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Tectonic boundaries in the southern Ötztal-Stubai-Complex: Kinematics, PT-conditions and timing of deformation

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The recognition of a significant Cretaceous metamorphic imprint in large parts of the Austroalpine crystalline basement had revolutionized the view on the tectonometamorphic evolution of the Eastern Alps 20 years ago (Purtscheller et al. 1987; Thöni & Hoinkes 1987). Whereas the earliest concepts regarded the Cretaceous event as a „static“ process of heating and re-equilibration, later studies also showed a significant deformational imprint (Sölva et al. 2005). These results suppose the subdivision of tectonic units within the Austroalpine crystalline complexes. However, the spatial position, metamorphic conditions, kinematics and age of tectonic activity at supposed boundaries are matter of discussion and need further investigation.

The Cretaceous tectonic boundary between i) the predominantly pre-Cretaceous metamorphic Ötztal-Stubai-Complex (OSC) and ii) the Cretaceous amphibolite to eclogite facies metamorphic Texel Complex (TC) has been clearly characterized in the central portion of the Schneeberg-Monteneve Unit (SC) (Sölva et al. 2005), but becomes ambiguous in its lateral SW and NE continuation. In order to constrain Cretaceous deformation processes in the hanging wall of the TC, three sections were investigated. In the i) Ferwalltal area structural and mineral compositional data document the interference of a predominant NW dipping amphibolite facies mylonitic foliation with a later N-dipping, strongly partitioned greenschist facies mylonitic foliation. Both indicate Top W shear deformation. In contrast, at the ii) Timmelsjoch mainly fold interference patterns were observed, which show only localized shear zones parallel to fold axial planes. In order to add relative age constraints, the deformational imprint of diabase dikes of presumed Permian-Triassic age (Purtscheller & Rammlmair 1982) has key importance. Due to strain partitioning, they may occur either discordantly cutting predominant earlier deformation structures, or as mylonites. Heterogeneity in deformation intensity also characterizes the iii) Matsch Unit W of the TC. Here, pegmatite-intrusions of Permian age - as constrained by Sm-Nd-garnet data - provide an excellent marker for pre- and post-Permian deformation. Multi-stage Cretaceous deformation covers folding by E-W trending axes and contemporaneous Top W shearing at lowermost amphibolite facies grade, followed by folding by NNE-SSW trending axes and again Top-W shearing at lowermost greenschist facies conditions.

The regional distribution of the described structural features in correlation with petrological and geochronological data allows identification of tectonic boundaries within the OSC, supposedly related with the exhumation of the Cretaceous eclogite facies rocks from the TC.

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New geochronological data of Kfs augengneiss in Ötztal - Stubai -Crystalline Complex, Reschenpass (Italy)

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In the S of the border triangle Switzerland - Austria - Italy, beneath the Mesozoic series of Piz Lad (2808 m) an exposed Kfs augengneiss [Qtz + Kfs + Pl + Ms + Grt + Ser + Ap + Zrn ± Bt ± Chl ± Ill ± Rt ± opaque ± Cal ± Gr] was sampled for both U/Pb (zircon) and Rb/Sr (white mica) age dating. It is one of numerous occurring augengneisses in the Ötztal – Stubai Crystalline Complex (ÖSC) and is intercalated in Ky - St - mica - schist/paragneiss.

The CL image of separated zircons illustrates magmatic crystallization, due to existing oscillatory zonings. Some of them feature recrystallisation. 29 in situ analyses of 23 zircons plot concordantly and define several zircon age ‘groups’, with the youngest zircon group yielding an age of 573 ± 10 Ma. This age is regarded as the crystallisation age of the protolith, with older zircons representing inherited xenocrysts. Altogether six zircon groups could be classified in this rock: [I] 573 ± 10 Ma (MSWD = 0.76; n = 6); [II] 677.8 ± 7.3 Ma (MSWD 1.60; n = 7); [III] 703.5 ± 9.8 Ma (MSWD 0.44, n = 2); [IV] 749 ± 19 Ma (MSWD = 4.9; n = 5), [V] 839 ± 12 Ma (MSWD = 0.13; n = 2) and [VI] 1960 ± 48 Ma (MSWD = 25; n = 3)

All age groups fit well into the regional age pattern as known from published data for the ÖSC, though this sample yields the oldest crystallization age known so far from all dated augengneisses/ orthogneisses. On the assumption that the 573 ± 10 Ma age dates the magmatic crystallization of the rock it implies that the metasedimentary rocks have a minimum Late Precambrian depositional age.

The Rb/Sr Ms-WR age of the orthogneiss is 328 ± 6 Ma (WR-Kfs-Ms1-Ms2) and confirms regionally known age data. Rb/Sr Ap-Fsp and the Rb/Sr Ap-whole rock regression reveals much younger ‘ages’ of 201.9 ± 2.2 Ma and of 241.7 ± 0.3, respectively, indicating either slow cooling or partial re-opening of the Rb/Sr isotope system in the augengneiss subsequently to Hercynian cooling.