ORIGIN OF THE CENTRAL MAGNETIC ANOMALY AT HAUGHTON IMPACT STRUCTURE, CANADA

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Context: Located on Devon Island, Nunavut, Canada, the 23-km diameter Haughton impact structure is one of the best-preserved medium-size complex impact structures. The impact occurred ~39 Ma ago in to a target formation composed of a 2-km thick sequence of Lower Paleozoic sedimentary rocks of the Arctic Platform overlying Precambrian metamorphic basement of the Canadian Shield [1]. Impact melt breccias filled the crater, while impact-related hydrothermal activity took place, but since then no significant geological event affected the area [2].

In the 1980s, ground magnetic and gravity measurements were carried out within the central part of the crater [3]. A significant anomaly was discovered and coarsely modeled by a source body of simple geometry. A recent airborne magnetic survey delivered additional data that covered the whole crater but no modeling was done [4].

Method: During Summer 2010, we performed a new ground magnetic survey to better characterize the central magnetic anomaly. A Geometrics G858 caesium vapor magnetometer was used. After correct removal of the external and core magnetic fields, the resulting dataset allowed us to produce a local magnetic field map of high quality at ground level, whereas [3] only used profiles. We precisely modeled the anomaly to constrain the geometry and magnetization of its source, also using results from laboratory measurements of magnetic properties (remanent magnetization and magnetic susceptibility) of all target lithologies.

Results: The amplitude of the central magnetic anomaly reaches ~900 nT over a distance of 1.5 km. A local sharp transition of the gradient was identified, probably indicating a very shallow top of the magnetized source. Modeling indicates that a 0.7 km^3 magnetized body with possible local superficial branches could be the source of this anomaly. Among the local lithologies, all Palaeozoic sedimentary rocks are too weakly magnetic to account for the magnetic anomaly. Even the highest total (i.e. induced + remanent) magnetization intensities measured on basement samples are about 1 A/m, slightly weaker than those resulting from source modeling (1.5 to 2.5 A/m).

Discussion: The geometry of the modeled source body corresponds to the one expected with a central uplift. Magnetization property investigations exclude Palaeozoic sedimentary rocks from comprising this inner part of the central uplift. Because the pre-impact magnetization intensities of basement formations cannot account for the magnetic anomaly too, an additional impact-related process is required. Post-impact hydrothermal alteration could have affected this uplifted basement, since evidence of such alteration is common at Haughton [2]. This geological process will enhance both remanent magnetization and magnetic susceptibility. In addition, the modeled magnetization directions correspond to the expected normal polarity regional directions of the main magnetic field when the impact occurred [5].

References: [1] Osinski G. R. et al. 2005. *Meteoritics & Planetary Science* 40:1759–1776. [2] Osinski G. R. et al. 2005. *Meteoritics & Planetary Science* 40:1859-1877 [3] Pohl J. et al. 1988. *Meteoritics* 23:235–238. [4] Glass B. J. et al. 2005. Abstract #2398. 36th Lunar & Planetary Science Conference. [5] Gattacceca J. et al. 2011, this meeting.