



Karem Azmy

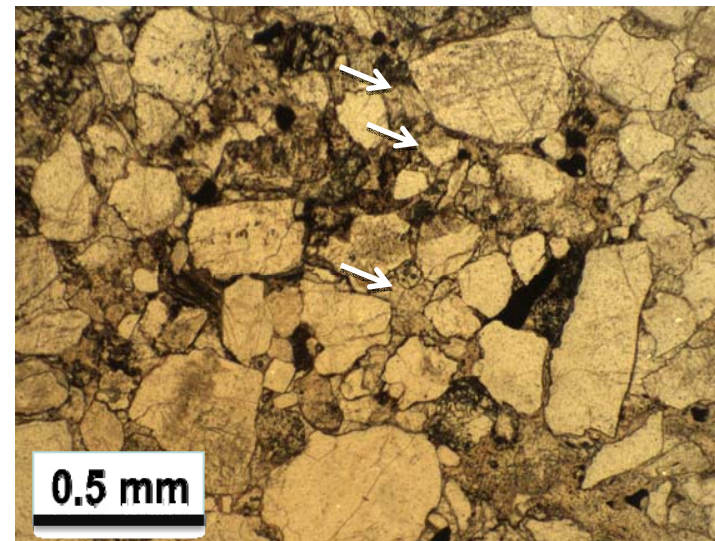
Origin of cementation during the burial history of sandstones (ex. North Brook Formation, WNL, Canada)

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.





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Publications (cont.) (* = student or post-doc fellow)
to be submitted

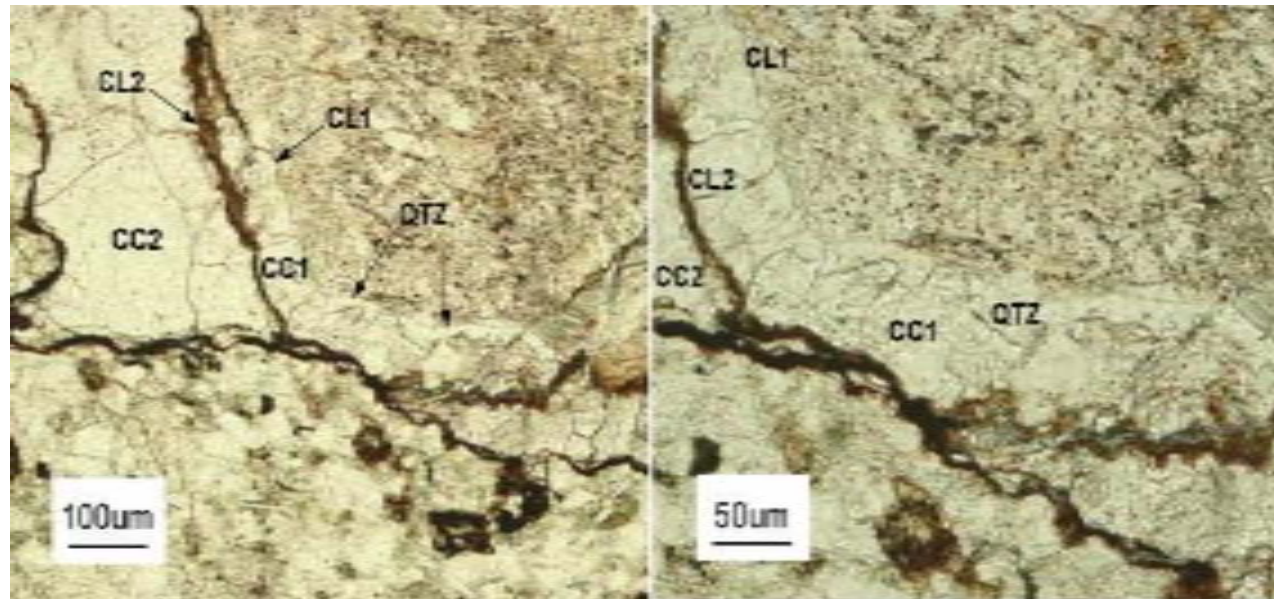
* Blamey, N., Azmy, K., Origin of cementation during the burial history of the North Brook Formation sandstones, western Newfoundland, Canada. *Sedimentary Geology or CJES*.



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Results / Achievements

Porosity was occluded by **2 cycles** of cementation, each consists of a sequence of **chlorite, quartz & calcite**.

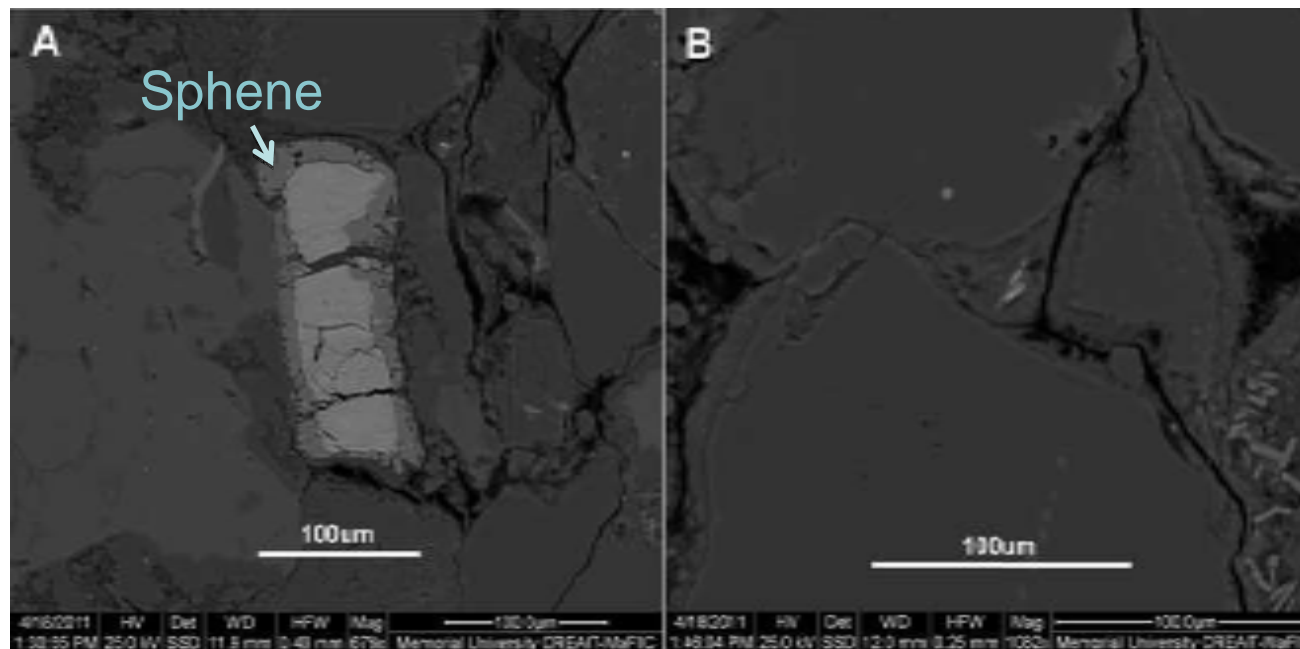




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Mineral Liberation Analysis (MLA)

(backscatter SEM image)

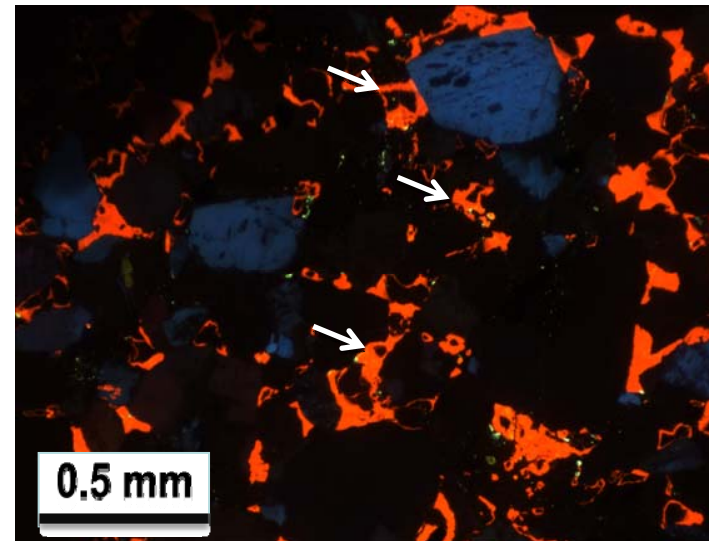
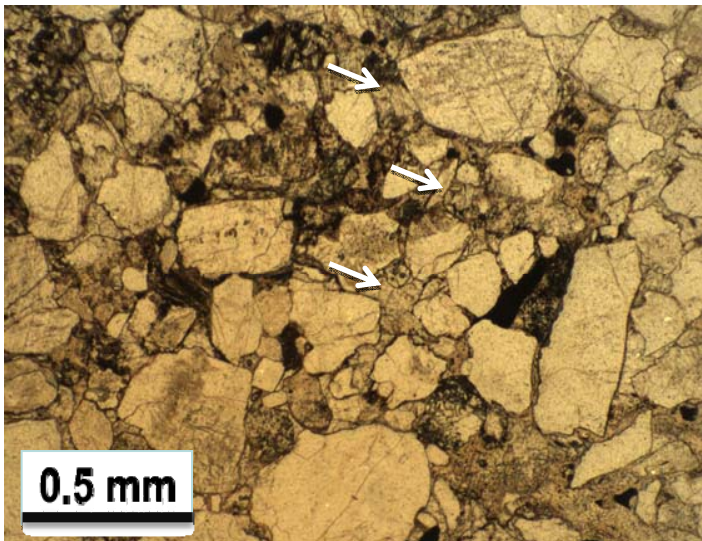


ilmenite altered to sphene, which requires addition of silica & Ca, both of which were available during the first cementation cycle.



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CL concentric zonation in calcite cement generations due to change in redox conditions (molar Fe/Mn ratios) during progressive burial

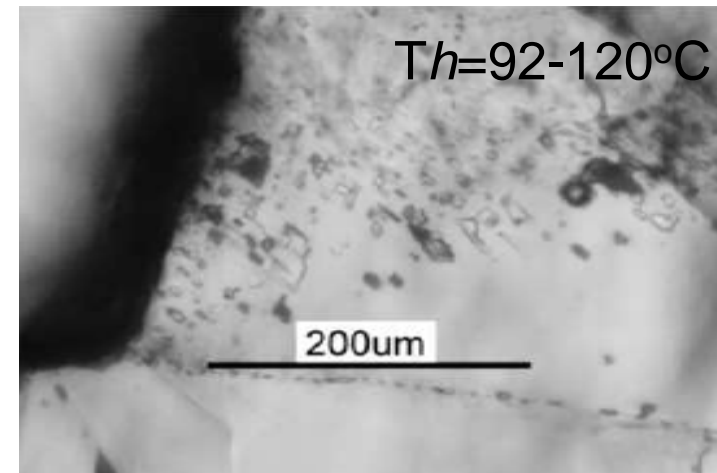
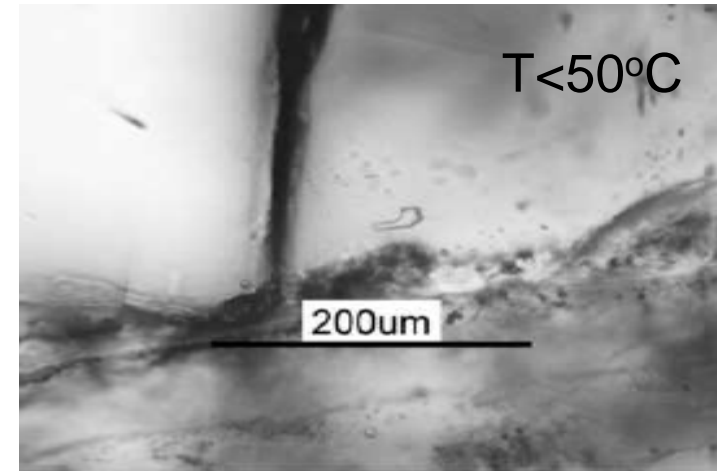




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Calcite has 2 generations:
an **early meteoric** at near-surface
temperature (all-liquid flincks)

late burial (primary 2-phase flincks) at
higher temperature ($\sim 130^{\circ}\text{C}$) of deep
burial settings





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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



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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.



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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



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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.



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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.



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Impact:

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



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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.



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Thank you