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Geologic map and structural analysis of the Victoria quadrangle, Mercury

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In this work we present a new geologic map and structural analysis of the Victoria quadrangle (H2) of Mercury, along with a reconnaissance study of the geometry and kinematics of lobate scarps in this area. To this end, we produced a 1:3,000,000 geologic map of the area using the images provided by the NASA spacecraft MESSENGER, which has been orbiting the planet since March, 2011. The geologic map shows the distribution of smooth plains, intermediate plains, intercrater plains units and a classification of crater materials based on an empirical distinction among three stages of degradation. Structural mapping shows that the H2 quadrangle is dominated by N-S faults (here grouped into the Victoria system) to the east and NE-SW faults (Larrocha system) to the west, with the secondary existence of NW-SE-trending faults (Carnegie system) in the north-western area of the quadrangle. A systematic analysis of these systems has led to the following results. 1) the Victoria system is characterized by a main array of faults located along Victoria Rupes – Endeavour Rupes – Antoniadi Dorsum. The segmentation of this array into three different sectors changes from north to south and is spatially linked to the presence of three volcanic vents located at the boundaries between each sector and at the northern end of the Victoria Rupes sector , suggesting that volcanism and faulting are interrelated 2) The main array of Carnegie system is kinematically linked and antithetical to the Victoria system. Both systems have arguably controlled the growth of a longitudinal, fault-free, crustal and gravimetric bulge in the central area of the Victoria quadrangle, which is interpreted as a regional contractional pop-up. 3) The Larrocha system is interrupted against the central bulge and thus is probably older than the Victoria and Carnegie systems. Buffered crater counting performed on the Victoria system confirms the young relative age of its fault segments with respect to the map units. The faults of the Victoria system post-date the smooth plains, even though the morphological evidence suggests a probable syndepositional fault activity. The structural analysis was supplemented by the method by Galluzzi et al. (2014, Geol. Soc. Lond., SP401) to calculate fault slip data using craters cross-cut by lobate scarps. Six analysable faulted craters are located within the H2 quadrangle and reveal that the Carnegie system and the Victoria – Antoniadi array have near-dip-slip kinematics. The former dips 30° eastward, the latter dips 15°-20° westward. Inversion of fault slip data allows estimation of the orientation of the strain field pertaining to the Victoria-Carnegie-systems, whose $\varepsilon 1$ kinematic axis (shortening axis) trends 71° N.