

Doctoral project (PhD) at Université du Québec à Montréal (UQAM)

Start: Summer / fall 2021

Stable strontium ($^{88} / ^{86}\text{Sr}$) isotope systematics in quartz-carbonate veins from orogenic gold deposits in the Val d'Or region, Quebec

Carbonate precipitation and decarbonation reactions are frequently associated with hydrothermal fluids and gold mineralization. The Val-D'Or vein field (Louvicourt to Malartic) in the Abitibi subprovince is a typical example of this association. The vein field and associated orogenic gold deposits in this zone are characterized by the association of gold with sulphide-quartz-carbonate veins (+/- tourmaline and other accessory minerals). The stable isotopes (C, O, H) and the radiogenic isotopes of strontium ($^{87/86}\text{Sr}$) of the different phases in the veins (quartz, carbonate, tourmaline) indicate that gold was deposited due to mixing between hydrothermal (metamorphic) fluids and shallow crustal waters. The metamorphic fluids are the product of the dehydration and decarbonation reactions of the Archean crust. We propose an innovative use of the stable isotopes of strontium ($^{88}/^{86}\text{Sr}$) to constrain the role of carbonation and decarbonation reactions associated with the formation of veins and gold precipitation. The main objective of this study is to build better exploration models and to better understand the origin of gold in orogenic gold deposits. This main objective will be accomplished via the following three objectives:

1. Determine the degree of fractionation of stable isotopes of Sr in carbonates (calcite) in the veins, then determine whether the fractionation varies with the contribution of metamorphic fluids in the veins.
2. Determine whether the $^{88}/^{86}\text{Sr}$ ratios vary with other indices of hydrothermal composition of fluids (O, C, radiogenic Sr) due to a similar fractionation process or due to mixing of the fluids.
3. Use the data obtained from the previous objectives to construct a hydrothermal circulation model for the Val-d'Or gold vein field. Apply the new hydrothermal model to other regions of Abitibi and Quebec.

The project will be led by Profs Stevenson (UQAM) and Beaudoin (Laval) in collaboration with the ministère de l'Énergie et des Ressources naturelles du Québec (MERN) and funded by FRQNT (programme de recherche en partenariat sur le développement durable du secteur minier). **The successful candidate will receive an annual scholarship of \$ 25,000 per year for 3 years.**

For more information, please contact Ross Stevenson (stevenson.ross@uqam.ca)