Alteration facies within iron oxide alkali-altered systems of the Great Bear magmatic zone, Canada: Linkages amongst albitite-hosted uranium, IOCG, and IOA deposits

L. CORRIVEAU[1], J.-F. MONTREUIL[2] AND E. G. POTTER[3]

[1]Natural Resources Canada, 490 rue de la Couronne, Québec, QC, Canada, G1K 9A9 (*correspondence: Louise.Corriveau@RNCan-NRCan.gc.ca)

[2]Institut National de la Recherche Scientifique – Eau-Terre-Environnement, 490 rue de la Couronne, Québec, QC, Canada, G1K 9A9 (montreuil.jean.francois@gmail.com)

[3]Natural Resources Canada, 601 Booth St., Ottawa, ON, K1A 0E8 (Eric.Potter@NRCan-RNCan.gc.ca)

The uranium and non-uranium-bearing polymetallic hydrothermal iron oxide and alkali-alteration (IOAA) systems of the Great Bear magmatic zone (GBMZ) are ideal natural laboratories to document this complex family of deposits. These systems have escaped orogenic metamorphism and their unweathered, glacially polished, nearly continuous outcrops expose in structural 3D the evolution of alteration facies that account for penecontemporaneous continua amongst iron oxide–apatite (IOA), high technology metal iron oxide, magnetite- to hematite-group iron oxide copper–gold (IOCG) and albitite-hosted uranium deposits. As fluid and host environment temperatures decline from the roots of the systems to preserved epithermal caps or laterally away from heat sources, the alteration facies prograde from: 1) sodic, 2) high-temperature calcic–iron, 3) high-temperature potassic–iron, 4) potassic felsite breccia or potassic skarns, and 5) lower temperature hydrolitic potassic–iron alteration. Each alteration facies exhibit systemic geochemical signatures and metal associations that have been documented within 36 IOAA systems of the GBMZ. The prograde sequence and diverse permutations of alteration facies associated with transition, juxtaposition, superimposition, telescoping, retrogression and cyclical build-up of alteration provide vectors toward the extraordinary range of deposits formed in IOAA systems. Through observations in the field, core logging or geochemical analyses, inferences can be drawn about the nature of incoming and outgoing fluids/metals for each alteration facies observed to prognosticate potential mineralization and system-wide components that remain to be discovered at district to deposit scales. To facilitate this, IOAA alteration facies terminology and typology have been refined and a new alteration index based on whole-rock geochemistry developed.