MICROTEXTURAL AND GEOCHEMICAL EVIDENCE FOR MAGMA HYBRIDIZATION IN THE GENESIS OF CALC-ALKALINE GRANITOIDS

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The Central Bohemian Pluton (CBP) is a heterogeneous granitoid complex composed of several petrogenetic suites of different petrography, mineral chemistry, whole-rock geochemistry and Sr–Nd isotopic composition. The presence of numerous mafic microgranular enclaves (MME) in many of the intrusions suggests that mingling between mafic and felsic magmas was a significant process in the evolution of CBP. Microtextural and mineral chemistry evidence from rocks of the calc-alkaline Sázava and Blatná suites documents such processes.

In the Sázava suite there are small bodies of quartz diorite, whose hybrid character is shown not only by field relations and geochemistry, but also by the presence of acicular (quenched) apatites, oikocrysts of quartz and K-feldspar as well as zoned amphiboles. Using cathodoluminescence, plagioclase megacrysts have either (1) bytownite–anorthite cores of bright-yellow luminescence, partly resorbed and overgrown by ochre andesine rims, or (2) cores of andesine with patches of labradorite–bytownite, overgrown by calcic spikes and andesine rims. Unzoned small andesines of the matrix compositionally match the rims of the mantled plagioclases and the plagioclase of the tonalite. The nearly euhedral calcic plagioclase cores (type 1) could have crystallized from a basic magma prior to its injection into a higher-level acidic magma chamber with decompression and water introduction leading to their (limited) resorption. Strong undercooling of the basic magma during the mixing resulted in dendritic crystal growth of patchy-zoned plagioclase (type 2), followed by sodic rims together with small, unzoned andesines of the groundmass.

In the Blatná suite, the Kozárovice granodiorite encloses numerous monzonitic bodies, some of which are net-veined by the surrounding granodiorite and broken into MME. These monzonites are themselves hybrid rocks as shown by the whole-rock geochemistry and the presence of resorbed biotites within mainly euhedral amphiboles, which is a disequilibrium texture resulting from interaction of acidic and basic magmas. Additionally, the presence of amphibole–biotite clots, acicular apatite and relic pyroxene in some amphiboles supports the hybridization hypothesis. Plagioclase occurs in two habits, as (1) large rectangular discontinuously-zoned crystals with andesine cores of ochre or dull yellow luminescence, overgrown by bright yellow labradorite spikes and dull ochre oligoclase–andesine rims, or (2) small lath-shaped andesines with dull ochre luminescence, often with bright yellow andesine–labradorite cores. The large plagioclases (type 1) are interpreted as xenocrysts, incorporated into the quartz monzonite from the granodiorite (which has plagioclase of identical composition), resorbed and overgrown by calcic spikes. At this stage the andesine–labradorite cores of lath-shaped plagioclases (type 2) nucleated. A second hybridization event involving a larger proportion of acidic magma is indicated by the abrupt change in plagioclase composition between the calcic spikes and the oligoclase-andesine rims (type 1). This event also resulted in the normally-zoned oligoclase-andesine overgrowths and the unzoned, lath-shaped andesines (type 2). This hybridization event has also been recorded in the granodiorite by xenocrystic labradorite cores and reversals in the plagioclase zoning.