UAV magnetometer survey of the Acraman's crater epicenter

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Introduction: Acraman crater is a large impact structure in South Australia, approximately 220 km west of Port Augusta. After the Acraman's crater discovery, multiple research projects lead to an approximate date at around 590 Ma [1]. The epicenter of the crater forms a flat shallow Acraman lake, intermittently a dry basin. Airborne magnetometer survey, performed by Geoscience Australia & GPX Surveys [2], shows magnetic anomalies in the epicenter. A peculiar "central dipolar anomaly" is a significant geophysical marker of the epicenter. Even though the airborne data are in relatively high resolution (400m spacing and approximately 80 m altitude) [3], some information about the epicenter can be missed. We carried out a detailed UAV magnetometer survey over the previously detected central anomaly to retrieve more information about the anomaly's origin while collecting samples from outcrop material of the crater center, characterizing the geology underneath the epicenter.

Data and method: A drone equipped with a fluxgate magnetometer made by Czech Technical University in Prague, Czechia was programmed for autonomous flight patterns. Flight altitude was set to 25m above ground level. Profile spacing was 25m. Profiles were 3.5km long each. Concerning local morphology, profiles were flown in NE - SW direction. The flight speed was set to 14m/s. The magnetometer frequency was set to 62 Sa/s. The profiles/flight lines were preprogrammed, and the UAV executed the mission autonomously. The flight path was monitored in real-time by the UAV pilot. The flux gate sensor-head case contains an air dumping to prevent swinging. The drone was landed, and the UAV battery was changed by the operator every two profiles. Recorded data were downloaded from the UAV and processed afterward.

Results: The UAV magnetometer data shows magnetic anomalies in the crater epicenter in much greater resolution than yet known data. The yet known central magnetic anomaly recorded by conventional airborne mag research appeared to be a dipolar anomaly. Our data show new features of the anomaly and are suitable for further data processing such as depth of magnetization and direction of magnetization estimate as well as tied to local rock magnetic characteristic of the area.

Discussion and conclusions: Yet known central magnetic anomaly of the Acraman crater is a dipolar-shaped anomaly. Tanks to our survey in high resolution with lower altitude and tight profile lines, the new magnetic image of the Acraman epicenter was revealed. The shape and features of the anomaly are shown considering the underlying geology. The high-resolution data have the potential to reveal if the central anomaly is caused by terrestrial rocks eventually uplifted by the impact or if some mixture of material with an extraterrestrial body can persist buried deep under the crater floor.

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