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NEWTON instrument performance example: Magnetic and mineralogical evidences for the origin of an impact crater-like structure of the Barda Negra plateau basalts (Argentina) now interpreted as giant caprock sinkhole

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The EU-funded (H2020) NEWTON project aims to develop a new portable multi-sensor magnetic instrument for planetary surface exploration. In this context magnetic devices have been tested with the general scientific objective to constrain the origin of crater-like structures. As a case study a 1.5 km wide and 40 m deep crater-like structure within the [U+0334][U+0334] 10 Ma old Barda Negra basaltic plateau, located 35 km to the South of Zapala in Argentina, was investigated. Due to similar morphological characteristics compared to Barringer impact crater in Arizona and its isolated occurrence which may argue against a maar-like origin, it was described as likely impact crater (Acevedo et al. 2015). In contrast to previous findings of Roca (2004) we did not found raised rims around the circular depression which could have been formed by either impact-related ejecta or deposits of pyroclastic material during an alternative phreatomagmatic maar-like origin. Magnetic mapping shows a ∼3000 nT lower magnetic signature within the crater compared to its basaltic rims. This lower remanent magnetic signature of the crater interior is consistent with (1) a 20 to 25 m thick sedimentary infill of the crater with very low magnetic susceptibility (as has been also mapped) and (2) underlying > 50 m thick basaltic lavas. Mineralogical investigations of rocks and sediments from representative sections of the crater does not show any high PT minerals, like coesite or stishovite, or remnants of an impactite or impact melt. Textural evidences for a meteorite impact-induced stress in minerals and rocks are also missing. Below the 100 to 120 thick plateau lavas of the Barda Negra 60 to 70 m thick carbonate-bearing rocks of the Collón Cura Formation contains sufficient calcite (50 to 70 vol.%) for dissolution and karst formation during a proposed sinkhole formation. Different kinds of up to 100 m deep und 6 km wide sinkholes have been formed on a cogenetic meseta with similar lithologies located 20 km westward of the Barda Negra support such scenario of origin. Our results indicate that large crater-like structures with a sinkhole origin can be also formed in areas with thick basalts layers and may be a more frequent feature on celestial bodies as still known. This assumption is supported by the recent discovery of pit structures and holes on Mars in areas with basaltic as well as sedimentary surfaces (e.g. Adams et al. 2009) and coment 67P Churyumov-Gerasimenko (Vincent et al. 2015).

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