GEOLOGICAL MAPPING OF THE NERUDA QUADRANGLE (H13), MERCURY: STATUS UPDATE.
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Introduction: The Neruda Quadrangle (H13) is one of the final geologically uncharted regions on the planet. H13 is one of fifteen mapping quadrangles that Mercury is divided into [**1**] and was first fully imaged by the MESSENGER (Mercury Surface, Space ENvironment, Geochemistry and Ranging) spacecraft during its primary mission in 2011. Prior to MESSENGER, only the very eastern fringe of the quadrangle (~5° of longitude between ~175°-180°) was imaged by Mariner 10 and geologically mapped, at a scale of 1:5M. With ESA-JAXA's BepiColombo mission underway, it is imperative that a full set of comprehensive geological maps are produced prior to the arrival of the spacecraft. This will provide context for an informed scientific campaign. Here we provide an update on the progress of our geological map, the first map of the entire H13 quadrangle at a scale of 1:3M.

Data: The primary basemap used is the 166 m/pixel (256 pixels per degree) v1.0 Base Reduced Record monochrome tiles with moderate (~74°) solar incidence angles. Secondary basemaps include the low (~45°) and high (~78°) incidence angle monochrome tiles, the ~655 m/pixel enhanced color mosaic, Mercury Laser Altimeter and stereo-derived Digital Elevation Models and an unreleased 222 m/pixel Digital Terrain Model produced from MDIS (Mercury Dual imaging system) NAC (Narrow angle camera) stereo images [**2**,**3**]. Ancillary products including WAC (Wide Angle Camera) and NAC images of differing illumination angles are used to help with morphological interpretations. All data were obtained by MESSENGER's MDIS instrument [**4**] and are sourced from the National Aeronautics and Space Administration's Planetary Data System Geosciences node and Cartography and Imaging Sciences node.

Methods: Geographical Information Software in the ArcGIS suite is used for mapping following both the United States Geological Survey (USGS) and Geologic MApping of Planetary bodies (GMAP), formerly PLANMAP (PLANetary MAPping) practices. The USGS's Integrated Software for Imagers and Spectrometers version 3 is used for WAC and NAC image processing and base map tile processing to produce map projected products with the correct spacecraft and camera information, radiometric calibration, and photometric corrections for ingestion into ArcGIS. The map is projected as a Lambert Conformable Conic with a central meridian of 135° and standard parallels of -30° and -58°. To enable accurate correlation with neighboring quadrangles, a 5° overlap is being mapped. Mapping in ArcGIS is undertaken at a consistent 1:300k drafting scale. A vertex is placed every 600 meters using ArcGIS's streaming tool.

Mapped units and features: Mercury's geological terrains are typically divided into four overarching units: crater materials, intercrater plains, smooth plains, and intermediate plains, however, intermediate plains are currently disputed [**5**].

Crater materials are subdivided based on the degree of crater degradation, with two schemes; a five-class scheme [**6**] used by the USGS and a three-class scheme [**7**–**13**] used by some GMAP/PLANMAP mappers. We are producing two versions of our map, one with the three-class scheme and one with the five-class scheme to be comparable and compatible with other MESSENGER era maps [**10**–**12**,**14**,**15**]. Craters ≥5 km in diameter are digitized and all craters ≥20 km in diameter are classified using the two degradation schemes.

Intercrater plains are the most heavily cratered plains unit and are found situated in between and around impact basins and large craters [**16**]. The intercrater plains morphostratigraphically are the oldest plains unit and are probably volcanic in origin, deposited prior to and possibly during the late heavy bombardment [**17**,**18**]. H13 is perhaps the most densely cratered quadrangle on the planet and as a result, most of the region is classified as intercrater plains.

Smooth plains are expanses of sparsely cratered flat to gently undulating plains and can characteristically have wrinkle ridges and ghost craters within them. Smooth plains are volcanic and are interpreted to have formed by effusive volcanism, near to the end and post late heavy bombardment [**19**]. Small, isolated patches of smooth plains may represent ponded impact melt. In H13, areas of smooth plains are found in the northern fringe of the quadrangle (in the 5° overlap with H08 and H09). These expanses impinge onto craters, and

flood crater interiors. These smooth plains are part of the Caloris exterior smooth plains and formed by effusive volcanism following the Caloris impact. Similarly, east and exterior to the Rembrandt impact basin that straddles H13 and H14 is a patch of smooth plains. This patch is probably due to localised effusive volcanism in relation to the Rembrandt impact. Small, isolated patches of smooth plains are observed infilling depressions and small craters and may be ponded impact melt.

Intermediate plains are characterized as hummocky terrain, intermediate between intercrater and smooth plains. The unit is more cratered than smooth plains but less than intercrater plains. Intermediate plains are likely intercrater plains that have been incompletely flooded by smooth plains. In H13, the identification of intermediate plains has been difficult as the unit is not easily distinguishable. There is perhaps a region of intermediate plains exterior to the Rembrandt impact basin.

Tectonic structures, lobate scarps, wrinkle ridges and high relief ridges [**20**,**21**] are found across the quadrangle cutting all types of plains material. We interpret an extensive system of structures striking generally north-south as part of the Alvin-Altair thrust system that extends into H08 & H09 northwards and southwards into H15.

Volcanic features in the form of putative pyroclastic deposits and vent structures [**22**,**23**] are present in H13. Structures have been identified by their morphology and associated facula and are mostly found within impact craters or on tectonic structures.

Publication: Both the five-class and three-class final versions of the geological map and corresponding morphostratigraphy of the region will be submitted to the Journal of Maps like previous quadrangle maps in the series [**7**–**13**].

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