

Imaging trace-element distribution in zoned crystals – an application to metamorphic garnet porphyroblasts

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Chemical gradients in minerals result from complex interplay between intracrystalline energy constraints (lattice strain field & solid-state diffusivity), and availability of components from the intercrystalline environment, governed by thermodynamic equilibria, reaction kinetics, mass transfer and chemical fractionation. Metamorphic garnet preserves excellent records of such variations, apparent in the zonality of key major elements. Progress in trace element distribution visualisation reveals an equally detailed picture while providing comparable information.

We present a time-effective high-precision quantitative analytical procedure for visualization of REE concentrations in garnet, obtaining compositional maps with micron-scale spatial resolution and a sensitivity better than 0.1 μg/g. The analytical setup comprises a Photon Machines Analyte G2 LA system coupled to an Thermo iCAP Q ICP MS.

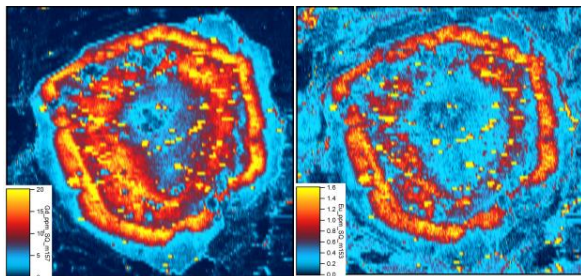


Figure 1 Gd and Eu distribution in a garnet recording polystage growth

The technique enables the visualisation of REE spatial patterns (e.g., concentric, patchy and overprint zonation, annular and recurrent structures, divergent lineages (fig. 1).

Application to medium-grade rocks from the South Carpathians in connection with major element distribution and mineral reactions noticed highlight and distinguish prograde growth vs. polycyclic or polyphase histories.