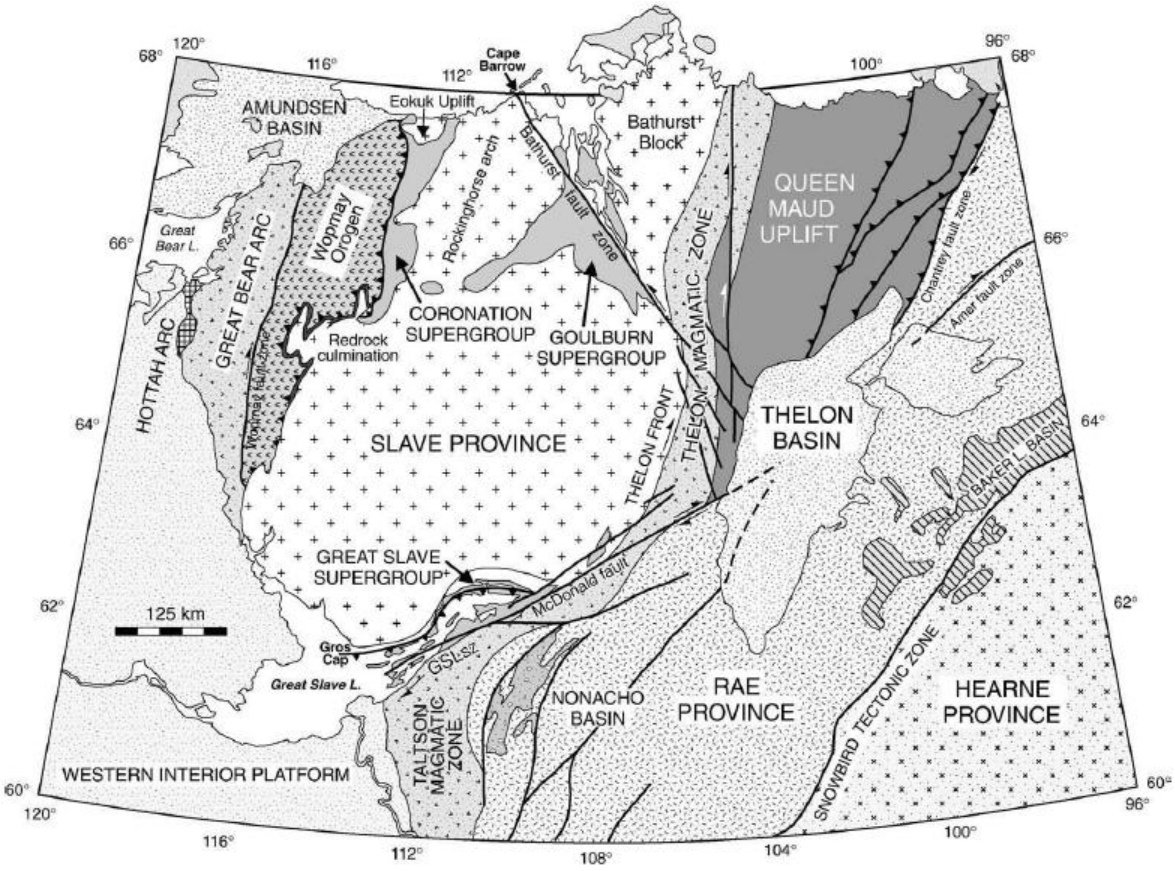
Slave Province: North America (Janine Sandersen 2010)



Geology of the Slave Province

Basement:

- Central Slave Basement Complex (CSBC): mixed assemblage of dioritic to tonalitic gneisses
- commonly contain old magmatic layering
- also see foliated, non-migmatised tonalities, granodiorites and minor granites
- Acasta Gneiss: 4.02 Ga, oldest rocks found
  - most basement rocks are younger ≈ 3.4-2.83 Ga
- intruded by mafic dykes and younger granites
- Basement complex is only found in the west and central Slave Craton, with more juvenile basement east of the isotopic boundaries.
  - leading edge of the CSBC is parallel to the strike of the Nd-line
- REE profile is highly fractionated
- No negative Eu anomaly
- eNd at 2.68 Ga: -4.3 to -10.5

Central Slave Cover Group (CSCG):

- 2.85-2.80 Ga
- CSBC is overlain by a highly deformed cover sequence
- Mafic to ultra-mafic rocks at the base are overlain by conglomerate and chromite-bearing fuchsite-rich quartzite and BIF
- < 200m thick
- Discontinuous across craton due to structural and plutonic influences
- Dated detrital zircons give an age of deposition younger than 2924 Ma
- CSCG indicates onset of supracrustal development and emergence/erosion of the CSBC
    - Possibly part of a shelf assemblage
- Similar fuchsitic quartzite sequences have been documented in cratons world-wide from 3.1-3.2 Ga
- After 2.4 Ga, quartzites are rarely fuchsitic

Yellowknife Supergroup (YKSG):

- Supracrustal sequence typical for basalt dominated supracrustal belts
- Complex greenstone belts sequences
- Occur province wide, with regional differences
- Components:
    - Kam Group: mafic volcanic rocks (2.73-2.70 Ga)
    - Banting Group: mixed calc-alkaline and mafic volcanics (2.69-2.66 Ga)
    - Duncan Lake Group: greywacke-mudstone package (2.67-2.61 Ga)
    - Jackson Lake Fm: clastic sedimentary deposits (< 2.60 Ga)

Kam Group: (2.73-2.70 Ga)

Chan Fm:

- 6 km thick
- Massive pillow basalts
- Gabbroic bodies and lots of mafic dykes
- Upper boundary ate Ranney Chert
    - Marker bed indicating intervals of sedimentation and felsic volcanism
- In some areas, dyke complexes resemble sheeted dykes of ophiolites

Crestaurum Fm:

- Massive pillowed mafic flows with laterally continuous cherts and felsic tuffs
- Syn-volcanic gabbro dykes are less abundant than in the Chan
- Post-volcanic mafic dykes are numerous

Townsite Fm:

- Corresponds to Townsite flows and sills which are exposed in the town of Yellowknife
- 2 sections each 250m of flow topped with 250m of gabbro sill
- Rhyodacite breccias, tuff, welded units and pillowed dacite
- Mark a change in chemistry of volcanism -> tholeiitic to calc-alkaline

Yellowknife Bay Fm:

- > 500m thick
- Massive, pillowed and pillow breccia flows
- Cherty tuffs and tuffaceous sediments
- Coarse turbidite sandstones with abundant quartz near the top of the Fm
- Contains major gold deposits

Banting Group: (2.69-2.66 Ga)

Shot Member:

- Quartz monazite grading into quartz feldspar porphyry (U-Pb dated 2667 Ma)
- Overlain by mafic lava flows, pillow breccia, felsic fragmental flows and bedded tuff inter-layered with conglomerate
- Topped by 60m of conglomerate (rare cross-bedding, matrix supported)
    - Interpreted as having a turbidite origin

Greyling Member:

- Medium to coarse-grained quartz feldspar porphyry intruded into felsic volcaniclastic rocks
- Overlain by 500m of mafic to intermediate pillowed flows
- Ash flow units with relic glass near top of Fm
- Pillow lavas and ash flows do not continue into the north of the craton where the top of the formation is bedded cherty tuff with local layers of chlorite schist and amphibolites

Prosperous Fm:

- Massive to bedded cherty tuff
- Interbedded mafic flows
- Turbidites and some conglomerates
- Stratigraphy is not continuous
- Possibly deposited by a sub-marine landslide

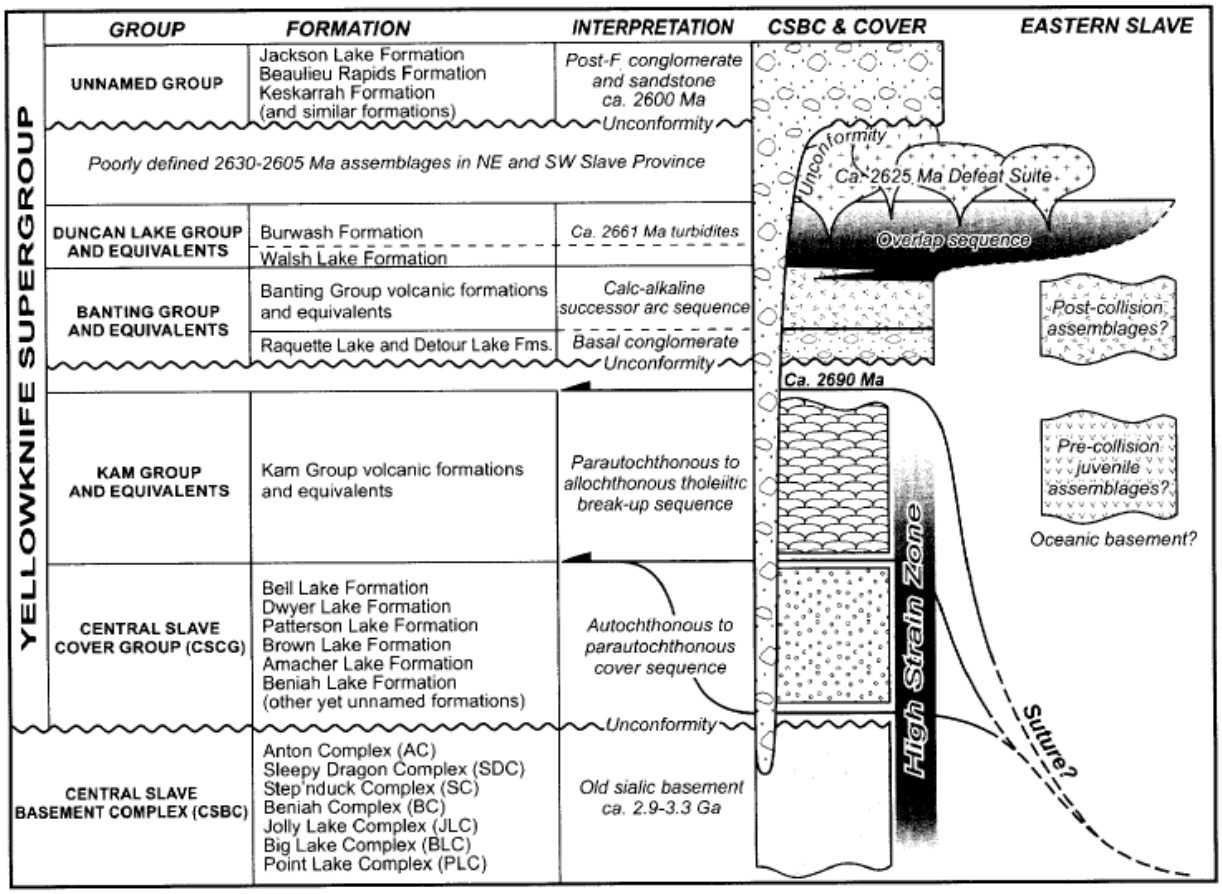
Duncan Lake Group: (2.67-2.61 Ga)

Burwash Fm:

- Walsh Fm is lateral equivalent in some areas
- Metaturbidites
- Greywacke-mudstone turbidites interbedded with felsic volcanic tuff (dated 2661 Ma)

Jackson Lake Fm: < 2.60 Ga

- Conglomerate and sandstone that unconformably overly Kam Group where Banting/Duncan Lake has been removed
- Youngest formation of the YKSG



Bleeker, W., Ketchum, J.W.F., Jackson, V.A., Villeneuve, M.E. 1999. The Central Slave Basement Complex, Part I: its structural topology and autochthonous cover. Canadian Journal of Earth Sciences, **39** (7): 1083-1109.

Turbidites:

- Greywacke-mudstone turbidites
- Interbedded silicate, sulfide and carbonate facies in some areas
- Metamorphism is variable, but generally greenschist to amphibolites facies (high T, low P)
- Difficult to subdivide due to:
  - All have similar in lithological characteristics
  - General lack of fossils and preserved contacts
  - Uncertain ages
  - Metamorphic overprinting and structural complexities produced by folding etc.
- Can be divided into 2 packages
  - *Package I:*
    - 2660-2650 Ma Burwash Fm turbidites
    - TIMS and U-Pb dated zircon from interbedded tuff 2661 ± 2 Ma
    - Rarely contain BIF
    - Commonly have concretions
    - Interpreted as rapidly deposited in a rifting arc environment

- Ash fall tuff beds are common
- Pan-Slave deposition event
- Source: Banting and Kam Group volcanics
- Metamorphosed and folded during intrusion of Defeat Plutons
- Rifted basin closed prior to Defeat and Package II

- *Package II:*
  - < 2640-2620 Ma
  - Typically contain extensive BIF
  - Minimum age of 2608 Ma
  - Same sourced as Package I
  - Deposition in a in a continental back-arc basin
    - Deposited on previously deformed continental crust
    - Deposited with BIF -> indicate shallow basin
    - Chemical precipitate with Fe sourced from hydrothermal vents
    - Spatially and temporally related to Defeat plutons
  - Basin closed and turbidites were folded
  - 2608 Ma intrusion of Concession Suite plutons
  - Followed by high T, low P metamorphism

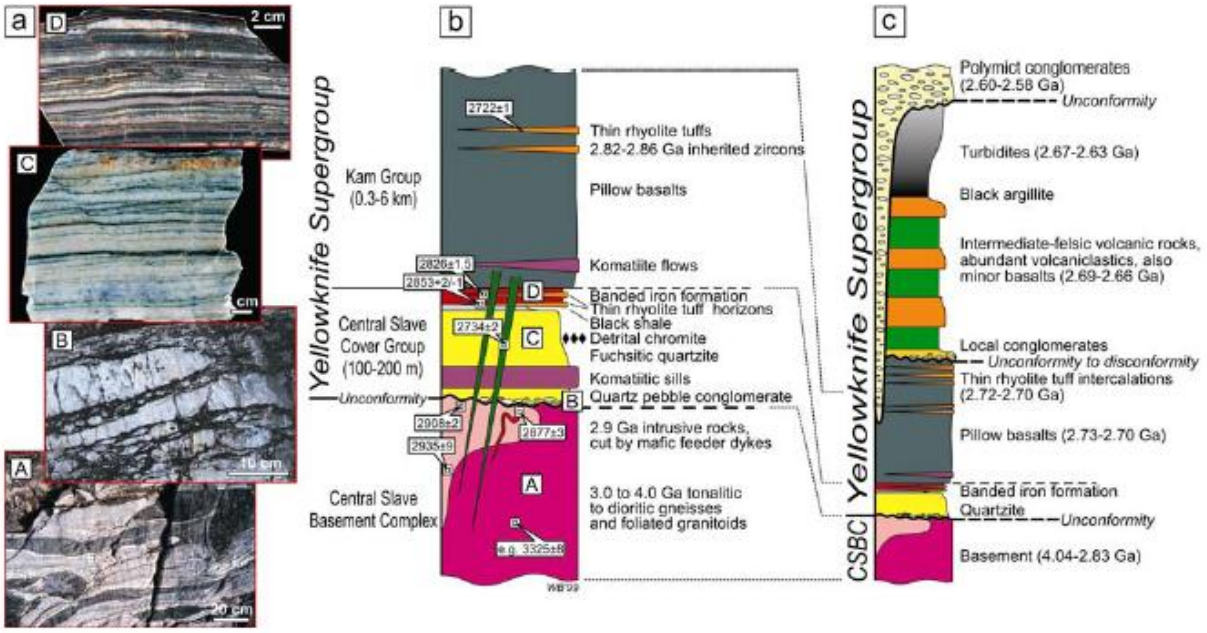


Figure 2. Generalized stratigraphy of the Slave craton. a) Photos (A...D, keyed to Fig. b) illustrating critical features of basement and cover. b) The basement complex and its cover sequence. c) Overall stratigraphy of the craton.

Bleeker, W., Ketchum, J., Davis, B., Sircombe, K., Stern, R., Waldron, J. The Slave Craton From on Top: The Crustal View. Lithoprobe website: *http://www.lithoprobe.ca/Contributed%20Abstracts/Oral%20Presentation/Bleeker-The%20Slave%20Craton%20From%20On%20Top.pdf*