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OCGC Seminar
11:30 am September 28, 2023
Room: 3120 Herzberg Building
Coffee will be available from 11:00

The monitoring of mechanisms that control gold precipitation from auriferous orogenic fluids using multiple sulfur isotopes

Dr. Crystal Laflamme, Université Laval

Zoom Meeting ID: 995 7207 9915
Passcode: 195344

https://carleton-ca.zoom.us/j/99572079915?pwd=SmxpL1UvQlRWSy9KOGdyOW1tVWlydz09

Abstract

The specific mechanism by which a hydrothermal fluid precipitates gold in typical orogenic sulfide-bearing quartz-carbonate shear veins remains elusive. However, due to the small geochemical footprint of orogenic gold mineralisation, understanding the specific mechanism responsible for gold precipitation is critical for targeting concealed high-grade veins, especially as exploration moves undercover. Reduced, near-neutral fluids, characteristic of orogenic gold, commonly ascend along deep structural corridors located in the middle crust (~7-15 km), and transport gold as $Au(HS)_2^-$. As a result, the precipitation of gold from hydrothermal fluids is best interpreted as the product of the evolving fluid SO_4^{2-}/H_2S ratio (fO_2) and/or H_2S concentration (fS_2), each a function of multiple competing processes that destabilize the $Au(HS)_2^-$ complex, such as fluid mixing, fluid-wall rock reaction, and/or phase separation. Recent developments in analytical techniques, including the measurements of sulfur isotopes by LA-ICP-TQ-MS in our lab, allow for $\delta^{34}S$ to be measured through a sulfide-paragenetic sequence thus deciphering evolving fluid physico-chemistry that lead to the destabilization of reduced Au-complexes.

In this talk, I will demonstrate new applications of in-situ multiple sulfur isotopes ($\delta^{34}S$-$\Delta^{33}S$) combined with trace element composition through gold-bearing sulfide parageneses, with examples from orogenic gold deposits hosted in the Neoarchean greenstone belts of the Abitibi subprovince, Canada, and Eastern Goldfields, Australia. By understanding differences controlling gold precipitation mechanisms, we can better explore in the near-mine space. For instance, at the Kanowna Belle deposit, multiple sulfur isotopes and trace element composition

of sulfides indicates that fault structures not only act as conduits for auriferous fluids, but also as drivers for gold precipitation, regardless of the host-rock chemical composition. This understanding opens up the search space to the upper Fe-poor lithologies of the host greenstone sequence. I will show in our most recent work, how we are working to develop sulfur isotope vectors to high-grade mineralisation in the Meliadine gold district, Nunavut.

Speaker Bio

Dr. Crystal LaFlamme is an Associate Professor and holder of the Canada Research Chair II in Sulfur isotope geochemistry at Université Laval. Her research program focuses the development of geochemical tracers and their application to tectonic processes and mineral systems, especially in Precambrian terrains. To do so, with a research team, she's developed a LA-ICP-TQ-MS lab focused on the development of in situ sulfur isotope measurements in sulfides.

For further information, and to arrange to meet the speaker, please contact Lyle Nelson (Lyle.Nelson@carleton.ca)