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Structural evolution of the Rieserferner Pluton: insight into the localization of deformation and regional tectonics implications

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The Rieserferner pluton (RFP, Eastern Alps, 32.2±0.4 Ma, Romer et al. 2003) represents a relatively deep intrusion (12-15 km; Cesare, 1994) among Periadriatic plutons. The central portion of the RFP consists of dominant tonalites and granodiorites that show a sequence of solid-state deformation structures developed during pluton cooling and exhumation. This sequence includes: (1) quartz veins, filling two set of steeply-dipping joints trending respectively E-W and NW-SE, commonly showing a millimetric grain size and associated with strike-slip displacement. (2) Quartz- and locally epidote-filled shallowly E-dipping joint set, commonly exploited as discrete derived from both the quartz veins and the host tonalite. These mylonites show a composite sense of shear with a first stage of left-lateral strike-slip followed by a top-to-E dip-slip (normal) movement. The synmylonitic assemblage includes biotite + plagioclase + white mica + epidote ± sphene ± garnet. (3) Set of N-S-trending steeply-dipping joints. These joints are concentrated in zones 1-2 m wide, separated by otherwise un-jointed domains a few tens to hundred meters wide, and are commonly exploited as brittle-ductile faults with dominant dip-slip (normal) kinematics. The mineral assemblage of fault rocks includes white mica + calcite ± chlorite ± quartz. The joints/faults are locally involved in folding. (4) Mafic dikes, dated at 26.3±3 Ma (Steenken et al., 2000), locally injecting the N-S trending set of joints. (5) Cataclasite- and pseudotachylyte-bearing faults also forming a set of steeply-dipping N-S-trending structures. These faults are commonly associated with epidote veins surrounded by bleaching haloes. (6) Zeolite-bearing faults marked by whitish cataclasites, fault gouges and mirror-like surfaces. These faults have a complex oblique- to strike-slip kinematics with an overall N-S trending lineation.
As observed in other plutons (e.g. Adamello; Pennacchioni et al., 2006), the network of deformation structures within the RFP is controlled by the development and later reactivation in shear of two main sets of joints during cooling and progressive exhumation of the pluton. These joints were either exploited as faults or localized ductile shear zones. In the RFP, the kinematics of shear reactivation is complex, with the same joint set recording different senses of shear and transport directions. Preliminary kinematic analysis and qualitative paleostress reconstruction show that there has been a clockwise rotation of the main regional shortening direction from WNW-ESE, during the first ductile event, to N-S during later brittle deformation. These two different shortening directions fit with those inferred, respectively, for Austroalpine nappe stacking by Ratschbacher (1989) and for the Alpine convergence during late Oligocene-Miocene within the Tauern window (Pennacchioni & Mancktelow, 2007).

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