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Isotope (C-O-S) and geochemical evidence of Juvenile origin for the Neoarchaean Orogenic gold deposits at Ajjanahalli and Gadag Gold Field, Chitradurga Schist Belt, Dharwar Craton, India

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One of the prolonged debated research topic with respect to the orogenic gold mineralization is the source of the auriferous fluids for such deposits; whether metamorphic or any other [1]. We present new $\delta^{13}C_{PDB}$ and $\delta^{18}O_{SMOW}$ values for 108 gold bearing carbonates samples from the auriferous quartz-carbonate veins (QCVs) of Ajjanahalli and Central Lode System, Gold Fields of the Neoarchaean Dharwar craton of southern India. We also present $\delta^{34}S_{CDT}$ for 21 auriferous sulphide samples from these deposits. We supplement the isotopic investigations with REE data for auriferous QCVs. On the basis of these we interpret the origin of mineralising fluids for these deposits.

The $\delta^{13}C$ and $\delta^{18}O$ values of the auriferous QCVs of Ajjanahalli range between -2.09 to -8.59‰ (average: -4.5±1.5‰) and 11.27 to 26.12‰ (average: 15.69±4.12‰) respectively. The calculated isotope composition of the possible original fluid i.e. $\delta^{13}C_{\sum c}$ and $\delta^{18}O_{H2O}$ range between -2.97‰ to -9.45‰ (average: -5.2 ±1.4‰) and 6.46 to 20.58‰ (average: 7.8 ± 0.95‰) respectively. Pyrite $\delta^{34}S_{py}$ of Ajjanahalli and GGF are in the range of -0.21 to 5.8‰ (average: 3.08 ± 1.82‰) and 0.93 and 3.36‰ (average: 1.98 ± 0.82‰) respectively. The arsenopyrite $\delta^{34}S_{asp}$ values range from 1.09‰ to 3.8‰ (average: 2.95± 1.08‰) for Ajjanahalli and 2.84‰ for the Gadag. The calculated isotope composition of the fluid i.e. $\delta^{34}S_{H2S}$ (calculated from $\delta^{34}S_{CDT}$ values) for Ajjanahalli gold deposit range from -0.03 to 4.6‰ (average of 1.89 ± 1.82‰) and -0.17 to 2.11‰ (average: 0.88 ±0.82%) for the GGF.

All the $\delta^{34}S$, $\delta^{13}C$, $\delta^{13}C_{\sum c}$ values and majority of the $\delta^{18}O_{H2O}$ of the QCVs are consistent with those of mantle/juvenile magmatogenic fluids ($\delta^{13}C$ -6±2‰; $\delta^{34}S$0±2%; $\delta^{18}O$; 8±2‰; [2]). In addition, Chondrite normalised REE patterns for QCVs of both Ajjanahalli and Gadag gold deposits show +ve Eu anomalies characteristic of hydrothermal fluids of mantle origin

On the basis of these new data, we conclude mantle/juvenile magmatic source for the mineralising fluids of these two Neoarchaean orogenic gold deposits of India.

[1]Goldfarb and Groves 2015, Lithos 233, 2–26 [2] Ohmoto, 1986 Rev Mineral Soc of Am 16, 491-560.

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