Preliminary observations of Rustaveli basin, Mercury

Conference or Workshop Item

PRELIMINARY OBSERVATIONS OF RUSTAVELI BASIN, MERCURY. J. Wright[1], D. A. Rothery[1], M. R. Balme[1] and S. J. Conway[2], [1]Dept. of Physical Sciences, The Open University, Milton Keynes, MK7 6AA, UK (jack.wright@open.ac.uk), [2]LPG Nantes – UMR CNRS 6112, Université de Nantes, France.

Introduction: Rustaveli basin (Fig. 1) on Mercury (82.76° E, 52.39° N) is a 200.5 km diameter peak-ring basin. Since the approval of its name on April 24, 2012, it has not featured prominently in the literature, although Ostrach et al. [1] note its ejecta. It is a large and important feature within the Hokusai (H5) quadrangle of which we are currently producing a 1:2M scale geological map [2]. Here, we describe our first observations of Rustaveli.

Age: Rustaveli has a widespread and undegraded ejecta deposit, as well as numerous catenae readily attributable to it. These superpose the surrounding smooth volcanic plains, indicating that the impact post-dates the emplacement of at least the local part of the Northern Plains. Furthermore, the ejecta blanket is superposed by only a small number of crisp craters all of which are smaller than 20 km diameter. Its raised crater rim is clearly identified and it has well preserved terraces around its perimeter. Crater rays have not been attributed to Rustaveli as most of the rays in this region unambiguously belong to Hokusai to the west and Fonteyn to the south-east. These observations lead us to assign it to the 2nd-youngest (c2) (or possibly 3rd-youngest, c3) of the five age classes used in [3]. This suggests a probable Mansurian age for the impact. Rustaveli is therefore among the youngest impact basins of its size on Mercury.

Infill: The floor of Rustaveli is covered by a smooth infill. It appears to have a crater density similar to or less than typical Northern Plains (nearby areas of NP contain a high density of secondaries from Rustaveli). Some terraces elevated above the basin floor also have a smooth covering. This could be due to splashing of impact melt

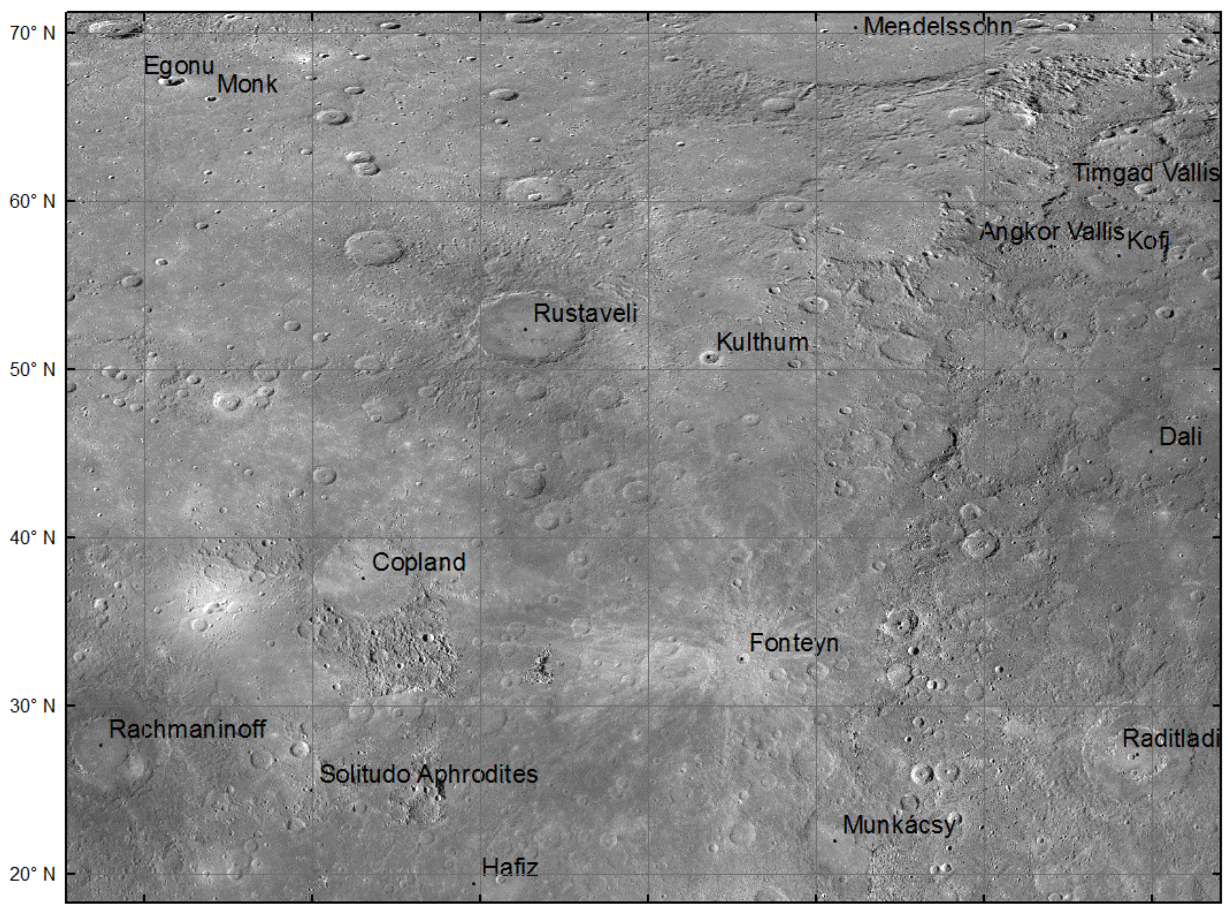

Fig. 1. The global context of Rustaveli. This image is cropped from the global mosaic of Mercury in a cylindrical projection (MDIS9). The view is approximately 2000 km across. (Image mosaic credit: MESSENGER Team NASA/Johns Hopkins University Applied Physics Laboratory/Carnegie Institution of Washington).

up onto the terraces during crater formation [4]. The basin is deeply flooded, as shown by the almost complete burial of the peak-ring. The required volume of infilling material has probably been supplemented by post-impact volcanism as is believed to be the case in Rachmaninoff [5]. However, the infill of Rustaveli is not significantly spectrally distinct from smooth plains elsewhere, whereas the fill of Rachmaninoff is more Mg-rich than the Hermian average [6]. Any vents responsible for post-impact effusive volcanism in Rustaveli are likely to be buried.

Peak-ring: As well as being flooded deeply, the peak-ring is highly irregular and incomplete. It appears to be elongated approximately E-W. Presumably, a significant fraction of the the ring is buried by the basin-fill. One possible explanations for the elongation of the peak-ring is that the impact was oblique, but not so oblique that the whole basin became ellipsoidal.

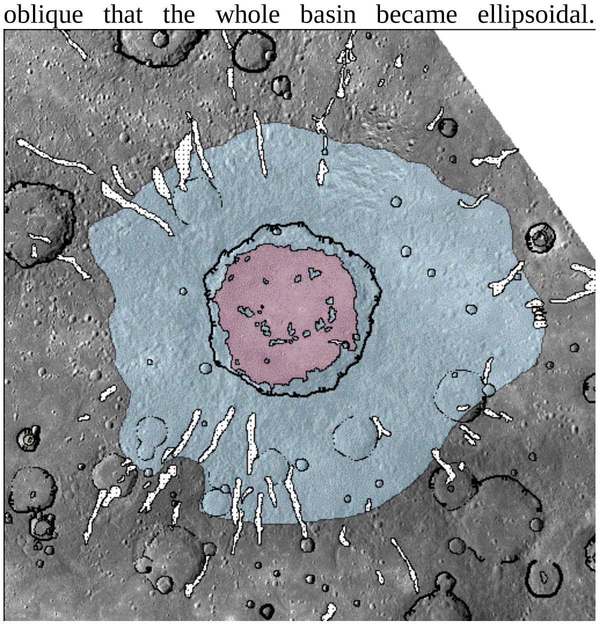

Fig. 2. A summary of the geology of Rustaveli. Blue denotes crater material, including the raised crater rim, peak-ring and ejecta blanket. The pink area is the smooth crater infill. The black hachured line represents the crest of the crater rim. Stippled shapes are chains of secondary impacts. The white space in the top-right is at the edge of the basemap. Image is 690 km across.

Polygonality: Rustaveli is clearly a polygonal impact basin according to the definition of [7], though missing from their list. The western portion of its crater rim can be closely approximated by straight lines as shown in Fig. 3. On Earth, polygonality in impact craters has been attributed to strongly developed fabrics in the target material [8]. In the case of complex craters, Eppler et al. [9] suggest that that the dominant cause of polygonality is slumping along joints in the target material during crater modification. Since Rustaveli is surrounded by smooth plains, it is likely that smooth plains was the target material. We plan to investigate the distribution of polygonal craters on Mercury to see if target material has a significant control on their formation. We have not yet ruled out that polygonality could be imposed by subsequent tectonic processes, although we think this is unlikely.

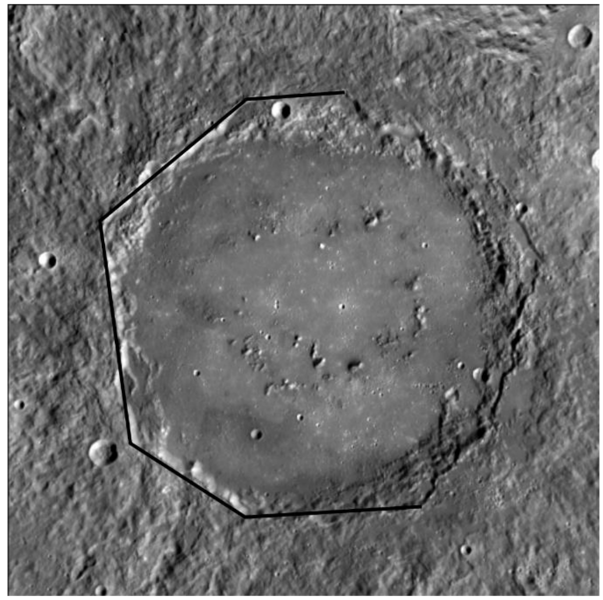

Fig. 3. Black lines showing the polygonality of the western portion of Rustaveli's rim. The eastern portion is more rounded. Image is 260 km across.

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