KINTAVAR EXPLORATION INC

Stratiform copper deposit in Québec

AME Roundup
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PRESENTED BY :
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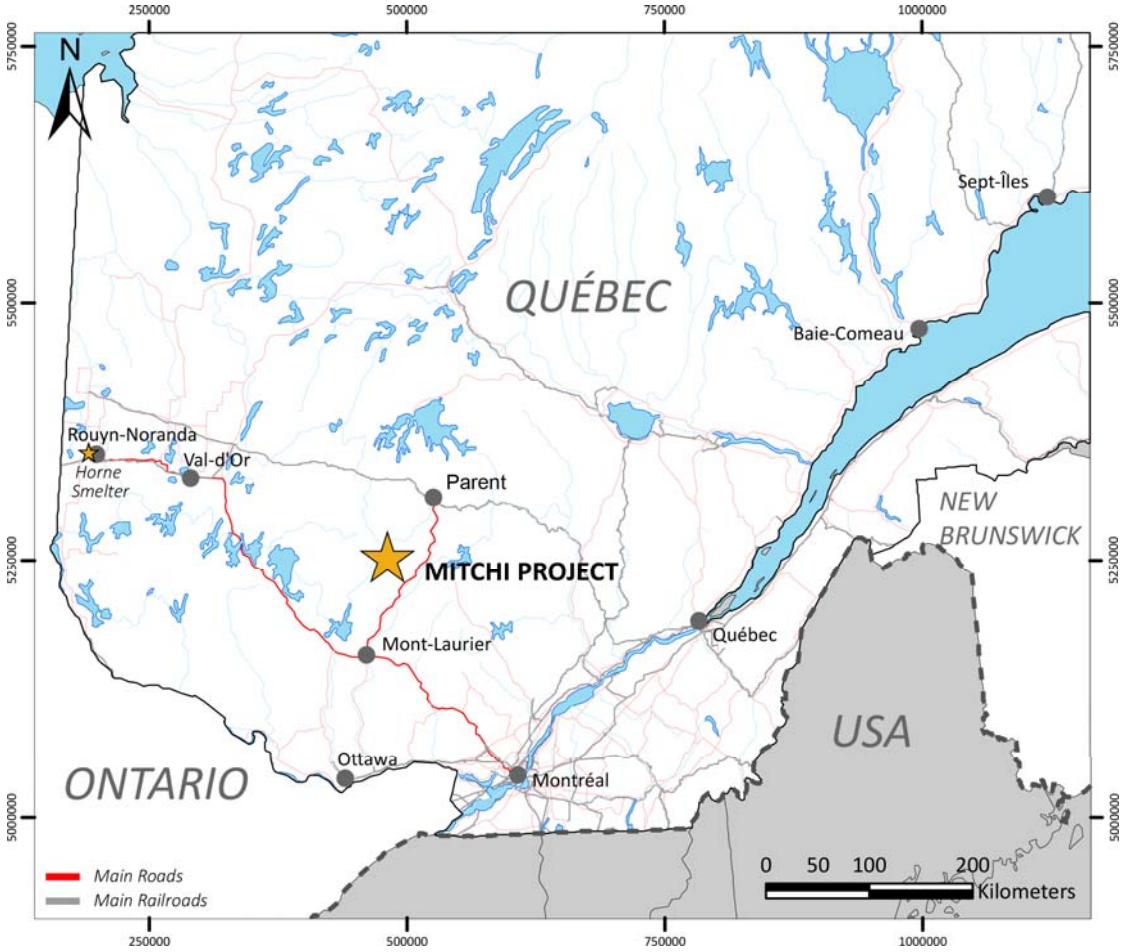
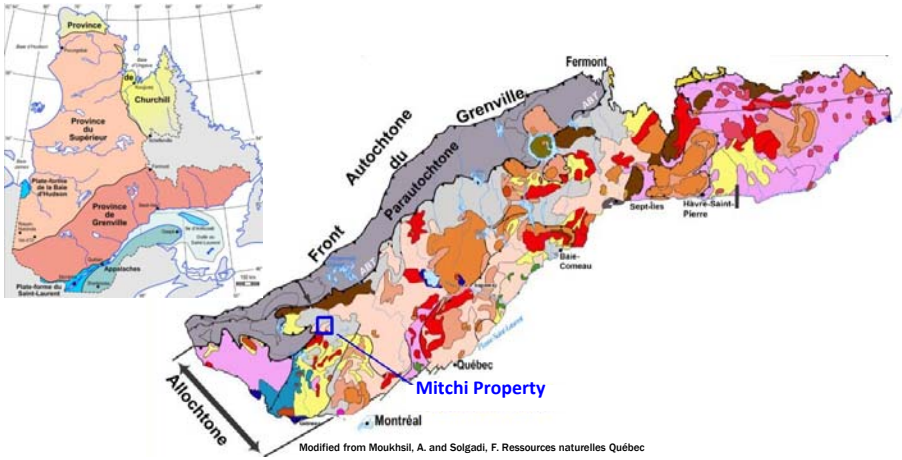
Location

- Québec – reliable and stable jurisdiction
- Local communities support
- Easy access by forestry road and ATV trails
- Less than 15km from a power substation and a commercial powerline on the property
- Road and railway access to a smelter, a seaport and to the U.S.A.
- A 150 person camp on site
- **538 claims – 30 609 hectares**
- The sedimentary basin is secured and royalty free

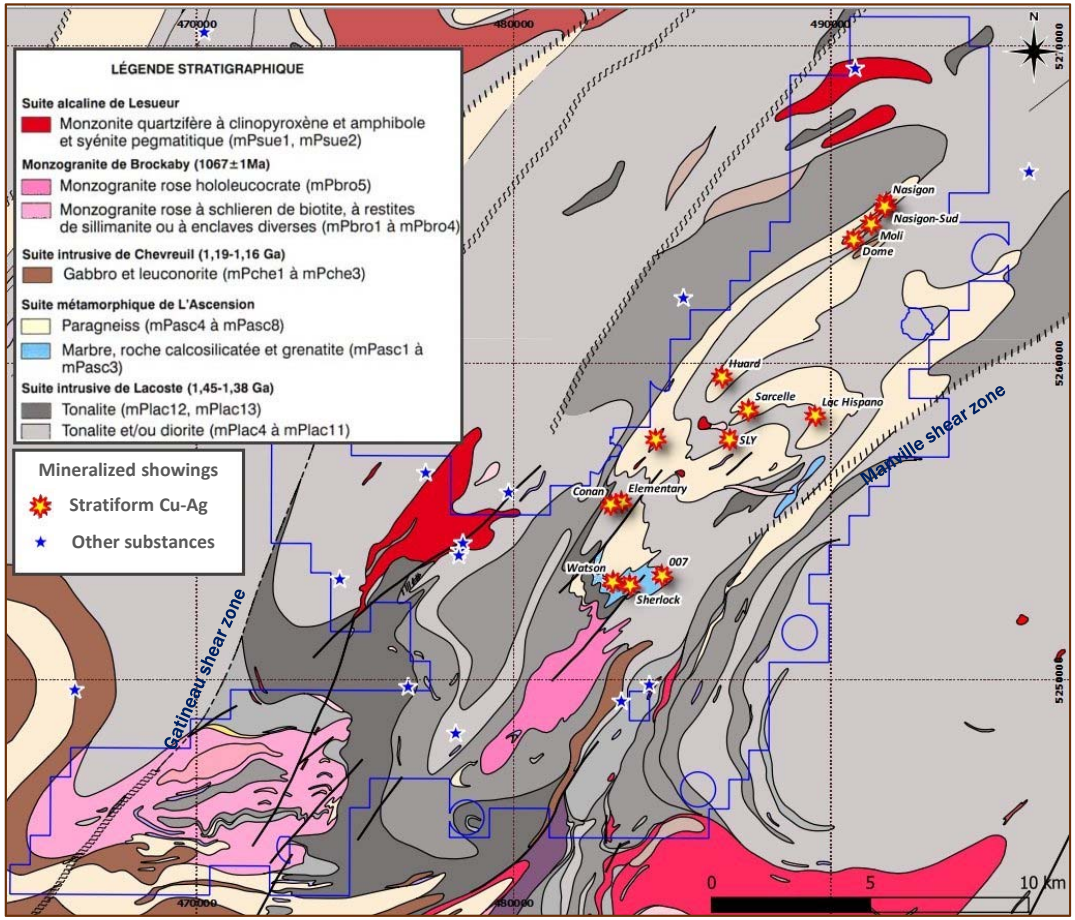


Geology – Grenville province



Modified from Moukhsil, A. and Solgadi, F. Ressources naturelles Québec

- Northern portion of the Central Metasedimentary Belt or Mont-Laurier Terrane.
- Ascension metamorphic sequence composed of paragneiss, calcosilicate rocks and marbles, including copper mineralization, overlying the Lacoste intrusive suite
- Crosscut by Brockaby monzogranite and Lesueur alkaline Suite (not-folded) and locally containing copper mineralization



From SIGEOM, modified from Nantel 2004 and Moukhsil 2016

Lithologic sequence

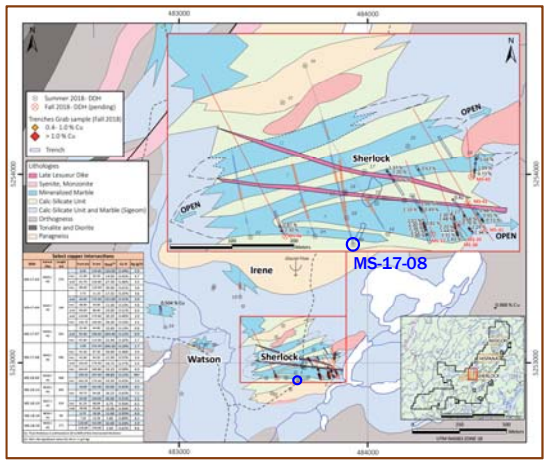
- Ascension metamorphic sequence (± 1,2 Ga, *Davis & al. 2016*)
  - Copper rich metadolomite : calcitic marble with olivine ± diopside ± phlogopite, **chalcocite / bornite / chalcopyrite**
  - Silicified cupriferous metadolomite : diopsidites and/or calcosilicate rocks with diopside, titanite, phlogopite ± tremolite ± scapolite, **bornite / chalcopyrite**
  - Episyenite with nepheline-cancrinite
  - Paragneiss with biotite ± garnets ± sillimanite ± muscovite
  - Quartzite with biotite ± feldspaths ± garnets ± magnetite ; garnetites

Marble with olivine and calcosilicate rocks

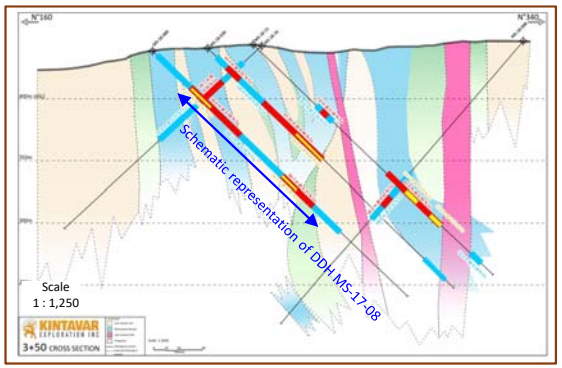
Marble, diopsidites and calcosilicate rocks

Episyenite with nepheline

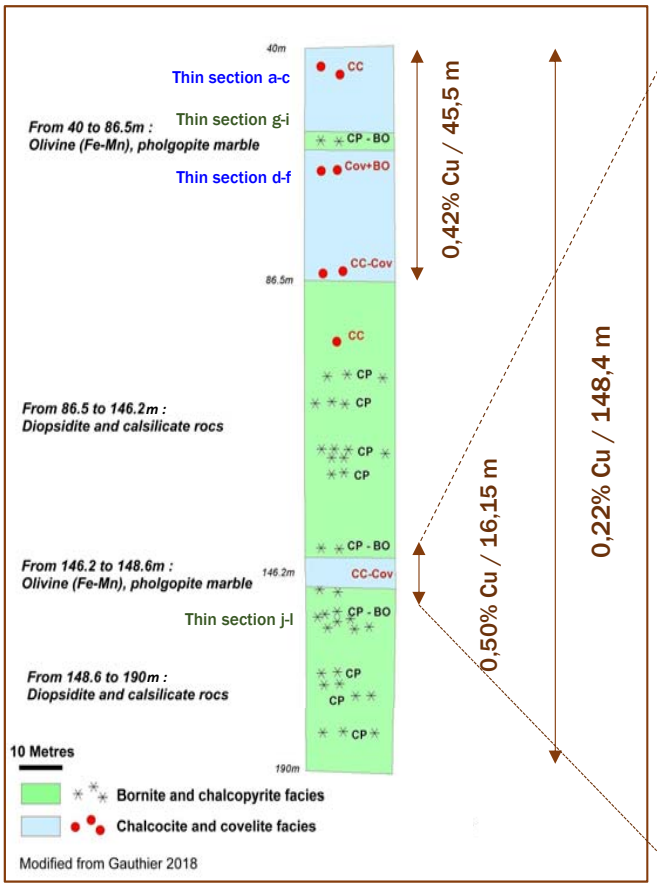
Drill hole MS-17-08



Plan view – Sherlock area



Cross section - 3+50 Sherlock area. Drill hole MS-17-03, 08 and 09

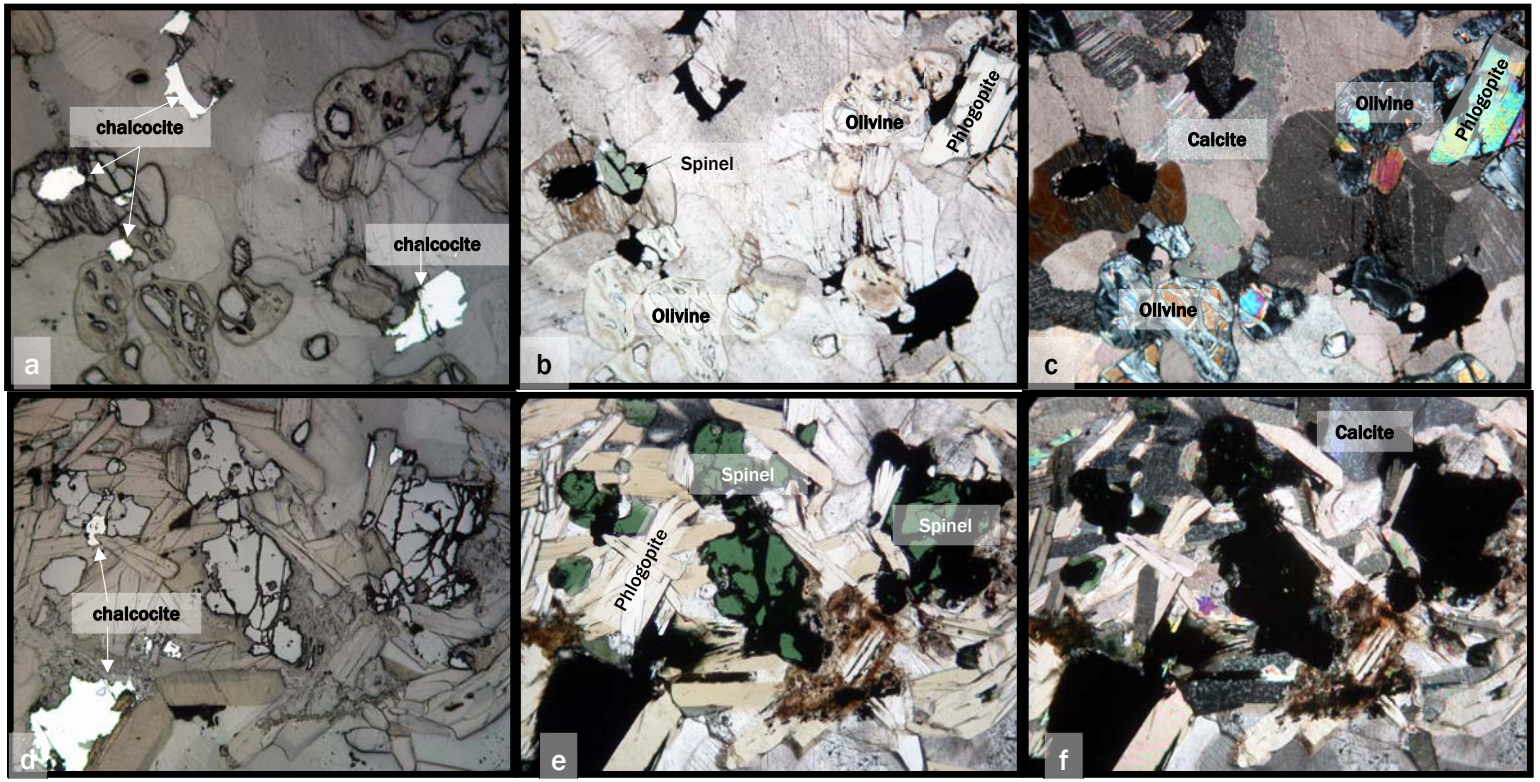


Schematic representation – Drill hole MS-17-08

White = Marble with olivine and chalcocite-covelite.
Yellow = Diopsidites and calcosilicate rocks with bornite-chalcopyrite

Chalcocite facies

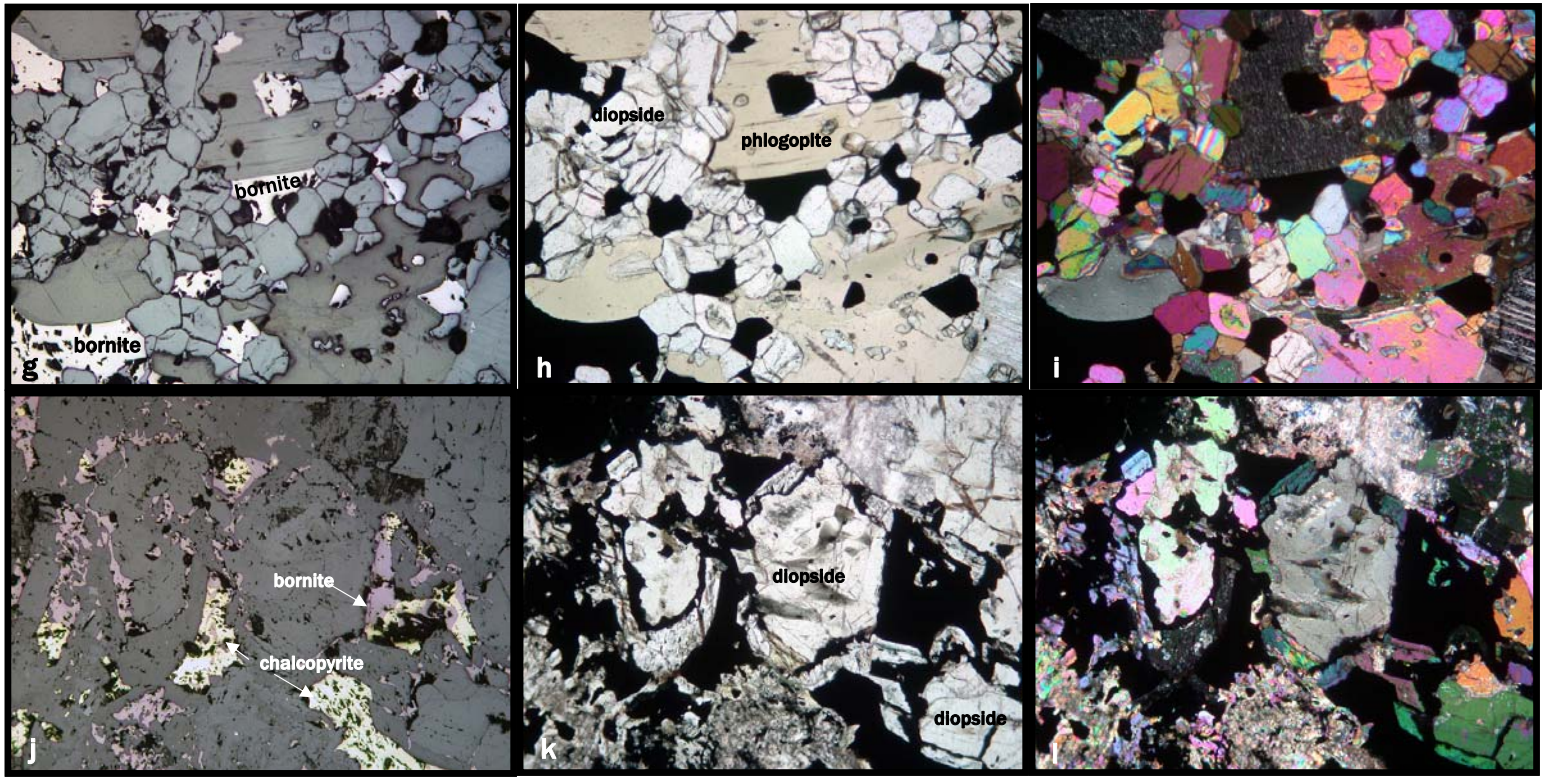
- Calcitic marble with olivine, phlogopite, spinel, **chalcocite**



Granoblastic texture of the calcitic marble with chalcocite, serpentinized olivine, phlogopite and spinel. Microscope reflected light view (a et d) ; transmitted light (b et e) and transmitted polarized light (c et f). Polished thin sections from 43,1m (a-c) and 78,6m (d-f) of the drill hole MS-17-08 located on the Sherlock zone. (Gauthier 2018)

Bornite and chalcopyrite facies

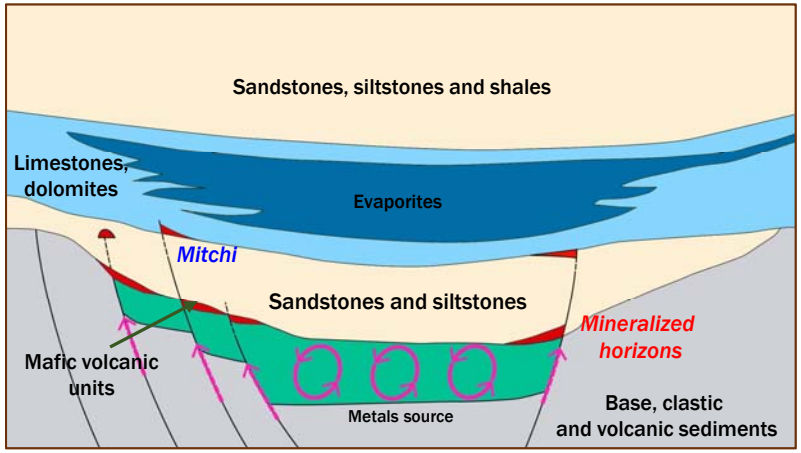
- Diopsidites and/or calc-silicate rocks with diopside, phlogopite, **bornite / chalcopyrite**

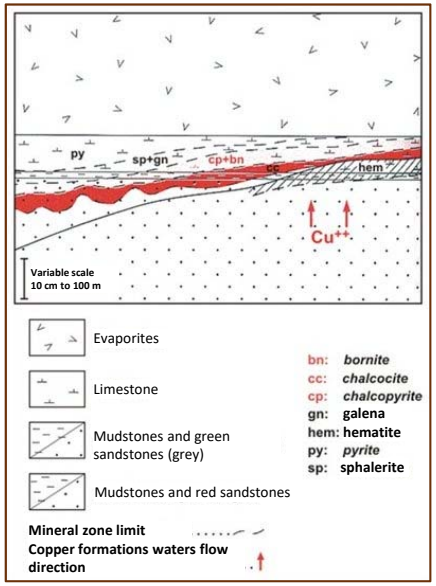


Granoblastic diopsidite presenting xenomorph bornite and chalcopyrite. Microscope view under reflected light (g et j) ; transmitted light (h et k) and transmitted polarized light (i et l). Polished thin sections from DDH MS-17-08 at 64.0m (g-i) and 148.6m (j-l) on the Sherlock zone. (Gauthier 2018)

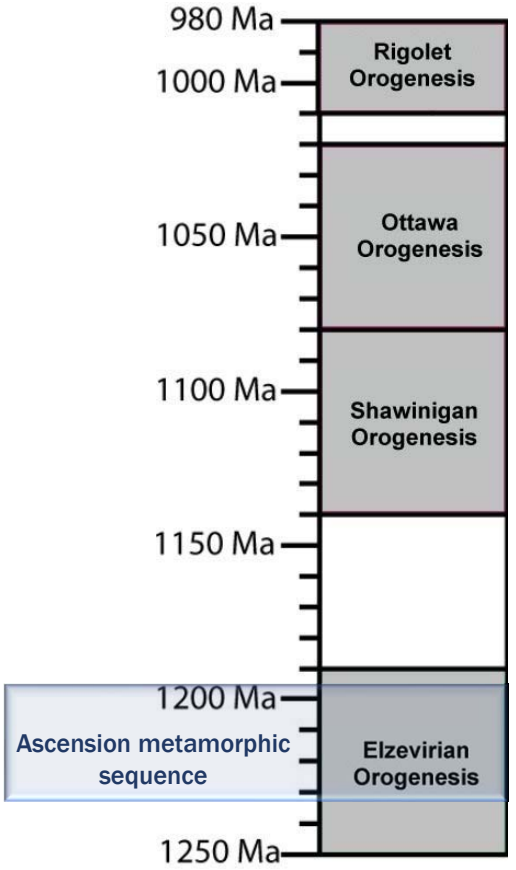
Stratiform copper

- **Mineralogy vs Metamorphism**
  - Deposition of the sedimentary sequence (± 1.2 Ga)
    - Dolomitic limestones, silicieous dolomite, dolomitic sandstones, evaporitic horizons (anhydrite, sylvite, etc) and quartzofeldspathic sediments
    - Diagenesis of the sequence – Stratiform copper deposit genesis – fluids rich in KCl, NaCl and CaSO4 ultra saline context





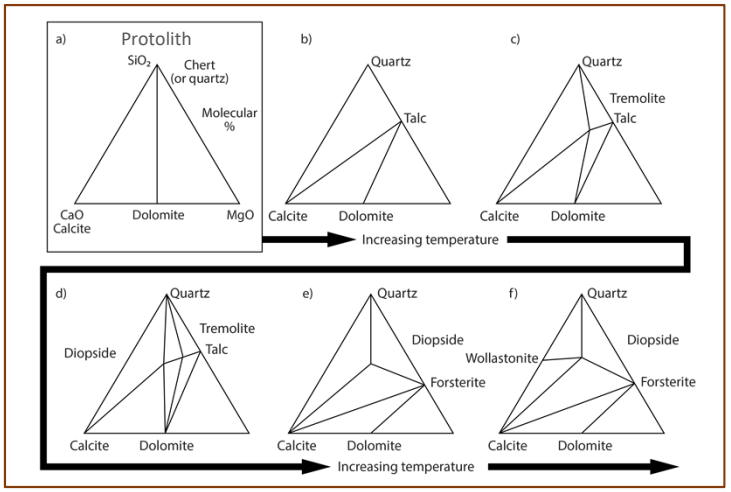
Lithological units and common mineral zonations in Kupferschiefer type deposits. Distribution of the mineral zones (Copper sulfides zones in red). Source : Kirkham, 1996.



Modified from Rivers 2002

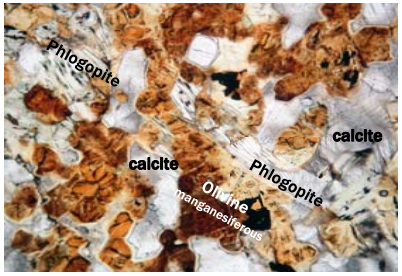
Prograde metamorphism

- PROGRADE metamorphism of the carbonate sequences (manganesiferous silicieous dolomites) at the superior amphibolites facies
  - Tephroite marble (manganesiferous olivine) – phlogopite - chalcocite
  - Diopside marble - phlogopite – bornite - chalcopyrite
    - Sulfur intake : anhydrite reduction = $CaSO_4$ -> $CaCO_3$ + H_2S
  - Bornite calc-silicate metasediments - chalcopyrite ± phlogopite
  - Nepheline-cancrinite episyenite (fenetization)
    - Interaction between evaporitic cupro-manganesiferous dolomites, K, SO_4, Cl, Na rich, and the quartzofeldspathic sediments.
    - Prograde metamorphic rebalances with the silica (consumed) and the potassic feldspars (transformed) and nepheline-cancrinite episyenite formation.

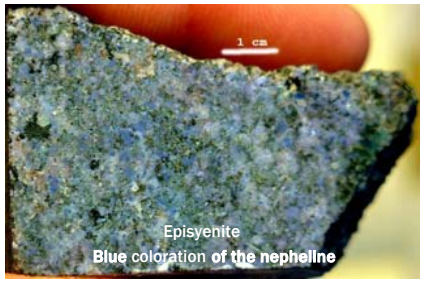


Ternary diagrams illustrating the paragenesis changes in the CaO-Mg-SiO_2-CO_2-H_2O system submit to a prograde metamorphic regime. The first triangle gives the considered protolith, a cherty dolomite or a dolomitic sandstone (adapted from Hulburt and Klein, 1977)


Tephroïte marble (Mn Olivine) phlogopite and calcocite




Calcsilicate unit with diopside bornite-chalcopyrite



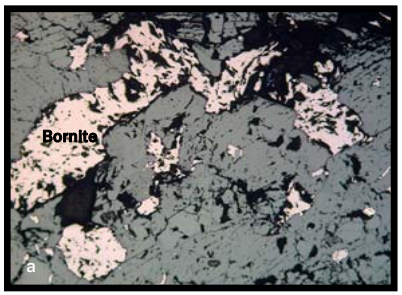
Episyenite
Blue coloration of the nepheline

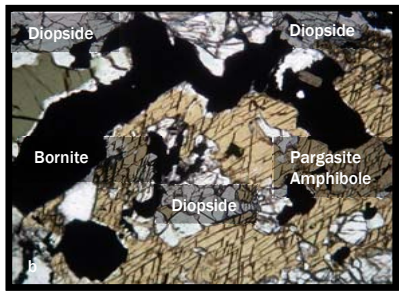
Retrograde metamorphism

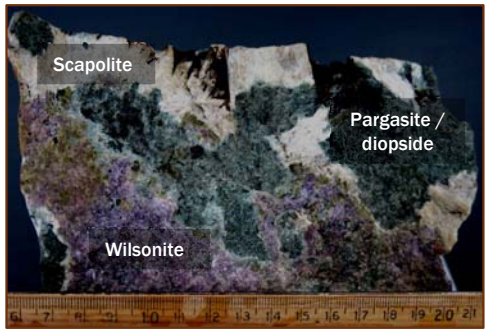
- RETROGRADE metamorphism of the carbonate sequences
  - Olivine MgFeMn retrometamorphism and Serpentine/Magnetite/Pyrolusite-psilomelane formation

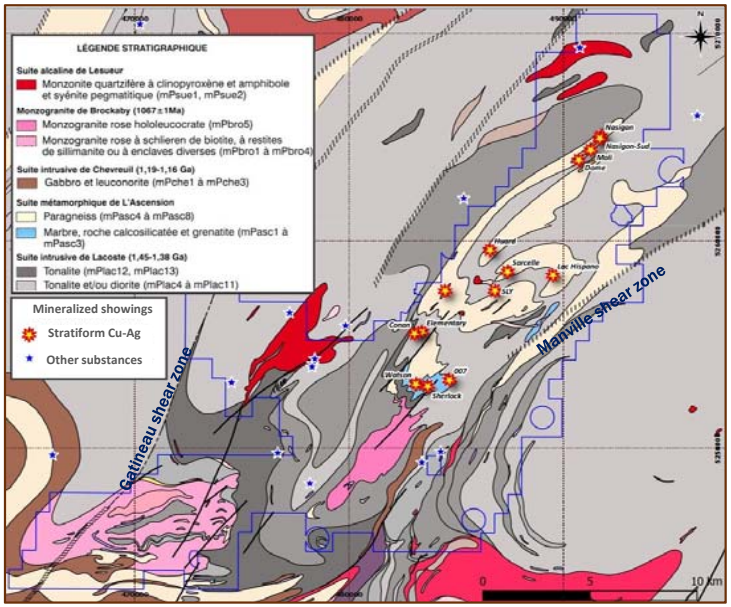
Late metasomatism

- End of Rigolet Orogenesis (±0,98 Ga) = Lesueur alcalin intrusion and late extension faults with sodi-calcic hydrothermalism and fenetization accompaigned by copper sulfides remobilization.









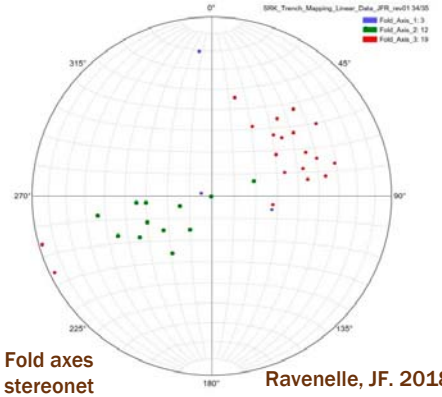
Grenvillian deformation

- **Folding**
  - Three phases of folding superimposed the thin mineralized horizons to thick mineralized zones.
    - ***F1*** : few folds are present on Sherlock trench
    - ***F2*** : Prevalent on Sherlock, tight to moderate folds with 45^0-90^0 sub-vertical dipping toward WSW
    - ***F3*** : Prevalent on Watson, open to tight folds with 30^0-55^0 toward ENE dipping, moderate fold axes

''F3'' sedimentary sequences folding on Watson showing

''F1'' sedimentary sequences folding on Sherlock showing

''F2'' sedimentary sequences folding on Sherlock showing



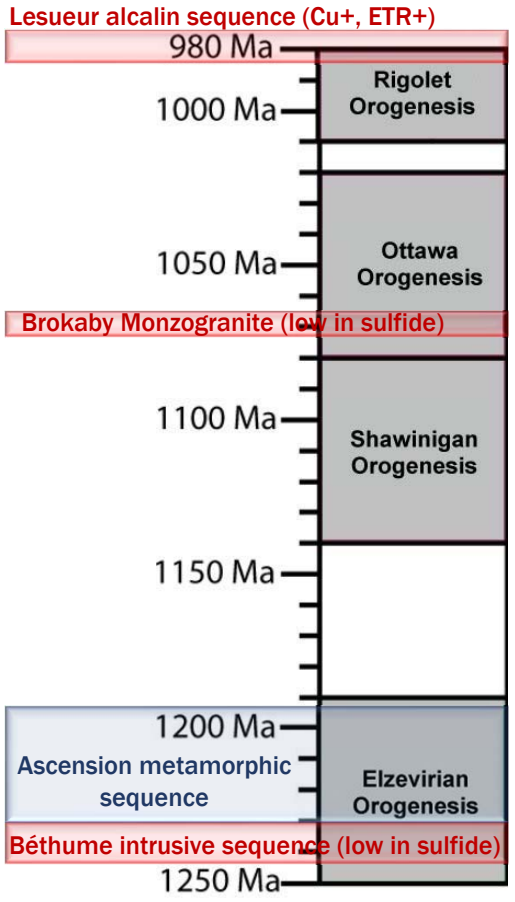
Fold axes stereonet

Ravenelle, JF. 2018. SRK

Ore Model

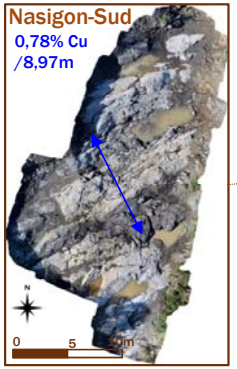
Stratiform Copper vs Skarn

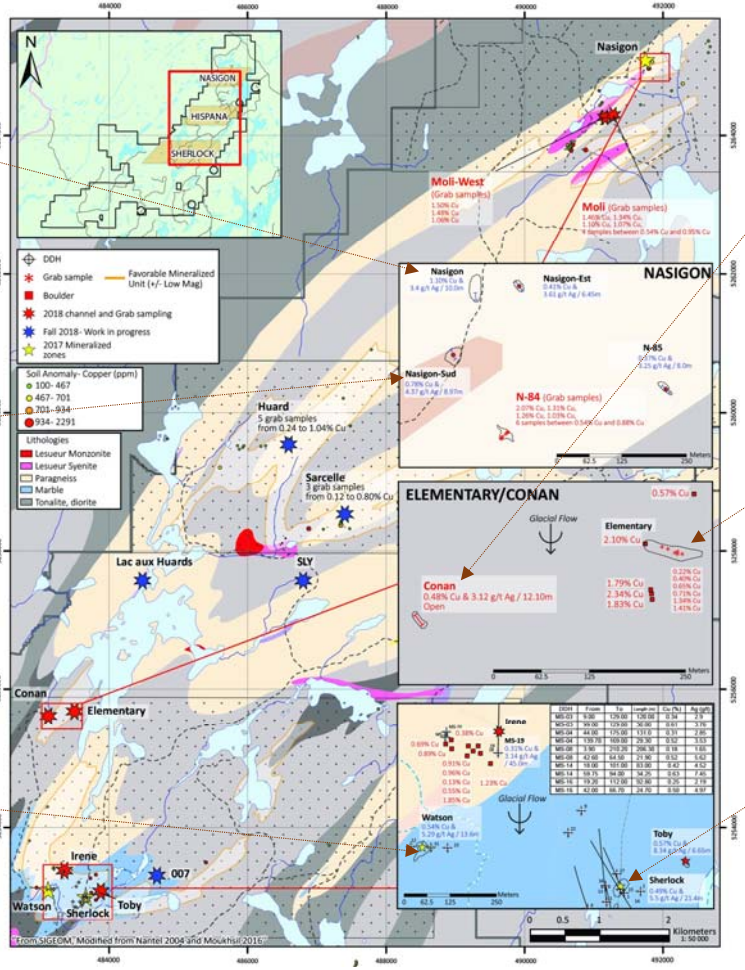
- Quasi-cryptic chalcocite mineralization, with close to 1% Cu content, is associated with a serpentized phlogopite-olivine marble, while the coarse bornite-chalcopyrite mineralization is associated with diopside marble and feldspar-quartz, diopside +/- scapolite rocks.
- In a pyrometasomatic system, the copper abundance is following the silica enrichment , like at « Mont de l'Aiguille » copper deposits in Murdochville, Gaspesie, Quebec. Therefore the silica content of those fluides would have developed exactly the opposite of what we are observing, the olivine is incompatible with the free silica.
- Geochronologically, the prograde mineralogic transformations of the carbonate units, to superior amphibolites facies, were completed before the Lesueur late magmatic episod (0,98 Ga). The chimical exchanges between pyrometasomatic fluides and sedimentary units couldn't have been important.

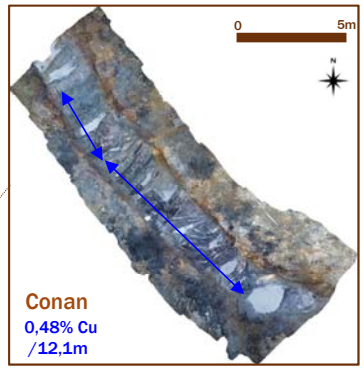


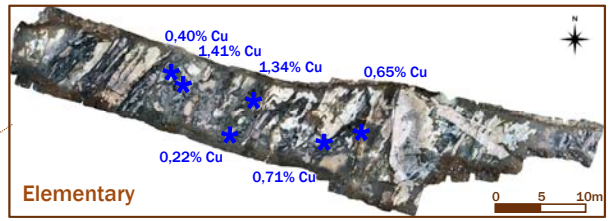
Modified from Rivers 2002

Mitchi : Sedimentary bassin of 75 km^2, extensive mineralized units









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