Metamorphic and structural evolution of the Gailtal basement complex: significance for Austroalpine tectonics in Eastern Alps

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Within the Eastern Alps, the Gailtal basement has a particular tectonic position between the Periadriatic fault in the S and, with a steeply N-dipping boundary, the overlying Drauzug Permomesozoic cover in the N. Over large areas, it comprises a subvertical structural attitude with four tectonic units, which are separated by subvertical ca. E-trending semiductile and ductile sinistral strike-slip shear zones (Heinisch, 1987; Unzog, 1989). In the south, these E-trending units and shear zones are cut by the ESE-trending Periadriatic fault. The Gailtal basement includes from S to N: (1) the Gailtal Palaeozoic complex with medium- und rarely fossil-bearing low-grade metamorphic formations; (2) the Staurolite-Garnet Micaschist unit including the prominent Dellach augengneiss; (3) the Phyllonite unit, and (4) the Garnet-Micaschist unit. The main lithologies comprise metapelites and thin intercalations of mafic rocks. The Phyllonite unit with retrogressed rocks and particularly strongly sheared boundaries was considered to represent part of a wide Early Alpine, Cretaceous-aged shear zone (Unzog, 1989). We conducted, therefore, $^{40}Ar/^{39}Ar$ white mica dating combined with structural and microfabric analysis to reveal the age of cooling after the main stage of medium-grade metamorphism and the age of shearing along northern and southern boundary of the Phyllonite zone. The study resulted in following particular features of the Gailtal basement: (1) the age of cooling after the medium-grade metamorphic overprint of the Garnet-Micaschist unit is ca. 315 Ma (Variscan). A weak thermal and deformational overprint was not able to reset $^{40}Ar/^{39}Ar$ white mica ages within this unit. Post-Variscan deformation resulted in brittle deformation and associated hydrothermal alteration. (2) The ductile shearing of the northern boundary of the Phyllonite zone is Late Variscan in age (310-312 Ma). This demonstrates that the steep ductile shear zone with E-trending stretching lineation and within low-grade metamorphic conditions is much older as believed before and represent a late Variscan event. (3) However, based on several dated white mica concentrates, the main age of ductile shearing along the southern boundary of the Phyllonite unit (to the Staurolite-Garnet Micaschist unit) is at ca. 180 Ma (early Jurassic). (4) In all units, there is only a weak indication of the Cretaceous-aged low-grade thermal overprint on Variscan/Jurassic ages.

The Gailtal basement contrasts, therefore, the Mesozoic evolution of the Austroalpine nappe stack (exposed to the N of the Drauzug) with its Cretaceous-aged metamorphic overprint and the associated ductile deformation between ca. 110 and 80 Ma (Dallmeyer et al., 1998) and widespread Permian metamorphic overprint in the basement (Schuster et al., 2001). We interpret the Jurassic shear zone to represent an indication of Jurassic transtensional motion during Penninic rifting and discuss the implications for Mesozoic reconstructions.

References

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