Abstract

Evolved silicic rocks display a variety of igneous textures, which can provide important information on crystallization kinetics and rheology in natural magma chambers. Individual kinetic effects such as diffusion rate, nucleation rate, growth rate and post-solidification modifications are likely to be reflected in the modal and textural appearance of the resulting rock. This work focuses on characterization and interpretation of solidification textures in a 600 m wide and 5 km long body of highly evolved, boron-rich aplites and pegmatites at the southern endocontact of the Říčany granite pluton (Central Bohemian Plutonic Complex). This rock suite is associated with biotite Říčany granite, hosting microgranite and aplite dyke swarm, and it is built up by massive tourmaline aplites, layered aplites with tourmaline-rich or locally garnet-rich bands, pegmatite pockets, pegmatite layers with unidirectional solidification textures (comb layers), megacryst zones (analogous to stockscheider), and late pegmatite dykes discordant to layering. Textural as well as modal variations are usually sharp and observable megascopically as well as on the microscale. All aplites and pegmatites usually contain similar proportions of quartz, albite-rich plagioclase, K-feldspar, various proportions of tourmaline (up to ~15 vol. %), muscovite, garnet, and accessory biotite, cassiterite, rutile, zircon, apatite, columbite-tantalite, ilmenite, xenotime, monazite, beryl and/or topaz. The anorthite component in plagioclase, *mg#* (molar $Mg/[Mg+Fe^{2+}]$) in tourmaline, muscovite or biotite (when present) decreases, whereas *mn#* (molar $Mn/[Mn+Fe^{2+}]$) in garnet and fluorine abundance in various hydrous minerals increases with progressive differentiation, from massive aplites and their megacryst zones through layered aplites and pegmatite layers to pegmatite dykes, which may represent products of *in-situ* fractionation. The aplites and pegmatites are classified as syenogranites or alkali feldspar granites, they are high-K calc-alkaline and strongly peraluminous (alumina saturation index = 1.43-1.68), and enriched in Si, Na, B, Be, Sn, W, Ta and Pb relative to the Říčany granite. They have flat REE-patterns with a pronounced negative Eu-anomaly (Eu/Eu^{*} = 0.04-0.39). The H_2O- and B-rich aplite-pegmatite melt is inferred to have evolved during solidification of the Říčany pluton or its parental magma chamber. Textures of the aplite-pegmatite suite indicate rapid crystallization from an increasingly viscous and undercooled melt. An evolved boundary layer developed ahead of a dense solidification front due to the inhibited diffusion of components in the viscous melt and rapid crystallization rate. This allowed the layered aplites to crystallize by a mechanism known as diffusion-controlled oscillatory nucleation. Crystal-size variations arose due to accumulation of fluxes (e.g. B, H_2O) in the boundary-layer melt, which reduced the viscosity of the melt, enhanced the diffusion rate and inhibited nucleation locally, thus allowing large crystals to form by constitutional zone-refining.