Origin of cementation during the burial history of sandstones (ex. North Brook Formation, WNL, Canada)

**Description:** The study of origin and distribution of cements in North Brook sandstones.

**Objectives:**
- investigate the multiple cementation events & their influence on porosity reduction
- shed light on whether fluid temperatures reached the oil window during cementation.
Publications (cont.) (* = student or post-doc fellow) to be submitted

* Blamey, N., Azmy, K., Origin of cementation during the burial history of the North Brook Formation sandstones, western Newfoundland, Canada. Sedimentary Geology or CJES.
Results / Achievements
Porosity was occluded by 2 cycles of cementation, each consists of a sequence of chlorite, quartz & calcite.
ilmenite altered to sphene, which requires addition of silica & Ca, both of which were available during the first cementation cycle.
CL concentric zonation in calcite cement generations due to change in redox conditions (molar Fe/Mn ratios) during progressive burial.
Calcite has 2 generations:

- an early meteoric at near-surface temperature (all-liquid flincs)

- late burial (primary 2-phase flincs) at higher temperature (~130°C) of deep burial settings
Stable isotopes and Major, minor & REE analyses (using SIMS)

applied to carbonate cements in sandstones by utilizing SIMS

Results are used to infer the nature and origin of the diagenetic fluids in a similar way to that of investigating carbonates
Summary of cementation

Multicycle cementation (chlorite – quartz – calcite)

Cementation dominated by calcite

Multiphase calcite cementation

Calcite cementation reduced porosity, thus limiting the chance of becoming a significant petroleum reservoir.
Conclusions:

- New mineral phases were identified to include: ilmenite, chromite, sphene, martite and allanite.
- Sediments were sourced from the Grenvillian basement and transported by fluvial systems.
- Fresh microcline, plagioclase & wood fragments infer quick & short transport distance and also support fluvial environment.
Conclusions (cont.):

- Weathering of parent rocks was dominated in earlier stages by relatively dry conditions.

- Two cementation events occurred: first shallow environment, second deep.

- Chlorite cements inhibited quartz cementation thus maintaining porosity & permeability until temperatures matched the oil window.
Conclusions (cont.):

- The 1st cementation cycle occurred at near-surface & oxidising conditions likely of a meteoric diagenetic environment.

- The 2nd cycle occurred under deep burial conditions around 130°C & 500bar (5km hydrostatic).

- The majority of calcite cementation occurred during the 2nd cycle, which greatly reduced the porosity post oil window, limiting the possibility of an oil reservoir.
Impact:

➢ Refined and more comprehensive evaluation of the North Brook sandstone reservoir characterization in western Newfoundland.
Proposed Work

Study of other sandstones in western Newfoundland for comparison with those from the North Brook Fm. & evaluation of other possible potential siliciclastic reservoirs in the area.
Thank you