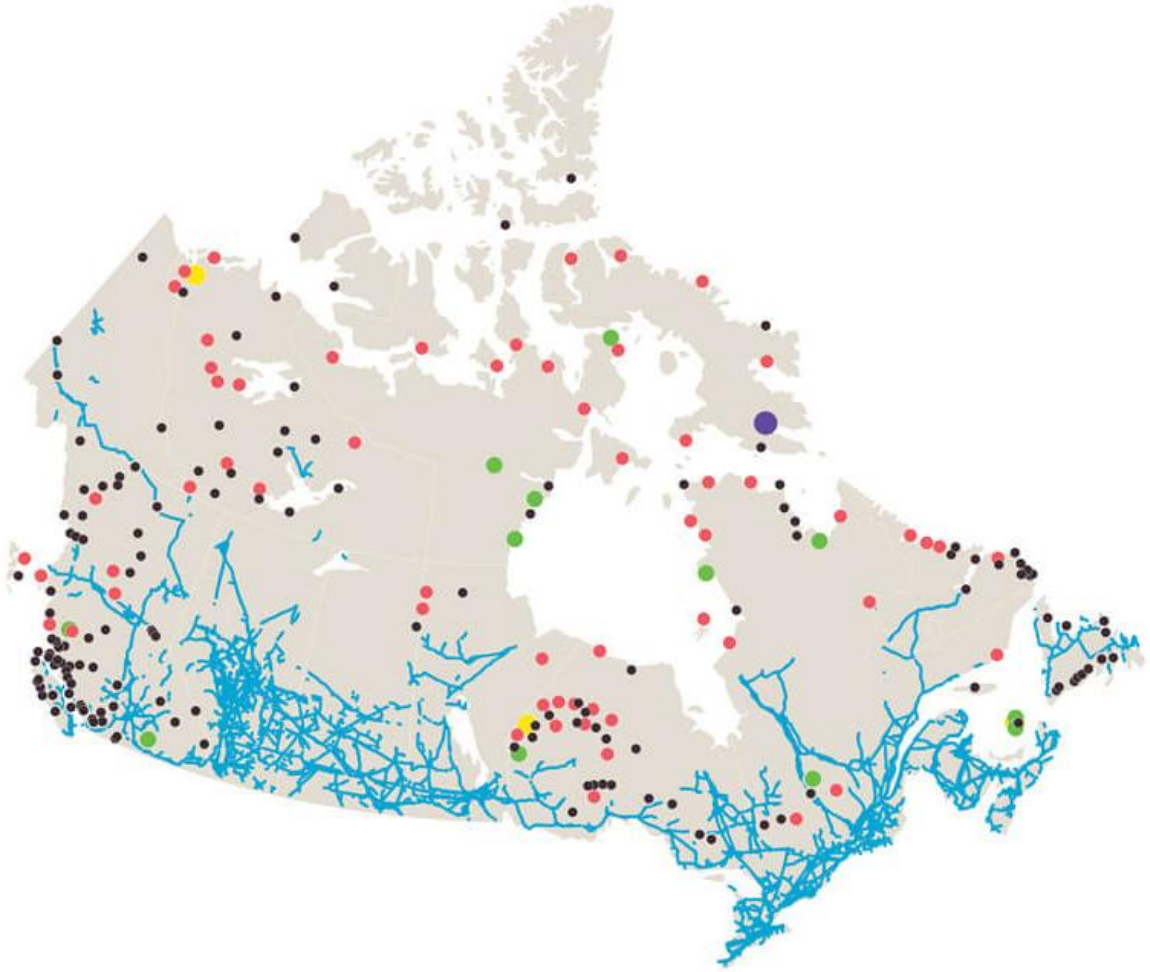
Geothermal research in Yukon, Northwest Territories, and Nunavut

Stephen Grasby
Geological Survey of Canada
steve.grasby@canada.ca

Remote Communities



- Majority of northern communities disconnected from energy grid
- Many rely on air-lift, sea-lift, ice roads for imported fuels

The Northern Geothermal Advantage

Energy

Food

Jobs

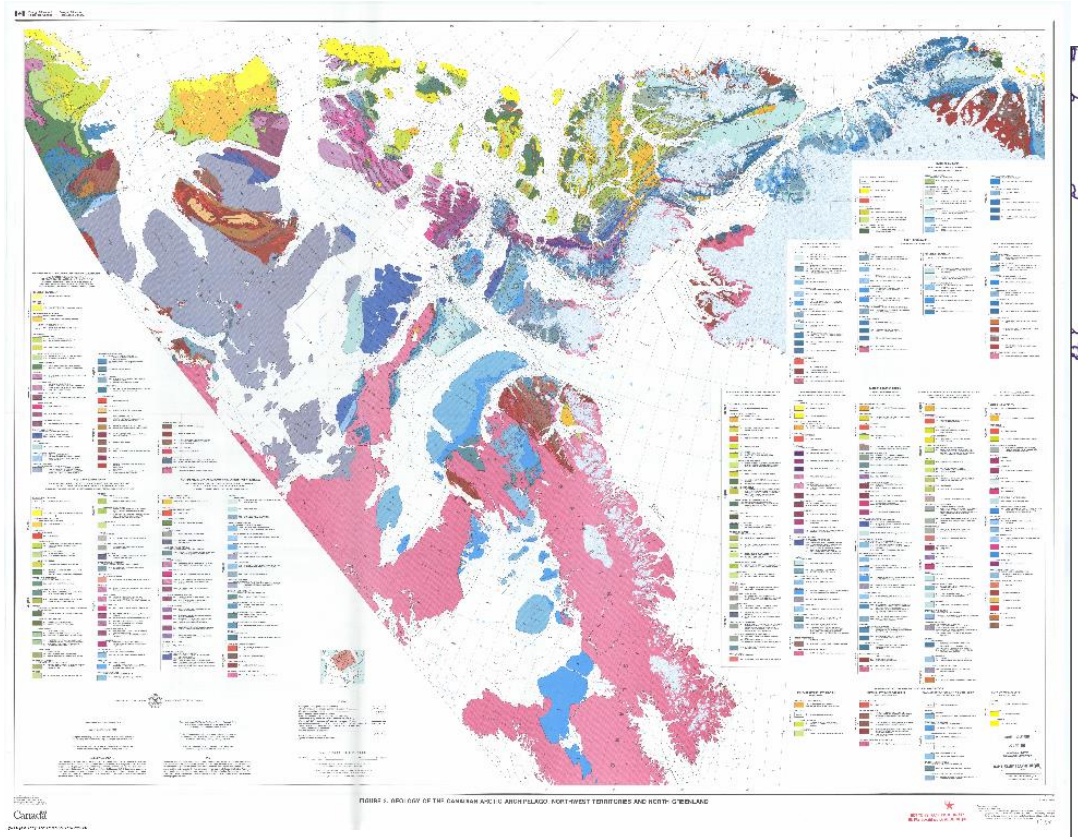
Chena Alaska (65 ^{o}N)

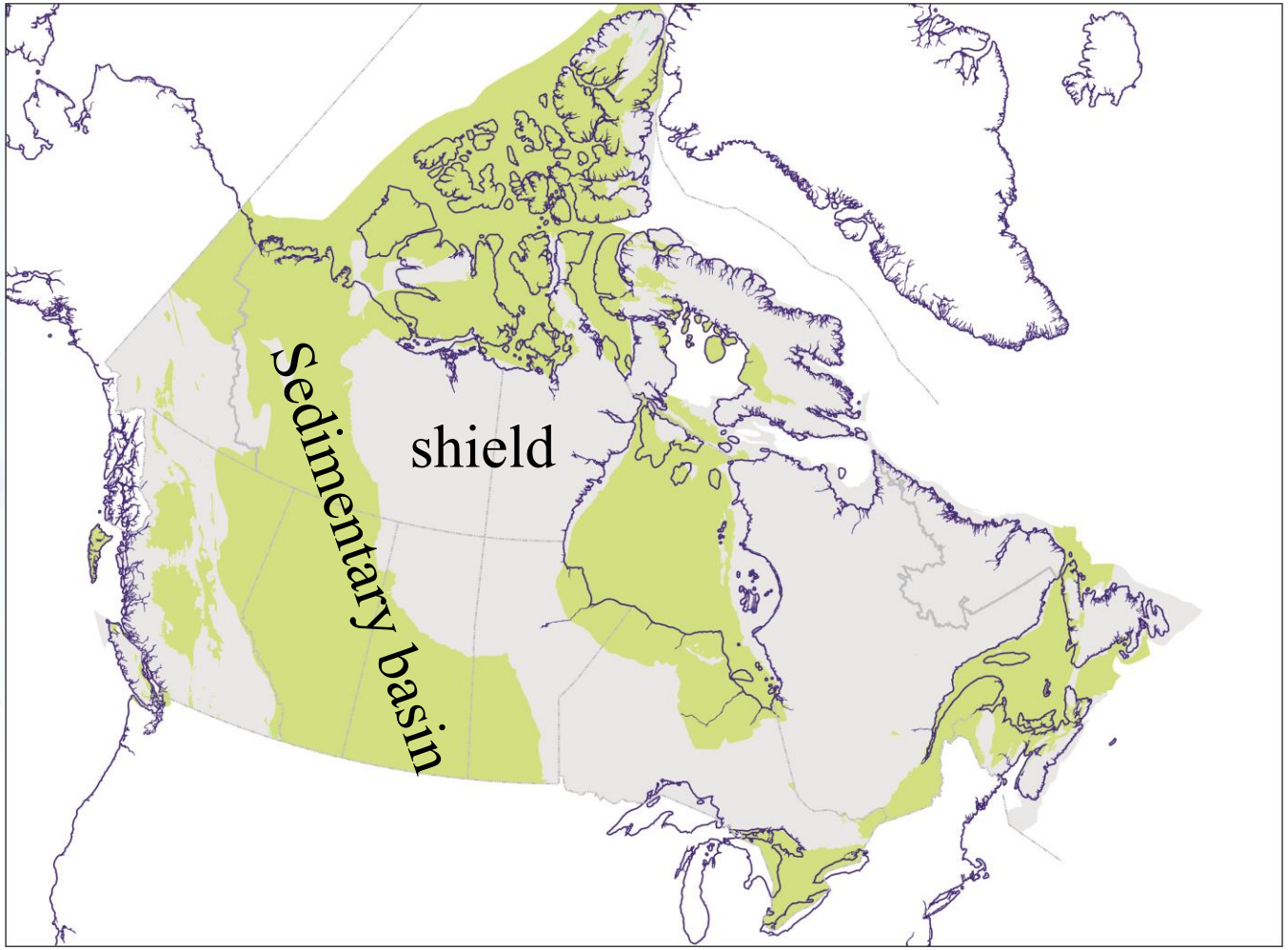
- Northern most geothermal electrical generation
- Lowest temperature power production in the world (ΔT advantage of Rankin cycle)
- Small energy demand

Northern Energy Demand

- 87 communities in the territories (27 Yukon, 33 NWT, 27 Nunavut)
- 58/87 rely on diesel generators
- 801,000 MWh power demand
- Subsidized costs up to 10x national average
- Government installations (e.g. weather, military, parks)

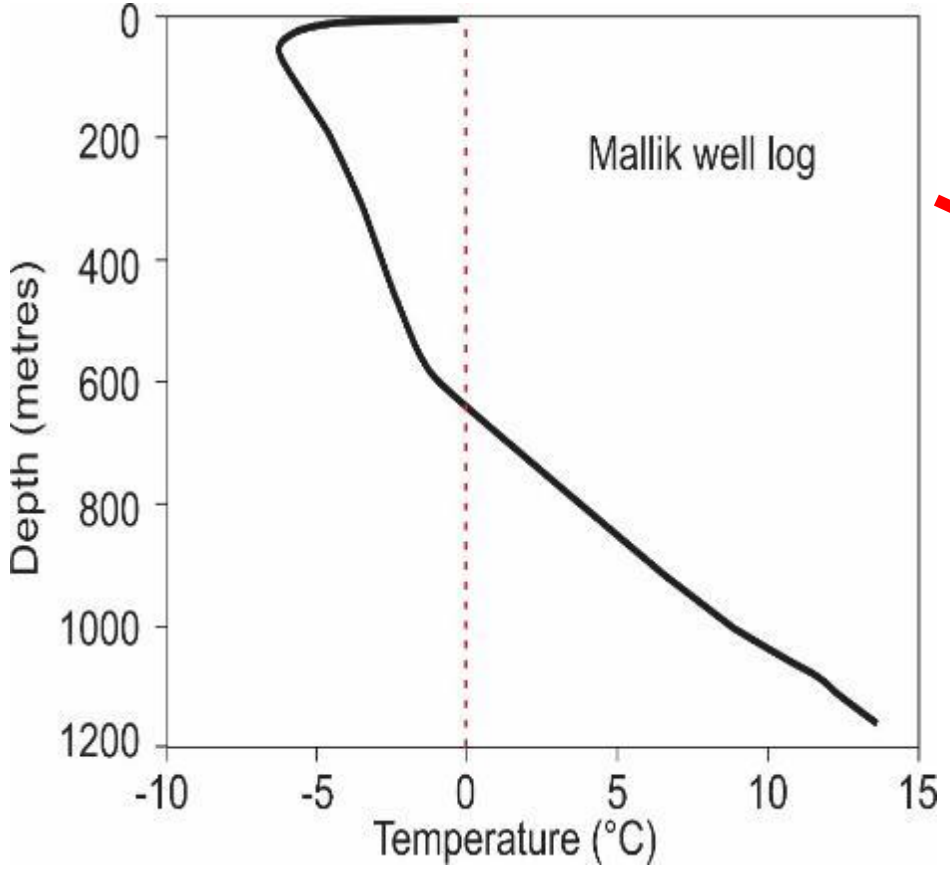
Arctic Geothermal



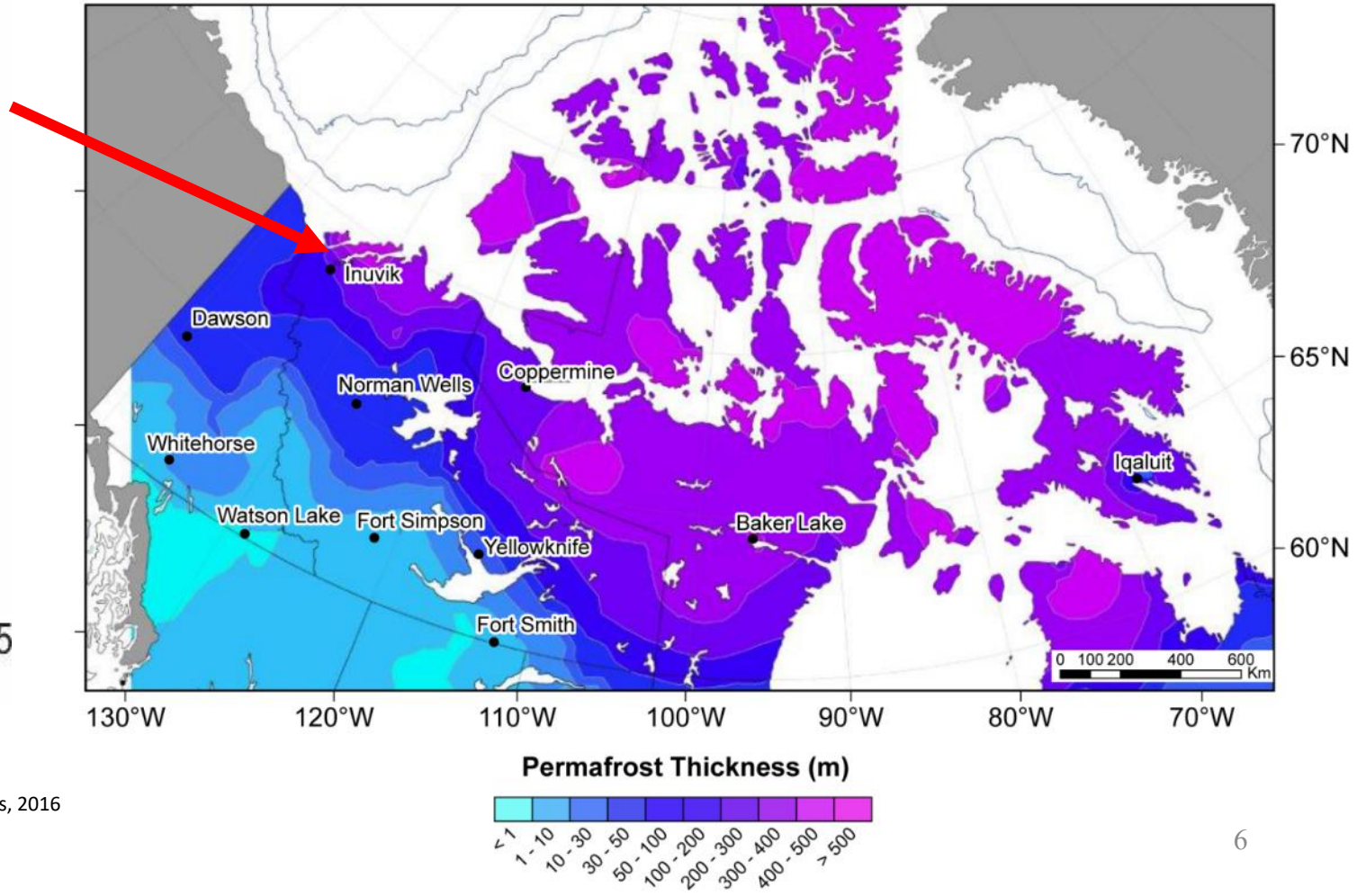


Permafrost challanges

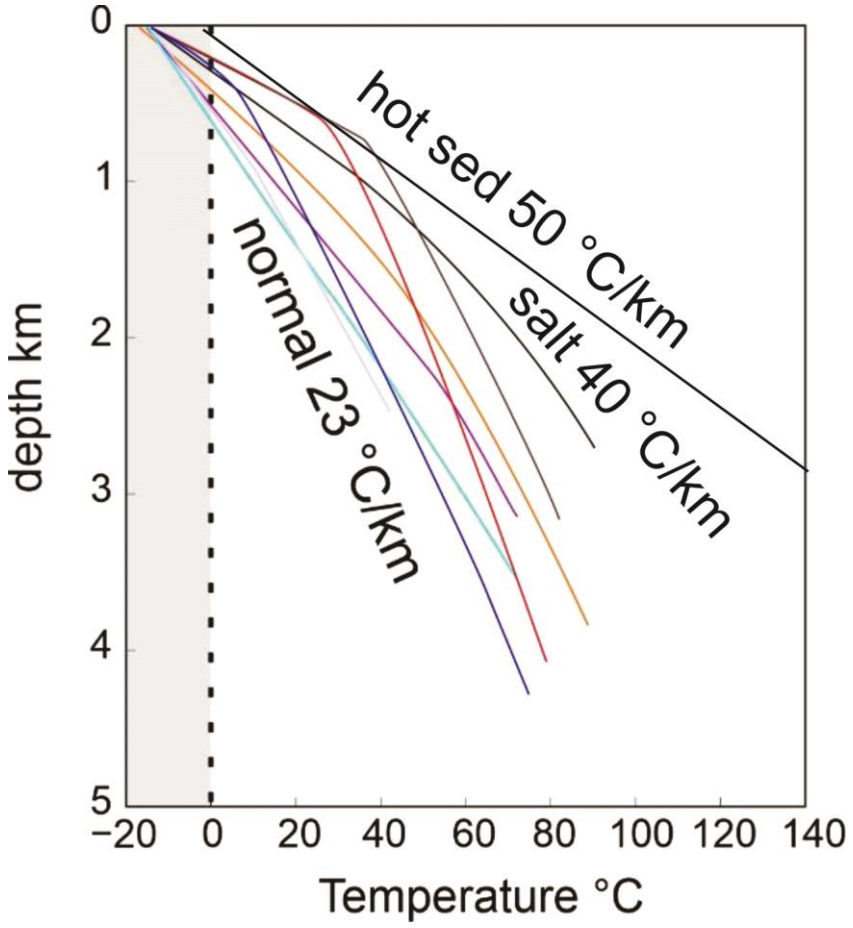
Osadetz et al. (2015)



Majorowicz and Grasby (2013)

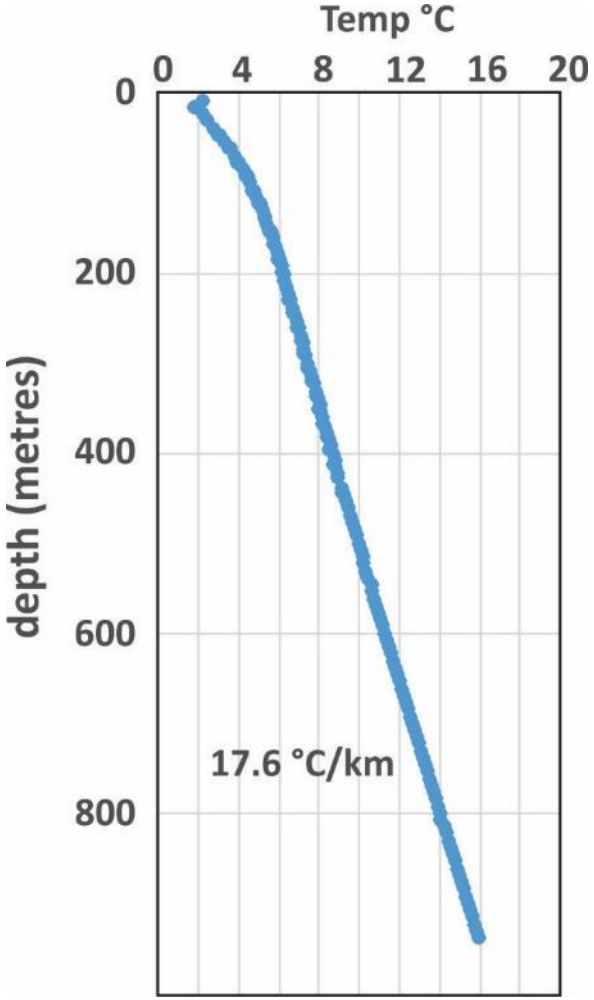


Sedimentary basin thermal gradients



- Mostly low thermal gradients except for salt domes, and hot sedimentary basins in southern NWT/ SE Yukon

Canadian Shield

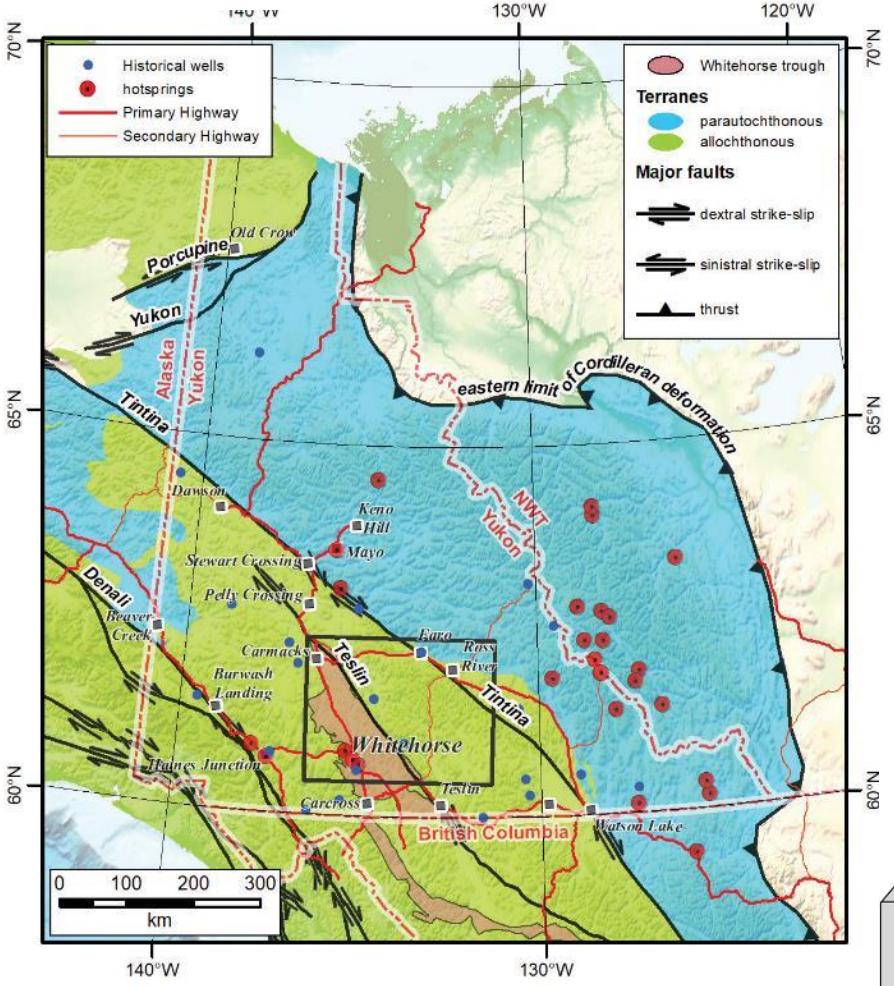


Con mine, Yellowknife

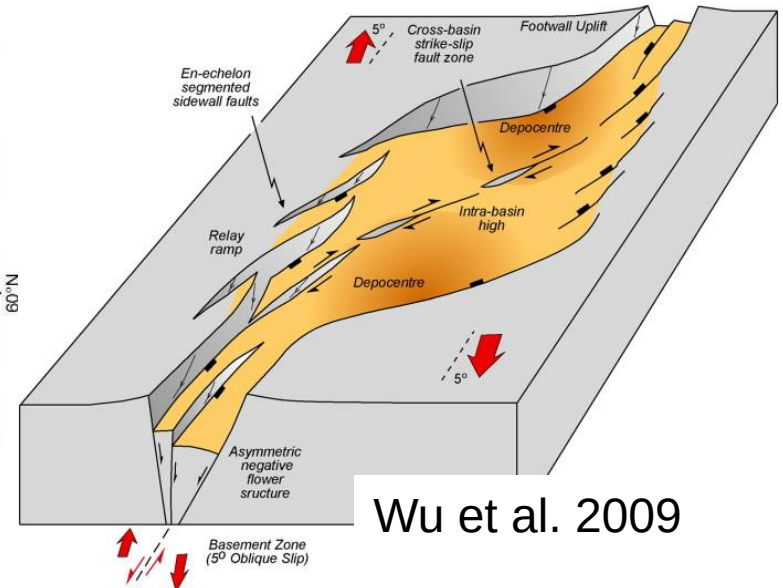
- Low thermal gradients
- Very low permeability
- Potential for direct heat use
- Abandoned mine potential

Other geothermal play types

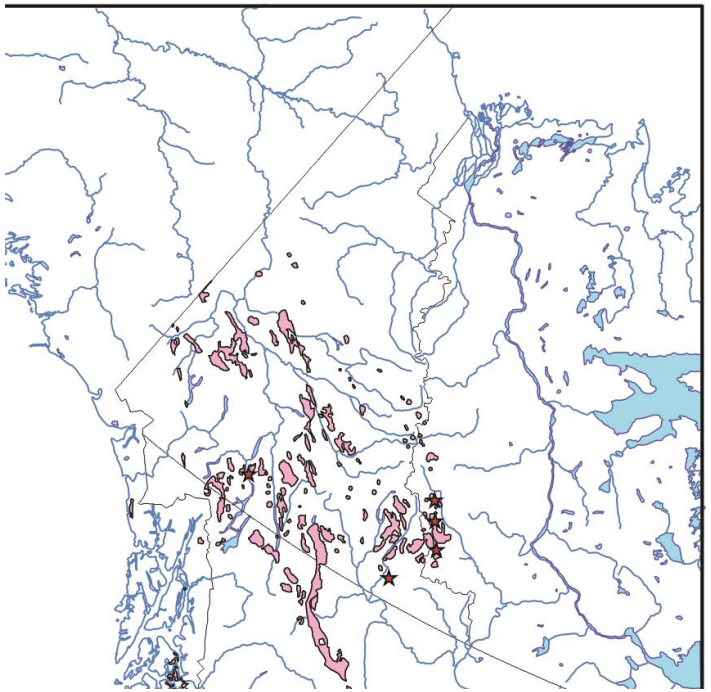
Fraser et al. 2019



- Recent volcanics
- Crustal transcurrent faults
- Hot plutons

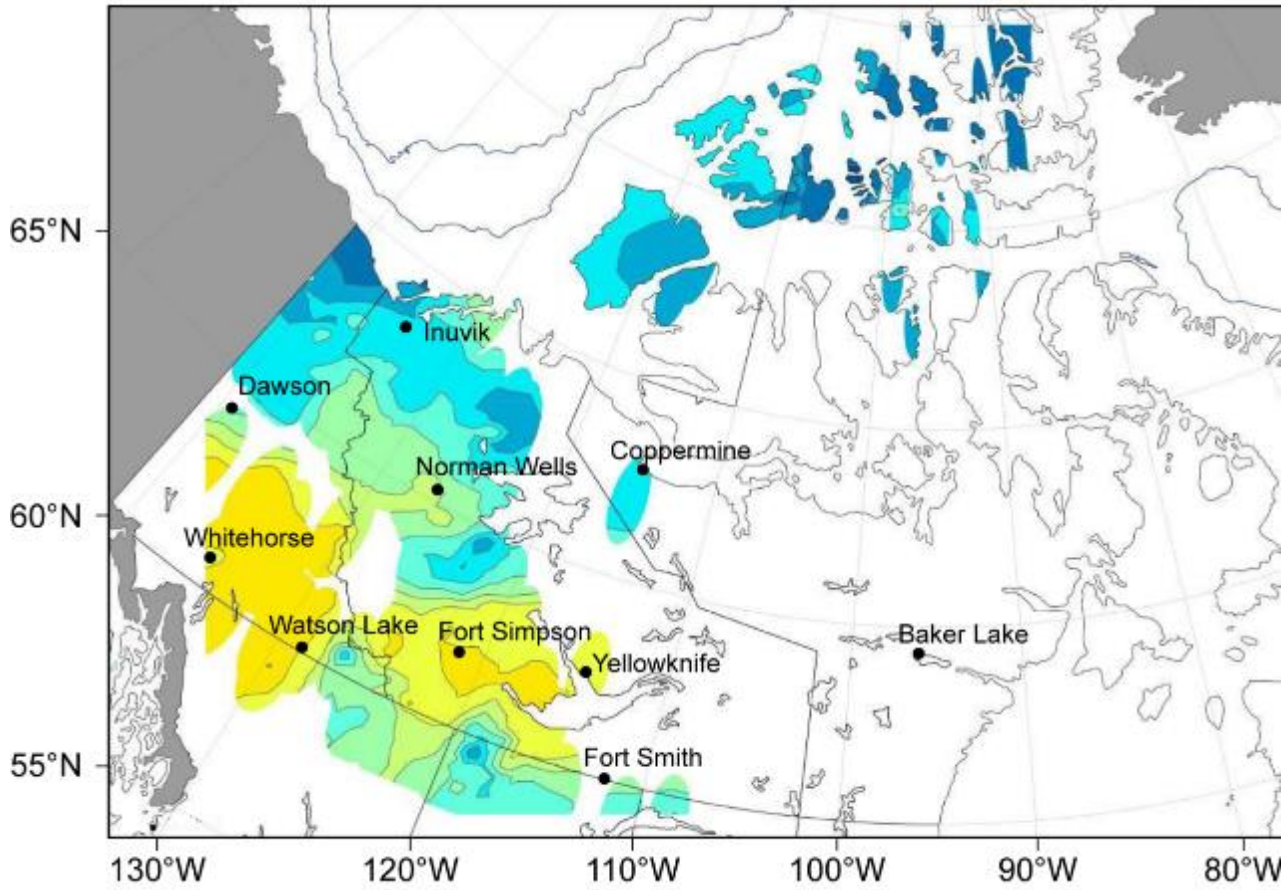


Wu et al. 2009

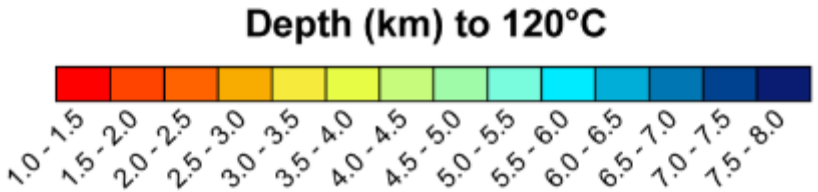


Power generation in the Arctic

Majorowicz and Grasby (2013)

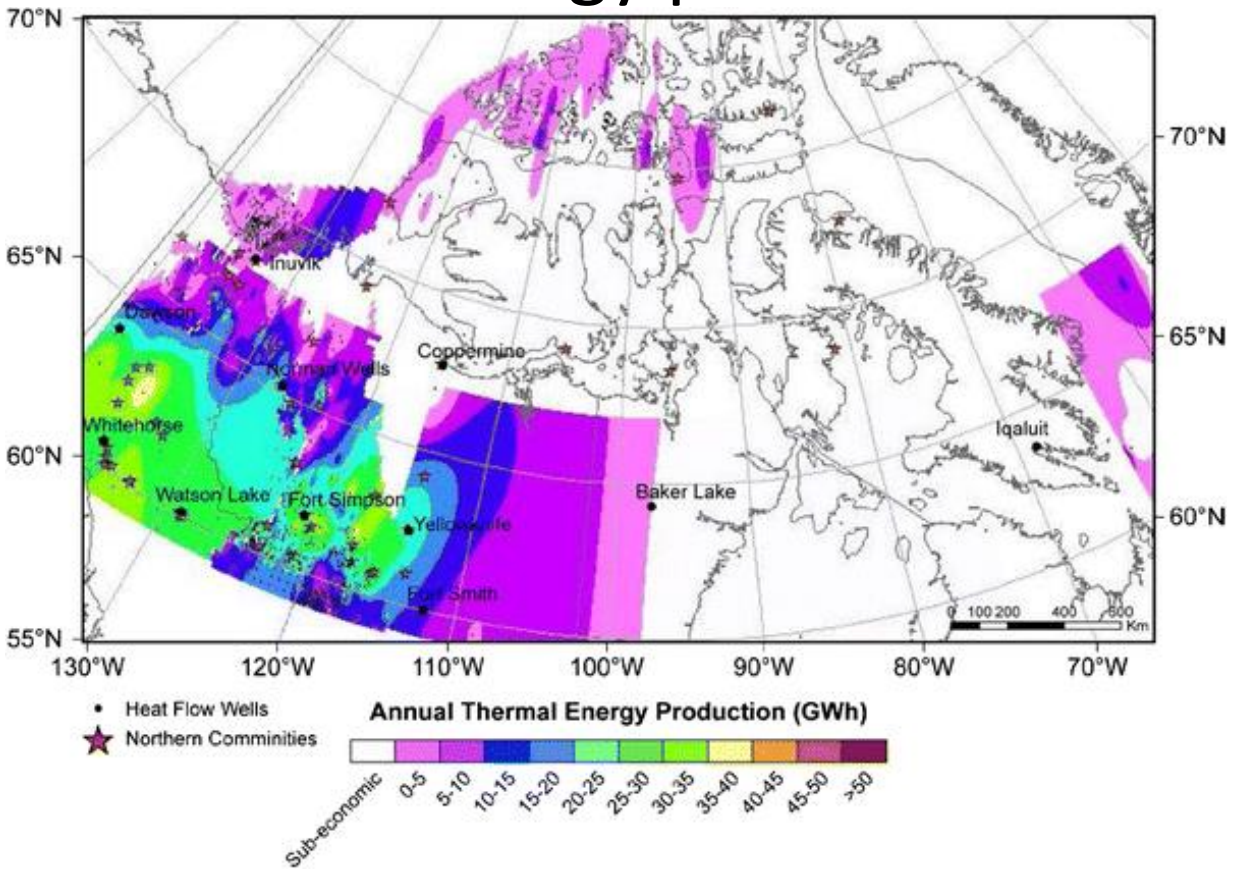


- Most of the northern regions thermal gradients are too low to consider power generation
- Parts of southern NWT/Yukon have potential



Direct heat use

Thermal energy production



- Similar high potential areas as for power production
- Much broader region for direct heat use
- Still large data gaps for area the size of western Europe, but likely low potential