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Kinematics of ductile deformation at the base of the Northern Calcareous Alps (Pailwand Klippe, Austria)

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Sedimentological observations from the Pailwand (Salzburg, Austria) and evidence for Late Jurassic high-pressure metamorphism led to the hypothesis of a south-dipping Jurassic subduction zone in the Northern Calcareous Alps. However, recently published 40Ar/39Ar dates from the Pailwand document illite/sericite formation ages younger than 110-120 Ma. The event is, therefore, part of the well documented mid-Cretaceous (i.e. Eo-Alpine) metamorphism of the Austro-alpine domain. Interestingly, no detailed structural field observations and micro-tectonic investigations have been published to support previous models. In this work, we present new field and microstructural data and discuss the results within the framework of previous petrological and geochronological results.

Our field observations support previous mapping and indicate that the Pailwand Klippe is divided by a central, roughly NW-SE striking calcite-mylonite zone dipping moderately steeply towards the SW to WSW. The adjacent western and eastern parts of the Pailwand record different geological histories in terms of structural evolution and lithostratigraphy. Most importantly, the central mylonite zone records evidence of low-temperature dynamic recrystallization of fine-grained calcite with left-over grains deformed by deformation twins. Dislocation creep was accompanied by dissolution precipitation creep, recorded in several generations of calcite vein formation that have been folded and stretched to various degrees. Vein formation was associated with a strong pressure solution cleavage perpendicular to the opening of the veins, forming an axial plane cleavage in folded and rotated veins. Depending on the dip of the myonitic foliation, these observations, together with local SCC' fabrics and σ-clasts in the calcite marble mylonites, suggest dextral strike-slip and/or top-to-the WNW thrusting kinematics.

Clearly, the deformation recorded was associated with the reported Eo-Alpine 40Ar/39Ar ages. Hence, our work gives further evidence for top-to-W thrusting of the Mesozoic cover units during the Eo-Alpine event, at the same time as parts of the Austro-Alpine Crystalline underwent high-pressure metamorphism.