THE EVOLUTION OF THE PRE-MESOZOIC CRUST WITHIN THE ALPS: EXAMPLES FROM THE BERNINA MASSIF, THE TAUERN WINDOW, AND THE AUSTROALPINE BASEMENT OF STYRIA

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High-precise chronological methods, such as U–Pb dating of zircon and monazite, have been applied to detect pre-Mesozoic processes within the Alpine Orogen. The role of recycled crustal material was constrained by Pb-Sr-Nd isotope investigations.

The nature of the Variscan orogenic phase in the Alps has been discussed for many years, with several questions in mind: Does it represent a continous phase of compression, subduction, orogenic collapse and extension, or several short lived events? Where there early Variscan high-pressure events as in the extra-Alpine Variscides ? The existing data set of isotopic ages has produced no definite answers. We know still little about the position and timing of the intra-Alpine Variscides.

U–Pb zircon ages of about 340 Ma may reflect the starting point for the Variscan evolution. The end of the Variscan orogenic cycle may be represented by rhyolitic flows in upper Carboniferous time (285 Ma; von QUADT et al., 1994). More than 100 Sm–Nd isotope data are meanwhile available for the pre-Alpine basement rocks in the studied areas. No Archean crust material was as yet detectable, neither within the Variscan granitoids nor within their older roof rocks. T-DM Nd model ages are typically mid- to late Proterozoic.

In the Variscan granitoids we observe the trend that the ε-Nd values increase with time, i.e. there are generally higher ε-Nd values in the late-Carboniferous than in the early Carboniferous intrusions. A common interpretation for that would be to assume that a juvenile mantle component became increasingly involved in granite genesis (FINGER et al.1993). However, metagabbros associated with the granitoids show no depleted mantle signatures. They are either strongly contaminated with crustal material, or the mantle source for these rocks was already enriched. The latter interpretation appears more likely, because all ε-Nd-T values for these mafic rocks cluster around zero, thus giving no evidence for a mixture of two isotopically distinct components.

Some granitoids displayed significantly higher ε-Nd-T values than these gabbros, around + 2. An interpretation of the Variscan plutonism in the Alps in terms of a simple AFC or mantle melt – crustal melt mixing model appears thus quite complicated. An alternative explanation for the negative t-εNd trend in the intra-Alpine Variscan granitoids could be that increasingly primitive lower crustal sources such as meta-andesites and meta-basalts became subjected to partial melting in the late Carboniferous, maybe in response to late Variscan lower crustal heating through magmatic underplating.

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