Fabrics and Emplacement of Variscan Ultrapotassic Melasyenite Plutons: Implications for Tectonic Processes in the Orogenic Root Domain (Moldanubian Zone, Bohemian Massif)

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Based on structural data from several ~343–335 Ma ultrapotassic melasyenite plutons which intruded the lower- to mid-crustal orogenic root domain (Moldanubian Unit, Bohemian Massif), we interpreted their fabric patterns, emplacement histories and implications for tectonic processes in the internal parts of the Variscan orogenic belt.

These specific plutonic rocks, which represent products of ultrapotassic igneous activity during later stages of the Variscan Orogeny (Lower Carboniferous), range in composition from durbachite sensu stricto (mafic K-feldspar-phyric amphibole-biotite melasyenite) to melagranite and pyroxene-biotite quartz syenite and are commonly accompanied by highly mafic enclaves and small bodies of texturally different ultrapotassic rocks. The magmatic fabrics and structures preserved in these plutons and in the nearby host rocks typically record multiple emplacement processes overprinted by increments of regional tectonic strain during later stages of the pluton cooling.

For example, structural data from the ~337 Ma Jihlava pluton (eastern part of the Moldanubian Zone) indicate that multiple processes (e.g., ductile flow within structural aureoles, magmatic stoping, formation of sheeted zones by magma wedging, shortening of outer partially crystallized margin during emplacement of inner magma pulses) accommodated the emplacement of the pluton. Multiple magmatic fabrics preserved in the pluton recorded strain during final emplacement overprinted by increments of strain within a dextral zone of distributed transtension associated with NW-side-up kinematics.

More to the northwest, magmatic to subsolidus fabrics of the ~343–340 Ma Milevsko pluton recorded exhumation of the Moldanubian orogenic root along an normal shear zone associated with SE-side-up kinematics developed along the south-eastern margin of the Central Bohemian Plutonic Complex. However, structures in the nearby ~337 Ma Tábor pluton recorded only internal strain during emplacement not overprinted by the shear zone, indicating that the pluton intruded after exhumation of the Moldanubian Unit. Its radiometric age thus represents the lower limit for exhumation in this part of the orogenic root.

Further to the southwest, we document that subhorizontal magmatic foliations and lineations in the Knížecí Stolec pluton (SW part of the Moldanubian zone) and metamorphic foliation and stretching lineation in the South-Bohemian granulites recorded a single regional strain field during HT-LP retrograde metamorphism.

Therefore, based on the above, we demonstrate that the ultrapotassic melasyenitic plutons, which are widespread throughout the internal parts of the European Variscides (namely the Moldanubian Zone), are structurally complex bodies emplaced by multiple processes. We suggest that careful determination of the temporal and geometrical relationships of the structures in and around these plutons may provide important constraints for the kinematic framework, local exhumation histories and timing of tectonic processes in different segments of the orogenic root during the later stages of the Variscan Orogeny.