Acraman crater morphology from the gravity aspects

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Introduction: In terms of gravitation, impact craters have a distinct pattern in terms of their gravity signature. An explosion associated impact cratering converts the kinetic energy into the heat. Due to collision velocity being in a range of tens of km/s most of the impactor upon impact converts into the rapidly expanding vapour. Expansion related explosion and a crater excavation process expands the rock substrate under the crater while compressing the rock under the crater rim. The outward compression creates radial compression environment that allows development of morphology detectable by strike angle solution. The strike solution reveals the elongation of a gravity anomaly. It does not matter whether it is a fracture or a solid thin wall (in case of a dike, the fracture and the solid dike are stuck to each other).

If a fracture due to impact is detected by strike angle, it should be also seen by Tzz. Over the impact crater's rim there is a radial extra mass, which is detected by Tzz. the strike shows the same radial mass which was detected by Tzz. While the fracturs in the rim are not observable by strike solution, this solution is however often associated with high alignment of strike solution, mostly correlating with high porosity and presence of water content.

Such areas can be source of water is in the polar regions of the Moon [1]. In addition, the resulting elevated crater's rim and excavated opening of the crater's interior, develops a tendency of the crater's rim material to flow back into the crater's opening. Such tendency is held by the brittleness of the rocks underneath the impact crater. And can be imaged by virtual deformation (VD) and second vertical derivative of the gravity field (Tzz) [2].

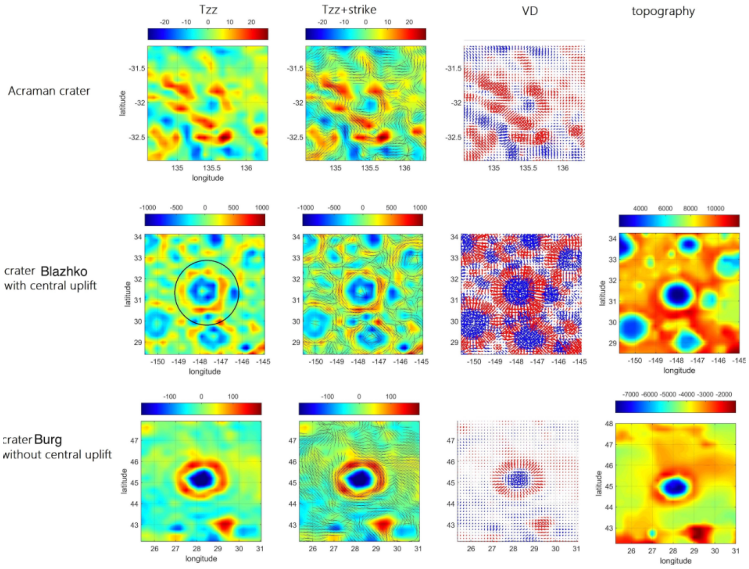

Figure 1: Gravity aspects (Tzz, Tzz and Strike solution and VD) of Acraman crater compared with Blazhko and Burg crater.

Discussion and conclusions: We use Tzz, strike, and VD on typical impact craters on the Moon, Blazsko crater with central uplift, and Burg crater without a sign of central uplift, both with similar crater diameters as Acraman crater in south Australia. An outline of the Acraman crater based on VD is ~70 km. Comparison of Acraman crater's VD, Tzz and strike, with the same variables for typical lunar craters, Blazsko and Burg craters, indicates that it lacks comparable central uplifted signature seen in Blazsko crater. Dispite the surface erosion of the Acraman crater, comparison of its VD seems to match lunar Burg crater that has no central uplift. This may have to do with the size of the impactor comparison with the layering of the substrate at the time of impact. Lack of the central uplift suggest that the substrate at the time of impact formed a homogeneous material with no significant horizontal layering, whose scale would compare to the size of the Acraman impactor. Impactor is usually considered to be one order of magnitude smaller than the crater diameter. VD analyses for Acraman crater suggests a current extent of ~70 km, suggesting about 7 km size impactor. Because the VD show no significant central uplift, this means that the substrate, at the time of impact, had not significant brake in composition down to 7 km depth.

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References: **[1] Kletetschka, G., et al (2022),** ***Scientific Reports*****, 12:4501. [2] Klokočník, J., et al (2014).** ***Earth Science Research*****, 88-101.**