Continental alkaline volcanism from Li–O isotope perspective

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Lithium–oxygen isotope compositions are presented for several suites of Cenozoic volcanic system associated with the Eger/Ohře rift, one of prominent tectonic features of the European Cenozoic Rift System (ECRIS). Distinct intrusive and effusive lithologies comprising basanites, nephelinites, ijolites, melteigites, polzenite varieties and chemically evolved rocks such as trachytes, tephrites, urtites, essexites and phonolites show substantial regional variations in both [Li] and δ^7Li values. The high-MgO (>16 wt.%) polzenites to basanites to olivine nephelinites from the Devil's wall dyke swarm have uniformly low Li contents (5–8 ppm) paralleled by near-constant pristine mantle-like δ^7Li (2.0–4.7‰) whilst primitive rocks from the Doupovské hory Volcanic Complex (DHVC) having low Li contents (<5 ppm) carry distinctly different δ^7Li (–0.6 to 3.9‰), implying partial importance of crustal contamination and/or fractional crystallization. This can be observed in DHVC derivative melts having high Li (up to 30 ppm) and variable δ^7Li (–1.1 to 11.3‰). Basanites and olivine nephelinites from the Český ráj area, the eastern truncation of the Eger/Ohře rift and the České středohoří Volcanic Complex (CSVC) display moderate Li enrichments (5–14 ppm) paralleled by variable δ^7Li (–2.2 to 6.2‰) despite generally high MgO contents (>11 wt.%). This may suggest greater reaction of mantle-derived magmas with ambient lower crustal wall rocks en route to the surface and/or crystallization of peculiar Li-fractionating phases. Modest olivine accumulation is not reflected in Li systematics of primitive rocks attesting to insignificant Li isotope fractionation during olivine segregation or addition into magmatic system. Contrary to this, olivine carries mantle-like δ^{18}O compared with the respective bulk rock analyses, providing evidence for fractional crystallization towards high δ^{18}O in low-MgO derivative melts. A sharp increase in δ^{18}O for 'low-MgO' (<7 wt.%) rocks may reflect preferential ^{18}O enrichments in evolved silicate melts and may also be related to segregation of plagioclase/augite from the melt although crustal contamination may be partly responsible for δ^{18}O variations in more evolved DHVC lavas. Collectively, combined Li–O isotope data for Cenozoic akaline lavas in the Bohemian Massif imply extensive magmatic fractionation with minor crustal contamination of their mantle sources, as also inferred from radiogenic isotopes (Sr, Nd).