

Mantle/magma derived auriferous CO₂ rich fluids for Archaean orogenic gold deposit of G.R.Halli, Dharwar Craton, Southern India

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The Archaean orogenic gold deposit, at Guddarangavanahalli (G.R.Halli), Chitrdurga greenstone belt, Dharwar craton, India is within a well-defined 30 km long NNE-SSW to N-S trending shear corridor in the metavolcanic rocks [1]. This is a zone of high strain and extensive carbonation. Gold is usually associated with a variety of sulfide minerals in quartz-ankerite veins (QAVs).

The average $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values of the host auriferous QAVs are -6.2‰ (± 1.9) and 14.1‰ , (± 0.5) respectively. The average $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values of the fluid (i.e. $\delta^{13}\text{C}_{\text{CO}_2}$ and $\delta^{18}\text{O}_{\text{H}_2\text{O}}$) are -4.64‰ (± 0.7) and 6.50 (± 0.6) respectively. The carbonate and fluid isotopic data are consistent not only with many orogenic gold deposits of the world [2] but also similar to those reported for mantle/ magma derived fluids [3].

The $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values carbonates in host metabasalt is -1.3 and 14.57‰ respectively. Since dissolution or decarbonation reaction produces CO₂ with similar or enriched $\delta^{13}\text{C}$ values than the precursor carbonates, the carbonate or fluid $\delta^{13}\text{C}$ values of the QAVs cannot be produced by metamorphic devolatilisation model as proposed for many orogenic gold deposits [4]. We therefore consider that the carbonates $\delta^{13}\text{C}$ values of the auriferous QAVs may be due to granitic magmatism or direct mantle derivation as the G.R. Halli gold deposit is spatially associated with crustal scale shear zones [10].

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Fingerprinting of kimberlite sources by isotope studies of accessory minerals: A mantle tracer

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Interest in determining the radiogenic isotope and trace element geochemical characteristics of uncontaminated kimberlitic magma has been rekindled by recent studies of accessory groundmass minerals e.g. perovskites, which are strongly resistant to isotope modification [1]. *In situ* Sr, Nd, and Hf isotope data along with U-Pb geochronology on perovskites have been preferred over bulk rock studies and they have been interpreted as the primary geochemical signature of kimberlite magma [2, 3]. In this study we have analysed several individual groundmass perovskites from different litho-facies of Group I kimberlites of Orapa, Botswana to investigate the trace element and isotope characteristics of the source material and how they vary among different lithofacies. Both *in situ* (LA-MC-ICPMS) and solution (MC-ICPMS) analyses have uniform Nd isotopic composition with an average $^{143}\text{Nd}/^{144}\text{Nd}$ ratio of 0.512742 ± 34 . But the initial results show that the $^{87}\text{Sr}/^{86}\text{Sr}$ ratios of individual grains are heterogeneous and vary from $0.703590 - 0.705407 \pm 22$. Samples with more radiogenic Sr also correlate with HREE enrichment. In a ϵNd vs ϵSr diagram all samples plot within the Group I kimberlite field, defined by whole rock analyses, and they are interpreted to be derived from a primitive mantle source. Though the uniformity of the data from perovskites compared to the bulk rock analysis emphasises their reliability over bulk rock geochemistry, some of the variation in Sr isotopes might be a result of post emplacement hydrothermal alteration, which is not always visually recognised. It may be that the perovskites are not as resistant to isotope modification as previously thought and, therefore, more care should be taken while interpreting the geochemical data from perovskites.

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