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LIPs and Proterozoic uranium (U) deposits of the Canadian Shield: Abstract

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Most large igneous provinces (LIPs) are associated with lithospheric extension driven by mantle upwelling. The Dubawnt Supergroup LISP (Large Igneous and Sedimentary Province) contains two LIPs and a BLIP of mantle-sourced magmatism likely driven by lithosphere plateau collapse and strike-slip deformation rather than plumes. LIP #1, the mafic/ultrapotassic Christopher Island Formation, was intercalated from 1845 ± 12 to 1785 ± 3 Ma with siliciclastic rocks of the trans-extensional Baker Lake Basin that partly covers the vein-style, unconformity associated, 1828 ± 29 Ma Lac Cinquante U deposit and correlates temporally with the Martin Basin of Saskatchewan's Beaverlodge district. LIP #2, granite/gabbro/basalt/rhyolite of the 1.75 Ga Nueltin Suite, was intercalated with siliciclastic rocks of the Wharton Group, invaded pre-Thelon Basin faults, and prepared the ground for basement hosted, unconformity associated U deposits inferred as <1667 ± 5 Ma (fluorapatite cement within Thelon Basin). Five to 10 km aeromagnetic rings are being investigated as potential, shallow bimodal volcanic centres that powered epithermal precious metals systems. The two LIPs broadly mobilized U, moving it upward in the crust and available to paleoweathering, basinal fluid alteration and transport, particularly by leaching incompatible element-rich volcanic detritus. The thin, ultrapotassic mafic Kuungmi lavas cap the Thelon Basin and this BLIP provides a 1540 ± 30 Ma (micro-baddeleyite) upper age for the LISP.

The proposed-plume-related 1.27 Ga Mackenzie event re-set unconformity U deposits in the Athabasca and Thelon basins, and developed new alteration vectors in the Athabasca Basin such as a third generation of chlorite. U-rich phosphate minerals in the Hornby Bay Basin dated as 1282 ± 11 and 1158 ± 80 Ma suggest the Mackenzie event drove sandstone U mineralization.

New ages of mafic igneous events constrain the tectonic development of siliciclastic basins and hydrothermal fluid events that formed U deposits. Once covered by more than 2 km of Hornby Bay Group strata, Port Radium's classic uraninite veins cut the 1.74 Ga Cleaver diabase dykes and are, in turn, cut by the 1.59 Ga Western Channel diabase; thus implying U mineralization beneath the Hornby Bay Basin unconformity.

Dating of Mackenzie diabase sills in the largely sub-surface Dessert Lake basin west of Yellowknife confirms its Paleoproterozoic age and supports correlation with the Hornby Bay and Athabasca basins. An outstanding question is the cause of the regional 1.4 Ga re-setting of U and precious metal deposit ages in the Athabasca and Thelon regions.

Key words: Geomapping for Energy and Minerals, uranium (U), LIPs, LISP, unconformity, geochronology

Speaking notes:

- NE-Thelon compilation is at a triple junction of larger compilations – get knowledge from all three compilers – Sally, Tom and Subhas
- Boundary trends of Nueltin suite almost a mirror of Bathurst –McDonald fault wedges
- Example of thinking outside the box (NE Thelon compilation box that is!)
- Rings are more clearly seen in high resolution aeromagnetic data but almost all can be found using the existing regional aeromagnetic data.
- Diameters of well defined circular rings range from 1.3 to 15 km; Mallery the type ring represents the 6 km average. Most are in the 5 to 10 km range, but one of the best developed – Man on the Manitoba border is 14.4 km.
- The automated search using double cylinder Keating algorithm is very sensitive to diameter so needs to be iterated for every 3 km diameter or so.
- This all started with observing Nueltin granite component in the Kiggavik U camp. How does this fit the big picture?
- Tony Peterson wanted to take this opportunity to find the mafic trigger for the Nuelin rapakivi granites, having known that Tony LeCheminant had mapped mafic lavas and gabbros in 65O south of our area.
- So Tony camped and mapped at Mallery Lake and came back with an aeromagnetic ring structure. Our team started looking at the aeromagnetic compilation
- Vicki Tschirhart (VT) had compiled and levelled high resolution geophysics of the northeast Thelon compilation area (GSC Open File 6944); she and I worked over this and found several more of the rings.
- Vicki tried using the single Keating coefficient to systematically search a larger aeromagnetic data set. It was not discriminating or effective enough. She then created a double cylinder model with much more success. We designed a 3-part experiment to see how far this would take us, which led to the current full presentation:
    1. Detailed gravity and magnetic analysis of the Mallery and Kasba ring structures, results of the Mallery being illustrated here.
    2. VT searches were systematic using the double ring algorithm, used a lot of computing power and very dependent on radius.
    3. Charlie J systematically vectorized aeromagnetic features and synthesized with existing geology, gravity, magnetics and assessed VT's search results (#2) to develop the present story.