CONTRASTING PRE-ALPINE TECTONOTHERMAL EVOLUTION OF AUSTRO-ALPINE BASEMENT UNITS: EVIDENCE FROM $^{40}Ar/^{39}Ar$ AND Rb-Sr MINERAL DATING

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$^{40}Ar/^{39}Ar$ and Rb-Sr mineral dating has been carried out on hornblendes and white micas of different basement units at the eastern margin of the Eastern Alps. Sample have been collected within the Kaintaleck Metamorphic Complex (KMC) of the Upper Austro-Alpine Nappe Complex and the Troiseck-Floning Crystalline (TFC) of the Middle Austro-Alpine Nappe Complex. Sample localities and selected results are shown in Fig. 1.

All $^{40}Ar/^{39}Ar$ analyses of the hornblendes display disturbed age spectra which are antipathetically matched in low-temperature release steps by fluctuations in K/Ca ratios. Hornblendes from amphibolites of the KMC are influenced by incorporation of extraneous ^{40}Ar components. The youngest ages reported in the medium- and high-temperature release steps are c. 400 - 420 Ma. From Rb-Sr whole-rock vs. white mica trend lines of garnet-micaschists of the KMC ages of c. 413 - 370 Ma have been calculated. White micas from the same rocks yielded systematically increasing apparent ages from c. 200 - 250 Ma in low-temperature release steps to c. 375 Ma in high-temperature release steps. The ages are interpreted to reflect post-metamorphic cooling. The pre-existing foliation of the amphibolites and garnet-micaschists is crosscut by discordant pegmatite and aplite. Rb-Sr whole-rock vs. white mica analyses on these rocks yielded ages of c. 348 - 390 Ma. $^{40}Ar/^{39}Ar$ analyses yielded well-defined plateau ages of c. 364 Ma and c. 375 Ma respectively. The ages from pegmatite and aplite are interpreted to reflect post-magmatic cooling post-dating the intra-Devonian metamorphism.

A $^{40}Ar/^{39}Ar$ analysis on a hornblende from a biotite-hornblende gneiss of the TFC yielded systematically increasing apparent ages in the medium- and high-temperature release steps from c. 175 Ma to c. 320 Ma. From Rb-Sr whole-rock vs. white mica trend lines of garnet-micaschists of the TFC ages of c. 332 Ma have been calculated. $^{40}Ar/^{39}Ar$ analyses on these white micas yielded systematically increasing apparent ages from c. 240 - 250 Ma to c. 290 - 330 Ma. From a discordant pegmatite a Rb-Sr whole-rock vs. white mica analysis yielded an age of c. 284 Ma. The ages of the amphibolites and garnet-micaschists are interpreted to reflect post-metamorphic cooling following a Carboniferous metamorphic event. The metamorphic event is post-dated by the intrusion of the discordant pegmatite at c. 284 Ma.

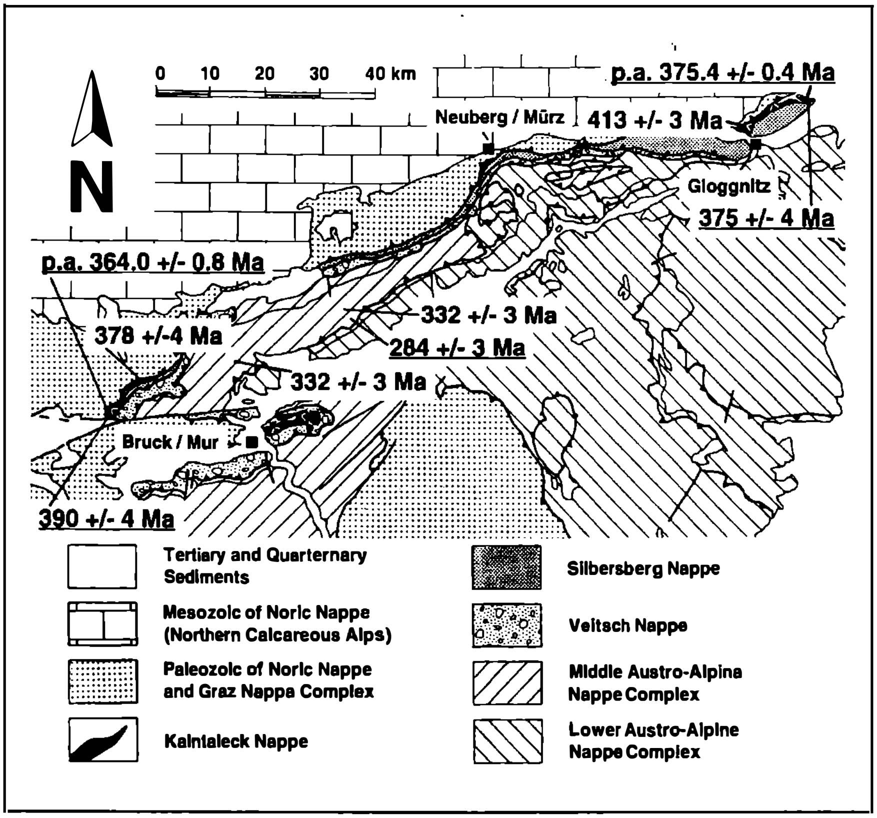

Fig. 1: Sample locations in the eastern part of the Eastern Alps. Ages preceded by p.a. indicate plateau ages from selected $^{40}Ar/^{39}Ar$ analyses on white micas. Other ages refer to selected results of Rb-Sr whole-rock vs. white mica trend lines. Underlined characters indicate results from pegmatite and aplite samples.

The difference between Devonian (eg. Caledonian) and Carboniferous (e.g. Variscan) tectonometamorphic evolution within the Austro-Alpine basement is also reflected in detrital material in different cover sequences within the Upper Austro-Alpine Nappe Complex. Cover sequences of Permian Verrucano-type sequences of the Silbersberg Nappe contain detrital white micas which report a $^{40}Ar/^{39}Ar$ plateau age of c. 360 Ma, white micas separated from a gneiss boulder of the Kalwang conglomerate (cover sequence of the KMC) yielded a $^{40}Ar/^{39}Ar$ plateau age of c. 384 Ma. In contrast, detrital white micas from a molasse-type sequence of the Upper-Carboniferous Veitsch Nappe and Permian to Scythian red-bed sediments of the Noric Nappe yielded $^{40}Ar/^{39}Ar$ plateau ages of c. 311 Ma and c. 303 Ma respectively. The $^{40}Ar/^{39}Ar$ ages of detrital minerals are interpreted to reflect cooling through the respective closure temperature of the source area prior to erosion, transport and sedimentation.

Our analyses clearly proof the independent tectonothermal evolution of the Upper Austro-Alpine basement complex, exposed in the KMC during the Late-Paleozoic. Whereas the Middle Austro-Alpine basement, exposed in the FTC, suffered Carboniferous metamorphism and pegmatite intrusion due to Variscan tectonothermal activity, the Upper Austro-Alpine basement of the KMC experienced intra-Devonian metamorphism and pegmatite intrusion.

TRANSITION FROM ECLOGITE- TO AMPHIBOLITE FACIES METAMORPHISM IN THE AUSTROALPINE ULTEN ZONE, SOUTHERN TYROL

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The crystalline basement, situated southwest of Meran (Italy) between the Peio line and the Insubric lineament, must be considered as distinct block within the Austroalpine basement units. Besides the occurrence of lense-shaped ultramafic bodies embedded in metapelites and metagranitoids, migmatites, "granulites" and metabasites (partly eclogites) indicate high grade metamorphic conditions. The granoblastic paragneisses consist of the primary mineral assemblage M1 (GRT-KY-BIO-MS-KFS-PL-QTZ-RT), indicative of eclogite facies conditions, which was replaced by retrograde amphibolite-facies reequilibration during uplift. In metacalcsilicates pseudomorphs of MRG and CZO after LWS are representative of the prograde path to the eclogite facies event M1. During the retrograde M2 MRG + CZO was replaced by AN + QTZ. Further reactions in paragneisses during decompression are:

1. GRT + MS = BIO + 2KY + QTZ
2. 2KFS + GRT + H_2O = 3QTZ + BIO + MS
3. GRT + 3RT = 3ILM + KY + QTZ

The M2 mineral assemblage of the paragneisses comprises GRT-KY-BIO-MS-PL-QTZ-ILM ± KFS ± ST. Using cation exchange thermometers (GRT-BIO, GRT-CPX), experimentally calibrated mineral reactions (Ghent-barometry, GRAIL), net transfer reactions (HODGES & CROWLY, 1985) and multiequilibrium methods (TWEEQ according to BERMAN, 1991) conditions for the high-grade metamorphic event M1 of about 700 °C and at least 15 kbar and for M2 about 7 - 8 kbar and 600 °C are estimated.

High-density fluids entrapped in kyanite are CO_2-rich and represent the fluid during M1, whereas secondary fluids entrapped during M2 along healed fractures in quartz have H_2O-rich compositions of high salinity. The migmatites occur in both lithologies, metagranitoids and metapelites. Melting started on the prograde path of metamorphism under fluid present conditions. First melts appeared in orthogneisses