# Thermomechanical Modeling of Variscan Orogenic Root System: Possible Sources for Moldanubian Metamorphism

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The crustal age and composition in the Bohemian Massif and in the Variscan belt in general are extremely heterogeneous containing both Cadomian crustal segments (Barrandian section) as well as relics of Cambro–Ordovician magmatism and rifting. The building of the Variscan orogenic root is undoubtedly controlled by pre-Variscan inherited pre-Paleozoic lithological heterogeneities and vertical distribution of lithological/rheological layers. More importantly, the Devonian subduction of the Saxothuringian belt below easterly situated precursor of the Moldanubian Zone strongly influenced the thermal and mechanical evolution of further development of the orogenic root system. Numerous geochronological studies document that Saxothuringian subduction pre-dates the development of deep and hot Carboniferous eclogites and high-pressure granulites within the Moldanubian root system. Also, massive calc-akaline potassium-rich magmatism in the area of the Central Bohemian pluton of Devonian to lower Carboniferous age antedates the 340 Ma old paroxysm of Moldanubian metamorphism and may be related to major subduction event. We suggest that the Early Devonian Saxothuringian subduction, in conjunction with possible back-arc type magmatism in the foreland of mechanically weakened lithosphere by Cambro–Ordovician thermomechanical events are the best candidates for development of deep and exceptionally hot orogenic root in the Moldanubian Zone.

Metamorphic petrology, geochronology of metamorphic and igneous rocks are combined in a thermomechanical model which emphasizes the role of Devonian to Carboniferous magmatism in the development of exceptionally hot and soft orogenic root system. We show that the progressive thickening and hardening of thermally weakened crustal rocks led to the development of stiff orogenic root floored by relatively thin, rigid sub-root mantle. The modelling shows the limitations of maximum thickening of the Moldanubian root system controlled by external heat supply during Devonian magmatism and lithological composition of the root. Finally, we suggest conditions favourable for rheological collapse of thickened crust.

We correlate metamorphism of the Gföhl eclogites and granulites with respect to maximum possible burial of the Moldanubian root system. In addition, peak pressure conditions of eclogites from Montonous and Varied groups are used to depict complete field geotherm for the thickening period. Both Gföhl high-pressure rocks and HP rocks from the Montonous Group are re-equilibrated at mid-crustal depths and granulite facies conditions. These metamorphic conditions were achieved during extensional tectonics, i.e., are related with flat fabrics and subvertical compression. Further thermo-rheological modelling is carried out to correlate these data with exhumation of lower crustal rocks under lateral compressional regime. Soft material was further extruded over rigid continental shoulders in the form of far-travelling crustal nappes in Carboniferous times.

# Geochemistry and Petrogenesis of the Klatovy Granodiorite, SW Part of the Central Bohemian Pluton

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The extreme SW part of the Central Bohemian Plutonic Complex (CBPC) is built by the Klatovy apophysis (c. 197 km$^2$). It is strongly elongated in the NE–SW direction following the Klatovy Deep-seated Fault that forms the first-order tectonic boundary between the Barrandian block in the NW and the Moldanubian block in the SE.

Most of the Klatovy apophysis is composed of highly inhomogeneous granitoids of the so-called Klatovy type (c. 85 km$^2$). The following rock varieties can be distinguished here:

(1) Relatively fine-grained porphyritic amphibole–biotite granodiorite, frequently with clinopyroxene and abundant plagioclase megacrysts. This variety is the most common one.

(2) Medium-grained light porphyritic amphibole-bearing biotite granodiorite to monzogranite, commonly with large K-feldspar megacrysts (up to 7 cm across).

(3) More mafic rocks and mafic enclaves, petrographically defined as melagranodiorite, quartz monzodiorite, quartz diorite and rarely tonalite. The enclaves are present in both of the two granitoid varieties and display typical microstructural features of mafic microgranular enclaves (MME; Didier and Barbarin 1991). Most of them show evidence pointing to their hybrid origin (such as the presence of ocellar quartz, acicular apatite, oikocrysts of K-feldspar and blade-shaped biotite).

The Klatovy intrusion belongs to the high-K calc-alkaline series (HK group of Holub et al. 1997). The three main rock varieties distinguished on petrologic grounds in this intrusion also markedly differ in their major-element contents. The first, most abundant variety has 63–66 wt.% $SiO_2$ and A/CNK of 0.93–1.14, the lighter granodiorite (of the second variety) contains 69–71 wt.% $SiO_2$ and displays metaluminous to slightly peraluminous chemistry (A/CNK = 0.85–1.16). More mafic rocks and enclaves have 57–61 wt.% $SiO_2$ and metaluminous character (A/CNK = 0.9). In many variation diagrams (e.g., the Hark-