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Calcic amphibole growth and compositions in calc-alkaline magmas: Evidence from the Motru Dike Swarm (Southern Carpathians, Romania)

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Abstract

A Late Pan-African calc-alkaline dike swarm (basalt-andesite-dacite-rhyolite) has been investigated in a region of over 2000 km^2 in the Alpine Danubian window, South Carpathians (Romania). Amphibole phenocrysts and microphenocrysts have been investigated by wavelength-dispersive microprobe analysis and BSE imaging. The Ca-amphibole population, represented in all the lithologies, displays a large compositional range, interpreted as the result of two processes: (1) magmatic evolution (kaersutite → Ti-pargasite → pargasite → Ti-magnesiohastingsite → magnesiohastingsite → edenite → tschermakite → magnesiohornblende) linked to magmatic differentiation from andesitic basalt to rhyolite; and (2) deuteritic alteration of the primary amphibole related to late-emplacement hydrothermal activity (yielding numerous varieties comprising those cited above). In all rock types, amphibole phenocrysts equilibrated at a nearly constant pressure of about 0.6 ± 0.1 GPa, but their temperatures of crystallization ranged from 1000–900 °C for basaltic andesites to 700–600 °C for dacites. In rhyolites, edenite to magnesiohornblende crystals reflect a continuous range of *P-T* conditions from 700 °C/0.6 GPa to 600 °C/0.1 GPa, in agreement with their change of habit from euhedral to subhedral. Complex zonations in pargasite-magnesiohastingsite (including resorption) are interpreted in term of self-organization of oscillatory zoning without significant heating and/or magma mixing.

Keywords: Crystal structure, calcic amphibole, crystal growth, magmatic zonation, igneous petrology, calcalkaline magma, thermobarometry