Basement to the Thelon Basin, Nunavut - Revisited

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Summary

This paper focuses on structural and stratigraphic revisions of Archean and early Paleoproterozoic sequences that have potential to host unconformity associated uranium deposits beside and beneath the late Paleoproterozoic Thelon Basin. The Neoarchean Woodburn Lake Group was previously divided into a lower volcanic-turbidite and an upper quartzite-dominated package. The lower package is here subdivided into 5 depositional sequences. The upper package is re-assigned to the early Paleoproterozoic Ketyet River Group that is correlated in three generalized sequences with the Amer Group. The position of a major plagioclase-phyric amygdaloidal mafic volcanic unit is resolved as overlying carbonate, overlying quartzite, at the top of the first sequence in the Amer Group. Detailed lithostratigraphic and structural correlation between the Woodburn-Ketyet and Amer belt packages remains one of the objectives of future detailed mapping projects.

Introduction

Can source, hydrothermal alteration and basement/structural focus criteria from the world class Paleoproterozoic Athabasca Basin be adapted to the poorly explored but contemporaneous Thelon Basin in Nunavut (Fig. 1), to reveal and promote undiscovered uranium (U) potential? This question has been addressed multiple times, e.g. Miller and LeCheminant (1985) and Renac et al. (2002). This paper focuses on two basement belts as preferred sites for unconformity associated U in and around the northeastern part of the Basin, here termed the Aberdeen Sub-Basin (Figure 2).

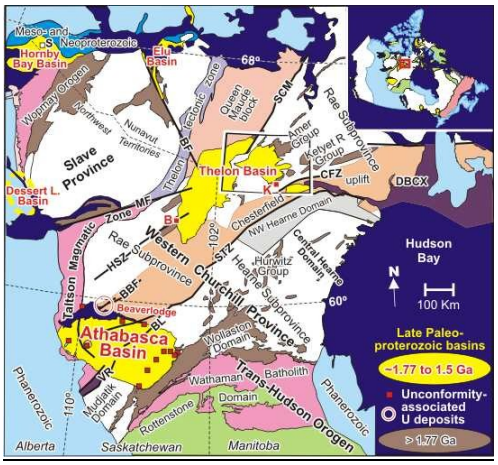

Figure 1. Setting of the northeast Thelon Basin study area (black rectangle) in the northwestern Canadian Shield, Nunavut. DBCX = Daly Bay Complex. Shear zones: BF = Bathurst, BL = Black Lake, CFZ = Chesterfield, HSZ = Howard Lake, MF = McDonald, SCM = Slave Chantrey, VR = Virgin River.

Theory and/or Method

The northeast Thelon project aims to improve the basement geology framework (this paper and Scott et al., 2010), extrapolate it beneath the Thelon basin using geophysical (Tschirhart et al., this session) and RADARSAT 2 data sets (Shelat et al., this session), and assess U sources and timing of basin development, diagenesis and low-T hydrothermal alteration mineralogy within the Paleoproterozoic sandstone cover (e.g., Davis et al., accepted) and Archean to Paleoproterozoic basement.

This paper reports highlights from a 2009 GSC-Industry-University field trip, updating knowledge of two major basement supracrustal belts adjacent to and underlying the Thelon Basin that may host unconformity associated U deposits. Both belts were intruded by Martell syenite co-mingled with Hudson granite at ~1.85 – 1.79 Ga, and by Nueltin granite at ~ 1.76 Ga (Scott et al., this session).

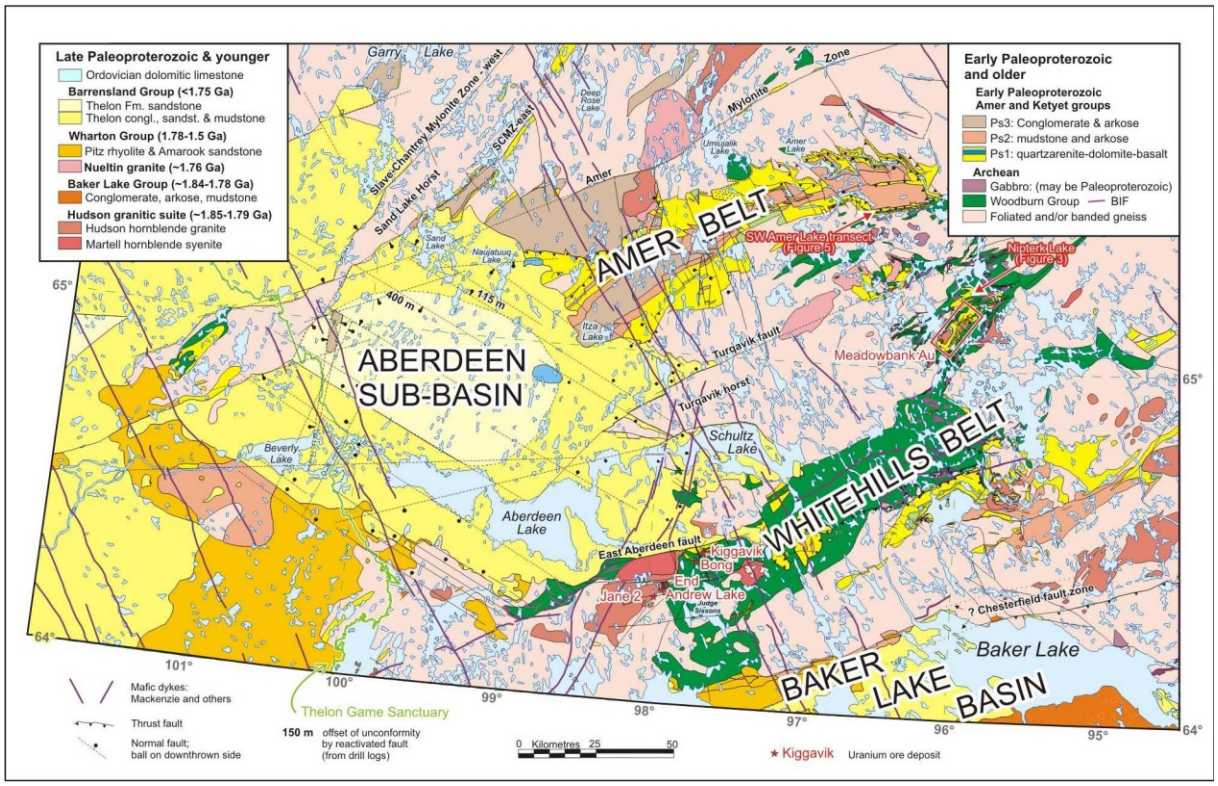

Figure 2. Geology of the northeast Thelon Basin region, NU. Modified after Skulski et al (in prep).

Fundamental Basement Stratigraphy and Structure Clarified

1. The Woodburn Lake Group (WLG) was previously divided into lower and upper Archean packages (Zaleski et al., 2000) with the upper succession interpreted to include ca. 2630 Ma quartzite, based zircon ages from an aluminous felsic volcanic rock interpreted to be interbedded with the quartzite. The dated site along with several others like it were re-examined by the co-authors in July 2009. The quartzite is everywhere separated from the felsic volcanic rocks by a laterally variable basal conglomerate and schist, and the two successions are isoclinally infolded (F1, Fig. 3). Strikingly similar relationships were found at every site of this contact, including at the base of the Amer Group much farther north. We therefore propose the quartzite overlies the 2630 Ma felsic and restrict the term “Woodburn Lake Group” to clearly Archean volcanosedimentary strata, which are now divided into 5 distinct successions (Fig. 4).

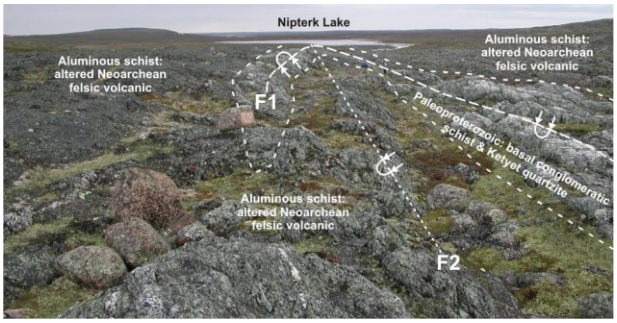

Figure 3. Early Paleoproterozoic basal conglomerate and Ketyet quartzite infolded with hydrothermally altered Neoarchean felsic volcanics at Nipterk Lake, north Meadowbank River area.

2. The Ketyet River Group (KRG) is redefined as the Paleoproterozoic part of the supracrustal belt (here termed the Whitehills belt) that stretches from Whitehills Lake to eastern Aberdeen Lake. It is correlated in three sequences with the Amer Group (Amer) (Fig. 5), although formation-scale correlation is hampered by uncertainties within each sequence.

This is now being examined. For example, amygdaloidal porphyritic subaerial basalt flows of very low metamorphic grade may be: a) Neoarchean in age, structurally intercalated with the Amer (Tella, 1994); b) Proterozoic, capping a major carbonate unit and in turn overlain by more quartzite (Rainbird et al., in prep) or c) stratigraphically above quartzite and carbonate (Young (1979, Knox (1980), Patterson (1986), and Figs. 5 and 6). This paper supports the third hypotheses for the Amer Group, however the Ketyet stratigraphy shown in Figure 5 follows the second hypothesis.

3. Tectonic history. Detailed mapping in 2010 will test a number of fundamentals:
- Four-phase Paleoproterozoic deformational history including refolded isoclinal D2 interfingering of the WLG and KRG.
- Regional consistency and variations in the five sequences constituting the WLG.
- Mappability of WLG and KRG as set out here.
- KRG lies in the deeper-level infrastructure of the TransHudsonian fold thrust belt, wheras the Amer Group is in the higher level superstructure - part way toward the foreland (Patterson, 1986) of the major collisional orogen that is rooted

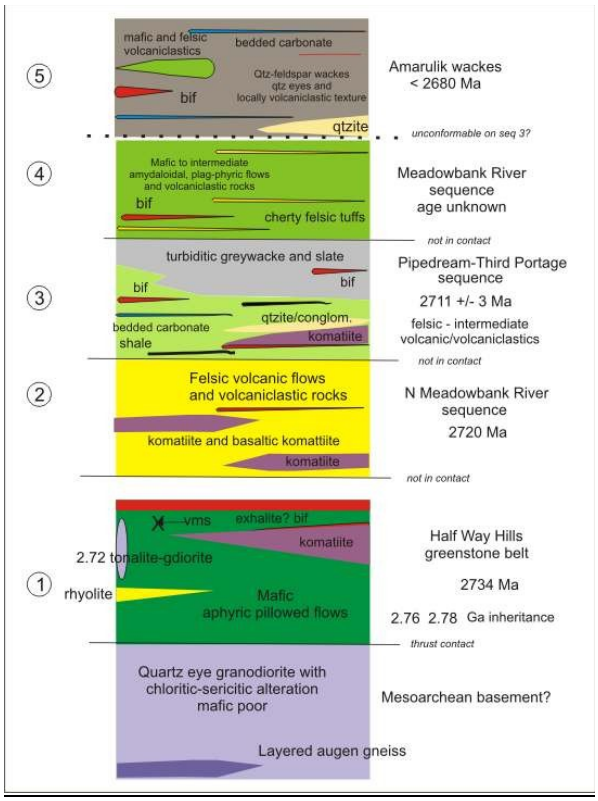

Figure 4. Stratigraphy of the Archean Woodburn Group (sensu stricto) (reference?).

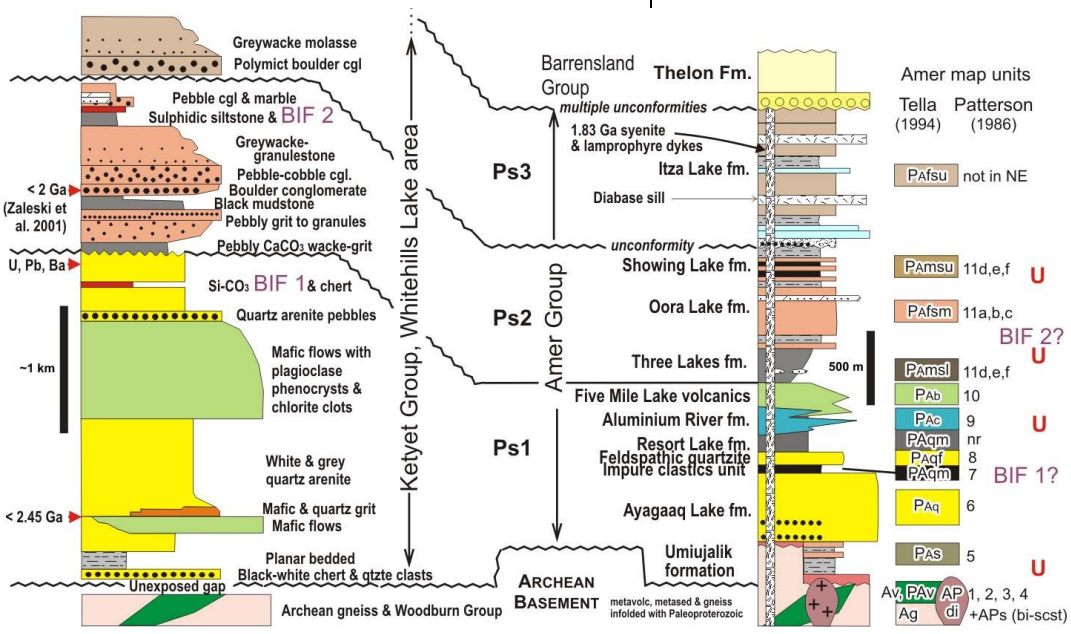

Figure 5. Sequence stratigraphic correlation of the Amer and Ketyet River groups. Vertical scale of Ketyet (after Rainbird et al ?) is slightly smaller than that of the Amer (after Young, 1979).

in the Chesterfield Fault Zone (CFZ, Figs. 1 and 2; Berman et al. 2007). Very little subduction magmatism was expressed along the southeast flank of the Rae–due to lateral docking of the ribbon-shaped Hearne continent along the Snowbird Tectonic Zone. Known magmatism (e.g., Daly Bay complex) is localized at the right-hand bend north of Baker Lake, where convergance was more orthogonal.

Figure 6. Mafic flows overlie carbonate and quartz arenite of the Amer Group, in the core of the isoclinal syncline southeast of Amer Lake (view to west).

Conclusions

The Archean WLG comprises 5 major sequences and excludes regional quartzarenite now assigned to the KRG. The latter is in the infrastructure of the Trans-Hudsonian fold thrust belt; Amer Group is in the superstructure of this major collisional orogen rooted in Chesterfield Fault Zone. The stratigraphic position of mafic flows in the Amer and Ketyet River groups is partly resolved. D1 in the Whitehills Lake through North Meadowbank River regions involves isoclinal folding of Archean WLG with the unconformably overlying KRG. We need to constrain how the deformation sequence in the KRG corresponds with that of the Amer Group. Poorly exposed BIF in all groups are important geophysical-structural–stratigraphic markers.

Acknowledgements

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