



Variscan and pre-Variscan basement units in the central Tauern Window (Austria): constraints from single zircon U-Pb geochronology

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Variscan and pre-Variscan basement units of the Tauern Window (TW) were strongly over-printed by Alpine orogeny; and, hence, delimiting the basement assemblages into their respective components remains to be challenging. Although considerable knowledge is accumulated from previous geological and geochronological investigations on the TW basement units; distinction between the pre-Variscan and Variscan components of the basement rocks is far from completion and, therefore, necessitates systematic approaches. Here we present new single-grain and within-grain zircon U-Pb ages ($\pm 2s$) of selected lithotectonic units (Basisamphibolit, Biotitporphyroblastenschiefer and equivalent lithologies, Zwölferzug, Habach Phyllite, and Zentralgneis) of the central TW basement sequence. The new and published previous age data are combined to place constraints on outstanding geologic problems such as the relationship of the Basisamphibolit to the Zwölferzug garnet amphibolite, the stratigraphic position as well as the maximum sedimentation age of the Biotitporphyroblastenschiefer and Zwölferzug leucocratic gneisses, and the distinction of the lower and upper magmatic sequences of the Habach Formation referred to here as LMS and UMS [1, 2].

Basisamphibolit

Conventional U-Pb zircon dating of the different varieties of the Basisamphibolit, namely a coarse-grained garnetiferous metagabbro, banded amphibolite, and medium-grained amphibolite yielded 343 ± 1 Ma, 349 ± 1 Ma, and 352 ± 2 Ma concordia

ages, respectively, which are interpreted as protolith formation ages. These ages are significantly younger compared to the formation age of the Zwölferzug garnet amphibolite ($486 \pm 5/-4$ Ma; [3]). Traditionally the Basisamphibolit and the Zwölferzug garnet amphibolite were equated together based on field relations and petrographic studies [4]; however, their different $\epsilon\text{Nd}(t)$ values [3], which suggest a distinct evolutionary history; and different magmatic protolith ages [3, this work] indicate that they are both genetically and tectonically unrelated. The Basisamphibolit formed during Variscan tectonics (Lower Carboniferous), whereas the Zwölferzug garnet amphibolite may have formed coeval with the LMS at the margin of Gondwana [cf. 5] before the opening of Paleo-Tethys.

Biotitporphyroblasten-schiefer, Zwölferzug

Laser ablation ICP-MS and conventional U-Pb detrital zircon dating of banded porphyroblastic biotite schist (Wager Alm, Amertal), porphyroblastic biotite schist (Lemperbach) and two-mica plagioclase gneiss (Brentling and Lemperbach) from the Biotitporphyroblasten-schiefer constrained the maximum time of sedimentation to between 362 ± 6 Ma and 368 ± 17 Ma. Leucocratic paragneisses (banded garnetiferous leucocratic gneiss and 'muscovite-granite') from Zwölferzug gave maximum sedimentation ages from 345 ± 5 Ma to 358 ± 10 Ma. The banded garnetiferous leucocratic gneiss and 'muscovite-granite' were believed to be granitoids emplaced into the Zwölferzug garnet amphibolite; however, the presence of detrital zircon grains of which some yielded older ages (496 ± 13 Ma, 550 ± 6 Ma, 587 ± 13 Ma) compared to the garnet amphibolite ($486 \pm 5/-4$ Ma; [3]) are suggestive for a sedimentary origin for the leucocratic gneisses.

Habach Phyllite

Conventional U-Pb dating of a pinkish euhedral magmatic zircon from gabbroic clasts and rounded detrital zircon grains from the meta-agglomerate (Habach Phyllite, Felberberg) yielded an upper intercept age of 536 ± 8 Ma and nearly concordant age of 506 ± 9 Ma, respectively. The 536 ± 8 Ma is interpreted as a magmatic protolith age of a gabbroic source that is comparable to LMS [6]. Even though, the detrital zircons were sorted during separation and hand picking to obtain more concordant zircons; and the number of zircon grains analyzed are statistically limited [e.g., 7] the 506 ± 9 Ma age can be tentatively considered as a maximum sedimentation age for the meta-agglomerate of the Habach Phyllite.

Conclusions

The Upper Devonian maximum sedimentation ages of the Biotitporphyroblasten-schiefer and Zwölferzug leucocratic paragneisses coupled with protolith ages of the

Basi-samphibolit, which has unconformable contact with the Biotitporphyroblastenschiefer [8], further constrain the maximum sedimentation age of the sediments to be Upper Devonian to Lower Carboniferous. The Basisamphibolit and the Biotitporphyroblastenschiefer form parts of the Variscan basement sequence of the central TW; but not Upper Proterozoic to Lower Palaeozoic pre-Variscan basement as previously thought. On the other hand, the LMS of the Habach Formation and the Zwölferzug garnet amphibolite predate the opening of the Paleo-Tethys in the Early Silurian. We therefore suggest these pre-Variscan basement units in the TW to have constituted part of the 'Intra Alpine' domain in the 'European Hun Terranes' [9]. The UMS of the Habach Formation, however, constitutes part of the Variscan basement series.

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