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Technical Program

SS24: Mineralogy of Plutonic Rocks: From Magmas to Ores. A Tribute in Honour of Andre E. Lalonde

Sponsored by / Parrainé par: **MAC / l'AMC**
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Room / Salle: **Tilley Hall, Room 125**
Date: **Friday, May 23, 2014**
Time: **8:40 AM**
Presenter: **Erin Adlakha**

Tourmaline in the metasedimentary country rocks of the McArthur River uranium deposit, Saskatchewan

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Tourmaline is a common alteration mineral of many hydrothermal deposits and its composition and species reflect the nature of the mineralizing fluids. Therefore, characterization of tourmaline in hydrothermal deposits is important. In the Athabasca Basin, the occurrence of dravite (Mg-rich tourmaline) has been reported as a regional alteration mineral and also in and around uranium deposits. The results of a detailed study of alteration minerals in the McArthur River uranium deposit, the world largest high-grade uranium deposit, reveals three different species of tourmaline. The majority of tourmaline around the McArthur River deposit is magnesiofoitite (alkali-deficient tourmaline), as reported from the Rabbit Lake by Rosenberg and Foit (2006). Magnesiofoitite is paragenetically late as it forms overgrowths on earlier tourmaline of dravite. Dravite likely formed during the regional metamorphism of sedimentary rocks under upper amphibolite facies conditions and associated injection of pegmatite. They form dark brown to black grains in metapelites and pegmatite. In thin section they are light brown to yellow pleochroic euhedral-subhedral, coarse-grains (>0.5 mm), and form wide (1-2 cm) oriented veins and isolated grains surrounded by fine-grained magnesiofoitite, and/or illite. They show little compositional variation among different grains, $[(?_{0.4}Na_{0.6})(?_{0.2}Mg_{1.9}Fe_{0.5}Ca_{0.2}Ti_{0.2})(Al_{5.9}Fe_{0.1})(Si_{5.7}Al_{0.3}O_{18})(BO_3)_3(OH_{3.8}F_{0.2})$; ? = vacancy], although a few grains show Fe-rich cores (high schorl component) and dravitic rims. Dravite contains 1.24 (± 0.09, 1σ) wt% TiO_2, 89 – 280 ppm Zn, 51 - 630 ppm Cr, 190 - 1500 ppm V, and atomic F/Cl ratios range 98 – 11000. Dravite contain high LREE ($[LREE]_N/[HREE]_N$) > 7), and has a positive Eu anomaly.

Paragenetically late tourmaline, magnesiofoitite (alkali-deficient dravite; $[(?_{0.7}K_{0.1}Na_{0.2})(?_{0.4}Fe_{0.1}Mg_{2.0}Al_{0.5})Al_6(Al_{0.1}Si_{5.9}O_{18})(BO_3)_3(F_{0.02}OH_{3.98})]$; ? = vacancy), has a vacancy (0.7-0.86 apfu) in the x-site (alkali site). They are fine-grained (<0.2 mm), and form radial aggregates around earlier dravite, within veinlets (<2 mm) or as matrix. Magnesiofoitite is bluish white in hand specimens and clear in thin section. The distribution of magnesiofoitite and its close spatial association with the U mineralization and ore-bearing basement faults (P2 fault) suggest that it formed from uraniferous fluids. The presence of U (up to 3.7 ppm U) in magnesiofoitite supports this interpretation.

Rosenberg, P.E., & Foit, F.F., Jr., 2006. Magnesiofoitite from the uranium deposits of the Athabasca Basin, Saskatchewan; The Canadian Mineralogist **44**: 959-965.