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Ultrapotassic magmatic rocks within the Moldanubian Zone of the Bohemian Massif: witnesses of vigorous interactions between the mantle and deeply subducted crust at the peak of the Variscan Orogeny

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Characteristic feature of the entire Moldanubian Zone of the Variscan Orogen in Western–Central Europe (French Massif Central, Vosges, Schwarzwald, Bohemian Massif, Alps and Corsica) is the occurrence of ∼345–335 Ma late syn- to post-tectonic intrusions and dyke swarms of (ultra-) potassic composition [1–8]. Prominent in the Bohemian Massif is the strongly porphyritic durbachite suite [9] of Amph–Bt quartz syenitic–melagranitic plutons rich in mafic enclaves; equigranular Bt–two-Px quartz syenites–melagranites are less common. The two suites share similar chemistry, with high Cr, Ni and Mg# on the one hand, as well as high Pb, LREE, LILE, U and Th, and low HFSE, on the other [1,4,10]. The crust-like Sr–Nd isotopic compositions of the most mafic members ($^{87}Sr/^{86}Sr_{337}$ ∼ 0.713, ε^{Nd}_{337} ∼ –7.5) cannot be reconciled by the shallow-level crustal assimilation but require an anomalous mantle source [11].

The intimate spatial and temporal association with felsic HP–HT (Ky–Grt–perthite) granulites, in particular complementary geochemical signatures (e.g., Cs, Rb, Th, U, Pb and Li, impoverished in the granulites, are strongly enriched in the ultra-K plutons) suggests causality [4,12]. Primary ultra-K magmas are thus interpreted as melts of anomalous mantle contaminated by metaigneous crust, or fluids/melts thereof, during the Visean granulite-facies metamorphism [13]. The full compositional range of the (ultra-)K plutons reflects magma mixing with anatectic leucogranite melts during ascent and emplacement [1,2].

Recent comparison between the deeply dissected Variscan and still ongoing Tibetan–Himalayan orogens [14] has shown important similarities. The chemically similar Cenozoic Tibetan (ultra-)K volcanites containing lower crustal xenoliths are interpreted as surface equivalents of the Moldanubian durbachitic plutons. Also in Tibet, the association of granulites and (ultra-)K magmatites indicates the presence of felsic rocks in the deep orogenic lower crust and melting of previously contaminated lithospheric mantle underneath [14]. The Sr–Nd–Pb–Hf isotopic compositions of such magmatic suites, albeit largely mantle-derived, are swamped by signal of the deeply subducted continental crust. This picture may be further blurred by crustal contamination/hybridization with anatectic melts, inevitable during the magma ascent through a hot collisional orogen. This makes the detection and quantification of a (crustally contaminated) mantle contribution to the crustal growth challenging [6].

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