MAGNETIC FIELD ANOMALIES OBSERVED OVER THE ROCHECHOUART IMPACT STRUCTURE.

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Summary: At 1 km of altitude, no magnetic field anomaly are observed over the Rochechouart impact structure, France, while a -11 mGal gravity field anomaly is clearly associated with the area of impact breccia deposits. Following the recent superficial drilling campaign in 2017, several ground and low altitude UAV magnetic field investigations were performed on several sectors of the impact structure. We will present the preliminary maps resulting from these surveys. In the Chassenon area where the melt-rich breccia deposit is thick (~40 m) and possess strong magnetizations, we unveiled ground magnetic field anomalies up to 100-200 nT of amplitude.

In french: Alors qu'une anomalie gravimétrique de -11 mGal identifie clairement la partie centrale de la structure d'impact de Rochechouart, aucune anomalie de champ magnétique n'est visible sur la grille aéromagnétique de la région. Suite à une campagne de forages en 2017, nous avons entrepris différents travaux géophysiques sur la zone, avec notamment des mesures de l'intensité du champ magnétique au sol et par drone à basses altitudes. Nous présenterons les premières cartes réalisées, en essayant de corréler les anomalies magnétiques relevées à différentes hauteurs avec les possibles sources géologiques impliquées.

Introduction: Among the geophysical signatures associated to impact structures, the observation of magnetic field anomalies reveals geological contrasts which may be caused by several pre-, syn- and post-impact processes. For example, the central uplift of deep formations (e.g. crystalline rocks, generally more magnetized than subsequent sedimentary deposits) can lead to a central positive magnetic field anomaly [1]. Post-impact hydrothermal alteration can also create new magnetic carriers which may lead to significant magnetic field anomalies [2]. Sometimes the signature only corresponds to the alteration of pre-impact magnetic field anomalies in the regional geology, by reseting the magnetization or disturbing the geometry of pre-impact magnetized formation [3]. These signatures of the terrestrial impact structures are complementary to other geophysical signals like the gravity field anomalies, which mainly reflect the brecciation/fracturation state of the impacted formations, or even the electromagnetic and seismic observations [4], and therefore help to constrain geological models of the present-day impact structures.

Context: The Rochechouart impact structure (France) was created about 205 Ma ago in the crystalline basement of the western Massif Central, part of the Hercynian Belt. It led to a 25-30 km diameter crater [5], but today no crater are visible: only thin (100 m max) deposits of impact breccia on the fractured basement are observed in a 10-12 km wide area. It offers the opportunity to access to the transition between impact melt rocks, impact breccia and the target. In 2017, a series of superficial drillings collected more than 540 m of fresh core samples covering all lithologies observed in the area (including basement). In parallel to this campaign, we performed several geophysical surveys in the area, which, surpisingly, was not really investigated until now. The first results of electrical and magnetotelluric surveys are now published and promising [6].

Method: Magnetic field surveys were also performed over several sectors of the Rochechouart impact structure, but mainly over the Chassenon deposit area (NW of the structure). We used ground prospection Total-Field measurements on crop/livestocks plots, while a light UAV equipped with a fluxgate magnetometer [7] was also used to fly over some areas at 10, 50 and sometimes 100 m of altitude.

Results: Preliminary maps of the processed data (after external and core field substraction, and reduction to the pole mainly) revealed significant anomalies over the prospected areas (Figure 1).

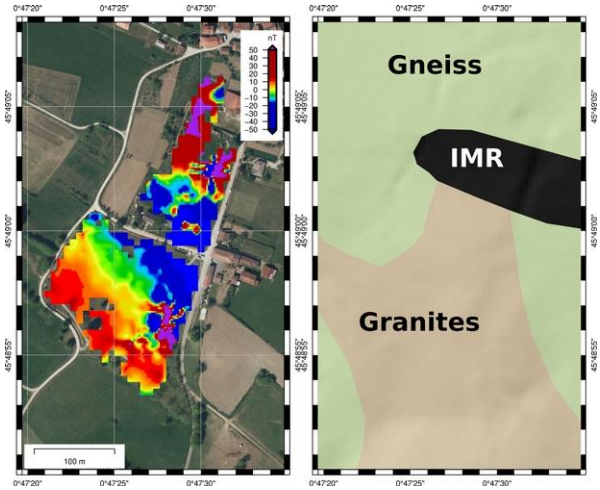

Figure 1 : *Comparison between ground magnetic field (left) and geological (right) maps over the Babaudus area (center of the structure).*

Over Chassenon in particular, NW-SE magnetic anomalies can be identified at different altitudes. These anomalies unveiled the thickness variations and the uncommon geometry of the impact melt-bearing breccia overlying the crystalline basement. We will also investigate the correlation between the signals at different altitudes, trying to link these data with the aeromagnetic grid which does not show any particular anomalies over Rochechouart.

Discussion: These promising results clearly indicate that we shall continue these magnetic field measurements on ground and at low altitudes. Combined with the electrical, electromagnetic and gravity field data, it will help to build more robust models of the geometry of this transition between breccia and basement of this eroded impact structure. It will also help to estimate the amount and intensity of the possibly-different magnetization processes within the structure.

This work is dedicated to Marc Munschy, who passed away in August 2020. We miss the man and the scientist.

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