Stable Isotope Data Evidence for a Mantle/Magma Origin of Chabyte Dyke and Auriferous Fluids, Archaean Orogenic Gold Deposit of G.R.Halli, Dharwar Craton, Southern India

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The Archaean orogenic gold deposit, at Guddadarangavvanahalli(G.R.Halli), Chitrdurga greenstone belt, Dhrawar craton, is located 7Km North of Chitradurga town, Karnataka state, India. The deposit is within a well defined 30 km long NNW-SSE trending shear corridor in the metavolcanics [1]. This is a zone of high strain and extensive carbonitisation. Gold is usually associated with a variety of sulfide minerals in quartz-ankerite veins (QAVs). A N20°W to N55°W trending carbonate dyke occurs to the immediate south of G.R.Halli gold deposit which has been referred to as chalbyte dyke by Sampat Iyengar (1905). Mineralisation comprises disseminations, stringers and fracture fillings in pyrite, arsenopyrite ± galena± sphalerite ± chalcopyrite in whitish to smoky grey, sheared quartz and minor carbonate [1].

In the present study, $\delta^{13}C$ and $\delta^{18}O$ data were obtained for QAVs along with carbonates occurring in carbonation zones, metabasalts and chalbyte dyke to constrain the source of auriferous fluids. The average $\delta^{13}C$ and $\delta^{18}O$ values of the host auriferous QAVs are -6.2‰ (±1.9) and 14.1‰, (±0.5) respectively and are consistent with the $\delta^{13}C$ and $\delta^{18}O$ data range of orogenic gold deposits world over [2]. The average $\delta^{13}C$ and $\delta^{18}O$ values of carbonates from carbonation zones are -1.8‰ (± 0.3) and 14.1‰ (± 0.6). The average $\delta^{13}C$ and $\delta^{18}O$ values of chalbyte dyke are -5.3‰ (± 0.07) and 14.1‰ (±0.6). The $\delta^{13}C$ and $\delta^{18}O$ value of carbonated metabasalt are -1.3 and 14.57‰ respectively. These indicates that the isotopic data of auriferous QAVs are comparable to those of chalbyte dyke rather than carbonated metabalts or zone of extensive carbonation. This indicates that the fluids responsible for auriferous QAVs and extensive carbonation in the shear corridor are not from same source. The isotopic values of carbonates from this zone is comparable with those of metabalsalts hence these can be a remobilization products of carbonates in metabasalts. Metabalsalts can also not be the source of the auriferous QAVs or chalbyte dyke as dissolution or decarbonation reaction during metamorphism produces CO_2 with similar or enriched $\delta^{13}C$ values than the precursor carbonates [3].

The $\delta^{13}C$ values of QAVs and Chalbyte dykes are consistent with those of magma [3] or mantle [4] derived fluids. The $\delta^{18}O$ vales are heavier than magma/mantle derived carbonates which could be due to low temperature alteration phenomena as generally observed in case of many igneous carbonatites [5]. We therefore suggest that the carbonates $\delta^{13}C$ values of the auriferous QAVs and

chalbyte dyke may be due to magmatism or direct mantle due to their spatial association with crustal scale shear zones [6].

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