Geomagnetic field dynamics in the Arctic

Recent observations have demonstrated that the geomagnetic field has undergone dramatic changes over the last century. This is best illustrated by changes in the position of the North Magnetic Pole (NMP) and the rapid decline of the dipole field (i.e, the main component of Earth's magnetic field). The NMP, restricted to the Canadian Arctic during historical times (last 400 years), has recently moved into the Arctic Ocean (Fig. 1). Direct observations reveal that the migration of the NMP has increased dramatically since the early 1970s, from 9 km/y to 41 km/y and to almost 60 km/y in 2003, whereas the annual rate of change in intensity measured at the Resolute Bay geomagnetic observatory has increased from about 10 nT/y to almost 70 nT/y over the last 50 years. In addition, the recent migration of the NMP occurred between two important areas of observed geomagnetic fluxes in North America and Siberia (Fig. 1). The role of these geomagnetic flux lobes in driving Holocene geomagnetic variability is currently unknown but may be key. These spectacular changes lead to the following questions: "*Are we in the initial stages of a large-scale geomagnetic change, or even a reversal*?" and "*Are these changes associated with the dynamics of the North American and Siberian flux lobes as they wax and wane*?"

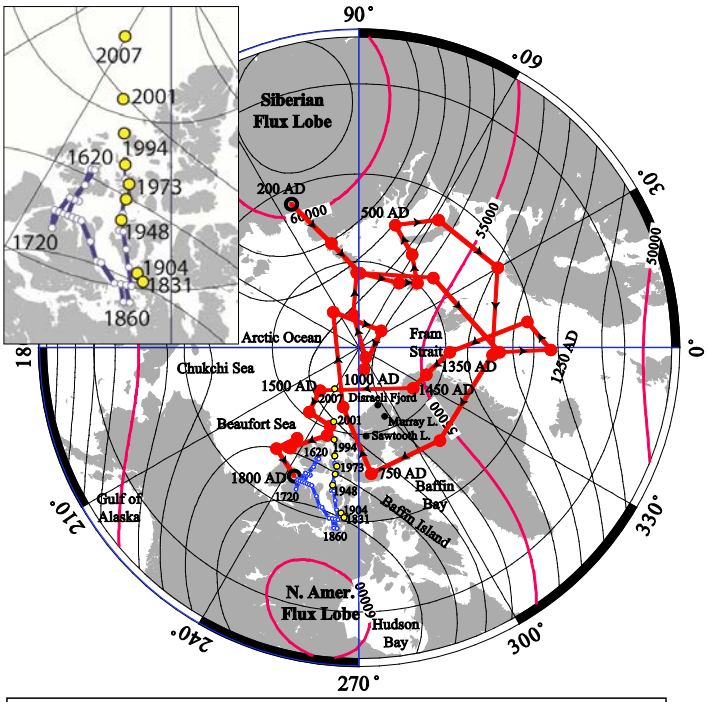

Figure 1. *The reconstructed location and movement of the NMP from 200 to 1800 AD (red). The reconstruction is based on the transformation of the paleomagnetic data from Lower Murray Lake (Cook et al., 2008; Besonen et al., 2008). The historical motion of the NMP calculated from Jackson et al. (2000) is shown in blue and direct observations of the NMP as yellow points. Also observed in the figure are the North American and Siberian flux lobes. Modified from St-Onge & Stoner (2011).*

To answer these fundamental questions, the first step is to place the historical record from the Canadian Arctic into a longer geological context. In the last few years, as part of several research projects and in close collaboration with various researchers and programs such as ArcticNet, a number of marine and lacustrine sediment cores have been collected from the Canadian Arctic that begin to extend this record back to a few thousand years. This Ph.D. project is aimed at extending these results through the entire Holocene by acquiring and studying new Arctic cores and by comparing them to other high- and mid-latitude paleomagnetic records.

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