Hypozonal Orogenic Gold Mineralization Explained by Metamorphic Devolatilization of Komatiites

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The widely accepted metamorphic devolatilization model, or supracrustal metamorphic model, for orogenic gold deposits emphasizes that gold and auriferous fluid are originated from metamorphic devolatilization of pelites or altered basaltic rocks when crossing the greenschist-amphibolite facies boundary. However, this model is thought to be invalid when applied to hypozonal deposits that are hosted in amphibolite facies terranes in greenstone belts. Except for metasedimentary and metabasaltic rocks, komatiites are important components in Precambrian greenstone belts and have potential to release metamorphic fluid during metamorphism. In this study, we simulated the devolatilization processes of gold- and sulfur-bearing komatiite to evaluate its feasibility as the source for ore-forming fluids of hypozonal gold deposits.

The situation results of komatiite show that there are two pulses of fluid and gold liberation. First, ~4 wt % of water and ~1 to 1.4 ppb of Au (relative to rock mass) can be released when crossing the greenschist-amphibolite boundary at ~550°C due to breakdown of antigorite. After entering amphibolite facies, a sharp rise in gold liberation occurs at ~700°C as a response to dehydration of talc and chlorite, which liberates ~0.5 wt % of water and ~2 to 5.5 ppb of Au. Although the second step of devolatilization releases less water than the first, more gold can be scavenged because of the higher solubility of gold in high-temperature metamorphic fluids. This simulation result indicates that devolatilization of komatiite at amphibolite facies may account for the formation of hypozonal gold deposits in greenstone belts.