Rogue hafnium isotopes in Lac de Gras kimberlites, Canada: Ultradeep vs. shallow mantle processes

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The Hafnium isotope compositions of kimberlites and related rocks tend to fall significantly below the terrestrial Nd-Hf isotope array, which is primarily defined by the compositions of oceanic basalts. Previous models suggested that this peculiar feature may fingerprint isolated ancient oceanic crust within the kimberlite magma source region [1], invoking the mantle transition zone as a viable source location. Based on new Nd-Hf isotope data for Greenland kimberlites [2], it was recently argued that departure from the terrestrial array can be equally well explained by interaction between convective mantle-derived carbonate-rich melts and phlogopite-rich metasomes residing in lower reaches of cratonic lithosphere.

Here, we present an extensive geochemical and Sr-Nd-Hf isotope data set for fresh 75-to-45 Ma hypabyssal kimberlites from the Lac de Gras area, central Slave craton, Canada. Although the Lac de Gras kimberlites mineralogically resemble South African Group-I kimberlites, their Sr-Nd isotope compositions are transitional between kimberlites and orangeites. Epsilon Hf ranges between -15 and +5 at relatively restricted epsilon Nd (-5 to 0), and these isotope systematics define a near vertical array that is at an even wider angle to the terrestrial Nd-Hf isotope array than the South African kimberlites. Furthermore, in data closely filtered to eliminate the effects of crustal contamination, there are pronounced negative correlations between the $^{176}Hf/^{177}Hf$ ratios and proxies of phlogopite-rich metasomes such as K_2O and TiO_2, which suggests that, similar to the Greenland kimberlites, the Lac de Gras proto-kimberlite magmas aquired 'rogue' Hf isotope compositions through interaction with long-term enriched mantle lithosphere. Based on the observation that the 'steep' Lac de Gras kimberlite Nd-Hf isotope array runs towards the unradiogenic metasomatic G10 garnet compositions from the Slave lithospheric mantle, we speculate that rogue Hf isotope compositions of Lac de Gras kimberlites may be linked to ancient fluid metasomatism that also facilitated diamond growth within the Slave cratonic lithosphere.

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[2] Tappe *et al.* (2011) *EPSL* **305**, 235–248.

Geochemical constraints on petrogenesis and geotectonic setting for Silurian basalts of the Prague Synform (Bohemian Massif)

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Similar to the other peri-Gondwanan terranes, the Prague Synform preserves the evidence of intense basic volcanic activity during Silurian. Studied alkaline basaltic volcanism was controlled by deep-seated faults, both parallel and perpendicular to the longitudinal axis of the synform, providing ascent paths for mantle-derived magmas.

The basalts are characterized by steep REE patterns [1] (La_N/Yb_N~3.5–13.5; Gd_N/Yb_N~1.8–3.6) lacking Eu anomalies, high LILE abundances, low Zr/Nb ratios (5.4–12), positive Ti anomalies in NMORB-normalized spiderplots, $^{87}Sr/^{86}Sr_{425}$ of 0.7028–0.7046 and positive ε_{425} values (+6.9 to +4.3), i.e. characteristics transitional between EMORB and OIB. Correlations of Sr and Nd isotopic data with independent geochemical parameters (e.g. mg#, 1/Sr, 1/Nd, Zr/Nb) document a general contamination (AFC) trend during Silurian. Nevertheless, temporal shifts from evolved to more primitive basaltic compositions are obvious within individual fault-related volcanic centres.

These features require primary melt generation by a low degree of partial melting of a garnet peridotite. The incompatible element ratios suggest within-plate setting, transitional between that of OIB and CRB [2]. Temporal progression from evolved to more primitive basaltic compositions could be explained in terms of diminishing crustal contamination of mantle-derived magmas. Given the geochemical variation in basalts and the well documented existence of Neoproterozoic continental basement, the geotectonic setting for the Prague Synform in the Silurian time can be characterized by progressive attenuation and rifting of continental lithosphere due to asthenosphere upwelling.

This study was funded by Grant Agency of the Czech Republic (P210-10-235).

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