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Technical Program

SS2: Gold Metallogeny of the North Atlantic borderlands and beyond

Sponsored by / Parrainé par: **Department of Natural Resources, Newfoundland and Labrador**
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Presenter: **Jason B. Duff**

Garnet as a tracers for the mineralization in a banded-iron formation-hosted orogenic gold deposit; Evidence from the Musselwhite deposit, North Caribou greenstone belt, western Superior Province

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Musselwhite, an orogenic Au deposit, is located in the central portion of the North Caribou Greenstone Belt (NCGB). Mineralization is hosted within a meta(chemical) sedimentary banded-iron formation (BIF) which is overlain and underlain by regionally continuous ca. 2.9 Ga amphibolite grade volcanics rocks. The NCGB is bounded by ca. 2.72 – 2.87 Ga TTG-granitiods and granites. Samarium-neodynium geochronology of garnet from the ore zone has been reported to yield a 2.69 Ga age, which post-dates plutonism and volcanism in the NCGB. Recent detrital zircon analysis from the metasedimentary rocks overlying the Au-bearing unit returned $^{207}Pb/^{206}Pb$ peaks at ca. 2.87 and 2.60 Ga. Here, we present recent LA-ICPMS trace element and EPMA major element compositions of garnet from Musselwhite. Samples were collected from auriferous garnet -grunerite schist, footwall and hanging wall schist in the mine, as well from auriferous schist outcrops north of Musselwhite. A sample was also collected from the non-mineralized meta-chemical sedimentary bed that is continuous 24 km from the deposit. Major elements of garnet from mineralized rocks show Mn and Mg rich rims and Ca rich rims. Mineralized samples show positive Eu anomalies in the ore zone in the mine, whereas auriferous rocks outside the mine show less prominent anomalies. Low Eu anomalies occur in the non-mineralized sample (Eu/Eu*= 0.706-2.19). The majority of garnet grains show high HREE concentrations with a mean $(Sm/Lu)_{CN}$ value of 1.6 and low LREE ($\sum$HREE/$\sum$LREE = 41). Rims of garnet from mineralized samples show large variations in Ni/MgO from ~ 0.14 to 15.5, and Y concentrations from ~ 0.89 to 198 ppm. The high Ni and low Mg are recorded in the core of these grains from the ore, whereas their rims show low Ni. Trace element zonation in garnet from the non-mineralized rocks is minor compared these samples. The data suggests that garnet growth was contemporaneous with precipitation of pyrrhotite and chalcopyrite; both sulfides are closely associated with the introduction of Au. Gold-bearing fluid was derived from rocks during metamorphism or extensive alteration of mafic rocks as reflected by variably high Eu/Eu* values and Ca- rich rims in the garnet crystals in the mineralized rocks. The origin of BIF-hosted Au deposits remains enigmatic and the source fluids (magmatic or metamorphic) are still in debate. Results here indicate that garnet effectively records the history of hydrothermal activity associated with Au deposits and the data indicates metamorphic fluid as the principle transporter of Au.