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Southwestward progression of a late-orogenic heat front in the Moldanubian zone of the Bohemian Massif and formation of the Austro-Bavarian anatexite belt

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The Variscan orogeny in Central Europe involves the Devonian–Early Carboniferous collision of various Gondwana-derived microplates and their attachment to Baltica (Franke 2002). Collisional tectonics led to the formation of several Barrow-type metamorphic belts of different age (e.g. ca. 380 Ma in the Tepla-Barrandian zone; ca. 340 Ma in the Moldanubian zone). In the course of the Carboniferous, the strongly thickened orogen experienced gravitational collaps (Zulauf 1997) with the exhumation of HT-HP granulites as a prominent feature. Following that a strong HT-LP metamorphism has affected large parts of the Moldanubian unit, in particular in the Southern Bohemian Massif. This resulted in a widespread formation of cordierite-bearing gneisses, meta- and diatexites. At about the same time large volumes of granitic magmas intruded. The reasons for this late-orogenic HT-LP metamorphism and granitoid plutonism in the Southern Bohemian Massif have been repeatedly discussed and various tectonothermal scenarios have been suggested. Some of these models involve radiogenic heat production within thickened crust combined with fast post-tectonic uplift (Gerdes et al. 2000), others assume an extra heat input from the mantle and heat advection via magmas into the middle crust (Clemens and Finger 1995, Kalt et al. 2000, Henk et al. 2000).

A systematic U-Pb TIMS geochronological study on monazites in the Moldanubian HT-LP units of Austria and Bavaria has now provided more detailed insight into these late Variscan high-heat-flow processes. The study revealed three different events: Monazites in the Monotonous Unit east of the South-Bohemian Batholith and in the

Böhmerwald zone in northern Upper Austria give ages of around 335 Ma, consistent with an isothermal uplift model of hot, previously Barrow-type metamorphic, Moldanubian crust.

As opposed to this, significantly younger monazite ages of 314–326 Ma were recorded in the Austro-Bavarian anatectic belt, which comprises the Mühl and Sauwald zones in Upper Austria and most of the Bavarian sector of the Bohemian Massif (Bayerischer Wald). North of the Danube fault, a latest phase of HT-LP crustal anatexis can be bracketed between 321-326 Ma (see also data in Kalt et al. 2000 and Grauert et al. 1974). The widespread presence of inherited monazite components with inferred formation ages of ca. 330-340 Ma (difficult to precisely constrain due to uncalculatable mixing and Pb-loss effects) implies that this anatectic event was superimposed on pre-existing metamorphic rocks with a ca. 335 Ma HT-LP history and perhaps a ca. 340 Ma MP or HP history. It would appear that Moldanubian crust, uplifted at ca. 335 Ma, was again reheated between 321 and 326 Ma in a relatively narrow but almost 250 km long stripe between Upper Austria and the Oberpfalz. Large masses of high temperature granitoid melts intruded this part of the Austro-Bavarian anatexite belt at this time and may play an important role as heat source for the anatexis.

Most interestingly, in the southernmost zone of the NW-SE trending Austro-Bavarian anatexite belt, (Sauwald zone south of the Danube fault), the monazite ages are again consistently younger (between 314-317 Ma) and prove an independent HT-LP anatectic event in this area, which can be followed over almost 100 km along strike. The major granitoid plutons in the Sauwald zone fall in the same age range (Schärding and Peuerbach granite; Friedl 1997). The overall situation thus implies a southwestward progression of a late-Variscan heat front in the Moldanubian unit.