



Young craters of Mercury correlating with offset magnetic anomalies

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In the last months of its mission, MESSENGER was able to obtain measurements at low altitude (< 120 km). This has made it possible to measure small magnetic field signals, probably of crustal origin (Johnson et al, 2015). Maps of the crust signatures at 40 km altitude were produced by Hood (2016) and Hood et al. (2018), showing that the strongest anomalies are about 9 nT in the Caloris basin. Some of the anomalies are associated with impact craters, and it has been demonstrated that this is not a coincidence (Hood et al., 2018). It is believed that these anomalies are the result of impactor materials rich in magnetic carriers (e.g., metallic iron) that were incorporated on the surface acquiring remanent magnetic fields during the cooling of the material. We analyzed whether the anomalies of the crustal field are related to geological characteristics by examining two Hermean craters in order to test this impactor hypothesis. Anomalies associated with Rustaveli and Stieglitz craters are slightly or totally asymmetric with respect to the crater center. The morphology and geological setting of these two fresh impact craters that still maintain a well-preserved ejecta blanket and visible secondary crater chains are investigated to constrain the overall impact dynamics. In both cases, slight asymmetries in the morphology and ejecta distribution show that the magnetic anomalies correlate well with the location of impact melt. Rustaveli is associated with a ~5 nT crustal magnetic anomaly centered close to the crater's midpoint, although offset ~20 km east-southeast. This offset is somewhat consistent with the downrange direction implied by Rustaveli's impact melt and crater chains distribution. For Stieglitz, an anomaly larger than 3 nT includes most of the ejecta melt locations towards southwest. The ejecta melt cluster to the north of the crater corresponds to an anomaly of ~5 nT, while the largest anomaly of ~7 nT is found further north and closely corresponds to the crater's deepest chain. For both craters, the melt likely recorded the prevailing magnetic field of Mercury after quenching. Hence, both impactors brought magnetic carriers to the surface that could record the past magnetic field of Mercury. *Acknowledgments: The authors gratefully acknowledge funding from the Italian Space Agency (ASI) under ASI-INAF agreement 2017-47-H.0 and the European Union's Horizon 2020 research and innovation programme under grant agreement No. 776276.*

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