A MARINE MAGNETIC STUDY OF THE ILE ROULEAU IMPACT STRUCTRE, LAKE MISTASSINI, QUEBEC, CANADA.

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Introduction: Ile Rouleau (a.k.a. Mintunikus Island) was categorized as an impact structure following the discovery of shatter cones on the sub-circular, 1 km diameter island located in Lake Mistassini, Canada [1]. The structure is hosted in the Paleoproterozoic dolomite-rich Lower Albanel Formation and has an uncertain age predating the Pleistocene. Geological mapping suggests that Ile Rouleau is a central peak structure characteristic of complex craters with a diameter limited to 5 km. This size coincides with the boundary between simple and complex craterforms, and thus provides a rare opportunity to study the magnetic signature of an impact crater in this transitional size.

Acquisition: In late June, 2006, we acquired 288 line-km of bathymetric and marine magnetic data in a 6.5 by 10 km area surrounding Ile Rouleau using an acoustic depth sounder and an Overhauser-type proton precession magnetometer. The magnetometer was towed at surface 30 m behind a 5 m aluminum boat. For positioning and navigation, we used a DGPS receiver providing sub-meter accuracy with the aid of CDGPS differential corrections. Magnetic field measurements were obtained at intervals of 1 second or approximately 4 – 5 m along each line. Survey lines, oriented both perpendicular and parallel to the regional geological structure were spaced 100 m apart within 2.5 km of the island and 300 m apart at greater distances to sample the regional signal.

Results and discussion: Water depths were typically 5 – 80 m but reached up to 140 m in a narrow trench striking NNE to the west of Ile Rouleau. Our map of the residual total magnetic field shows several coherent anomalies with amplitudes in the range of 10 to 50 nT. The most prominent feature is a high-amplitude anomaly that wraps around the western side of Ile Rouleau and correlates with an abrupt change in bathymetry. To the east, an arc-like anomaly that may be impact-related parallels the island 100 m from shore. This feature is locally transected by faulting. NNE-SSW trending anomalies, resolvable throughout the survey area, parallel the glacially shaped long axis of Lake Mistassini and thus may be related to glacial landforms on the lake bed. Measurements of the magnetic susceptibility of bedrock samples collected on site are practically negligible ($<10^{-6}$ SI units). Therefore, we argue that magnetic till, which overlays much of N. America, is responsible for the regional short-wavelength features in our area of study [2].

Future Work: We are currently working to differentiate impact-related anomalies from the overprinting effects of glacial landforms, bathymetry and the underlying Archean basement. Forward modelling of impact-related anomalies will follow with the intent of resolving faults and other magnetic sources at the Ile Rouleau impact site.

References: [1] Caty, J.L., Chown, E.H. and Roy, D.W. 1976. *Canadian Journal of Earth Sciences* 13: pp. 824-831. [2] Gay S. P. Jr. 2004, *The Leading Edge* 23, pp. 542-547.