Palaeogeography of Prague Synform in Silurian times (Wenlock–Ludlow): insights from palaeomagnetism, geochemistry and biostratigraphy

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INTRODUCTION
A complex study of selected Silurian volcanic centres in the Prague Synform involved palaeomagnetic analysis of those centres and the Silurian sediments. It was combined with whole-rock and isotope geochronological and geochemical dating. The obtained constraints on palaeolatitude and geological setting of the Prague Synform contribute to the refinement of Wenlock–Ludlow palaeogeography of peri-Gondwanan terrains [see (1) Cocks & Tornow 2004, and (2) Stampfli et al. 2002].

However, present-day geometry of mantle domains (intraplate) in N–NE–SW cross-section through the Bohemian Massif (5), which is based on seismic anisotropy, suggests a distinct structure and deformation history of the TBU.

GEOLOGICAL SETTING
Prague Synform is a tectonically predisposed NW–ENE trending trough, outlined by Ordovician–Middle Devonian sequence and represents a part of Topo-Diarrhean Unit (TBU) Bohemian Massif. Silurian palaeogeographic concepts for the TBU are modified after Kříž (1998) and based on N–NE–SW trending syn-volcanic deep-seated structures, which were reactivated during Variscan orogeny forming present-day structure of the basin – the Prague Synform (4). Effective products are restricted to Llandovery–Ludlow series (3), with maximum activity in Wenlock (Pruner, 7). Sr and Nd isotope (c. 425 Ma) and Lu–Hf isotope (c. 420 Ma) correlation of volcanics was marked by short Devonian (Erzanian) episode.

Thus, our results are consistent with the original palaeogeographic concepts.

PALEOMAGNETISM – METHODS
1) progressive thermal demagnetization using the MAVACS (Magnetic Vacuum Control System, Přihoda et al. 1989) equipment with step interval of 40°C, (2) alternating field (AF) demagnetization using a Superconducting Rock Magnetometer (type TK-IV K) with steps of 5 mT to 20 mT, (3) viscous field (VF) demagnetization (5 mT for 10 min) using principle component analysis as outlined in Kříž (1998) and Man (2003).

PALAEMAGNETISM – RESULTS
Primary remanent magnetization component C reflecting diagenetic or magnetic presence is in agreement with literature data on Volcanic Centres (see: (1) Babuška 1971, 1989; (2) Stampfli et al. 2002). Component C was determined by temperature range of 280–480 °C (300°C) and by alternating field (AF) range of 0–100 mT. Component C was separated from the paleomagnetic signal of about 175° and/or clockwise palaeomagnetization of 190° is inferred for the Prague Synform. Secondary remanent magnetization component B, reflecting altered basaltic or magnetic presence, was determined by temperature range of 60–200 °C (320 °C) and by alternating field (AF) range of 3–230 mT (560 mT). Component B is Back to represent a Magnetic Overprint.

A1) Virtual pole positions for Vincovice (pink) and Ludvice (blue) sampling sites.
A2) Apparent Polar Wandering Path, inferred from Eastern European Craton for Early Devonian to Middle Triassic time frames presented by bulk rock data (Přihoda et al. 2003).
B) Open green circles denote pole positions for the selected volcanic centres indicated in fig. 4. Horizontal dashed lines indicate distribution of pole positions due to palaeomagnetic anisotropy.

BASALT GEOCHEMISTRY
The age resolution of the graphitic dating (16°) allows tracing volcanic events and correlation of individual events across trough through the TBU, as well as across the entire Prague Synform. Silurian volcanics are distinguished by high LILE abundances, high LREE/HREE ratios and lack HFSE components. Also, moderately positive values of Nb/Yb and Nb/Y suggest a local origin for volcanism and an involvement in the early stages of continental rifting.

CONCLUSIONS
Based on geochemical data along with biogeochronological and palaeomagnetic data we infer that crustal extension associated with rifting of peri-Gondwanan terrains had been an important factor of basaltic volcanism. The magma originated by a low degree of accessory melting of garnet-peridotite source. Remanent magnetization component C (determined by a higher temperature than NW component B) reflects complex remanence acquisition by the volcanics and represents a part of Topo-Diarrhean Unit (TBU) Bohemian Massif. Palaeomagnetic data for Prague Synform will allow for precise definition of the Bohemian Massif palaeocentres. Thus, our results are consistent with the original palaeogeographic concept outlined by Kříž (1998), rather isolated from other Gondwanian-derived terrains of the European Variscides.

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