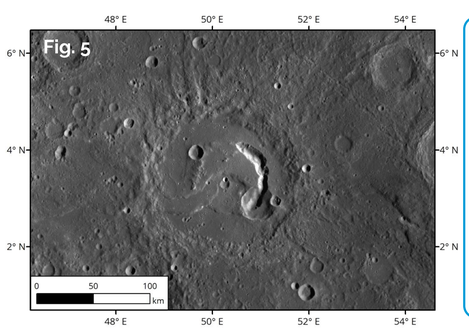


4 Picasso Crater and Red Pits

Spectrally red irregularly shaped pits on Mercury are thought to be expressions of explosive volcanism.

A particularly noticeable series of pits is found in an arcuate depression around the centre of the crater Picasso. This appears to be a series of pits, representing multiple explosive centres. This is possibly a temporal progression of pits exploiting a pre-existing structural weakness, such as a peak ring. The rest of a possible peak ring may well be partially covered by Picasso's basin infill. Figure 4 is Picasso in 'Enhanced Colour'.

Also in Picasso are small quasi–radial, curvilinear lobate scarps. These seem to match well with a regional break in slope (see fig. 5). However the small scarps here show some unusual strain localisation. We have begun to examine other craters for examples of these small lobate scarps in basin fill.



5 Derain and a Volatile Planet

Derain is a Mansurian crater, located in the B36 basin and is shown in Fig 6.

Derain contains an area of 'hollows' towards the NW of the crater. Hollows on Mercury are thought to form through localised loss of a volatile phase. Derain is the only crater in the B36 basin to have hollows, suggesting a volatile phase is not widespread across the basin.

Derain also contains red pits, and so evidence of explosive volcanism. However, unlike in Picasso, red pits in Derain occur as small, shallow, depressions that amalgamate in to a larger area of 'pitted ground'. This is an unusual expression of explosive volcanism on Mercury.

To the north and west of the crater there is an area of low reflectance material. LRM may be a remnant of Mercury's primary crust (Ernst *et. al.*, 2010).

6 Future Work

We have now completed mapping of craters over 5km in diameter. The next stage will be to classify craters over 20km in diameter (blue outlines) according to degradation state. Work is progressing on the mapping of linear features and this will probably occur in tandem with crater classification. Following this we plan to map geomorphological units. As part of this we will carefully examine if an intermediate plains unit needs to be invoked when mapping at this scale. We also hope to continue to investigate small scarps in basin fill and 'red spot' vent siting mechanisms and morphological style.

7 Acknowledgements

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