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Sm-Nd partitioning between garnet, feldspar and high-REE accessory minerals (Ap, Xtm, Mnz): new constraints on timing and duration of the "Permian-Triassic event" (Eastern Alps)

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Detailed Sm-Nd mineral ID-TIMS analysis of meta-pegmatite and metapelite samples from the central-southern Koralpe, Austria, involving single crystal separation and acid leaching techniques, yielded new insight into timing/duration and PT of the protracted "Permian-Triassic event" in the Austroalpine basement units of the Eastern Alps.

At the locality Rostockbach, a distinct, c. 50 cm thick "core domain" from within a few metres thick, mylonitic meta-pegmatite layer contains abundant apatite, xenotime, zircon, uranium minerals and rare monazite and violet-pink garnet (5-8 mm). Sm-Nd regression of feldspar, garnet, apatite, xenotime and monazite (n = 8) from this domain yielded an age result of 273.0$\pm$2.8 Ma (εNd t = -7.3; MSWD = 7.7). In contrast, the "outer domain" of the pegmatite is free of macroscopically visible phosphate accessories and zircon, but contains cm-sized garnet. Internal Sm-Nd isochron regression of feldspar and several garnet fractions (n = 6) from this "outer domain" yielded a significantly younger age of 258.1$\pm$3.4 Ma (εNd t = -7.6; MSWD = 2.9). Major element composition of garnet from the two domains is similar, while Sm-Nd isotope systematics for both feldspar and garnet are strikingly different. Abundant micro-inclusions of kyanite are typical for garnet in both domains.

In a hanging wall position, the pegmatite-rich Koralpe basement is bounded by the polymetamorphic “Plankogel unit“. Garnet core separates from a kyanite-garnet-mica schist (Laaken area) yielded an internal Sm-Nd age of 271±4 Ma (εNd t = -8.6; MSWD = 12; n = 11). This date is in perfect agreement with the result of 271±3.5 Ma (εNd t = -8.9; MSWD = 3.9; n = 6) for another kyanite-garnet-mica schist from the Plankogel type-locality, Saualpe, some 70 km further NW.

The new data support prograde crystallization of metamorphic garnet well within the stability field of kyanite during the Late Permian. During and/or following Variscan orogenic collapse, PT conditions in the Austroalpine basement may have changed continuously due to ongoing extension of the crust, accompanied by multiple generation of pegmatite (273 Ma, 258 Ma, and later), and rifting, thus probably indicating a near-back-arc position for the Koralpe at the NW margin of the young Neo-Tethys during the long-lasting Permian-Triassic episode.