MINERALS SOUTH 2023

SHORT COURSE

November 7th, 2023

Heritage Inn & Convention Center. Cranbrook, BC

Geological footprint of metasomatic iron-rich and alkali-calcic mineral systems as a guide for exploring IOCG and affiliated critical and precious metal deposits

Organizer: Louise Corriveau, Geological Survey of Canada, Natural Resources Canada

Presenters: Louise Corriveau, Jean-François Montreuil, and Nicolas Piette-Lauzière

Description

Metasomatic iron and alkali-calcic (MIAC) mineral systems encapsulate a wide range of iron-rich to iron-poor deposit types such as iron oxide-apatite (IOA), iron oxide-copper-gold (IOCG), albitite-hosted U or Au, Fe and W skarn, and five-element veins. Minerals deposits formed in MIAC systems commonly contain primary critical mineral commodities, with resources in Bi, Co, Cu, F, Mo, Nb, Ni, PGE, REE (both HREE and LREE), U, W and Zn, as well as resources in Ag, Au, Fe, P, Pb, Re, and by-product potential for Al, In, Sb, Sn, Ta, and Te.

The short course will highlight the geological footprints of MIAC systems and the linkages among their alteration facies and mineralization types to facilitate the identification of exploration targets and the optimization of exploration strategies to reexamine the Canadian regions with MIAC-related mineralization types such as the Iron Range in BC. Case studies from Canada and global mining districts will illustrate the pervasive changes in mineral assemblages, bulk rock composition, textures, and physical properties undergone by pre-existing host rocks as metasomatic fluid-rock reactions progress across the upper crust through the flux of high-volume, high-temperature (peaking ~900°C), hypersaline fluid plumes ponded in mid crust. As physicochemical conditions of the plume evolve toward surface, highly distinct alteration facies couple and decouple co-precipitating metals into a predictable series of mineralization types that can be rich in iron oxides (e.g., IOCG and IOA deposits), iron silicates (e.g. W skarn, Fe-Co-Au or Fe-Ni), iron sulfides (e.g. iron sulphide-copper-gold) and iron carbonates or poor in iron. The wealth of critical and precious metal deposit types formed will be defined and classified.

Deposits are known to cluster into mining districts within the observed regional footprints of MIAC systems while the districts form extensive metallogenic belts along major crustal discontinuities (e.g. fault zones) at the margins of thick continental lithospheres. At the scale of a mining property or a deposit, the spatial association between different mineralization types relates to: 1) the formation of distinct mineralization types as distinct alteration facies form, 2) the imbrication of distinct mineralized zones through faulting and 3) the addition of mineralization through overprinting and remobilization. Finding a suite of diagnostic alteration facies in a region implies that a system may occur and mapping the alteration facies helps to predict possible mineralization types. In those alteration zones typical of MIAC systems, finding a deposit or prospect implies that other comparable or different deposit types may occur within the region. Documenting a MIAC system in one part of a geological province implies that other may occur in the same province to form a metallogenic belt. The short course will review how MIAC systems form, what are the relations between alteration facies and mineralization, what are the deposit types possible in MIAC systems and how to use alteration facies as vectors to mineralization.