

Low oxygen fugacity mantle derived auriferous fluids for Archaean Orogenic Gold deposit of Ajjanahalli, Chitradurga Schist belt, Dharwar Craton, India

S. SARANGI^{1*}, A. SARKAR², V. BALARAM³
AND R. SRINIVASAN³

¹Department of Applied Geology, ISM-Dhanbad, India
(ssarangi2@Rediffmail.com)

²Dept of Geology and Geophysics, IIT-Kharagpur, India

³National Geophysical Research Institute, Hyderabad

The BIF hosted Ajjanahalli gold deposit of Chitradurga Schist Belt, Dharwar Craton, India has been grouped under Orogenic type of gold deposit in an Archaean set up [1]. Recently magma/mantle origin has been proposed [2] for the source of CO₂ rich auriferous fluids based on $\delta^{13}\text{C}$ values of carbonates ($-5.1 \pm 1.4\%$) and the fluid ($-5.81 \pm 1.14\%$). We present here the REE compositions of same carbonates from the auriferous quartz-carbonate veins (QCVs) and compare them with our previous obtained isotope data to understand the source of the mineralising fluid.

Both the chondrite and PAAS normalized REE plots of the carbonates of QCVs shows distinct positive Eu anomaly. As positive Eu anomaly is seen under low oxygen fugacity condition of fluids [3], we propose that the auriferous fluids responsible for gold mineralisation at Ajjanahalli could be from a oxygen depleted source. The $\delta^{13}\text{C}$ values of carbonates of these carbonates have also indicated a mantle or a felsic magmatic source of auriferous fluids [2]. Though felsic magma source has also been believed for the ultimate source of auriferous fluids [4], positive Eu anomaly of QCVs goes against such a possibility as granitic magma generated hydrothermal fluids could have shown a negative Eu anomaly. We therefore suggest that auriferous fluids could be from a mantle reservoir under a low oxygen fugacity condition.

Since the Orogenic gold deposit at Ajjanahalli deposit is spatially located on a crustal scale shear zone [1] possibility of a mantle derived auriferous fluids cannot be ruled out.

[1] Kolb *et al.* (2004) *Econ. Geol.* **99**, 743–759. [2] Sarangi *et al.* (2009) *GCA*.73, A1158. [3] Drake *et al.* (1975) *GCA*.39, 689–712. [4] Ridley & Diamond (2000) *Soc Econ Geol Rev.* **13**, 141–162.

Oxygen isotopes in perovskites from kimberlites

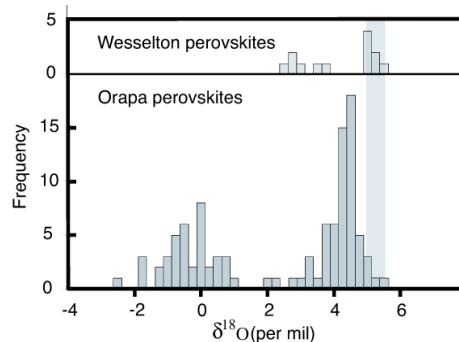
CHIRANJEEB SARKAR^{1*}, C.D. STOREY²,
C.J. HAWKESWORTH³ AND R.S.J. SPARKS¹

¹Department of Earth Sciences, University of Bristol, Bristol, BS8 1RJ, UK (*correspondence: C.Sarkar@bristol.ac.uk)

²School of Earth & Environmental Sciences, University of Portsmouth, Portsmouth, PO1 3QL, UK

³University of St Andrews, Scotland, KY16 9AJ, UK

Isotopic data (Sr, Nd and Hf) obtained from groundmass perovskites (CaTiO₃) within kimberlites have been shown to more accurately reflect the unaltered signature, which has besieged whole rock studies. However, recent studies have questioned their suitability to represent primary kimberlite magma. *In situ* trace elements along with Sr and stable O isotope data have been employed to assess the effects of contamination on perovskites from Orapa and Wesselton kimberlite. Crustal contamination had a minimal role as the samples have an extended range in La/Yb and Sr/Yb rather than scatter around low values. Moreover, lack of any perovskites with elevated $\delta^{18}\text{O}$ also suggests minimal interaction with upper crustal material.



The $\delta^{18}\text{O}$ values from Orapa perovskites show two distinct peaks (around $+3.6\%$ and -0.6%). Wesselton perovskites in contrast are clustered around $\delta^{18}\text{O}$ values of $+4\%$. Perovskite in equilibrium with the mantle has lower $\delta^{18}\text{O}$ than other common upper mantle minerals. One group of Orapa perovskites and the Wesselton perovskites are interpreted to reflect the $\delta^{18}\text{O}$ of uncontaminated upper mantle derived kimberlite magma (4.2%). The negative $\delta^{18}\text{O}$ values from the second group of Orapa perovskites are attributed to crystallisation of perovskite after magma degassing, rather than to crustal assimilation, magma mixing, cooling or hydrothermal alteration. The Wesselton sills, however, did not suffer significant degassing, at least to the extent to deplete the magma in ^{18}O .