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Ore fluid characteristics at Gadag Gold Field, Dharwar Craton, southern India: Evidences from tourmaline chemistry and fluid inclusion study

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Dharwar Craton in southern India hosts several gold bearing greenstone belts including the well-known Kolar and Hutti. Among them, the Gadag greenstone belt in the western part of Dharwar Craton contains many potential gold mines. It has three different lode systems named western, central and eastern lodes. These lodes are spatially distributed as linear groups along the shear zone with distinct lithological assemblages. Tourmaline is one of the most common hydrothermal minerals present in the alteration zones apart from chlorite, muscovite and sericite. These tourmalines show two textural association (i) occur as isolated, euhedral grains along the mylonitic foliation defined by chlorite, muscovite, sericite, quartz and carbonates (ii) occurrences of anhedral bizarre shaped tourmaline grains along with carbonate and quartz. Though texturally different, compositionally both the tourmalines are similar. They are dravite in nature with high Al_{tot} (6.02 to 6.56 apfu), low Na (0.42 to 0.88 apfu) and medium X-vacancies (0.08 to 0.57 apfu). The predominance of Fe^{2+} (high Fe^{2+}/Fe^{3+}) and low Na in the tourmaline crystal structure indicates low saline, reduced ore fluid of metamorphic origin that is responsible for gold mineralization in Gadag.

Microthermometric study of aqueous, carbonic and aqueous-carbonic inclusions from the auriferous lodes at Gadag reveal low to medium saline (0.04 to 9.59 NaCl equiv.) H_2O-NaCl-CO_2±CH_4 ore forming fluid. Presence of trace amount of methane content within the carbonic inclusion indicates mineralization occurred at reducing environment. Thus, fluid inclusion results consistent with the tourmaline chemistry and strongly supports the metamorphic origin of ore fluids that responsible for gold mineralization at Gadag.