Calcium isotope composition of carbonatites – a case study of Sevattur and Samalpatti, S India

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Calcium isotope compositions are presented for two suites of carbonatites and associated alkaline silicate rocks from Neoproterozoic Sevattur and Samalpatti complexes in Tamil Nadu, South India. Despite their geographic proximity, the mean $\delta^{44/40}$Ca values are different for Sevattur ($\delta^{44/40}$Ca = 0.69 ± 0.10‰, n = 7) and Samalpatti (0.81 ± 0.16‰, n = 5). The former suite is derived from an enriched mantle source without significant post-emplacement modifications [1] and its Ca isotope composition falls to the lower end of Ca isotope range reported for mantle-derived rocks [2]. Some carbonatites from Samalpatti show a ^{44}Ca-enriched signature which could reflect large-scale low-temperature modification, recognized also by their ^{13}C–^{18}O-enriched isotope systematics and sizeable loss of REE, when compared to pristine carbonatites from the area [1]. This is also consistent with albite–epidote metasomatic sample and shistose pyroxenite from Samalpatti, both showing a ^{44}Ca-depleted signature. Leaching experiments confirm a systematic $\delta^{44/40}$Ca offset with isotopically light carbonate relative to bulk sample [also 3]. Pyroxenites from Samalpatti are isotopically heavier than accompanying unmodified carbonatites and their $\delta^{44/40}$Ca values fall into the mantle range. In contrast, pyroxenite and phosphate from Sevattur have a $\delta^{44/40}$Ca value identical with associated carbonatites, indicating a homogeneous mantle source for the latter complex. For K-rich syenites and monzonites, ^{40}K-decay corrections need to be considered for the intrinsic mass-dependent isotope fractionations considering the Neoproterozoic age and high K/Ca character of some samples.

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[1] Ackerman et al. (2017) Lithos, in press. [2] Gussone et al. (2016) Springer Intl. Publ. [3] John et al. (2012) Nature Geosci 5, 489-492.