Granitic magmatism and late-stage fluid activity vis-à-vis gold mineralization in schist belts in parts of the Eastern Dharwar Craton, India

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ABSTRACT OF THE Ph.D. THESIS

The late Archean granitic magmatism in parts of the Eastern Dharwar Craton (EDC) (South India) is scrutinized in terms its implications towards lode gold mineralization. For this, detailed investigations were carried out on the physicochemical parameters of magma emplacement and associated fluid activity. The Closepet granite along with other allied units exposed in close proximity to Ramagiri-Penakacherla gold camps were chosen. Geothermobarometry from mineral compositions imply granitoid emplacement under mid-crustal (~19 to 14 km) conditions. The spatial variations in estimated parameters are in disagreement with the earlier deciphered tilt of the crust in EDC. The biotite chemistry indicates its crystallization under high oxygen fugacity conditions (mostly above QFM buffer) with variable halogen fugacity ratio of the evolving fluid. Additionally, detailed fluid inclusion studies were carried out on granitoids (and associated veins/pegmatites) and greenstone-hosted auriferous lodes of Ramagiri-Penakacherla schist belt (RPSB). The variably saline H_2O-NaCl±CO_2 fluids of magmatic derivation are totally devoid of methane as against its variable enrichment in the ore fluid. In RPSB, heterogeneous nature of the H_2O-NaCl±CO_2±CH_4 ore fluid precludes a single-source origin for the volatiles. In view of the comparable depths of fluid activity in the granitic and auriferous schistose domains as evident from fluid inclusion barometry, the Cl-rich H_2O±CO_2 component of the ore fluid can be visualized as being magmatically derived. Even, results of crush-leach analysis of inclusion fluids do not show any perceptible difference in the bulk composition of fluids in the granitic and ore domains. The oxygen isotope composition of the ore fluid at Ramagiri (8.3±1.9 ‰) and Penakacherla (5.0±0.7 ‰) is slightly enriched as against the late-stage magmatic fluid (4.7±0.9 ‰). A concurrent variation in the $^{18}O/^{16}O$ and CO_2/CH_4 ratio of the fluid among the ore zones of Ramagiri and Penakacherla and granitic domain is observed. The 'H_2O-NaCl±CO_2' –dominated fluid exsolving out of crystallizing granitoids is visualized as the ore fluid that effectively scavenged and transported gold under the estimated P-T-fO_2 and favorable halogen fugacity conditions. Thus, the channelization of this fluid through the shear zone(s) under fluctuating fluid pressure conditions and accompanied with fluid-rock interaction processes elucidate a causal relationship between the granitoids and gold mineralization.