Stable Cr isotope systematics in carbonatites from S India

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Stable Cr isotope variations in the mantle and mantle-derived melts are constrained at $\delta^{53}Cr$ broadly between −0.2 and 0‰, attesting to large-scale homogeneity of Earth's mantle [1], with small mineralogy-based variations and secondary alteration capable to shift $\delta^{53}Cr$ toward higher values [2]. Because Cr does not partition into carbonate and resides in silicate fraction, low Cr contents in carbonatites could preclude possible identification of ultimate mantle sources of carbonatites. Our preliminary data for carbonatites and unusual Cr-rich silicocarbonatites from S India show significant $\delta^{53}Cr_{NIST\ 979}$ variations (−0.25 to +1.28‰), extending beyond the mantle range. Calc-silicate marble has the highest $\delta^{53}Cr$ value, perhaps related to metamorphic effects [also noted by 2]. While $\delta^{53}Cr$ does not correlate with CaO, a broadly negative correlation with MgO in carbonatites may indicate a predominant mantle component in low-$\delta^{53}Cr$ samples. The trend towards high $\delta^{53}Cr$ values for Samalpatti carbonatites may suggest post-emplacement modifications or mixing with surface crustal materials which show prevalently heavy Cr isotope signature [3].

Two associated pyroxenites from Sevattur and Samalpatti carbonatite bodies show an identical $\delta^{53}Cr$ value of ~0.85‰, which is, however, outside of currently accepted mantle value. Whether this may hinge on inter-mineral Cr isotope fractionation, remains to be investigated but clinopyroxene in mantle xenoliths does not carry heavy Cr isotope signature [4].

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[1] Schoenberg et al. (2008) ChG 249, 294-306. [2] Farkaš et al. (2013) GCA 123, 74-92. [3] Gilleaudeau et al. (2016) Geochem Persp Lett 2, 178-187. [4] Xia et al. (2017) EPSL 464, 103-115.