Geochemical fingerprint of the orogenic gold mineralization in the Cadillac-Larder Lake Fault Zone, Abitibi, Canada

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Numerous orogenic gold deposits in the Archean Abitibi greenstone belt are distributed along the Cadillac-Larder Lake Fault Zone (CLLFZ), Canada. These deposits display characteristic host rocks, mineralization styles, sulfide abundance, and hydrothermal alteration. However, the geochemical fingerprint for these deposits remains cryptic. Major and trace element composition of ore-bearing rocks from eight orogenic gold deposits in CLLFZ were systematically analyzed. These data were used to unravel the relationship among elements, as well as the host rock, alteration, and mineralization by principal component analysis (PCA) that clearly oppose lithophile and hydrothermal ore elements. The coupled behavior between Re and Au indicates that Re-Os dating of auriferous pyrite can be used to constrain the age of gold mineralization. The peculiar close association of Pt, Hg, Mo, Re, and Au implies that platinum-group elements may have been remobilized from mafic rocks or magmatic sulfides during metamorphic/hydrothermal activity. Major and trace element compositions of ores are efficient in characterizing the elemental/mineral assemblages and unraveling the relationship among gold mineralization, host rock types, and hydrothermal alteration. Distinct alteration assemblages, sodic, potassic, silicic, and carbonate alteration are identified and can be used to discriminate different deposits. The main factors controlling the formation of gold deposits include host rocks, alteration, and ore fluids (metal associations) that are recorded by ore geochemistry. These factors constitute the main discriminators for classifying the different orogenic gold deposits. A revised depositional model for orogenic gold deposits in Abibiti is proposed where alteration zonation with the depth is emphasized.