The Teplá-Barrandian/Moldanubian terrane boundary in the Orlica Mountains, Central Sudetes, NE Bohemian Massif: structural and petrological evidence

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The Sudetes in southwestern Poland and northern Czech Republic expose a Palaeozoic collage of the northeasternmost extremity of the Variscan belt (e.g. Matte et al. 1990, Aleksandrowski – Mazur 2002). One of the presumed terrane boundaries occurs in the Orlica Mts, along the contact between the phyllite-amphibolite (Neoproterozoic?) complex of the Nové Město unit to the SW and the orthogneiss (Early Ordovician protolith) and mica schist (Neoproterozoic?) complexes of the Orlica-Śnieżnik unit to the NE. Our structural and petrological study has allowed recognition of several features that are known as typical of the Teplá-Barrandian/Moldanubian boundary elsewhere in the Bohemian Massif to occur in the Orlica Mts, and, thus, it supported earlier suggestions of the Teplá-Barrandian affinities of the Nové Město unit (Malkovský 1979) as well as those considering the Orlica-Śnieżnik rocks as an extension of the Moldanubian (Gföhl) terrane (cf. Matte et al. 1990, Turniak et al. 2000).

The synmetamorphic structural evolution of both units in question comprised four deformation events. The Nové Město rocks have recorded an early stage of ductile, top-to-SE thrusting (D_1). The subsequent, dextral shear-dominated event (D_2) produced a 1–2 km wide shear zone at the boundary of both units, in which earlier fabric elements were overprinted and mostly obliterated. This deformation brought the low-grade Nové Město rocks into contact with those of the hot, high-grade Orlica-Śnieżnik unit. Postdating this juxtaposition are E-W-trending folds (formed at stage D_3), which affect both the adjacent units. The contact zone also contains record of a late, top-to-SW, semi-brittle, normal-slip displacement (D_4), downthrowing the Nové Město side of the shear zone.

The mica schists comprised in the boundary shear zone between the Nové Město and Orlica-Śnieżnik units underwent amphibolite-facies metamorphism. The peak temperatures calculated for these rocks, using the garnet-biotite and garnet-muscovite geothermometers, vary in the range of 564±16 – 616±19 °C and 527±15 – 615±10 °C, respectively. The maximum pressures estimated with Grt-Pl-Ms-Bt-Ttn geobarometer yielded values of 8.6±0.8 to 9.6±1.7 kbar. Somewhat lower pressures in the range of 7.7±1.3 – 8.7±2.4 kbar were estimated with phengite geobarometer. These peak metamorphism conditions were apparently achieved during the D_2 deformation event.

Similar results were acquired from the Nové Město amphibolites defining an approximately continuous belt along the contact with the Orlica-Śnieżnik unit. The hornblende-plagioclase and garnet-hornblende geothermometers thus produced the values of 609±6 °C and 586±23 °C, respectively, whereas the Grt-Hbl-Pl-Qtz geobarometer yielded pressure of 9.7±1.2 kbar. Significantly lower P-T conditions were recorded in the phyllites of the Nové Město unit. Temperatures calculated with the plagioclase-muscovite geothermometer do not exceed 340±38 °C, whereas the pressures obtained from the phengite geobarometer are equal to 4.3±0.5 kbar. Furthermore, in contrast to those in the Orlica-Śnieżnik unit, these peak metamorphism conditions can presumably be correlated with the earlier, D_1, deformation event.

The structural relationships recorded at the contact of the Nové Město and Orlica-Śnieżnik units are comparable and equivalent to those known from the Teplá-Barrandian/Moldanubian terrane boundary in the Železne Hory hills and along the Central and West Bohemian shear zones. The characteristic features of this boundary in all those areas are high metamorphic gradient, but not metamorphic inversion, across the boundary, the occurrence of mid-Carboniferous stitching granitoid plutons and conspicuous effects of mid-Carboniferous significant downthrow of the low-grade Teplá-Barrandian terrane relative to the uplifted high-grade, hot, lower to middle crust of the Moldanubian terrane. The downthrow of the Teplá-Barrandian occurred on ductile shear zones showing either the down–dip slip kinematics (Zulauf 1997, Zulauf et al. 2002, Pitra et al. 1994) or that of a transfer strike-slip, as was the case with the Orlica Mts, both mutually associated within the same regional-scale linked shear zone extensional system. The extensional crustal collapse was probably preceded by a SE-directed crustal stacking which involved thrust-emplacement of the Teplá-Barrandian on top of the Moldanubian terrane.

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Post-magmatic metamorphism in the mid-German Crystalline High-evidence from the Northern Odenwald/Germany

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Remnants of the Variscan collision of the microcontinents Avalonia and Armorica can be found along the mid-German Crystalline High (MGCH). In the MGCH mid-crustal plutonic rocks of the magmatic arc of the northern edge of the overriding Armorican plate are still preserved. The Western part of the Odenwald Crystalline Complex is part of this magmatic arc. Rocks of a calc-alkaline suite comprise nearly 90% of the complex (Henes-Klaiber, 1992).

The Frankenstein intrusive complex (ca. 360 Ma) is situated in the northern Odenwald. It mainly consists of medium- to coarse-grained gabbros and diorites. In addition, ultramafic rocks occur as part of these gabbros. The Frankenstein intrusive complex is generally regarded as beeing unmetamorphosed.

The ultramafic bodies of wehrlitic composition are serpentinzed with relics of olivine and clinopyroxene. The present study shows that in the sepentinized ultramafic bodies euhedral to subhedral tremolite overgrowths the fabric and mineralogy of the serpentinite. This strongly suggests a metamorphic overprint after the magmatic pulses in this region. In addition, the microfabrics of the feldspars of the gabbro show evidence of high-temperature deformation, which was earlier described by Kreher (1994). Willner et al. (1991) postulated a post-magmatic pressure-increase, as revealed by phengite-barometry of granitoid dykes nearby.

Therefore, the PTt-path of this region of the mid-German Crystalline High has to be modified. It is not known if the fabric evolution of the gabbros and the metamorphism of the serpentinites are of the same age. However, the weak lattice-preferred orientation of the newly formed tremolite rather suggests a regional metamorphic overprint of the northern part of the Frankenstein intrusive complex.