



Geology and Mineral Potential of the Tehery-Wager area, Nunavut: Highlights from a GEM-2 Rae activity

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GEM 2 - Rae Project / CNGO

Tehery-Wager activity

Collaborative project:

- *Geological Survey of Canada (Geomapping for Energy & Minerals Program (GEM 2 - Rae Project))*
- *Canada-Nunavut Geoscience Office (SINED)*

Multidisciplinary project:

- *Targeted bedrock mapping*
- *Regional surficial mapping*
- *Targeted stream sediment & water survey*

Contributions from:

- *Université Laval*
- *Université du Québec à Montréal*
- *University of New Brunswick*
- *Dalhousie University*
- *University of Victoria*
- *Nunavut Arctic College*

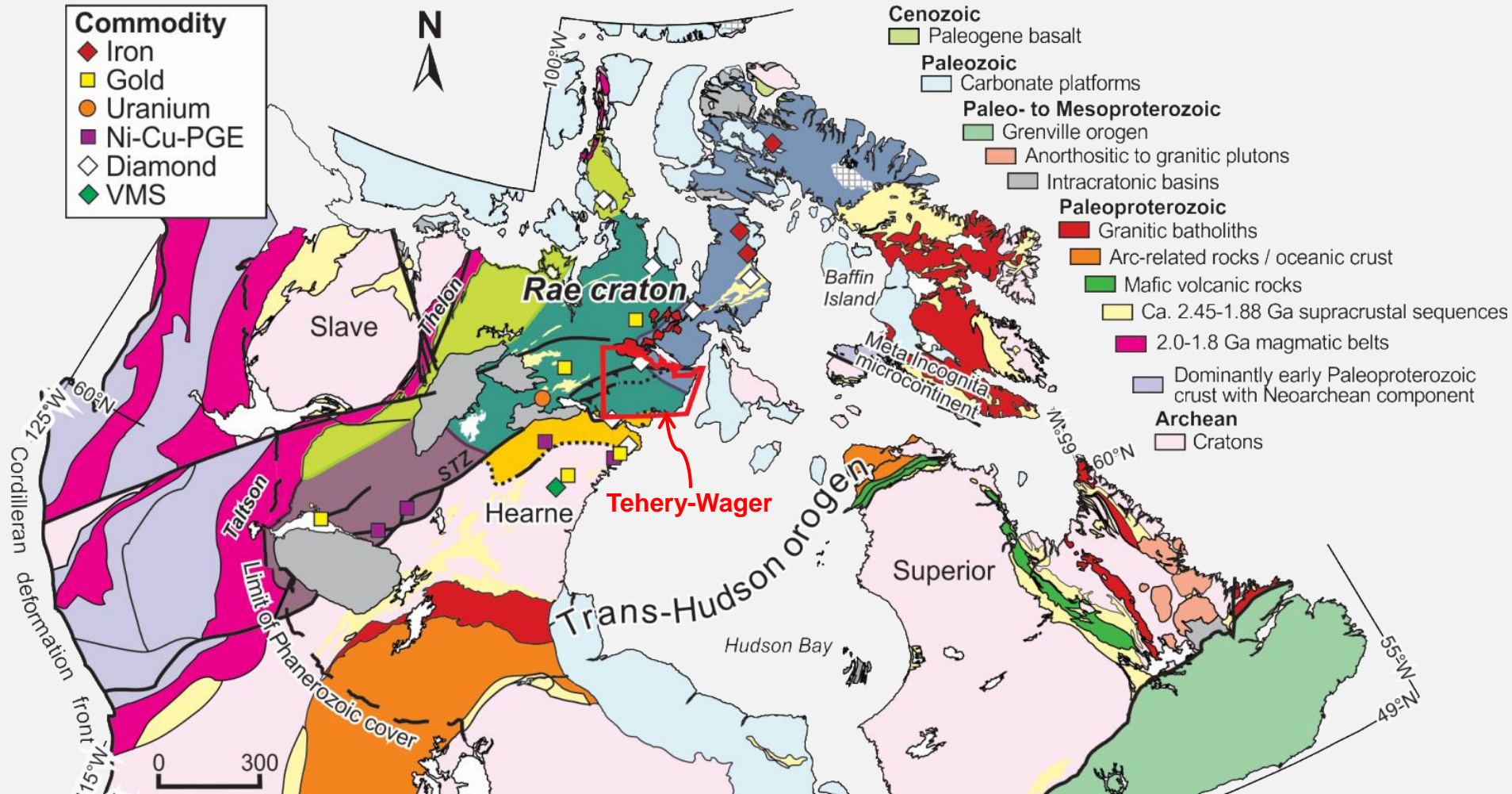


Duration:

- *2 field seasons (2015/2016), outputs through ~2019*



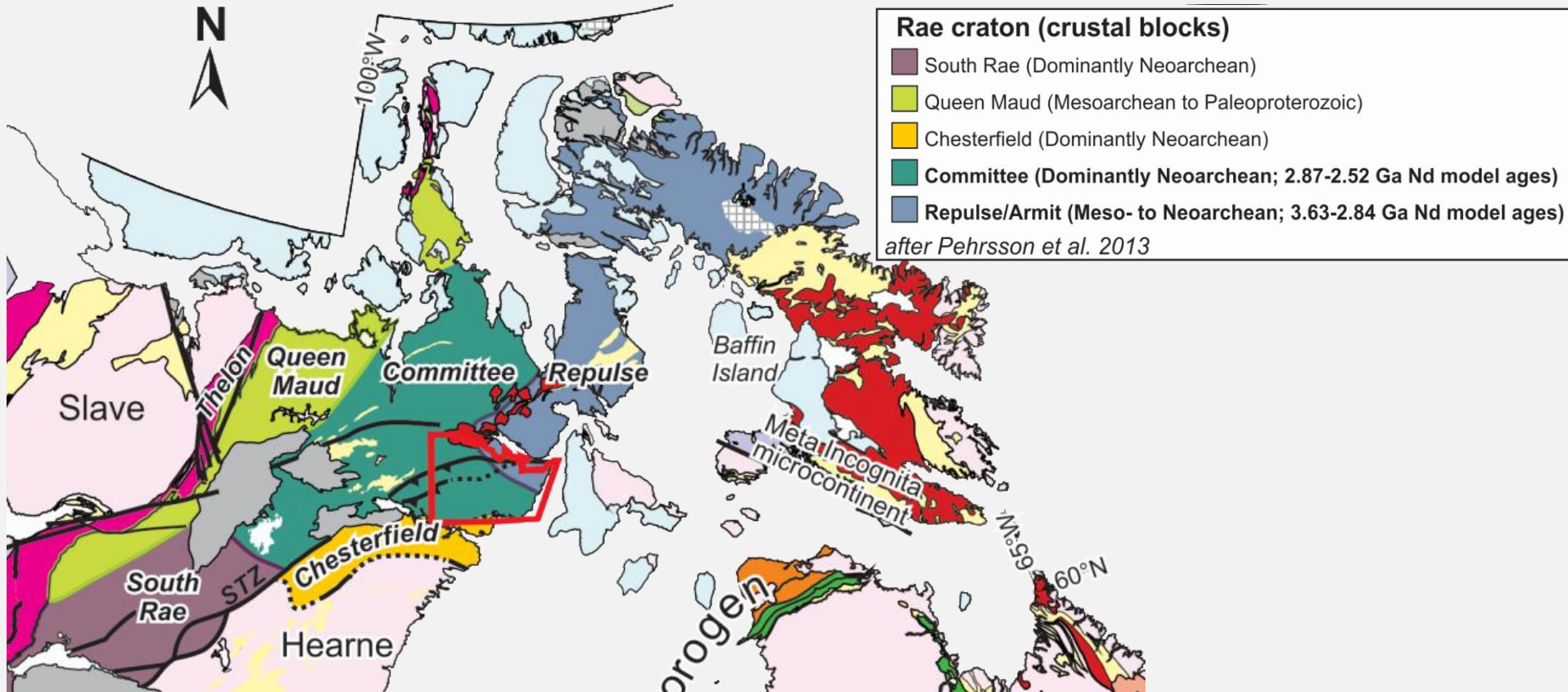
Why Tehery-Wager?



- **Underexplored:** One of four identified regions of the Rae craton that has been little explored
- **Outdated information:** Reconnaissance mapping in 1950's-1960's
Detailed studies in 1980's-1990's (Wager Bay area/Daly Bay Complex)
Remote predictive mapping and isotopic dating in 2000's



Why Tehery-Wager?



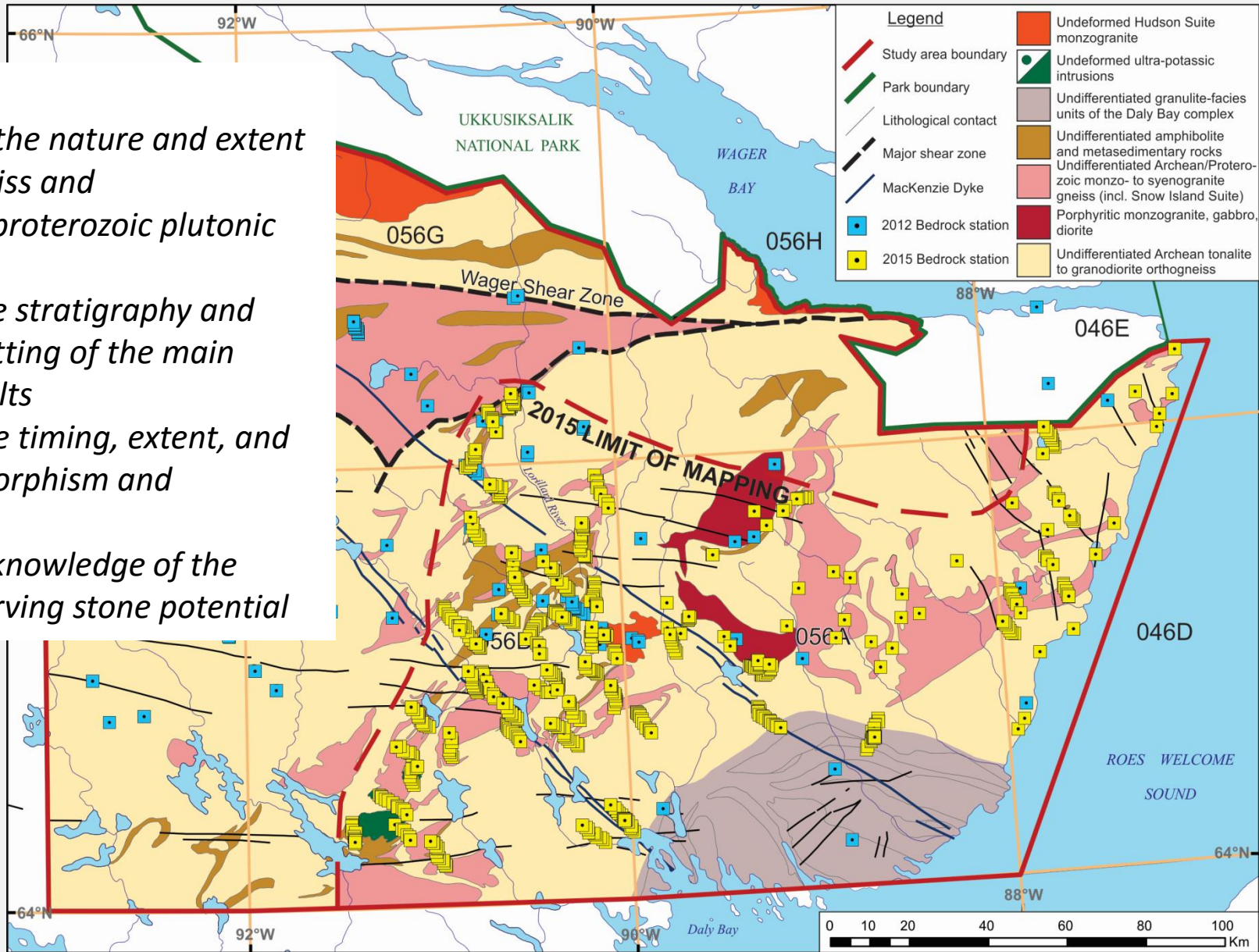
- Contains boundary between two Archean crustal blocks (*precise delineation unknown*)
- GEM-1 reconnaissance survey (2012): *Potential for base- and precious-metal mineralization*
Mantle-derived indicator minerals in surficial sediments
- Transected by major faults: *Favourable environments for mineralization?*



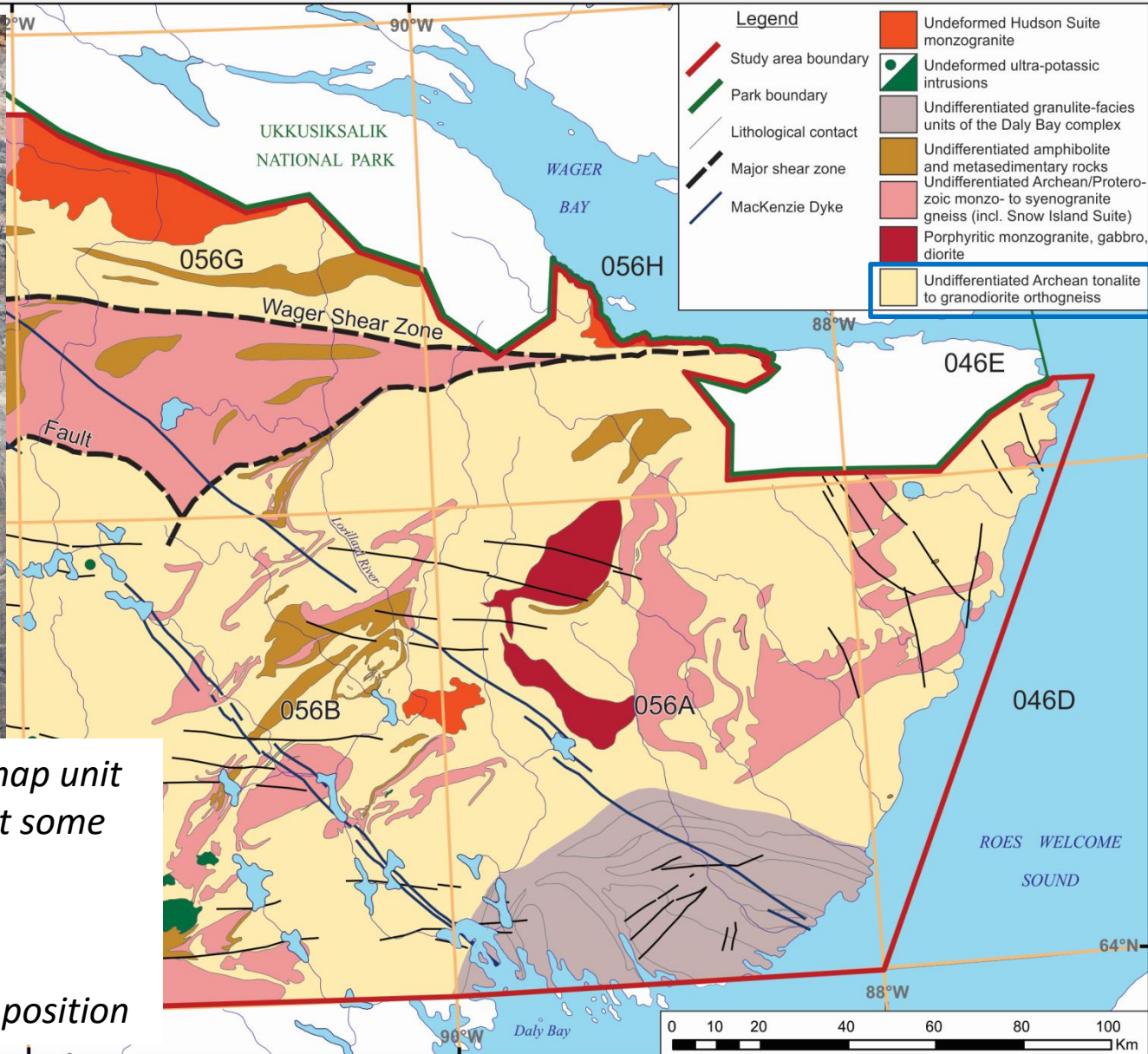
2015 Targeted bedrock mapping

Project goals:

- Characterize the nature and extent of Archean gneiss and Archean/Paleoproterozoic plutonic rocks
- Document the stratigraphy and depositional setting of the main supracrustal belts
- Determine the timing, extent, and style of metamorphism and deformation
- Increase our knowledge of the mineral and carving stone potential



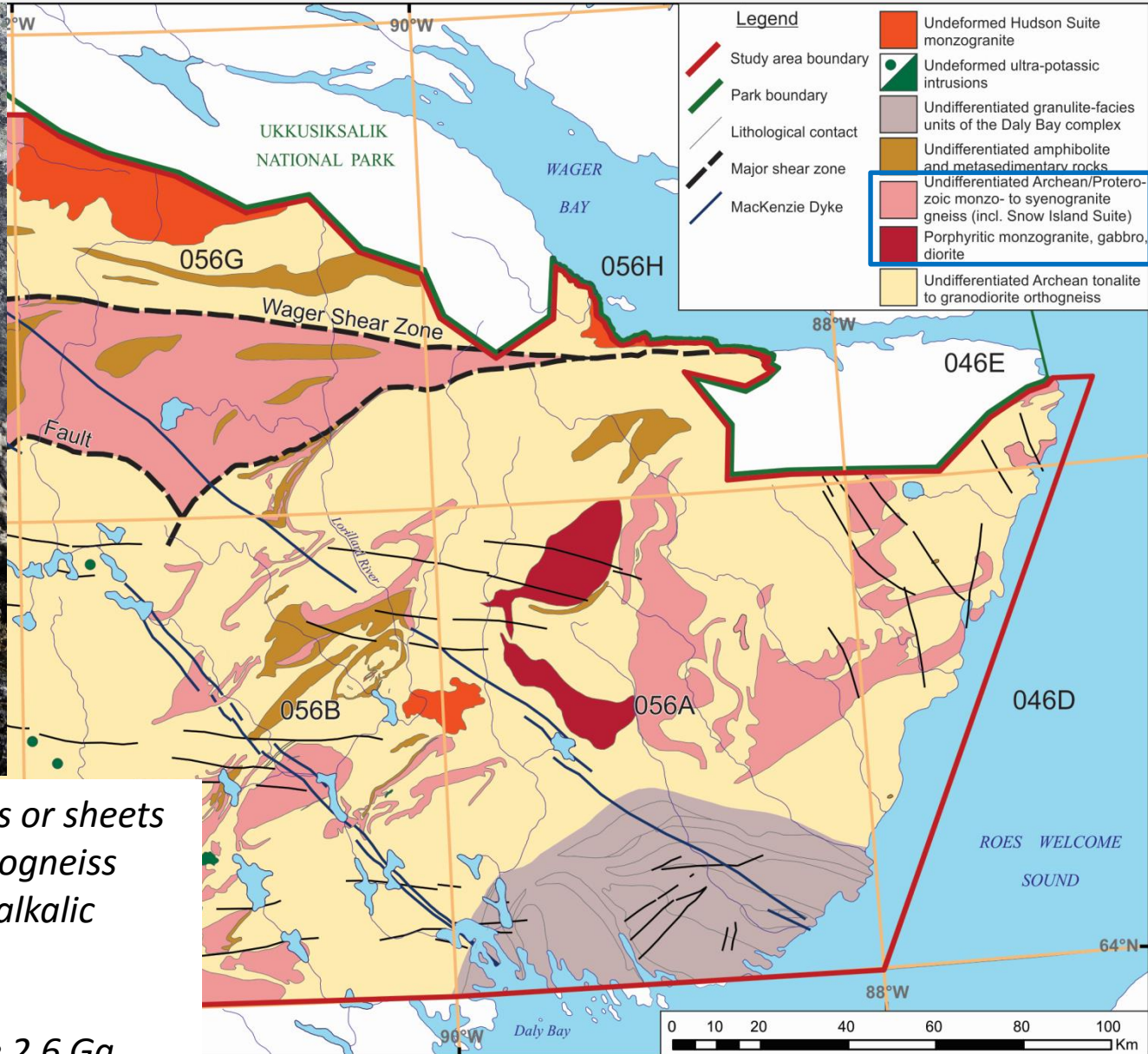
Archean tonalite to granodiorite gneiss (2.90 & 2.71-2.69 Ga)



- Oldest and most prominent map unit
- Dominantly 2.7 Ga in age (but some rocks as old as 2.90 Ga)
- Primitive, calcic affinity (TTG)
- Contains pods and bands of ultramafic to intermediate composition

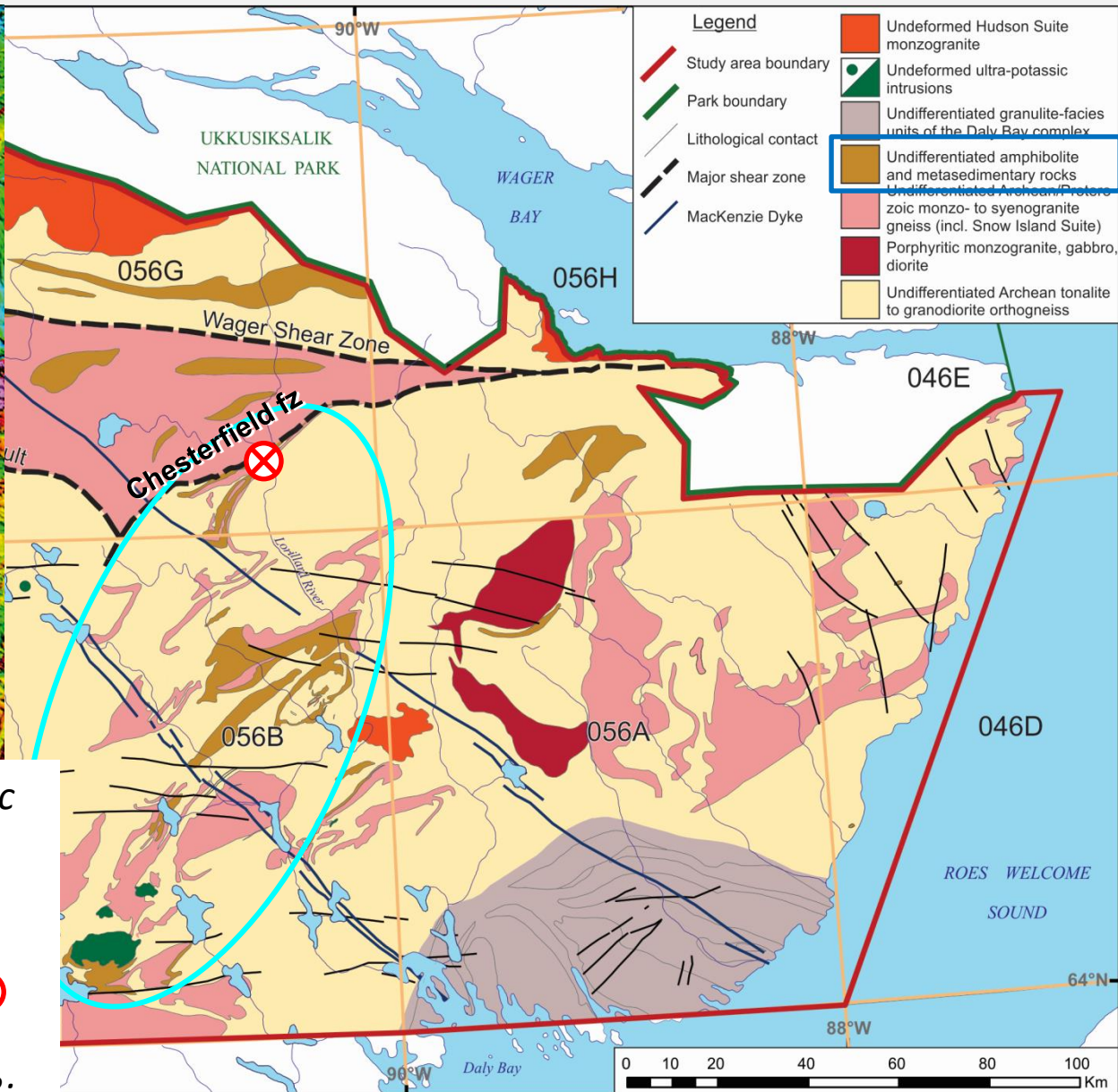
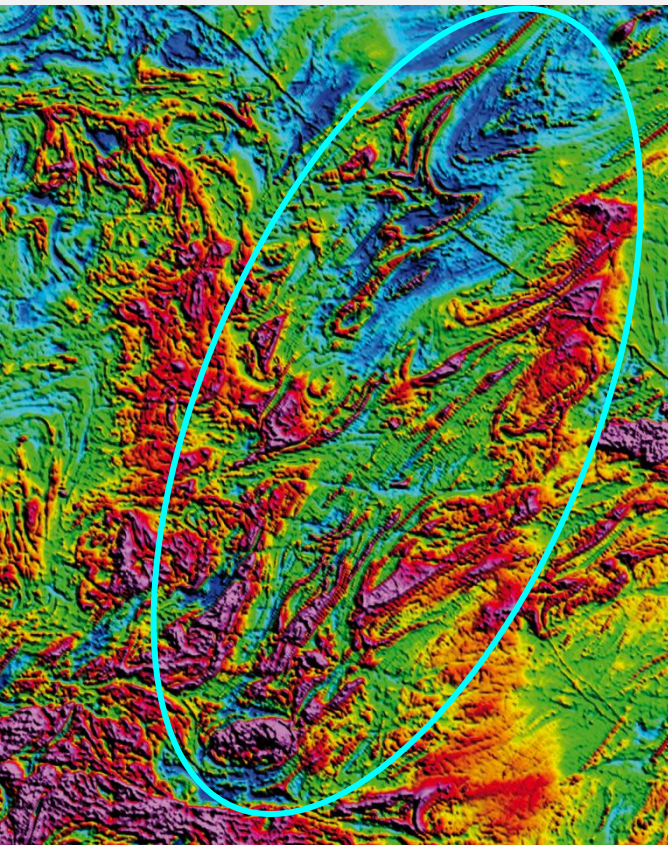


Archean monzogranite to syenogranite (2.70-2.66 & 2.61-2.58 Ga)



- Occur as large plutonic bodies or sheets
- Locally cut older tonalite orthogneiss
- More evolved, calc-alkalic to alkalic affinity
- Commonly porphyritic
- Some are correlative with the 2.6 Ga Snow Island suite

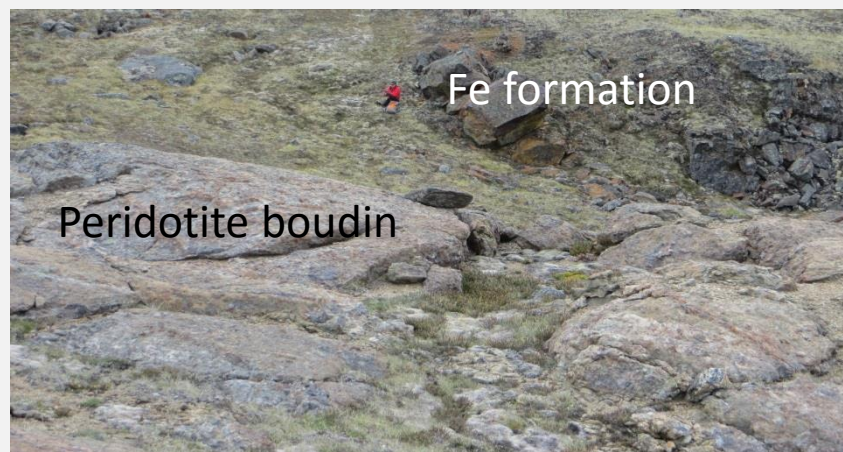
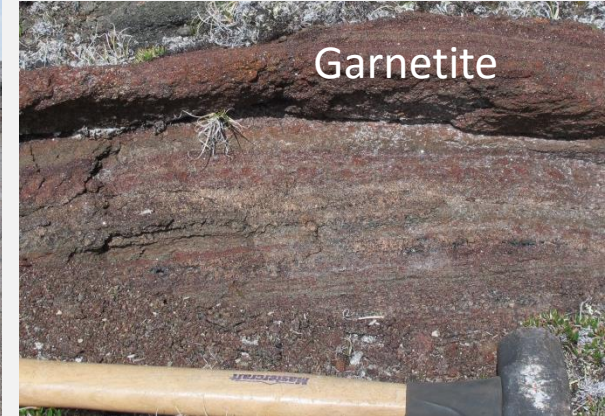
Folded supracrustal panels south of Chesterfield fault zone



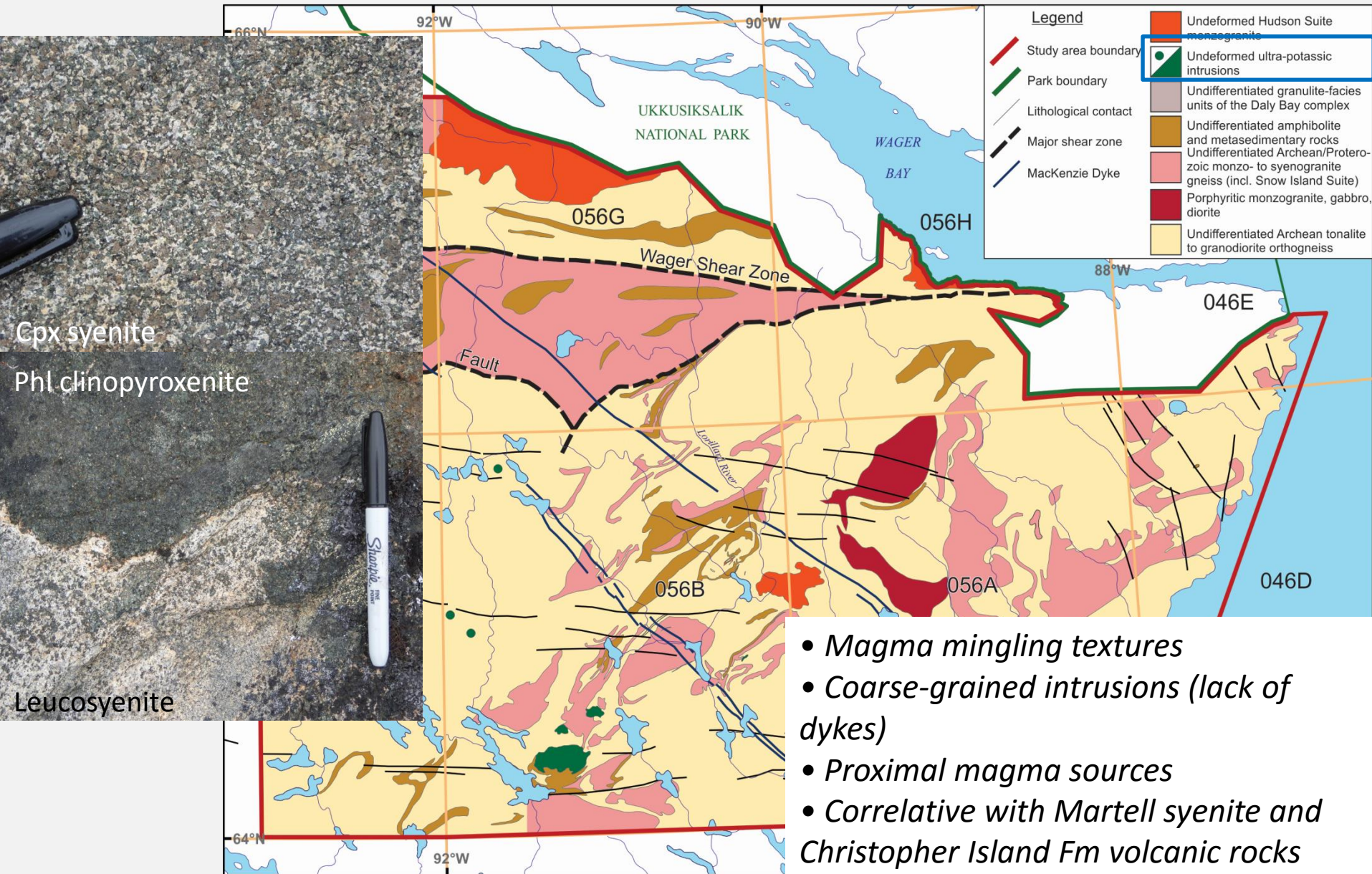
- Panels define prominent magnetic anomalies
- Primarily distributed in central region of map area
- Potential for base and precious metals (Ag, Cu, Bi, Au/safflorite) in surficial sediments; Day et al., 2013; McMartin et al., 2013

Folded supracrustal panels

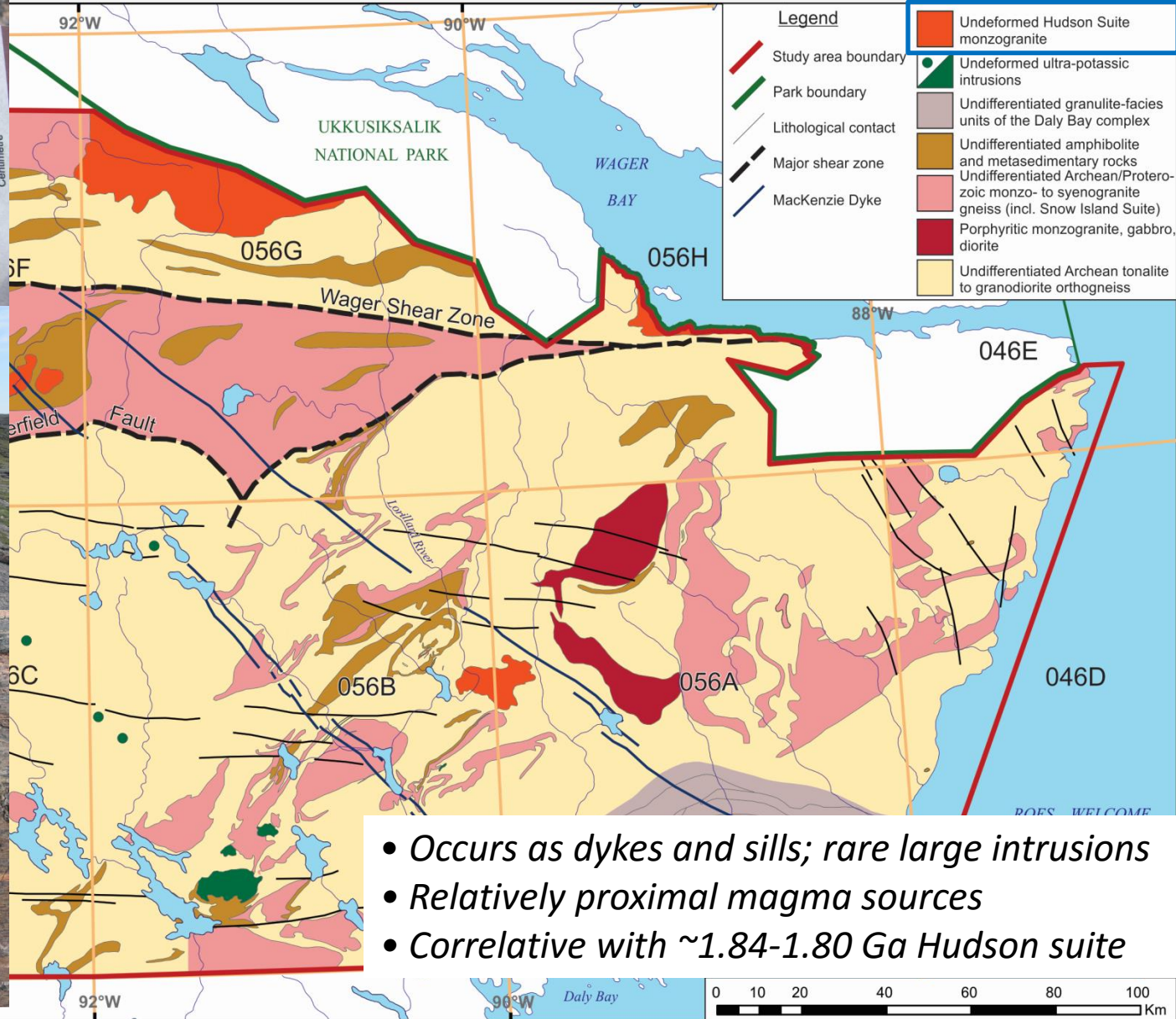
- *Diverse assemblage of quartzite, psammite, semipelite to pelite, garnetite, silicate-facies iron formation, amphibolite (= volcanic rocks), calc-silicate, and rare marble*
- *Unknown stratigraphy owing to high strain deformation and scale of mapping*
- *Granulite-facies to amphibolite-facies assemblages with partial retrogression*
- *Maximum age of ca. 2.74 Ga for quartzite (U-Pb detrital zircon)*
- *T_{DM} Nd model age of 2.75 Ga for intermediate volcanic(?) rock; Neoproterozoic or younger?*



Ca. 1827-1826 Ma ultrapotassic intrusions



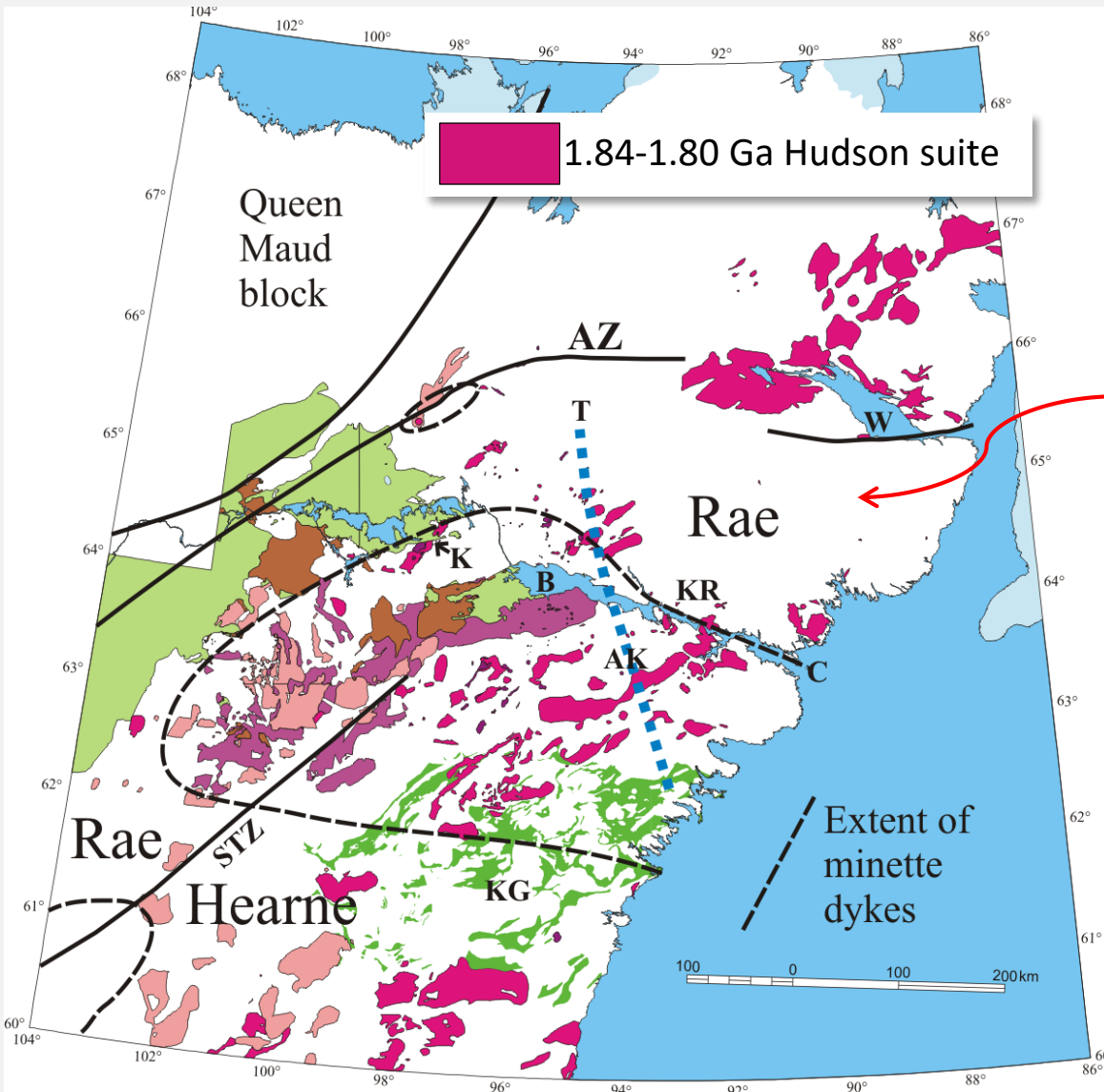
Ca. 1816 Ma monzogranite



- Occurs as dykes and sills; rare large intrusions
- Relatively proximal magma sources
- Correlative with ~1.84-1.80 Ga Hudson suite



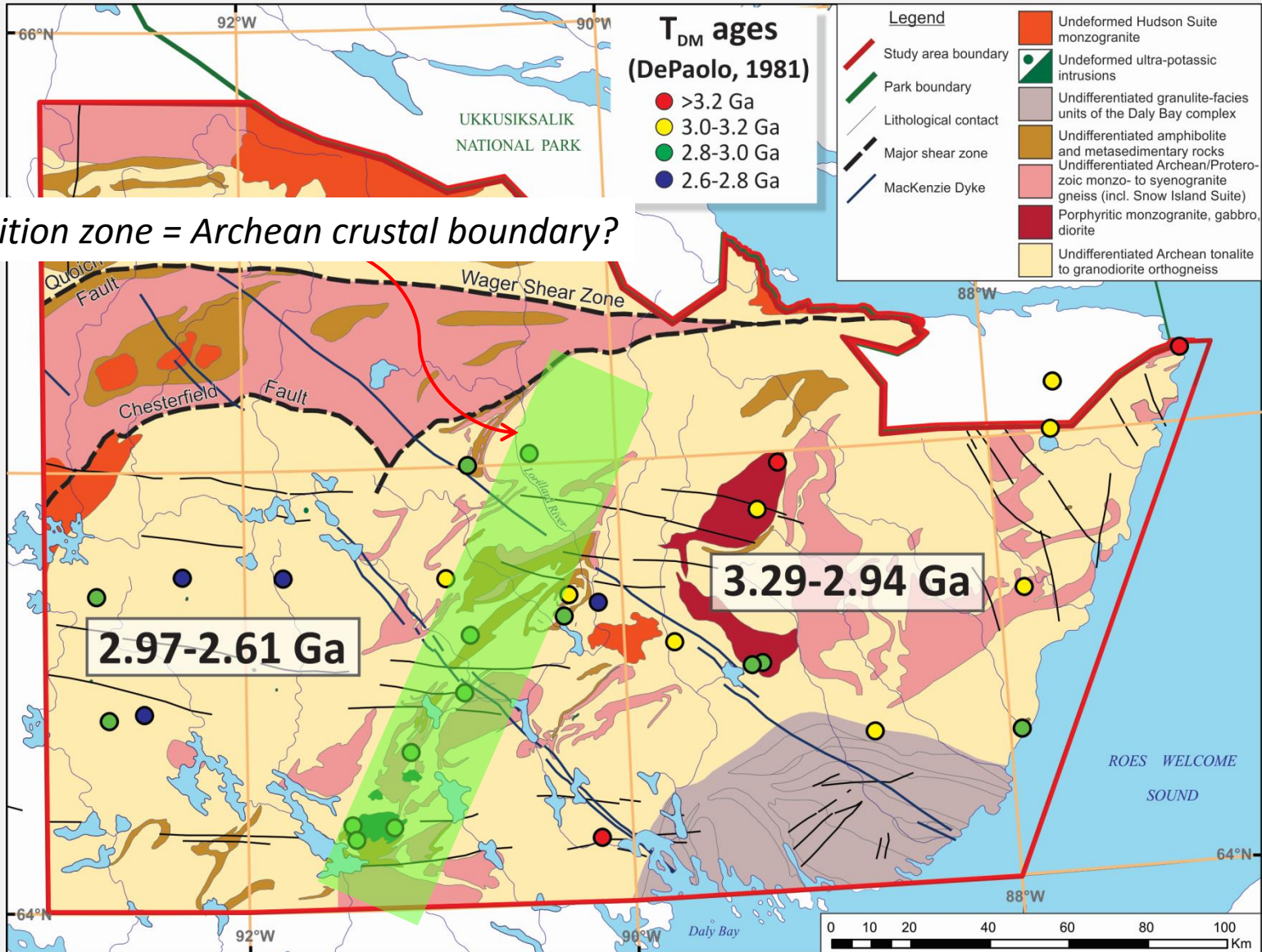
Distribution of 1.84-1.80 Ga Hudson suite and minette dykes outside of Tehery-Wager area



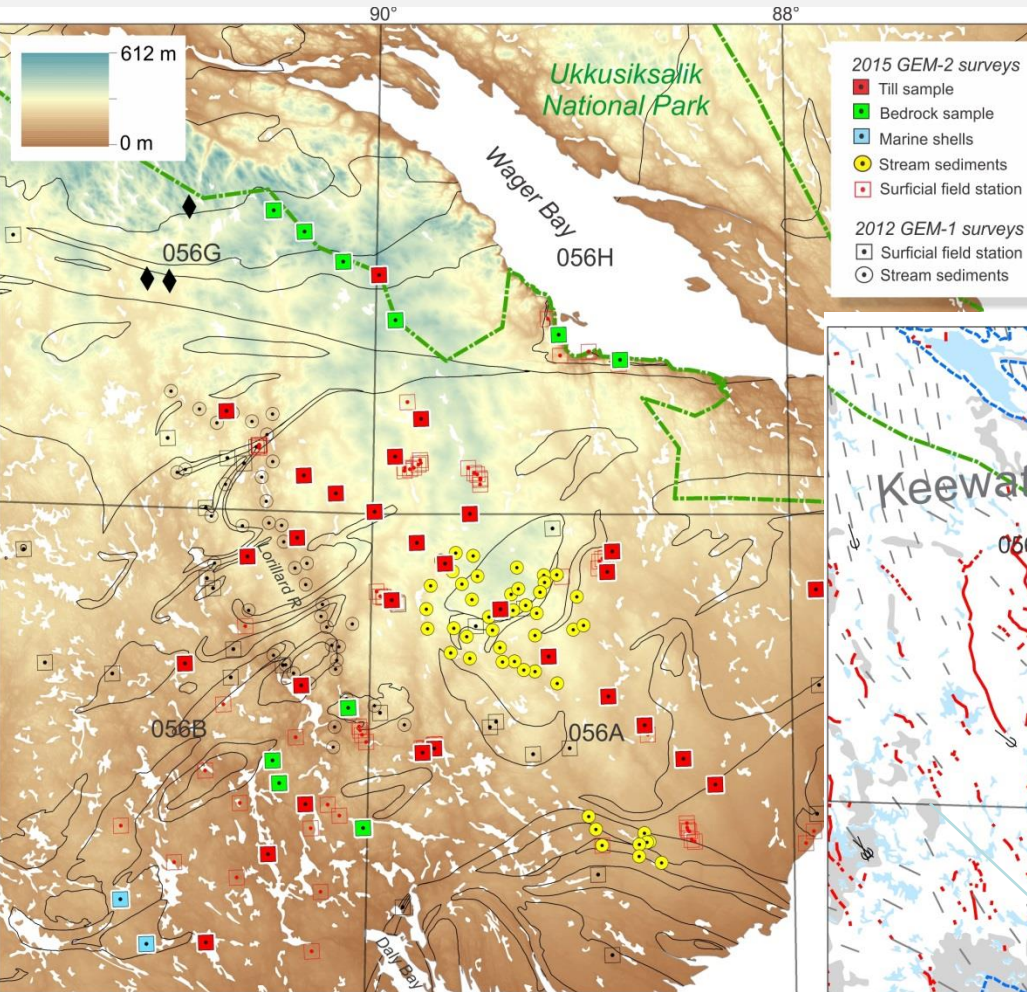
Tehery-Wager area exposes a deeper crustal level compared to nearly all other exposures of Hudson suite and Martell Syenite rocks elsewhere in the western Churchill Province



T_{DM} model ages from Archean magmatic rocks Delineation of Archean crustal blocks?

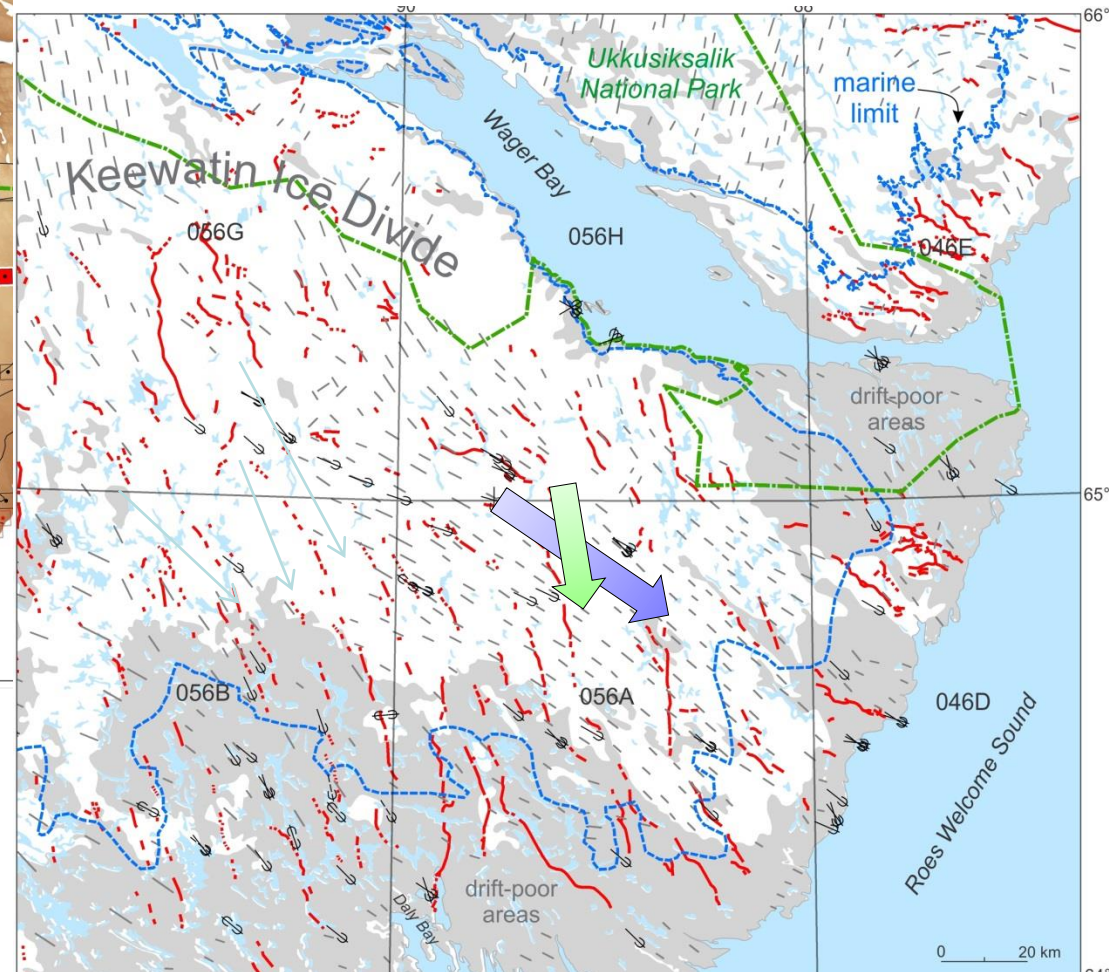


Regional surficial mapping & till and stream sediment surveys



2015 field campaign:

- 33 till samples (111 stations) (I. McMartin & I. Randour)
- 46 stream sediment and water samples (S. Day)



South of Keewatin Ice Divide, dominant ice flow direction was to the southeast and was overprinted by a later more southerly flow

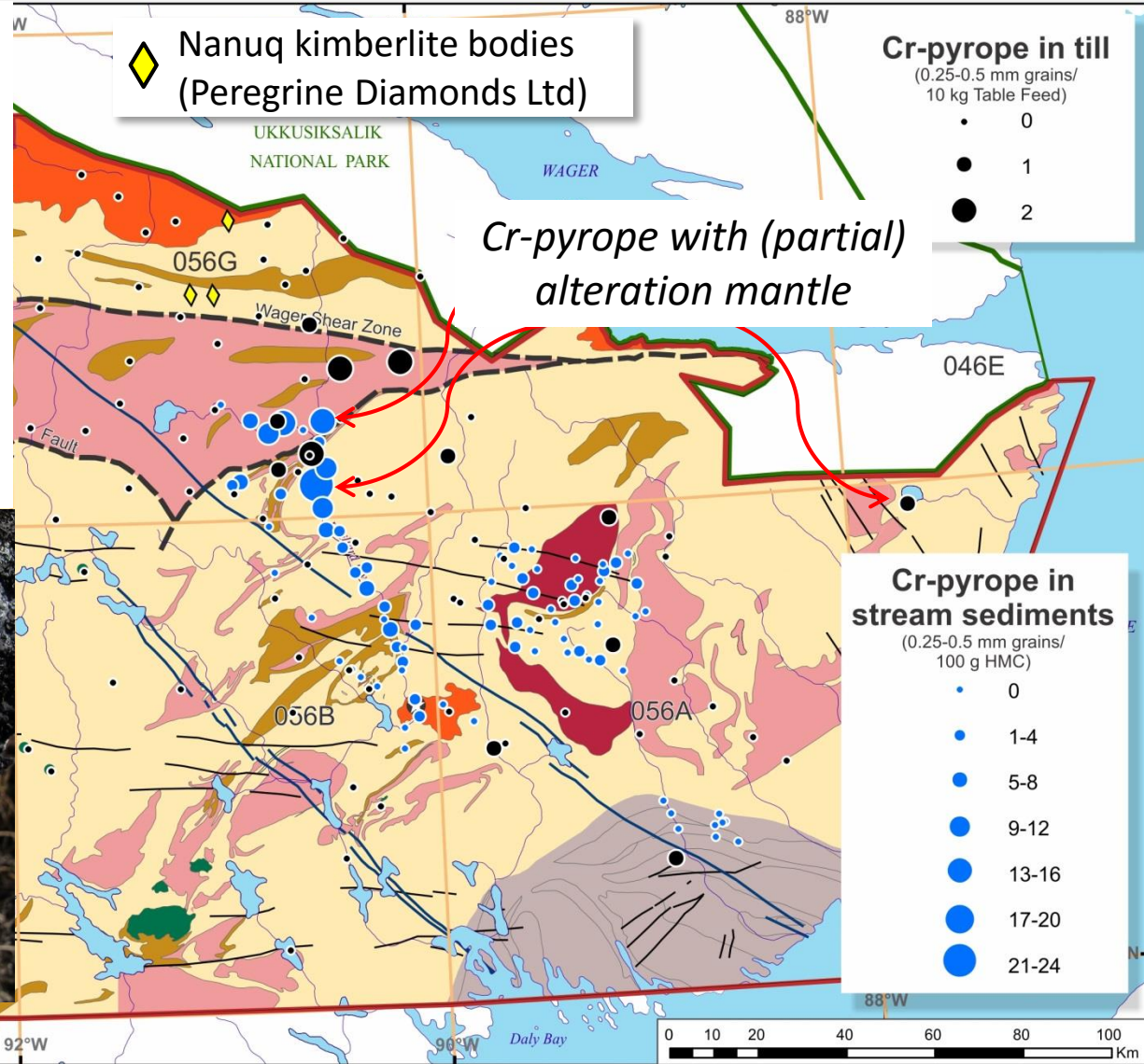
Economic considerations

Preliminary surficial sediment results (mantle-derived IM's)

Mantle-derived indicator minerals in till and stream sediments suggest potentially diverse sources

• High Cr-pyrope dispersal trains/counts suggest possible link to Peregrine's kimberlite field plus additional sources (kimberlite? ultramafic intrusions?)

Layered mafic-ultramafic intrusion

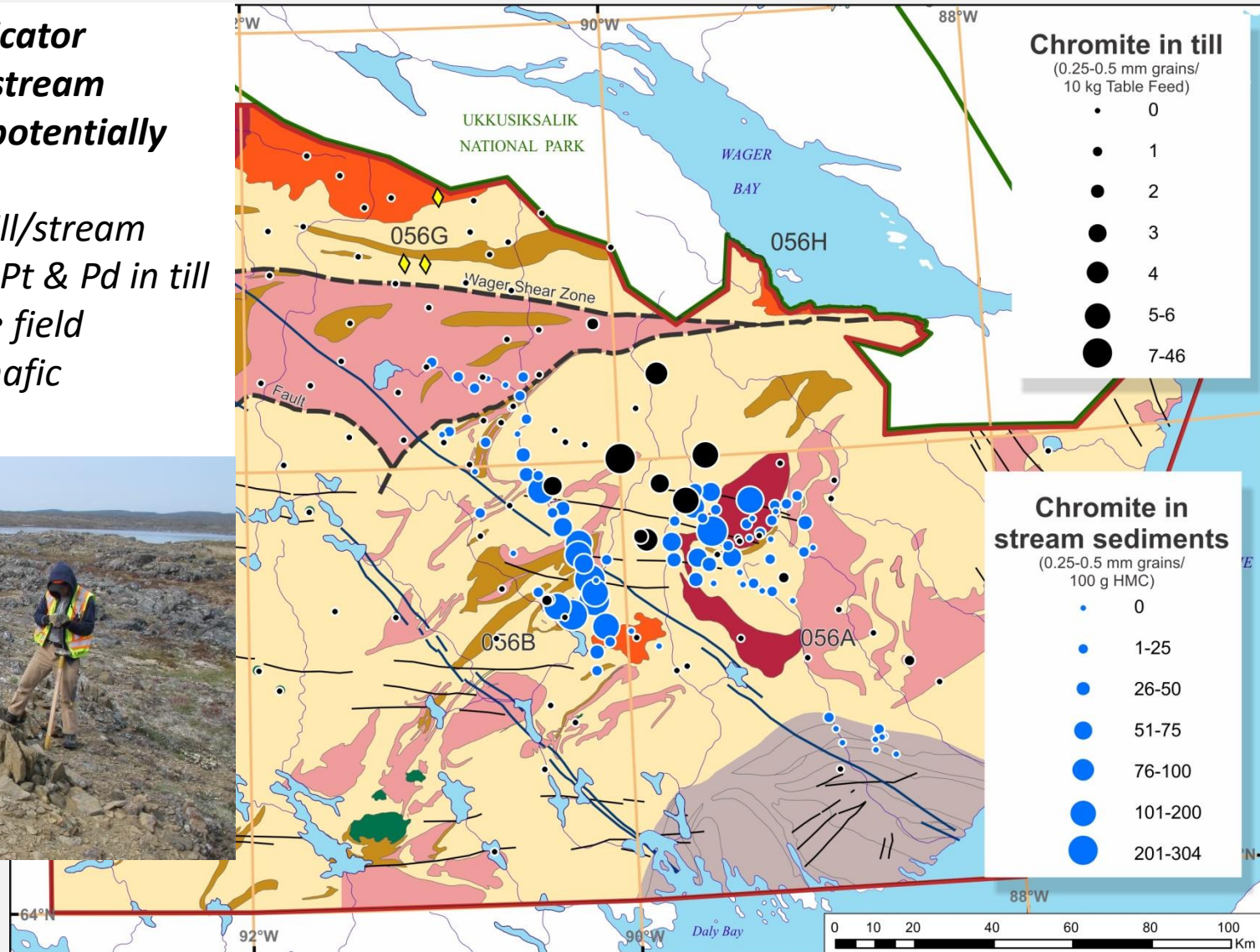


Economic considerations

Preliminary surficial sediment results (mantle-derived IM's)

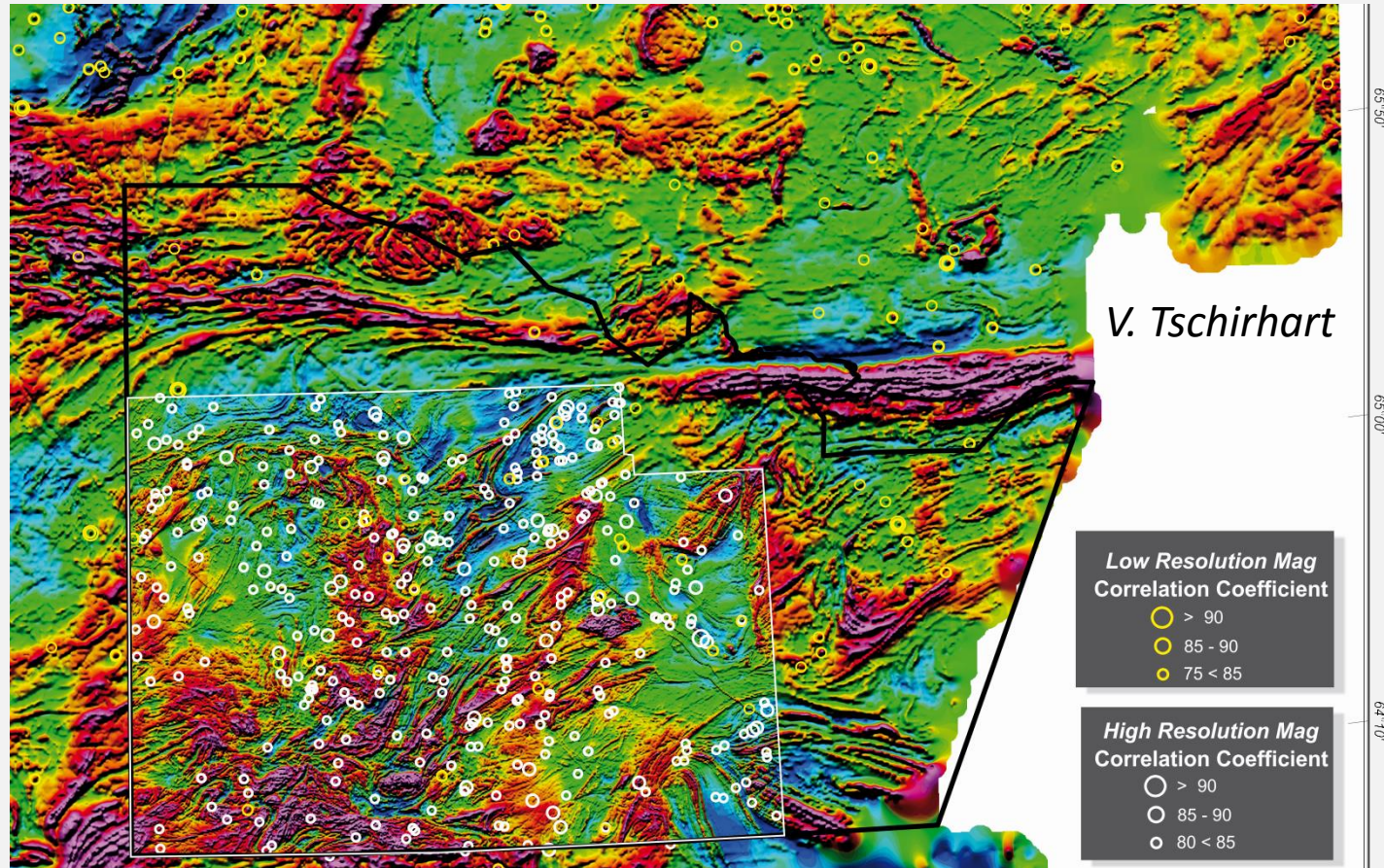
Mantle-derived indicator minerals in till and stream sediments suggest potentially diverse sources

- High chromite in till/stream sediments plus high Pt & Pd in till outside of kimberlite field sourced from ultramafic intrusions?



Economic considerations

Keating correlation coefficient of aeromagnetic data



*The most favourable targets are those that exhibit the highest correlation coefficients. **Other magnetic sources may correlate well with the kimberlite model, whereas some kimberlite pipes of irregular geometry, remnantly magnetized, or of insufficient diameter may not. ***

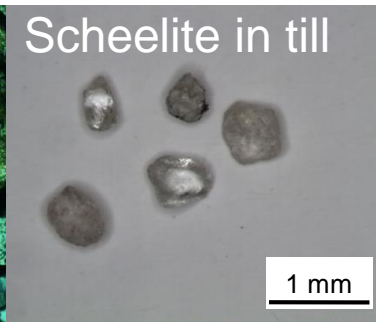
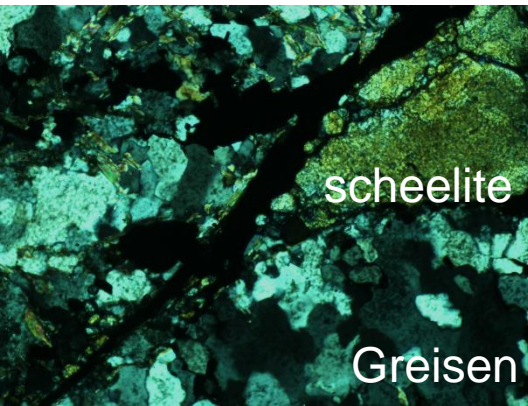
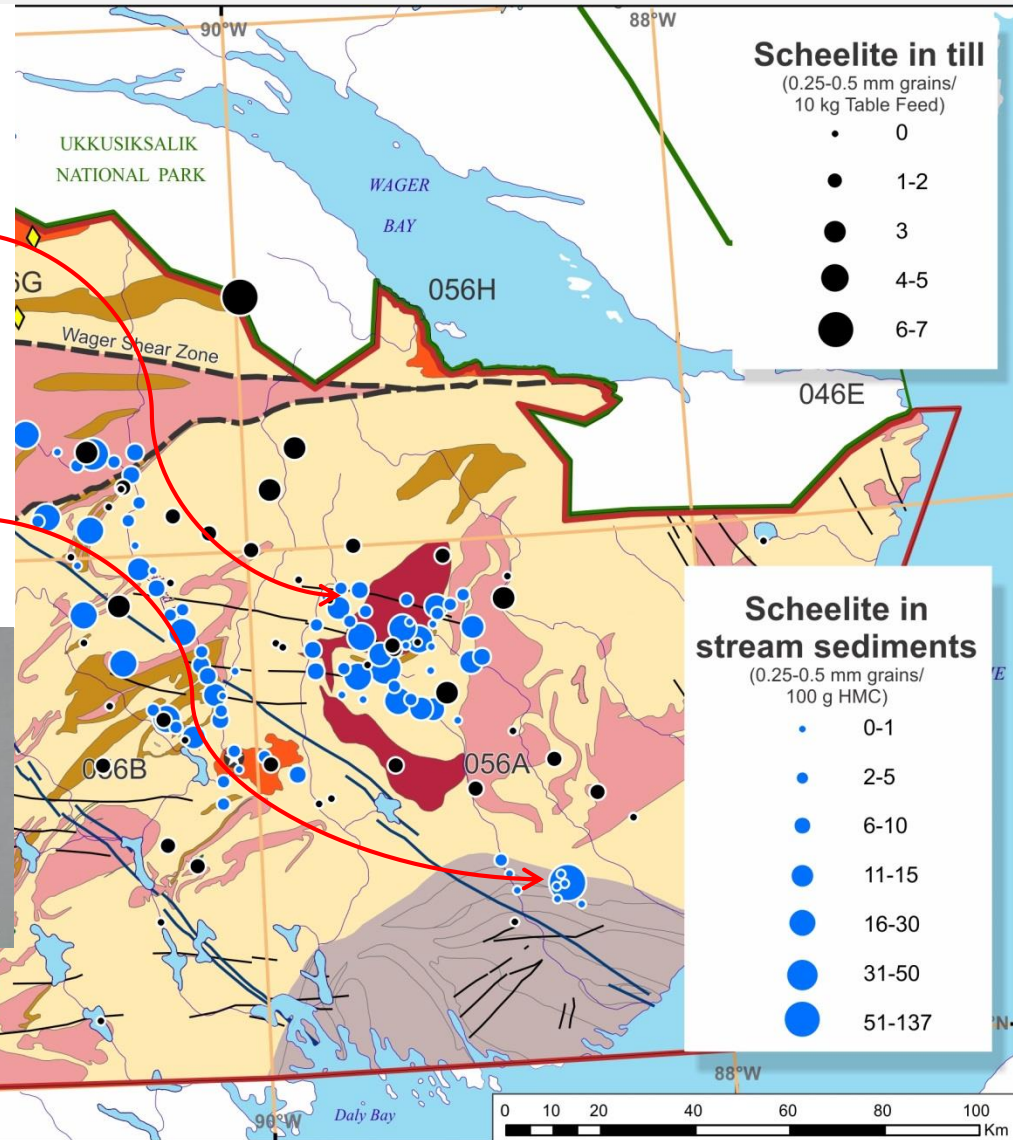


Economic considerations

IM's in till and stream sediments and geochemistry of potential source rocks

Intrusion-hosted polymetallic mineralization?

- High scheelite counts within and near ~2.66 Ga rapakivi monzogranite intrusion (with rel. high Pb & Mo) and Hudson monzogranite (with rel. high Pb & Sn)
- High scheelite counts in vicinity of Ms-bearing tonalite-trondhjemite intrusion (unknown age) with associated greisen-style alteration and mineralization (fluorite, tourmaline, scheelite, and high W)



Publications

Post-field reports

Bedrock mapping reports

- Wodicka et al. 2015. Report of Activities for the Bedrock Geology and Economic Potential of the Tehery-Wager Area: GEM-2 Rae Project. ***GSC Open File 7970.***
- Steenkamp et al. 2015. Overview of bedrock mapping and results from portable X-ray fluorescence spectrometry in the eastern part of the Tehery Lake-Wager Bay area, western Hudson Bay, Nunavut. ***CNGO Summary of Activities 2015.***
- Lawley et al. 2015. Portable X-ray fluorescence geochemical results from the Tehery Lake-Wager Bay area, western Hudson Bay, Nunavut; ***CNGO, Geoscience Data Series 2015-011.***

Surficial geology reports

- McMartin et al. 2015. Report of 2015 activities for regional surficial mapping, till and stream sediment sampling in the Tehery-Wager GEM 2 Rae Project area. ***GSC Open File 7966.***
- Byatt et al. 2015. Mapping surficial materials south of Wager Bay, southern Nunavut, using RADARSAT-2 C-band dual-polarized and Landsat 8 images, a digital elevation model and slope data: preliminary map and summary of fieldwork. ***CNGO Summary of Activities 2015.***



Upcoming/continuing work

- 1:250,000 scale bedrock and 1:100,000 surficial maps of eastern region
- Write-up of bedrock (lithogeochemistry, Sm-Nd) and surficial analytical results (geochemistry, indicator minerals, pebble counts)
- U-Pb analytical work to define age of key bedrock map units (including supracrustal rocks)
- Second field season in summer 2016 focused in western region of project area (bedrock and surficial mapping plus stream sediment and till sampling)
- Gravity survey along a transect across the Wager shear zone and Chesterfield fault zone
- Thesis work: Ph.D. candidate H. Steenkamp (metamorphism and mineral potential of supracrustal rocks); M.Sc. candidate I. Randour (surficial geology of NTS 56H); M.Sc. candidate J. Byatt (remote predictive surficial materials map))



Thank you!

- Hamlet of Chesterfield Inlet
- GIS and field assistants: E. Girard, R. Buenviaje, I. Randour, W. Garrison, J. Beales, K. Hatogina, J. Byatt
- Prairie Helicopters and Ookpik Aviation
- Polar Continental Shelf Program

