Mineral assemblages and metamorphic history of granulites in the Rychleby Mts., Bohemian Massif

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Relics of high-pressure metamorphic rocks are preserved in various crustal and mantle segments of the Variscan orogen in central Europe. These rocks may provide important insights into early stages of plate convergence and burial as well as exhumation mechanisms. We use mineral assemblages and chemistry to reconstruct the pressure-temperature (*P-T*) paths of high-pressure granulites in the Rychleby Mts., Bohemian Massif. Mafic granulites consist of garnet, omphacite, kyanite, two feldspars, and quartz with accessory rutile and zircon. The peak assemblage was partly replaced by pargasitic amphibole and biotite during exhumation. Garnet grains are zoned from $Gr_{36}Py_{10}Alm_{54}$ (core) to $Gr_{20}Py_{38}Alm_{42}$ (rim), and host inclusions of phengite, omphacite, unmixed feldspars, kyanite, and rutile. Omphacite composition varies from $Di_{44}Hd_{14}Jd_{42}$ (inclusions in garnet) through $Di_{63}Hd_{20}Jd_{17}$ (porphyroblasts) and $Di_{63}Hd_{24}Jd_{13}$ (symplectitic intergrowths with plagioclase). Reintegrated composition of the feldspar porphyroblasts is $Or_{43}Ab_{53}An_{04}$. Felsic granulite variety is composed of garnet, kyanite, two feldspars, quartz, accessory rutile, and zircon. Garnet preserves zoning from $Gr_{32}Py_{10}Alm_{68}$ (core) to $Gr_{25}Py_{24}Alm_{51}$ (rim), and it contains inclusions of phengite, sometimes replaced by biotite and zoisite. We have applied various univariant equilibria in order to estimate the *P-T* conditions of inclusion entrapment, porphyroblast growth as well as matrix recrystallization during exhumation. The phengite-garnet pairs indicate pre-peak temperatures of 840-860 °C. Ternary feldspar solvus and Zr concentrations in rutile (with a maximum at 1400-1900 ppm Zr) indicate 830-910 and 850-890 °C, respectively. The corresponding pressure, constrained by garnet-omphacite-kyanite-quartz and garnet-feldspar-kyanite-quartz equilibria, ranges between 15 and 18 kbar. Exchange equilibria between omphacite and garnet reveal peak temperatures as high as 950-980 °C, followed by decompression to 900 °C and 14 kbar associated with the formation of amphibole. Crystallization of biotite, at the expense of garnet, occurred near 740 °C possibly after a melt loss, which facilitated preservation of peak mineral assemblages. The reconstructed pressure-temperature path is consistent with extrusion of bimodal calc-alkaline igneous suite from orogenic root.

Biochemical characterization of single weathering hyphae of *Paxillus involutus* using CLSM and synchrotron based μFTIR

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The mycelium of symbiotic ectomycorrhizal fungi (EM) increases nutrient uptake by the plants through fungal secretion of low molecular weight organic acids that can accelerate mineral dissolution. This EM weathering with pine trees plays a key role in nutrient mobilization processes and pedogenesis. Here we report first insights into the chemical variability of the weathering mycelium when studied on a micrometer scale using Confocal Laser Scanning Microscopy (CSLM) and synchrotron based micro Fourier Transform Infrared (μFTIR) spectroscopy.

Pine seedlings ectomycorrhizal with *Paxillus involutus* were grown in microcosms containing wells with olivine, quartz, basalt, granite and limestone. CLSM analysis of EM hyphae with the molecular probe SNARF4F in contact with basalt and limestone revealed a pH below or at 4.6 while the pH of EM in contact with granite identified pH values that varied from pH 4.6 to 6.5 with variations observed within single cells. Chemical μFTIR maps of single hyphae at a resolution of 5x5 μm identified variabilities within the spatial distribution of lipids, amides and carbohydrates. Particular distinctions in intensities of carbohydrates and lipids were discovered on a single cell level.

We conclude that mineralogy has a significant impact on the biochemistry of colonizing symbiotic EM mycelia, individual hyphae and cells. Earlier studies showed that exudation of oxalate is increased in the presence of basalt and limestone[1] and here we report the corresponding biochemical changes that take place on a single hypha scale.

[1] Schmalenberger, A. *et al.* (2010) *Geochim. Cosmochim. Ac.* **74**(12), A923.