THE SM-ND METHOD APPLIED TO A SINGLE PERMIAN PEGMATITE GARNET: DATING CROSSCUTTING RELATIONSHIPS

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Generally, dikes represent good deformation markers, as they are distinct lithological elements in polymetamorphic rock series with a complex deformation history. Furthermore, they often preserve primary mineral associations and chemical signatures, at least in some minerals, even if post-intrusive metamorphism and deformation are pervasive. Geochronological data of such minerals and/or possible postmagmatic events enable a detailed reconstruction of the deformation history.

In this study a 3.5 cm sized Grt crystal and a 5 cm sized Kfs from a coarse-grained pegmatite from the Austroalpine Campo basement unit have been investigated by the Sm-Nd method. Primary minerals of the pegmatite sample are Qtz, Kfs, Ms, Tur, Grt and Ap. The Grt core was mechanically separated from the rim and HCl leaching was applied to both fractions. The analysed magmatic Grt gave extremely high Sm/Nd ratios of 10.7 to 13.01, which are among the highest ever reported worldwide. The results affirm the suitability of the Sm-Nd dating method for pegmatite/magmatic Grt.

Isochron calculations for the leached Grtt fractions and Kfs yielded 255.4 ± 2.8 Ma for the Grtt core and 250.4 ± 2.7 Ma for the rim, respectively. Both results are interpreted as crystallization ages. Three leachates and an unleached Grt rim fraction plot systematically off the isochrons, implying the presence of mineral phases, which are not in equilibrium with Grt and Kfs. Electron microprobe investigations revealed, that post-magmatic fine-grained Chl and white mica occurs in small cracks within the Grt. These secondary phases are responsible for the disequilibrium between leachate and leached Grt.

Crosscutting and overprinting relationships of Permian pegmatites and their host rocks
in the study area indicate the presence of at least three tectonometamorphic events in this part of the Campo basement:

i) a pre-intrusive (pre-Permian) metamorphic layering,

ii) an upper greenschist-lower amphibolite facies post-intrusive event (eo-Alpine), which is pervasive in the host rocks, and

iii) a late, lower greenschist facies event, which might be attributed to activities on the Oligocene Giudicarie fault system.

In summary, these results confirm the great potential of the Sm-Nd dating method applied to pegmatite Grt for unravelling the magmatic and deformation history of complex, poly-phase metamorphic units.