

Re-Os and Lu-Hf isotope constraints on the origin and age of pyroxenites from the Bohemian Massif

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The Bohemian Massif hosts abundant bodies of garnet/spinel peridotites commonly accompanied by layers of mafic rocks such as spinel/garnet pyroxenite and eclogite. A suite of pyroxenites from the Czech and Austrian parts of the Variscan Bohemian Massif, which varies in composition and origin, has been analyzed for Lu–Hf (whole rock and mineral separates) and Re–Os (whole-rock) isotopic compositions. The pyroxenites were sampled from nine localities in the Gföhl Unit and Kutná Hora Complex of the Moldanubian Zone and they represent garnet clinopyroxenites and/or websterites with one occurrence of spinel websterite.

Studied pyroxenites have variable Re and Os concentrations with ranges from 0.103–1.45 ppb and 0.15 to 4.43 ppb, respectively. These contents are in compliance with variable isotopic ratios of ¹⁸⁷Re/¹⁸⁸Os (0.48–16.6) and ¹⁸⁷Os/¹⁸⁸Os (0.1425–0.4751). Some of the studied pyroxenites have slightly suprachondritic values of γ Os (330 Ma), which is in agreement with their derivation from subcontinental lithospheric mantle. However, most of the studied pyroxenites display variable, highly radiogenic γ Os with values up to +274 suggesting significant contribution of recycled crustal material (subducted oceanic crust) into the migrating upper mantle melts from which they were crystallized. Osmium model ages (T_{MA}) of the studied pyroxenites yield values from 0.4 to 21.5 Ga.

The whole-rocks and mineral separates (garnet, clinopyroxene) show variable Lu and Hf concentrations and isotopic ratios. Lutetium concentrations vary between 0.004 ppm and 1.082 ppm, while Hf contents between 0.076–1.071 ppm. Isotopic ratios of ¹⁷⁶Hf/¹⁷⁷Hf range from 0.282383 to 0.288707 corresponding to variably negative ϵ Hf values (at 330 Ma) from –7 to –0.1 in few samples, but predominantly positive ϵ Hf values varying from +0.5 to +66 in the rest of samples. Two to three-point Lu-Hf isochrons yield an age of 337 ± 4 Ma, 337 ± 5 Ma and 353 ± 17 Ma, while one four-point isochron yield 337 ± 11 Ma. These values are similar to previously obtained Sm-Nd ages for host garnet peridotites.