***Scott S, Ross M, 2016, Quaternary stratigraphy and till provenance across the drumlinized terrain of the McArthur River uranium mine area in the eastern Athabasca basin, Abstract, PDAC-SMC, Toronto, ON***

The McArthur River uranium mine is located in northern Saskatchewan within a corridor of elongated drumlins and long dispersal trains that have been associated with a major ice stream of the Laurentide Ice Sheet. The high-grade uranium deposit is located at a depth of approximately 550 m and the complex Quaternary geology makes it challenging to apply drift prospecting successfully. In addition, differences in till composition can mask magnetic and geochemical anomalies which are often used to discover deposits. This study describes and analyzes the Quaternary sediments (stratigraphy and composition) that are covering the mine site. One of the main goals is to develop an understanding of till provenance and production, which could have implications for drift prospecting in similar prospective regions. Erosional ice flow indicators on available sandstone outcrops and the orientation of drumlins indicate dominant ice flow towards 221°. A total of 110 till samples have been collected across the study area. In addition, one section through the side of a large drumlin was studied in detail for stratigraphy. Grain size analysis and pebble lithological counts on the 4-8 mm size fraction were applied. At least one sub-till fluvial unit of medium to coarse sand with abundant iron and manganese oxides, as well as diamictic clastic dykes formed by subglacial hydro-fracturing is recognized. Overlying this unit is a stiff till with relatively high silt content and approximately 33% basement clasts which are 92% felsic and 8% mafic. Higher up the stratigraphy, the till sheets become more sandy and increasingly rich in local sandstone of the Manitou Falls Formation. These hybrid tills are further topped by a thin sandy ablation till with slightly higher basement clast content (19.6 ±6.7%; n=46). These results indicate a sequence of glacial dispersion events that includes 1) a till production event that first brought distal lithologies to the study area, 2) partial erosion and re-entrainment of that till and mixing with local lithologies. The amount of distal (basement) debris in the till have an effect on the till matrix geochemistry and the source of sandstone can also vary considerably depending on which till (distal, hybrid, or local) is sampled. Mapping the tills at surface will help improve the mapping and understanding of dispersal patterns of altered sandstones and related indicators/pathfinders.

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