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# African kimberlites revisited: *in situ* Sr-isotope analysis of groundmass pervoskite

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Although isotopic data have been employed for many years in the study of mantle-derived rocks, obtaining reliable primary magmatic signatures for kimberlitic rocks has proved problematic owing to the combined effects of crustal contamination and element mobility during weathering processes. Heaman (1989) first suggested a possible method for circumventing these problems by analysis of groundmass perovskite ($CaTiO_3$), a phase that is both robust during weathering and free of entrained materials. This approach has not been widely adopted, however, possibly owing to the difficulty in efficiently separating often very small (<50 micron) perovskite grains for chemical analysis.

Recently we have developed methods for *in situ* Sr-isotopic analysis of groundmass perovskite using laser ablation multi-collector ICPMS (Woodhead *et al.*, 2005; Paton *et al.*, 2007a; Fig. 1) and showed that this technique greatly improved both the reliability and resolution of Sr-isotope results in a study of Indian kimberlites (Paton *et al.*, 2007b; Fig. 2).

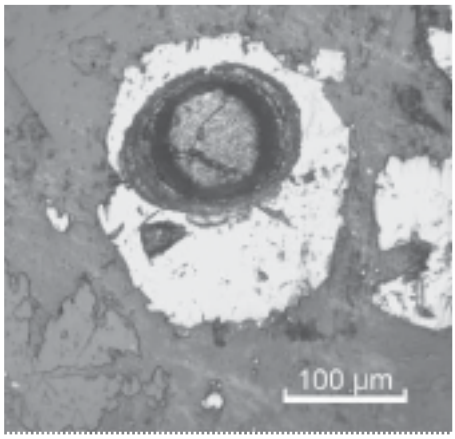


Fig. 1. Groundmass perovskite (pale grey) into which a 93 µm diameter laser ablation pit has been drilled during analysis (Polished thick section, reflected light). From Paton *et al.* (2007b).

Following on from this success we decided to revisit the classic Sr-isotope study of South African kimberlites by Smith (1983). A suite of African kimberlites encompassing over 40 individual intrusions, representing both group I and II types, and covering both on- and off-craton locations has been analysed using these new methodologies.

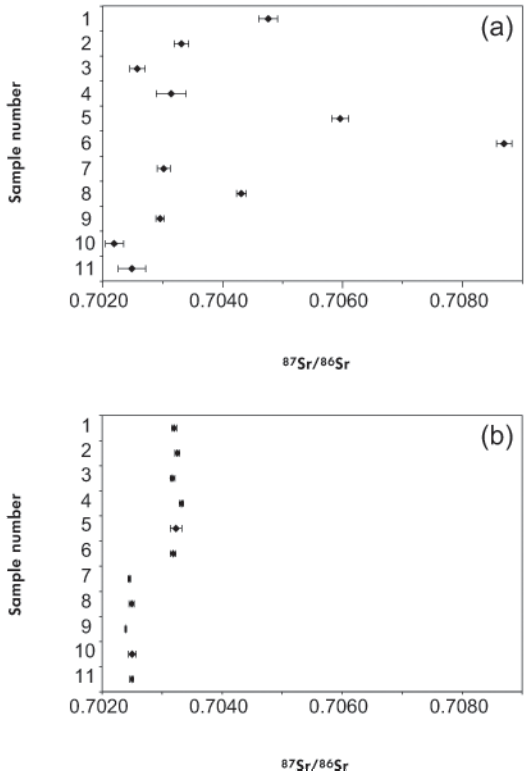


Fig. 2. Comparison between conventional bulk-rock solution Sr isotope data (a) and *in situ* perovskite data (b) for 11 Indian kimberlites from two fields. The scatter in initial Sr isotope values in the bulk-rock data is resolved into two distinct populations using perovskite analyses, revealing homegeneity within, and a subtle difference between, the magmas in each field (see Paton *et al.*, 2007a and 2007b for further details). From Paton *et al.* (2007b).

We will present our new data, discuss further analytical refinements (especially for the analysis of Group II perovskites which are often ~20 micron in size), and suggest options for future work. A few initial observations can be made here. First, unlike the data illustrated in Figure 2 above, there is far closer agreement between published bulk-rock Sr isotope analyses for kimberlites from southern Africa and the

new perovskite data from our study. Thus, despite rare discrepancies (of up to ~0.003 in one case), the broad arrays for Group I and Group II kimberlites remain very similar to those already reported in the literature (Fig. 3). Second, we see no evidence for any variations between Group I kimberlites that correlate with their emplacement on- or off-craton. Consequently, the Sr isotope data do not require (and indeed may not be able to accommodate) the significant involvement of any lithospheric component in these magmas. Finally, at least in the case of Group I samples, there are variations that do not correlate with age and appear to reflect substantial differences in the source regions from which the magmas originated.

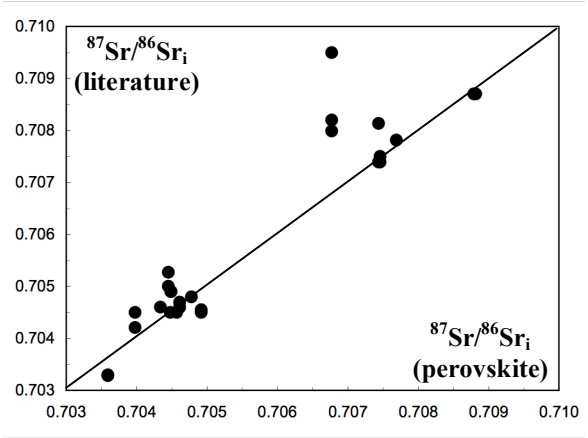


Fig. 3. $^{87}Sr/^{86}Sr_i$ data for Group I and Group II kimberites from our study, compared with equivalent data reported in the literature (e.g., Smith, 1983; Becker & le Roex, 2006). The datasets are very similar as indicated by their proximity to a 1:1 line. Some samples reported in the literature plot at significantly higher $^{87}Sr/^{86}Sr_i$ values, although not to the same extent observed in Figure 2.

**Acknowledgements**

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