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Combined noble gas, fluid inclusion and clumped isotope analysis of carbonatites from Sevattur and Samalpatti, South India

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Studies of isotope systematics of noble gases in carbonatites mostly agree upon their mantle origin, varying from deep mantle to enriched lithospheric mantle to sub-continental lithospheric mantle source. Occasionally, a recycled crustal component in the source of carbonatites has been advocated, for example at Amba Dongar [1]. For south India carbonatites, coupled Ne–Ar isotope analyses indicate mixing of an enriched lithospheric mantle with a subducted air-like component incorporated into the deep mantle via Neoarchaean subduction [2]. Incorporation of recycled carbon and/or contamination with regional crust can also be revealed using stable C–O isotope compositions.

We combined isotope analysis of noble gases (He–Ne–Ar) and H–C–O, in tandem with microthermometry and Raman analysis of fluid inclusion assemblages (FIA) and clumped isotope measurements (δ_{47}), to unravel the formation, evolution, potential contamination with ambient crustal materials and post-emplacement history of the Neoproterozoic Sevattur–Samalpatti carbonatite twinned complex in S India.

Sevattur carbonatites have He isotope systematics almost indistinguishable from the average crust (~0.2% mantle component) whereas ~3% mantle component is indicated for Samalpatti. Likewise, Ne isotope compositions in Samalpatti carbonatites show a prominent mantle value falling almost exactly on the air–Reunion hot-spot mixing trajectory whilst a pure crustal signal is revealed for Sevattur. Combined with other lines of evidence, we suggest that crustal contamination evidenced by noble gases is the result of a shallow-level hydrothermal imprint rather than the indication of a mantle advection process involving the remelting of a subducted slab or contamination during the ascent of the carbonatite magma.

[1] Hopp & Viladkar (2018) EPSL 492, 186-196. [2] Murty et al. (2007) J Asian Earth Sci 30, 154-169.

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