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Two-pyroxene syenitoids from the Moldanubian Zone of the Bohemian Massif: peculiar magmas derived from a strongly enriched lithospheric mantle source

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(Ultra-)potassic plutonic rocks constitute a conspicuous association with metamorphic rocks of the high-grade, lower crustal/upper mantle Gföhl Unit (Moldanubian Zone). They can be subdivided into two contrasting suites: (1) coarse Kfs-phyric amphibole–biotite melagranite to quartz syenite (the durbachite series *sensu* Holub 1997), and (2) essentially even-grained biotite–two-pyroxene quartz syenites to melagranites (Tábor and Jihlava plutons). The latter, "syenitoid suite", characterized by an originally 'dry' mineral assemblage orthopyroxene + clinopyroxene + Mg-biotite, with accessoric zircon, apatite, ilmenite, monazite and/or rutile ± Cr-spinel, is a subject of the current study.

Our conventional U–Pb ages for zircon (336.9 ± 0.6 Ma) and rutile (336.8 ± 0.8 Ma) from the Tábor Pluton, together with the age from the Jihlava body (U–Pb zircon: 335.1 ± 0.6 Ma; Kotková et al. 2010), provide a precise time bracket for the emplacement and rapid cooling of the syenitoids below c.600 °C (closure temperature of U–Pb system in rutile: Cherniak 2000). This is in line with post-tectonic emplacement of hot dry melt into shallow levels of essentially consolidated orogenic crust. Comparably low temperatures obtained by zircon and rutile saturation calculations document probably a delayed onset of crystallization of the accessories in a hot, alkalis and ferromagnesian components-rich magma derived from a mantle source.

Indeed, the structural relations inside and around the ultrapotassic plutons suggest that the most important regional HT/LP flat-lying fabric(s) in the Moldanubian Zone are closely related with the emplacement and crystallization of the durbachite suite at 343–338 Ma. They have formed prior to the relatively shallower emplacement of the essentially post-tectonic syenitoids dated at ∼337–336 Ma (Žák et al. 2005; Verner et al. 2006, 2008). The two magmatic suites are thus essentially diachronous and not (nearly) contemporaneous (c. 335 Ma) intrusions at contrasting crustal levels as assumed by Kotková et al. (2010).

The syenitoid plutons show mutually comparable, crustal-like radiogenic isotope signatures with highly radiogenic Sr (^{87}Sr/^{86}Sr$_{337}$= 0.7119–0.7125) and unradiogenic Nd (ε^{337}_{Nd} = -6.8 to -7.6). This, together with the rest of the whole-rock geochemical variation, is in line with a generation from a strongly enriched lithospheric mantle source. It was, shortly before, modified by a deep subduction and relamination of the upper crustal material, similar to the felsic HP granulites common in the Moldanubian Zone (Janoušek & Holub 2007; Lexa et al. 2011). The petrology and chemical data indicate that large-scale mixing with crustally-derived acid magmas can be largely or fully discounted and the key role is ascribed to closed-system fractional crystallization with, or without, crystal accumulation of various combinations of biotite, clinopyroxene and/or orthopyroxene with minor amounts of apatite. This stands in a sharp contrast with the history of volumetrically prevalent, slightly older, durbachite suite, in genesis of which the magma mixing of chemically and isotopically contrasting mantle and crustal components was clearly much more significant (Holub 1997).

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