

GEOLOGICAL MAPPING OF THE DEBUSSY QUADRANGLE (H-14) OF MERCURY, PRELIMINARY RESULTS. D. L. Pegg¹, D. A. Rothery¹, M. R. Balme¹, and S. J. Conway². ¹The Open University, Milton Keynes, MK7 6AA, UK david.pegg@open.ac.uk. ²LPG Nantes – UMR CNRS 6112, Université de Nantes, France.

Introduction: Geological mapping of Mercury is crucial to build an understanding of the history of the planet and to set the context for observations made by the recently-launched BepiColombo mission when it begins science operations in orbit around Mercury in 2026 [1]. Geological mapping of the Debussy quadrangle (H-14) is underway (Fig. 1) as part of a program to map the entire planet at a scale of 1:3M using MESSENGER data [2-7]. The quadrangle is located at 0° – 90° E and 22.5° – 65° S. This will be the first high resolution map of the quadrangle as it was not imaged by Mariner 10.

Data and Methods: Mapping began in October 2017 using ArcGIS software. The base map is the MESSENGER 166 m/pixel mosaic supplemented with additional images from MESSENGER's Mercury Dual Imaging System [8]. The map projection is Lambert Conformable Conic, and mapping follows both the Planmap standards [9] and USGS guidelines [10] with linework drawn at 1:300k. Craters larger than 5 km have

been outlined. Ejecta, where observed, is being traced for craters larger than 20 km.

A 5° overlap with the adjacent quadrangles will enable correlation between maps from different workers.

Mapped Units and Features: Craters are classified based on crater degradation using both 3 class [3] and 5 class [11] schemes to enable comparison between historical and current maps, and to enable placing features and units into morphostratigraphic context. In addition, the Rembrandt impact basin and surrounds will be divided into several units based on morphology, in a similar way to the larger Caloris basin.

Plains units: The remaining surface will be separated into plains units:

Smooth plains are the youngest plains units on Mercury, thought to have been emplaced mostly by 3.5 Ga [12]. They have the highest albedo of all the plains units and tend to be spectrally more orange. They are mostly interpreted as being of effusive volcanic origin.

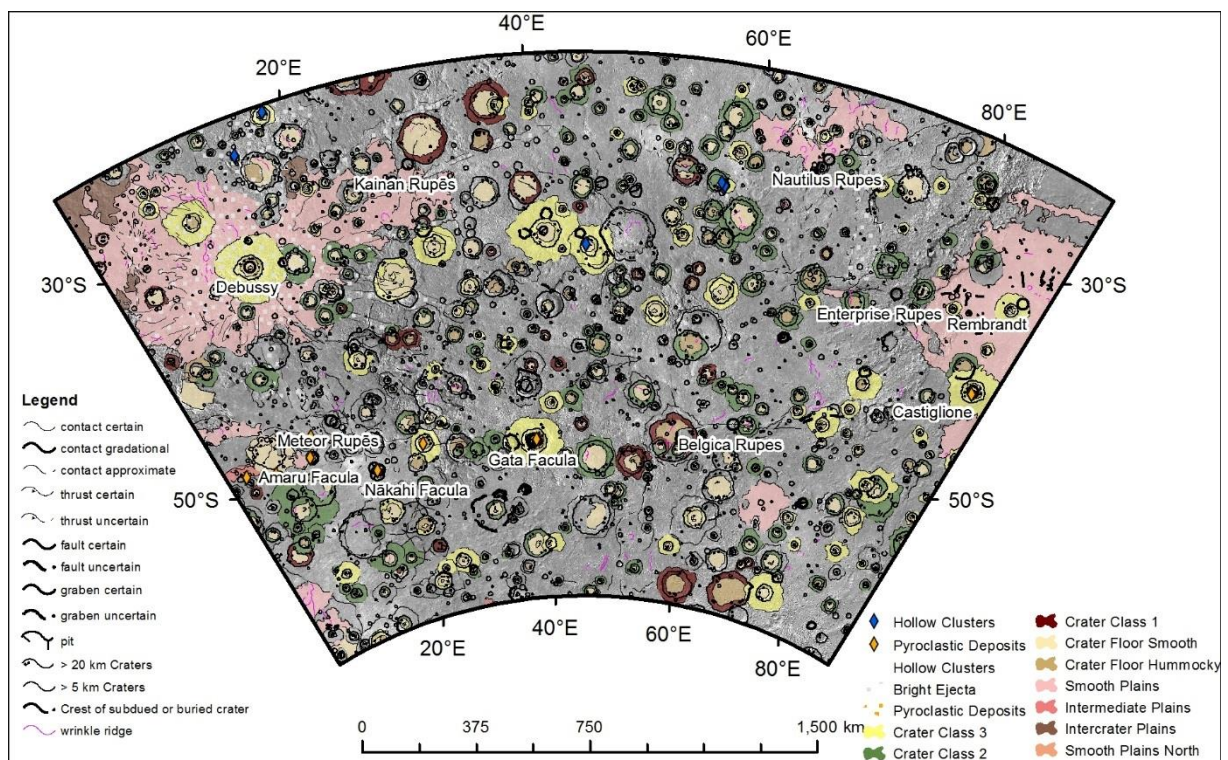


Fig. 1. Current working geological map of the Debussy Quadrangle H-14 Mercury Highlighting some key named features. Symbology is similar to that used in [3, 4, 5, 6, 7]

Intermediate plains appear older and more cratered than the smooth plains, and their boundaries are less distinct. The identification of this materials as a unit is controversial, as it has been suggested that intermediate plains might simply be a more degraded version of smooth plains [13]. Hence, the use or not of this unit will be based on morphological observations within the quadrangle.

Intercrater plains are the oldest plains unit. Whilst not so saturated by craters as the lunar highlands, they represent the oldest known terrain on the surface of Mercury [13]. The unit is heavily cratered with many secondary craters, giving it a rough hummocky texture; within enhanced color images this unit often appears as spectrally blue.

Tectonic features are shown by linework. The cooling and contraction of Mercury has led to the formation of thrust faults which manifest themselves at the surface as lobate scarps, [14] which are the dominant tectonic features in the quadrangle. Grabens have been mapped within the Rembrandt impact basin, and were probably generated by extension linked to basin relaxation after impact and subsequent emplacement of smooth plains [15]. Wrinkle ridges are found within the more recent plains units and crater infills. They can often be seen outlining ghost (totally infilled) craters.

A separate layer for superficial units has been produced which includes ejecta rays, high albedo faculae postulated to be pyroclastic deposits [16], and large collections of hollows.

Features of Debussy Quadrangle: There are several large-scale features within the Debussy quadrangle that are of particular interest for mapping:

Rembrandt Basin: This 720 km diameter impact crater is the largest well-preserved basin in Mercury's southern hemisphere [17]. Smooth volcanic plains that postdate the impact partially fill the basin [18]. Rembrandt hosts many of the features characteristic of large basins including wrinkle ridges, grabens, and ghost craters [19]. Unlike Caloris it is only partially flooded with lavas [20].

Enterprise – Belgica Rupēs fold system: Enterprise Rupes cuts across Rembrandt basin, and Belgica Rupes runs parallel to Enterprise Rupes forming a fault bound valley between the two structures [21]. It can thus help our understanding of the tectonic history of the planet [17]. The interaction of the lobate scarps with other landforms illustrates the structural controls that pre-existing landforms can have on the morphology of scarps [22].

Kainan Rupēs represents an unusual arrangement of 3 lobate scarps: two are facing each other and a 3rd is displacing the block situated in between the two verging

faults. Two additional lobate scarps systems within the quadrangle are Nautilus Rupes and Meteor Rupēs.

Explosive volcanism within the quadrangle includes: Nakahi, Amaru, and Gata Faculae (interpreted to be pyroclastic deposits) and their associated vent sites which form a chain aligned along the strike of Meteor Rupes. In addition there is a facula within Castiglione crater. Rembrandt basin does not have so many faculae associated with it as Caloris.

We present the latest version of the map and with a working geological interpretation.

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