Study of geophysical conductors

associated to unconformity-related uranium deposits of the Athabasca

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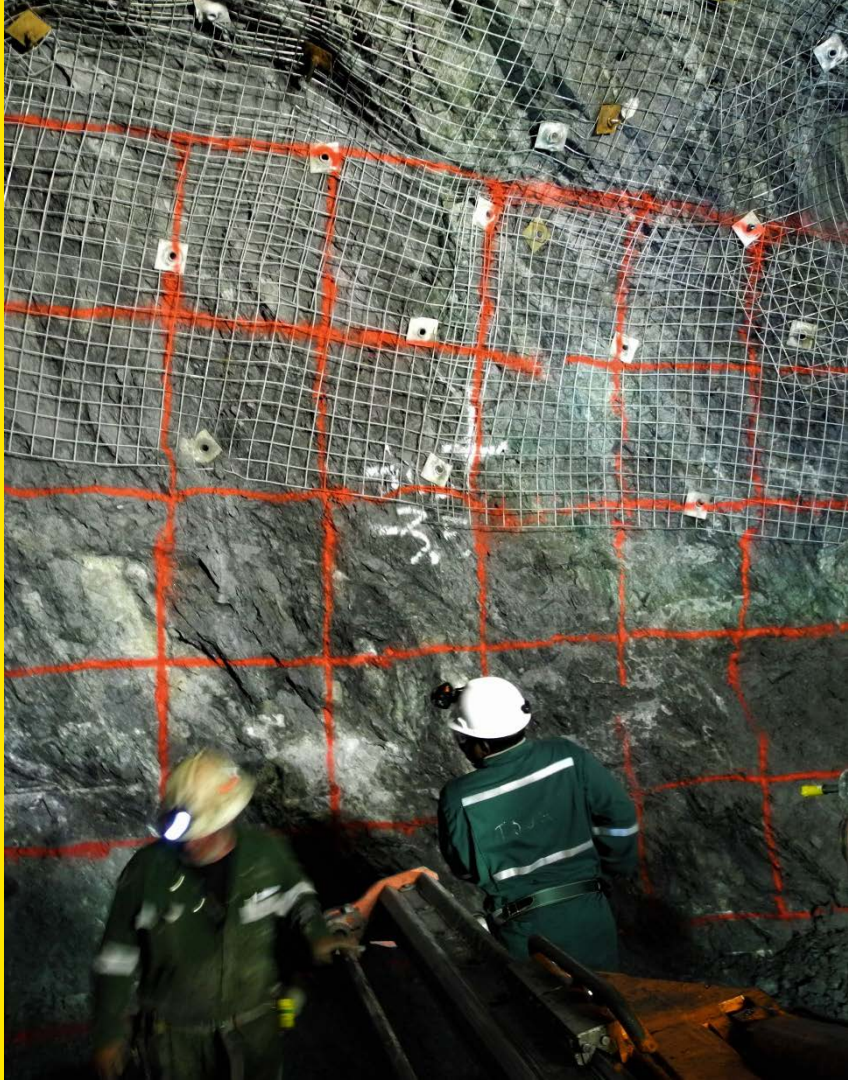
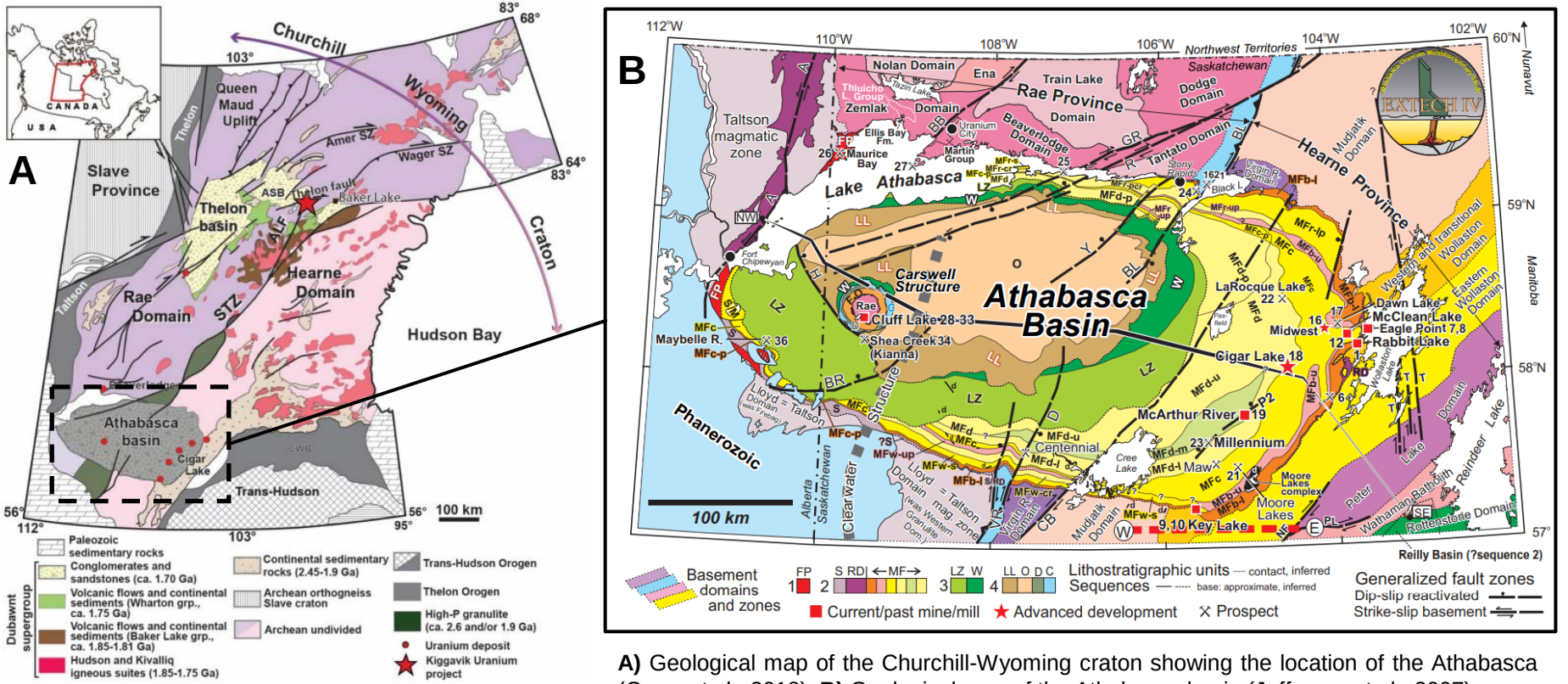
Summary

01

INTRODUCTION



01 a. Geological context



A) Geological map of the Churchill-Wyoming craton showing the location of the Athabasca (Grare et al., 2018). **B)** Geological map of the Athabasca basin (Jefferson et al., 2007).

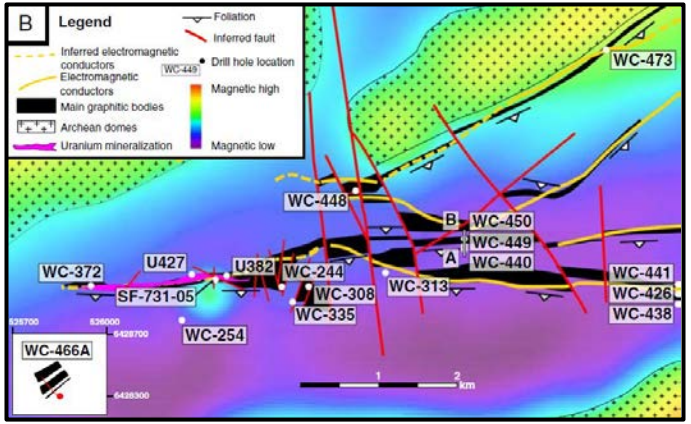
01 b. Objectives

Why some electromagnetic conductors are able to host uranium mineralizations?

- **All URU deposits in Athabasca** are associated with **graphitic conductors**, but it is not possible to **distinguish mineralized** and **sterile** ones.

- These are counted in **tens of thousands of kilometers**, and **more than 99%** are however **sterile**.

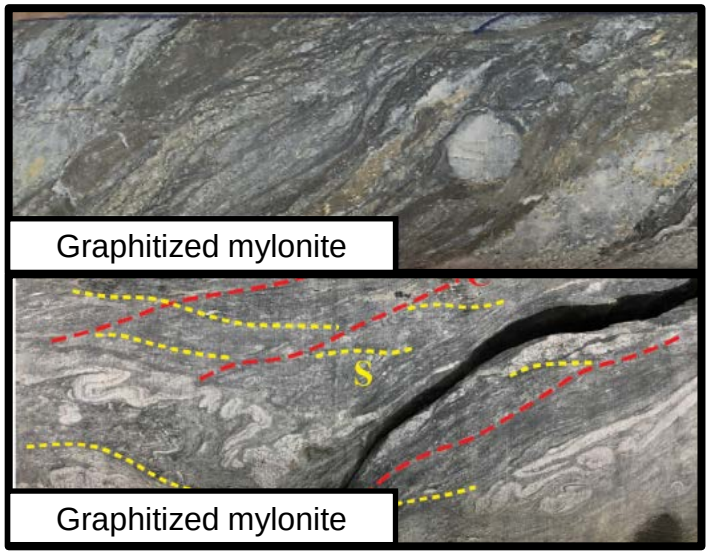
- Comparing the different **typologies of conductors** could reveal the **key parameters** involved in the **formation of uranium deposits**.



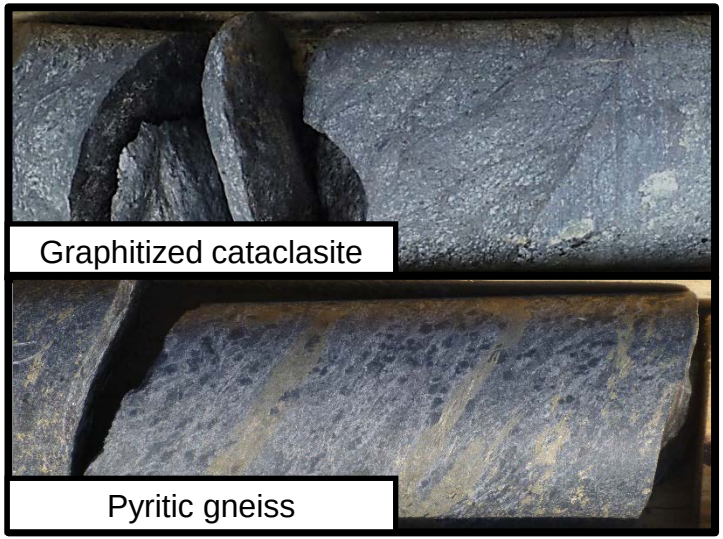
Simplified geological and aeromagnetic maps of the basement at the unconformity, Cigar Lake U deposit (Martz et al., 2017)

The objective is to define what is an uranium-bearing graphitic conductor.

01 c. Methodology



Conductor from Arrow deposit – Western Athabasca
(Hillacre et al. 2021)

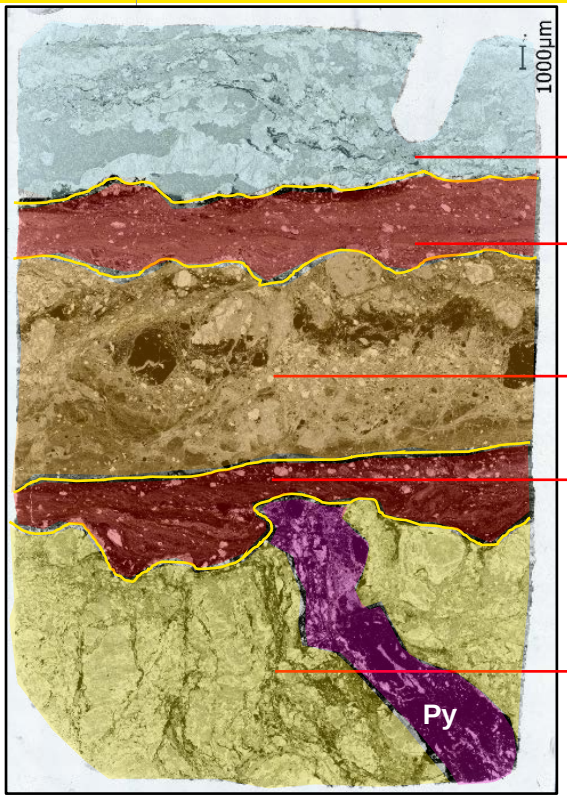


P2 fault zone, McArthur deposit – Eastern Athabasca

02

RESULTS

02 a. Fault rocks characterization



Altered Gneiss

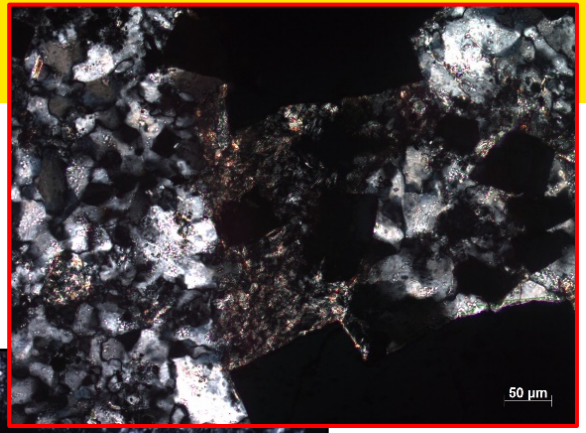
Cataclasite

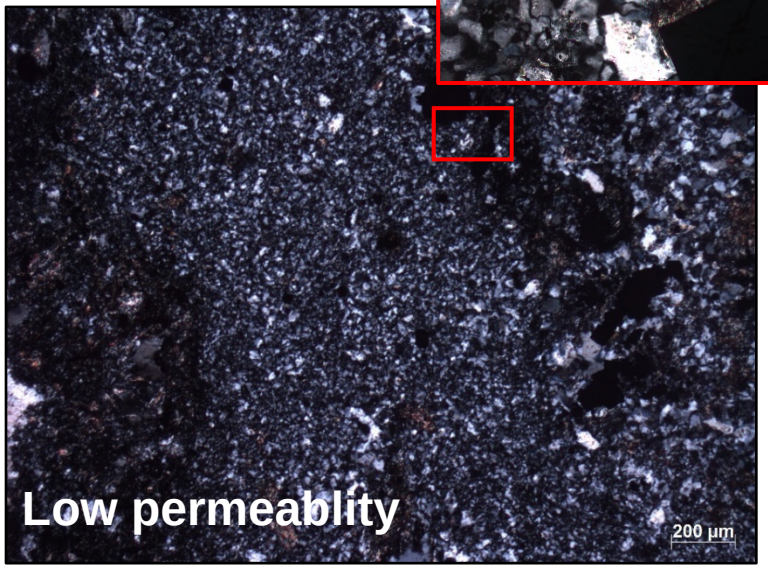
Protocataclasite

Cataclasite

Breccia

Microcrystalline quartz (< 30 µm)

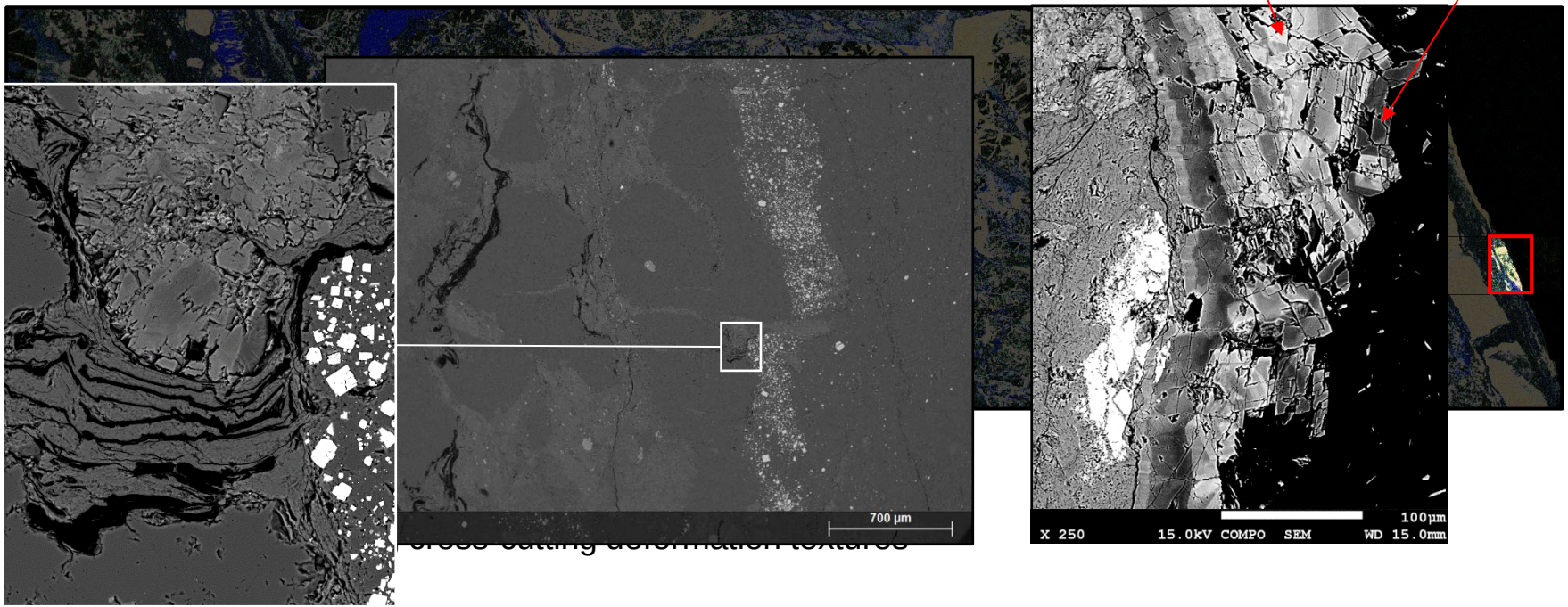




02 b. Carbonates

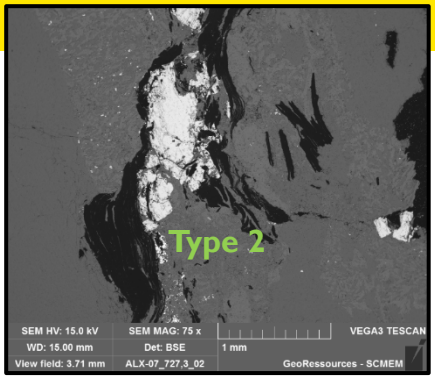
Formula	Weight%
MgO	12.94
CaO	27.88
Fe2O3	14.17
Total	55.0

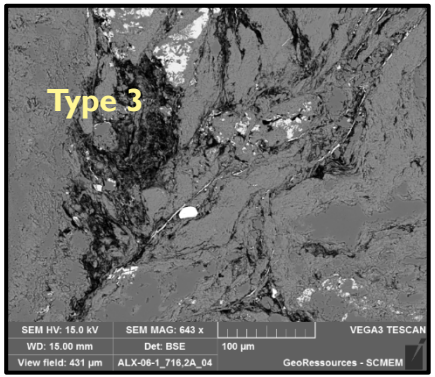
Formula	Weight%
MgO	20.11
CaO	30.1
Fe2O3	0.66
Total	50.9

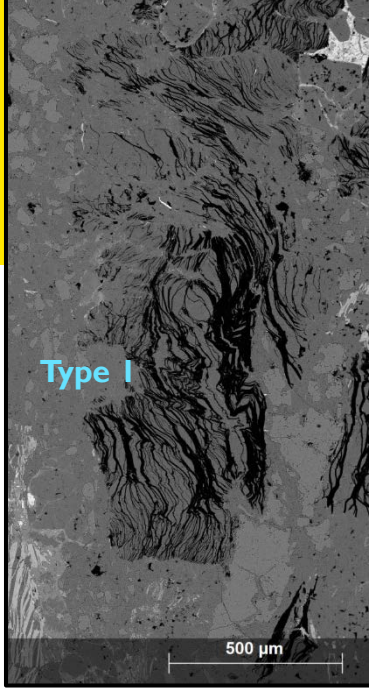


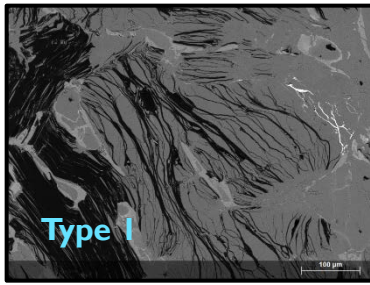
02 d. Graphite in western conductors

- **Type 1:** Very thin flakes, texture in « filaments », high reflectivity, well-structured, no particular association.
- **Type 2:** Large flakes, high reflectivity, well-structured, often associated with pyrite.
- **Type 3:** Diffuse patches, low reflectivity, low-structured, no particular association



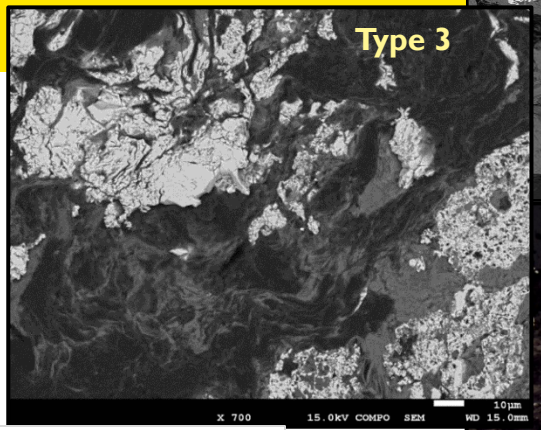


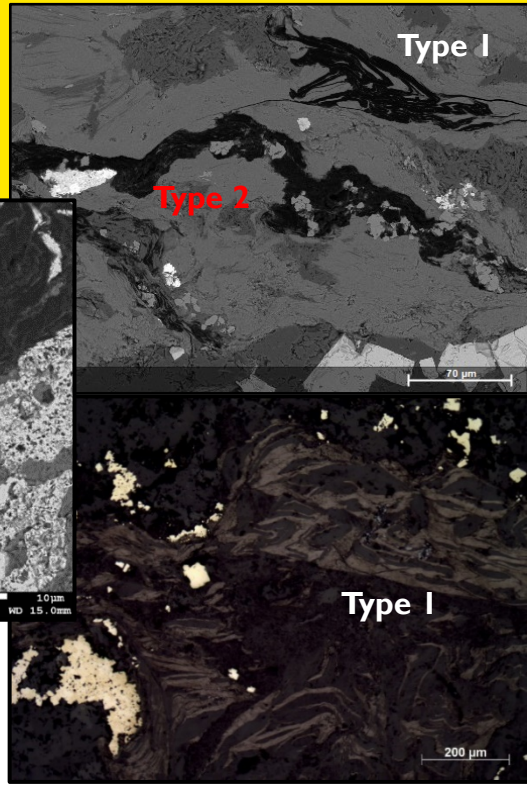


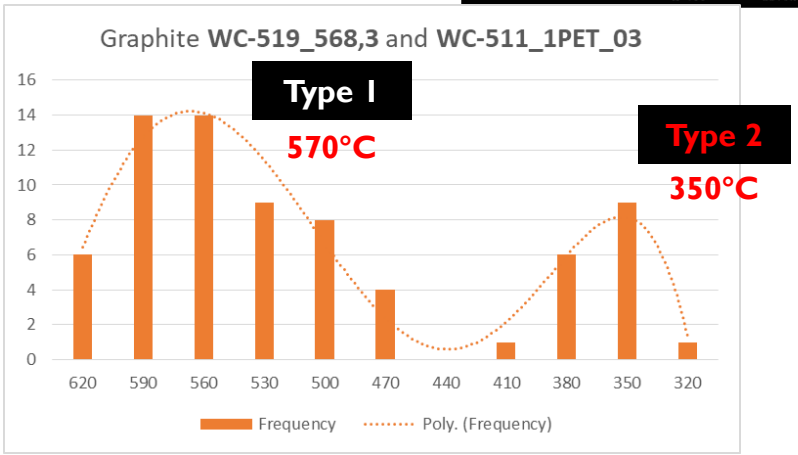


02 e. Graphite in eastern conductors

- **Type 1:** Large flakes, high reflectivity, oriented in foliation
- **Type 2:** In stylolites, low reflectivity
- **Type 3:** Low-structured nodules, low reflectivity,, often associated with pyrite





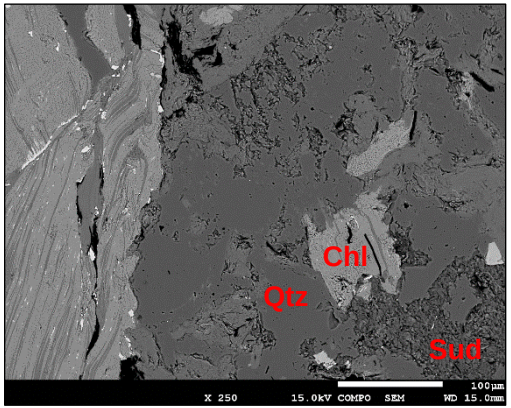


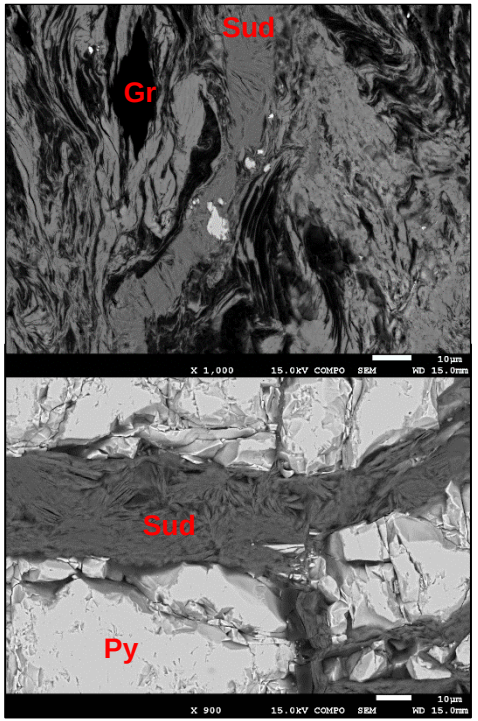
02 f. Fluids circulation

- **Hydrothermal alteration** stage, due to ore deposit, is associated with **micro fracturing** filled by **sudoite.**

- The **permeability** of the fault rocks in which sudoite circulated is **very low** currently.

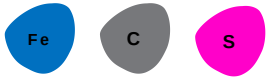
- This suggests that the **permeability** of these faults rocks could have been higher at the ore deposit time.

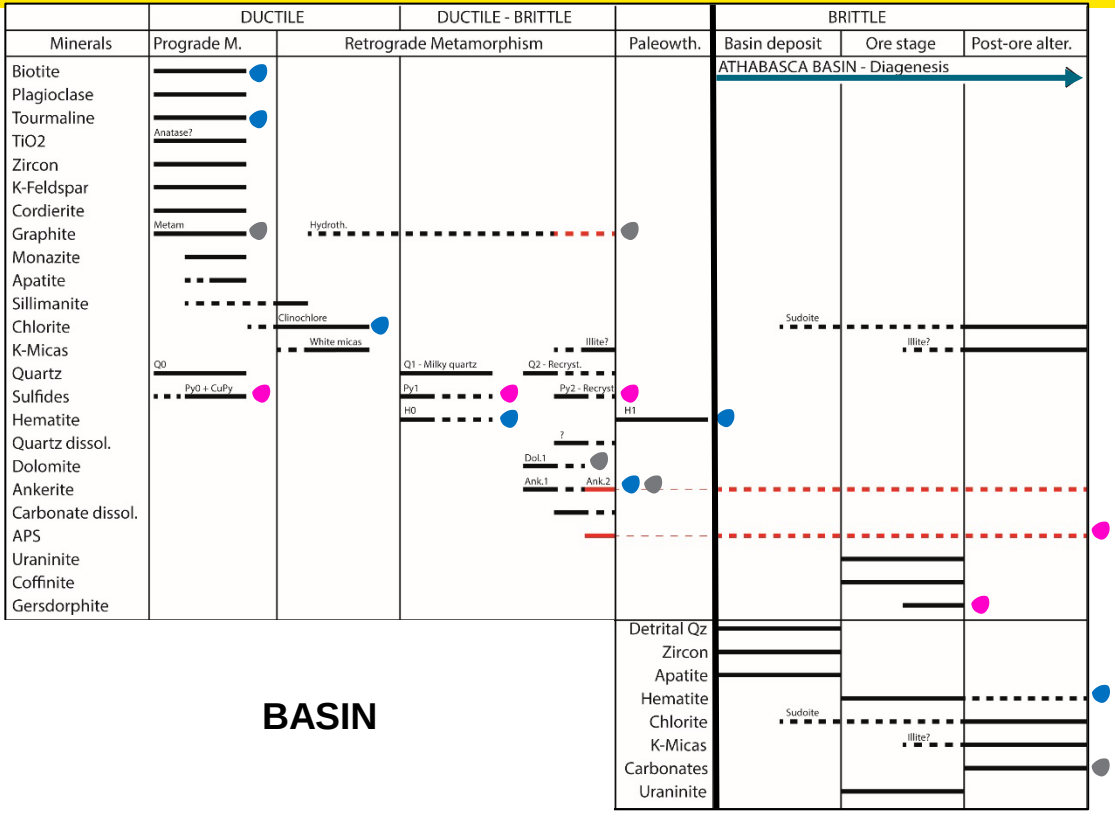




02 g. Paragenetic sequence (Cigar L.)

BASEMENT



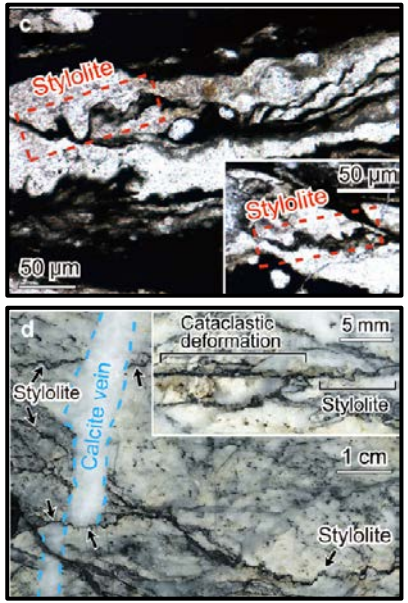


BASIN

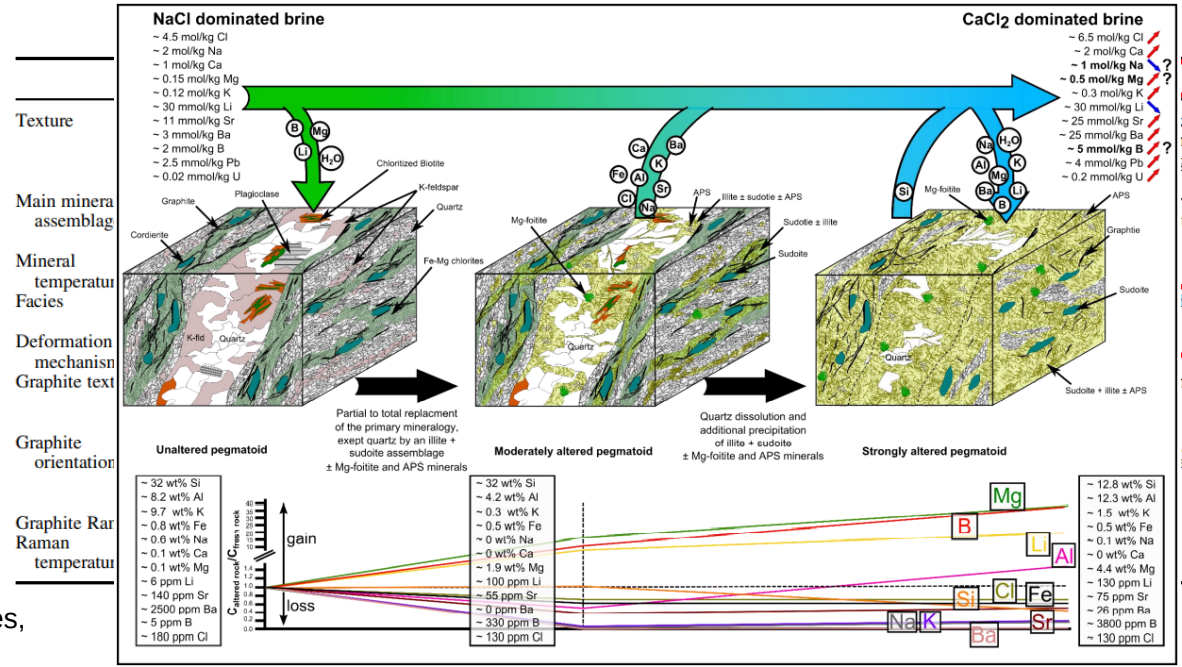
03

DISCUSSION

03 a. Elements involved in the formation of URU deposits

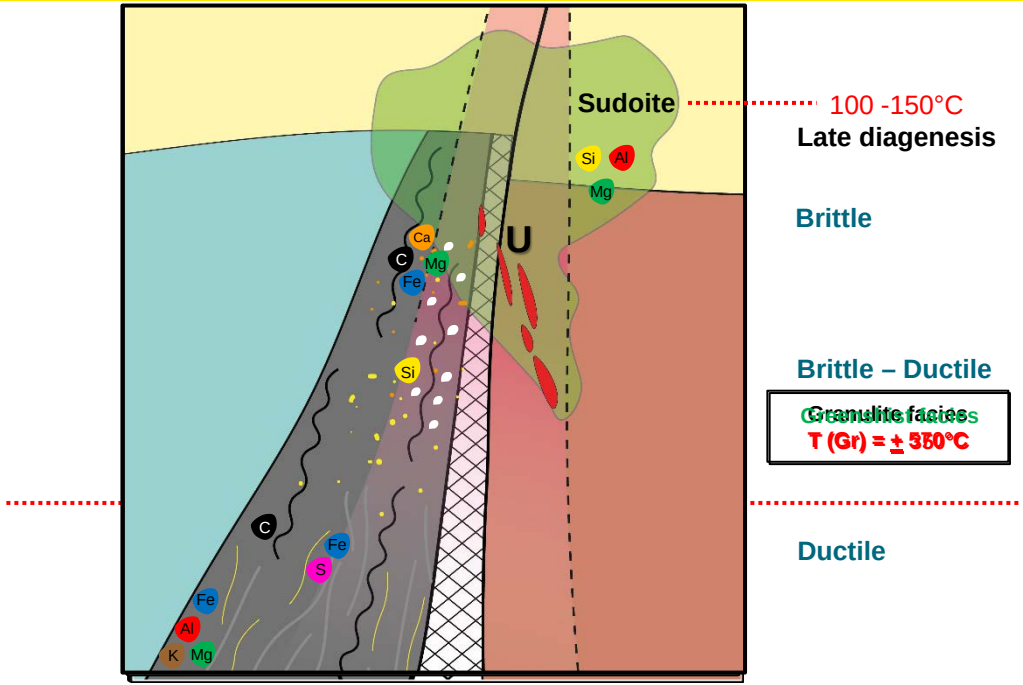


Graphitic stylolites in cataclasites, Oohashi et al. (2012)



Model of brine-rock interactions with the main lithologies of Athabasca basement, Martz (2017)

03 b. Elements mobility in conductors



03 c. Perspectives

- **Microstructures** and **alterations preserved** at the edges of these structures, or in clasts within these breccias, could give us information on the nature of the fluids and the PT conditions that existed during the formation of these rocks not very permeable currently.

- **Sulfides isotopy** to characterize the different phases of pyrite identified in the paragenetic sequence.

- **RSCM** on graphite.

- **Carbonates datation** (if U-Pb-Th concentrations make it possible).

Thank you for your attention !

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