

## Discussion

# Reply to the discussion on “Emplacement, structural and P–T evolution of the ~346 Ma Miřetín Pluton (eastern Teplá–Barrandian Zone, Bohemian Massif): implications for regional transpressional tectonics”

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## Introduction

First of all we would like to appreciate all the remarks made by P. Pitra, which allow wider discussion of emplacement of the Miřetín Pluton and Variscan geodynamic evolution of its host metamorphic rocks in the northeastern Bohemian Massif. We believe that our results made by a combination of several methods of structural analysis, thermobarometry, new geochronological data and regional geological context of eastern part of the Bohemian Massif allow an alternative interpretation of the emplacement and geodynamic evolution of the Miřetín Pluton and upper-crustal host rocks in the eastern Teplá–Barrandian Zone as published by Vondrovic et al. (2011).

## 1. Teplá–Barrandian?

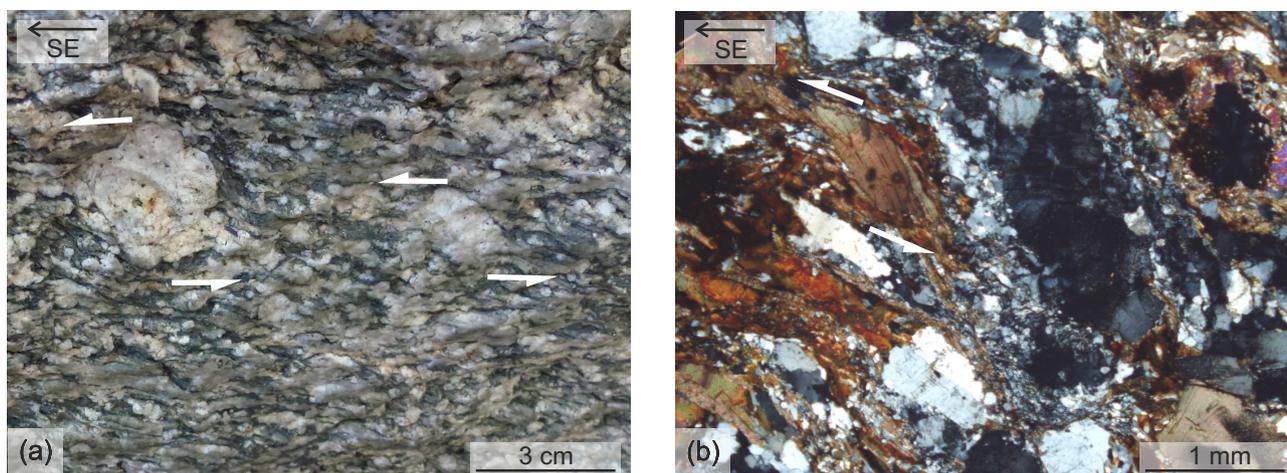
We admit that the lithotectonic affinity of the Hlinsko and Polička units to the Teplá–Barrandian Zone (e. g. Mísař et al. 1983; Pertoldová et al. 2010) or Western Sudetes (Cháb et al. 2010; Štorch and Kraft 2009) is partly controversial and ambiguous. In our article we have adopted a geological division of the Bohemian Massif published by Chlupáč and Vrána (eds) (1994) or other authors (e. g. Mazur et al. 2005; Pertoldová et al. 2010) where both units were classified as more metamorphosed part of the Teplá–Barrandian Zone. Based on similarities in lithological composition, geological position and Variscan tectonometamorphic evolution of the western Polička Unit and Hlinsko Unit (Mísař et al. 1983; Buriánek et al. 2003; Buriánek 2009; Verner et al. 2009; Pertoldová et al. 2010) we assume an identical position and evolution of both units in the Variscan upper continental crust along the boundary with exhumed high-grade rocks of the Moldanubian Zone.

## 2. The Miřetín Pluton

Based on our detailed microstructural analysis of the Miřetín Pluton were defined: (i) NW to WNW moderately dipping submagmatic to HT solid-state fabrics (see chapters 6.1 and 6.2; Vondrovic et al. 2011) reflecting the final stages of syntectonic emplacement and crystallization of the Miřetín Pluton, and (ii) sharply superimposed WNW steeply dipping brittle to brittle–ductile fault structures and shear zones predominantly localized along the western flank of the Pluton (see Fig. 3; Vondrovic et al. 2011). Below we discuss several remarks made by P. Pitra to this issue: (i) Rare microfractures in quartz and feldspar grains related to HT fabric (see Fig. 5a; Vondrovic et al. 2011) have variable orientation which excludes this phenomenon as a valid kinematic indicator. (ii) The HT fabric in domains not affected by LT overprint contains a prevailing reverse (thrusting) asymmetry of dynamically recrystallized grains (Figs 1a, b and 4b; Vondrovic et al. 2011). (iii) The orientation maxima of c-axes of quartz subgrains in HT fabric exhibit no obvious asymmetry indicative of the NW-side-down sense of shearing (Fig. 6a in Vondrovic et al. 2011). We agree with the comment of P. Pitra that the presence of asymmetrically folded dikes as evidence of syntectonic crystallization during regional transpression is unsuitable. However, the Miřetín Pluton disposes with a broader spectrum of thrusting indicators such as an asymmetry of partly deformed mafic microgranular enclaves, xenocrysts and recrystallized grains (Fig. 1a, b)..

## 3. The Hlinsko Unit

The Hlinsko Unit is an asymmetric synform with a well developed axial planar cleavage subparallel to the HT solid-state foliations in the Miřetín Pluton and its intrusive



**Fig. 1** Photographs of HT structures from the Miřetín Pluton (Česká Rybná locality) indicating NW-side-up (thrusting) kinematic: **a** – Field photograph of asymmetrically deformed and recrystallized feldspar grains (XZ section). **b** – Photomicrograph of biotite fish and other dynamically recrystallized aggregates (XZ section).

contacts with the Polička Unit. In metamorphic rocks of the Hlinsko Unit, the lineations associated with the main deformation event  $D_2$  (according to Pitra et al. 1994) were observed rarely, predominantly in a subhorizontal NNW–SSE orientation (see Fig. 5b; Pitra et al. 1994). These lineations have a relatively lower intensity and are discordant to the orientation of well developed HT linear fabrics in the Miřetín Pluton (see Fig. 3; Vondrovic et al. 2011). We suspect that lineations  $L_2$  in the Hlinsko Unit have an intersectional character and, thus, it is not possible to use the asymmetry of recrystallized grains in the lination-parallel sections as a valid kinematic indicator.

#### 4. The Svatka Unit

Based on recent detailed geological mapping and related structural research of the Svatka Unit only localized normal LT shear structures were identified (e. g. Buriánek et al. 2009; Verner et al. 2009; Pertoldová et al. 2010). These structures have neither temporal nor spatial relationship to the transitional submagmatic to HT solid-state fabrics reflecting emplacement of the Miřetín Pluton.

#### 5. Conclusions

According to our data, knowledge of regional geological evolution of northeastern Bohemian Massif and the comments discussed above we insist on our alternative model of emplacement and geodynamic evolution of the Miřetín Pluton (Vondrovic et al. 2011). Our idea assuming syntectonic emplacement of the Miřetín Pluton during a regional compressional (transpres-

sional) event at *c.* 346 Ma is based on the following arguments: (i) Correspondence of metamorphic degree and P–T path in both the host units (Hlinsko Unit and western Polička Unit) as well as estimated pressure conditions for emplacement of the Miřetín Pluton which exclude significant movements along the Hlinsko Unit and Polička Unit boundary. (ii) Similar orientation of regional metamorphic fabrics in both units, intrusive contacts and presence of transitional magmatic to HT solid-state fabric of the same orientation. (iii) Absence of transtensional kinematic indicators and (iv) new crystallization age of the Miřetín Pluton ( $345.9 \pm 5$  Ma; U–Pb on zircon) at time when no arguments for extensional tectonics have been reported from the wider surroundings of the studied area (e.g. Schulmann et al. 2005; Pertoldová et al. 2010; Tajčmanová et al. 2010).

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