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Investigating the mantle source of carbonatites from Spitskop (Kaapvaal Craton, South Africa) using short- and long-lived isotopic systems

THOMAS ROUYER, PHD[1,2], RÉGIS DOUCELANCE[1], MAUD BOYET[1] AND HANIKA RIZO[2]

[1]Université Clermont Auvergne
[2]Carleton University

Carbonatites are carbonate-rich (> 50 wt%) and silica-poor (< 20 wt%) mantle-derived rocks, with Pb, Sr, Nd radiogenic isotopic compositions similar to those of ocean island basalts (OIBs). In order to gain insights into the mantle source of carbonatites, we have studied carbonatites from the 1341 Ma Spitskop intrusive complex (South Africa). The outer zone of the complex comprises coarse-grained calcic carbonatites (sövites), while the central zone is composed of dolomite-rich carbonatites (beforsites). The negative initial $\varepsilon^{143}Nd$ down to -7.8 **[1]**, are uncommon among other carbonatite occurrences and thus suggest the contribution of a recycled enriched component in their source. The presence of a metasomatized source spread under the Kaapvaal Craton has been previously suggested **[1]**, and further supported by the negative initial $\varepsilon^{143}Nd$ also observed in carbonatite's mantle source of the Phalaborwa complex (2047 Ma **[2]**) located nearby.

Our first results obtained on the ^{147}Sm-^{143}Nd isotope systematics on whole rocks show that Spitskop carbonatites display a large range of initial $\varepsilon^{143}Nd$ from 0 to -7.9 regardless of carbonatite type. Most of the samples, plot along a regression line in the $^{147}Sm/^{144}Nd$-$^{143}Nd/^{144}Nd$ space, corresponding to a slope fitting the 1341 Ma age. Internal isochrons built from separated minerals (amphibole, calcite, dolomite, magnetite) and whole-rock samples for 3 carbonatites agree with the whole-rock isochron. This suggests that there is minimal internal redistribution and no complete re-opening of the ^{147}Sm-^{143}Nd system. Thus, the contrasting isotopic data obtained between our samples suggest a heterogeneous source for these carbonatites. Samples are currently investigated for the two short-lived ^{146}Sm-^{142}Nd and ^{182}Hf-^{182}W systems. Combined, these systems are powerful tools to trace deep mantle processes and Hadean differentiation signatures and could help to better constrain the origin of the Spitskop and Phalaborwa carbonatite complexes.

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