Petrology and Tectonic Significance of Spinel Metaperidotites at an Interplate Thrust Boundary (Staré Město Belt)

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Metaperidotites from a part of narrow continental rifted domain of Cambro-Ordovician age at the NE margin of the Bohemian Massif were investigated. Here, the mafic lower crust of Cambro-Ordovician age and upper mantle were exhumed during the Variscan convergence. At present, the boudins of spinel metaperidotites mark a major interplate thrust boundary between the Moldanubian/Lugian orogenic root domain and the Brunian Pan-African microcontinent.

Metamorphic evolution of spinel peridotites is marked by early hydration and serpentinization followed by prograde metamorphism resulting in the development of a mineral assemblage consisting of orthopyroxene - magnesiohornblende - spinel - chlorite - olivine. An increase in temperature is documented by overgrowths of higher-grade minerals over lower-grade minerals and by prograde chemical zoning of spinel, amphibole and orthopyroxene. The maximum temperature conditions estimated on the basis of calculated reactions and conventional thermometry correspond to 700-800°C at pressure conditions below ~10 kbar.

The proposed scenario of thermal evolution and tectonic significance of the studied peridotites is based on their metamorphic evolution, metamorphism, structure and zircon geochronology of surrounding rocks and thermal and rheological modelling. Upwelling of upper mantle and thinning of lower crust occurred during Cambro-Ordovician rifting, and consequently both lithologies were exhumed to rather shalow level. After ~ 150 Ma of cooling at the beginning of the Variscan collision, both lithologies were ”cold” and very ”strong”. Such previously rifted domain cannot be thickened because it is stronger than the adjacent continental lithosphere. Therefore, the prograde metamorphism of partly serpentinized mantle rocks can be seen as a result of the thermal effect of underplated magma, indicated at the present erosional surface by close granodioritic sill. The heat from magma was sufficient to considerably weaken thin layer of the uppermost mantle and to allow initiation of a ductile thrust in peridotites which exhumed cold and brittle part of the lower mafic crust.