Abstract

The principal goal of the thesis is to constrain nature of magmatic and alteration processes, character of mantle source(s), geotectonic setting and palaeogeographic implications of the Silurian and Devonian volcanism in Prague Basin (Teplá–Barrandian Unit, Bohemian Massif). The thesis is based on extensive geochemical study covering major- and trace-element geochemistry, neodymium isotope geochemistry and mineral chemistry supported by petrographic and field observations.

The most important conclusions of the thesis are as follows:

1. The Silurian volcanic rocks of the Prague Basin represent within-plate, transitional alkali to tholeiitic basalts, which erupted in continental rift setting through thick Cadomian crust. The basalts originated by low degrees of partial melting of garnet peridotite mantle source. Older Wenlock basalts are similar to alkaline ocean island basalts (OIB) derived from subcontinental lithospheric mantle (SCLM), enriched most probably by frozen pods of Ordovician magmas. Younger Ludlow basalts resemble tholeiitic enriched mid-oceanic ridge basalts (EMORB) derived from subduction-modified SCLM depleted by Late Cambrian melting. The Wenlock–Ludlow melting is characterized by contemporaneous mixing of melts derived from both enriched and depleted SCLM mantle domains.

2. Silurian volcanic eruptions were accompanied by intrusion of basalt dolerites and meimechites. The latter represent olivine-rich cumulates of basaltic magmas of predominantly Ludlow age.

3. Meimechites and dolerites were exposed to late-magmatic alteration (rodingitization and serpentinization) leading to enrichment of low ionic potential elements. As a result, slawsonite-celsian-hyalophane assemblage precipitated in interstitial matrix of the rocks. Natural occurrence of slawsonite has been reported for the first time from Europe. Metasomatic alteration took place at $T \leq 350$ °C and $P \leq 0.5$ GPa.

4. The trigger and termination of Wenlock–Ludlow volcanism is related to slab-pull regime due to progressive closure of the Iapetus Ocean. Main stage of the Baltica–Laurentia collision caused the Prague Basin rift failure at ca. 425 Ma and hence it never reached an oceanic stage.

5. The Devonian volcanic rocks of the Prague Basin represent within-plate alkali basalts to foidites, which erupted in continental, probably post-rift setting through thick Cadomian crust. The basalts originated by low degrees of partial melting of garnet peridotite mantle source. Devonian (Emsian) basalts are similar to OIB and their geochemical characteristics is highly similar to that of Late Ordovician alkali basalts. The trigger and termination for Emsian volcanism remains unclear although could be possibly connected to changes in structural regime related to advanced stages of Baltica–Laurentia collision.