Abstract

The bimodal greenstone volcanism within the Hutti-Maski- and the South Kolar Greenstone Belt (HMGB and SKGB), in the eastern Dharwar Craton occurred at ~2.67–2.66 Ga. Both the greenstone belts witnessed lower to middle amphibolite grade metamorphism with clockwise P-T evolutionary paths at ~2.56–2.55 Ga. The prograde increase in pressure and temperature in both the belts indicates a subduction setting. The HMGB rocks record near-isothermal decompression-assisted retrograde metamorphism as a consequence of ~2.55 syn-tectonic plutonism, which dragged the greenstone cover to shallow crustal levels. The decompressional cooling during retrogression in the SKGB is indicative of the waning phase of metamorphism in the accretionary setting. The P-T evolutionary paths indicate convergent setting for the HMGB and SKGB.

Fluid focusing along steep transcrustal shear zones during retrograde metamorphism led to hydrothermal alteration and gold mineralization. Tourmaline, scheelite, fluorapatite and calcite from altered wall rocks and gold-quartz veins from the Hutti and Hira-Buddini deposits were analyzed for major and trace element contents to constrain fluid composition/source and to understand the hydrothermal processes. Tourmaline compositions suggest heterogeneous fluid composition/source for gold mineralization in the HMGB. Low salinity, reduced, trace element poor metamorphogenic fluid was responsible for two-stage gold mineralization at Hutti. Such a fluid was most likely derived during metamorphic devolatilization of lower greenstone pile. On the contrary, high salinity oxidized REE enriched fluid of magmatic origin, with a possible derivation from syn-tectonic TTG plutons, was responsible for gold mineralization at Hira-Buddini. Textural and compositional evidence suggest asynchronous precipitation of scheelite, fluorapatite and calcite in the stage-2 mineralization at Hutti, indicating precipitation from cyclic fluid flow. These observations are consistent with the preservation of sharp oscillatory Co and As zoning in pyrite and arsenopyrite, which suggests fluctuating fluid salinity and f_{S_2}/f_{As_2} ratio, respectively. Most likely such fluctuations resulted due to phase separations by fault-valve actions. Trace element compositions in pyrite and arsenopyrite from Hutti and Hira-Buddini indicate decoupled Au-As relation, unlike what is observed in sediment hosted gold deposits. Rather, gold displayed coupled behavior with the chalcophile elements (Ag, Pb, Bi, Te).

Key words: Greenstone metamorphism, monazite dating, tourmaline, scheelite, sulfides, orogenic gold, Eastern Dharwar Craton