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PERMO-TRIASSIC DUCTILE DEFORMATION IN THE AUSTROALPINE STRIEDEN COMPLEX (KREUZECK MOUNTAINS/ AUSTRIA)

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During Permo-Triassic time the Austroalpine – Southalpine realm was affected by an extensional event (BERTOTTI, et al., 1993; SCHUSTER et al., 1999). This extensional regime caused a high temperature/low pressure (HT/LP) metamorphic imprint and the formation of extensional structures. In the Kreuzeck-Goldeck-Drauzug area a more or less continuous section through a Permo-Triassic middle and upper crust up into the contemporaneous sediments is preserved. Metapelites of the Strieden Complex show distinct metamorphic zonation, indicating increasing temperatures with increasing structural depth (HOKE, 1990). They range from sillimanite-bearing schists with evidence for partial melting at the base, to low-grade phyllites at structural higher levels. This succession is transgressed by the Permo-Mesozoic Drauzug sequence. For the Strieden Complex a polyphase metamorphic and structural evolution, with at least four pre-Alpine ($D_I - D_o$) and two Alpine ($D_p - D_q$) ductile deformations have been discovered by HOKE (1990). New structural and geochronological data mostly confirm this deformation history but indicate a much more prominent deformational event D_o under HT/LP conditions which is Permo-Triassic in age.

Remnants of the earliest visible deformation phase D_I are a segregation layering S_I and concordant quartz mobilisate layers. During D_m the main schistosity (S_m) of the rocks developed. In amphibolites and marbles S_I defines tight to isoclinal folds (F_m) with dm to m-scale wave lenghts. In metapelites F_m is preserved as dismembered isoclinal fold hinges, which form quartz rods aligned with the foliation S_m. Syndeformative garnets were rotated and pressure shadows formed within the S_m foliation. F_n folding caused the repetition of amphibolites and marbles within the metapelites on a 10–100 m scale. The folds are open to tight with wave lenghts up to 100 m, their axes are dipping to the SE. A medium-grade assemblage including staurolite, kyanite and garnet formed syn to post-deformative to D_n. Hornblende and staurolite porphyroblasts are orientated within the NW-SE directed stretching lineation (L_n). A Sm-Nd garnet-whole rock isochron of 342 ± 3 Ma (SCHUSTER et al., 1999) defines D_m and D_n as Variscan in age.

Subsequently the Variscan assemblages are overgrown by andalusite, sillimanite and biotite respectively clinopyroxenes in amphibolites. In the sillimanite zone the steeply SSW dipping S_m was overprinted by a subparallel penetrative foliation (S_o) and a stretching lineation (L_o) defined by the high-temperature mineral assemblage and neosom layers. Pegmatitic intrusions that are interpreted as metamorphic mobilisates from the sillimanite-bearing schists are mostly concordant and show a variable grade of deformation. Some exhibit magmatic textures, whereas others are foliated or mylonitized. Core and mantle structures and grain boundary migration in feldspar indicate deformation at temperatures of more than 500°C. Discordant pegmatite veins are folded by open to tight folds (F_o) with E –W trending axes. The axial planes of the folded pegmatites correspond to the S_o foliation of the surrounding schists. Shear sense indicators are scarce and give no clear sense of shear. This might indicate plain strain as the dominant deformation mechanism.

As the intensity of D_o is rapidly decreasing above the sillimanite-zone S_o is most probably induced by thermal softening of the rocks in the zone of partial melting. Within the overlying andalusite zone irregular-shaped pods and veins of andalusite + quartz + muscovite are crosscutting S_m and S_n. According to HOKE (1990) and new Sm-Nd isochron ages on magmatic garnets the pegmatites are Permo-Triassic in age. The isochron from a coarse grained sample (RS35/00) yields 261 ± 3 Ma whereas a mylonitised pegmatite vein (RS43/99) yields 228 ± 4 Ma. The muscovite of the latter sample shows an Ar-Ar cooling age of 193 ± 2 Ma. As Ar-Ar ages on muscovite are interpreted as cooling ages below c. 400°C and as the high-temperature ductile deformation of the feldspars occurred at more than 500°C, D_o has to be Permo-Triassic in age.

In Eo-Alpine time (100–80 Ma) the base of the Strieden Complex was affected by a high strain and plastic deformation (D_p) under lower greenschist-facies conditions (HOKE, 1990). The main mylonite zone is presumed to be responsible for the primary exhumation of the eclogite-bearing Polinik Complex which borders the Strieden Komplex in the north. D_p structures are overprinted by the deformation D_q which caused a km-scale folding with WNW–ESE trending axes, as a consequence of N–S shortening.

In the Oligocene the dextral E - W Ragga-Teuchl fault zone developed in continuation of the Defereggen-Antholz-Vals lineament. This fault represents the present day contact of the Strieden and Polinik Complex. Contemporaneously basic and intermediate dikes aligned to the Periadriatic plutonism (30–40 Ma) intruded. They are subvertical and show no ductile deformation.

During the exhumation of the Tauern Window (c. 20 Ma) a system of brittle faults developed. In the northern part of the Strieden Complex the most prominent fault set is dextral, NW–SE orientated and aligned to the Mölltal fault. In the area W of the Möllkopf these faults crosscut the Ragga-Teuchl fault zone and induced up to 10 m deep gorges with cataclastic crystalline rocks and pseudotachylites at the base.

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