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Latest Cambrian–Early Ordovician rift-related magmatic activity in the Kouřim Unit, Bohemian Massif

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Pre-collisional history of high-grade Variscan complexes is mostly difficult to reveal, due to intense reworking during the development of the orogenic belt. An ancient magmatism could provide a unique possibility to study it. The Kouřim Unit represents an extensive pre-Variscan plutonic body involved into the tectonic collage of the Kutná Hora Crystalline Complex, at the northern margin of the Moldanubian Domain in the Bohemian Massif. The LA-ICP-MS zircon ages and geochemical characteristics of (meta-)igneous rocks from the Kouřim Unit allow us to determine the timing and nature of magmatic activity within this part of the Bohemian Massif and thus to decipher its pre-Variscan evolution.
The Kouřim Unit is composed of strongly metamorphosed and deformed sequence of magmatic rocks, dominated mainly by various types of migmatites, coarse-grained orthogneisses and minor metadiorites. The newly obtained LA-ICP-MS U–Pb zircon ages of four orthogneisses ranging between 486 $\pm$ 2 Ma and 484 $\pm$ 2 Ma are interpreted as timing the magma crystallization. The single metadiorite gave concordia age of 337 $\pm$ 2 Ma interpreted as the age of migmatitization. Few discordant older ages from metadiorite are considered as older xenocrysts more or less reset during the Variscan metamorphism. The orthogneisses are acid (SiO_2 = 68.6–76.4 wt. %), exclusively subaluminous and seem to form a single calc-alkaline trend, whereas the metadiorite is intermediate (SiO_2 = 54.3 wt. %; mg# = 61), distinctly metaluminous and displays tholeiitic character. The chondrite-normalized REE patterns for the orthogneisses show LREE enrichment (LaN/YbN = 1.5–8.9) and deep negative Eu anomalies (Eu/Eu* = 0.42–0.32); the NMORB-normalized spiderplots feature LILE/HFSE enrichment with deep negative Nb– Ta–Ti anomalies. In contrast, both patterns of metadiorite resemble those of NMORB (LaN/YbN = 0.5, Eu/Eu* = 0.96).

The apparent magmatic arc-like geochemical signature of the orthogneisses is interpreted as inherited from the source, represented most likely by recycled immature arc-related material (?metagraywackes). The real tectonic setting of this Late Cambrian magmatic activity seems rather indicated by the within-plate geochemistry of the metadiorite.

These results bring further evidence for the presence of the Late Cambrian–Early Ordovician extensional event documented throughout the basement of the European Variscan Belt. Together with other occurrences of bimodal magmatism, as well as metamorphic and sedimentary record, indicate an important period of lithospheric thinning. This overall Early Palaeozoic rift-related architecture is often considered as a consequence of the Rheic Ocean opening.