Nappe stacking vs. extension: structures and microfabrics at the northern margin of the Gurktal Nappe Complex

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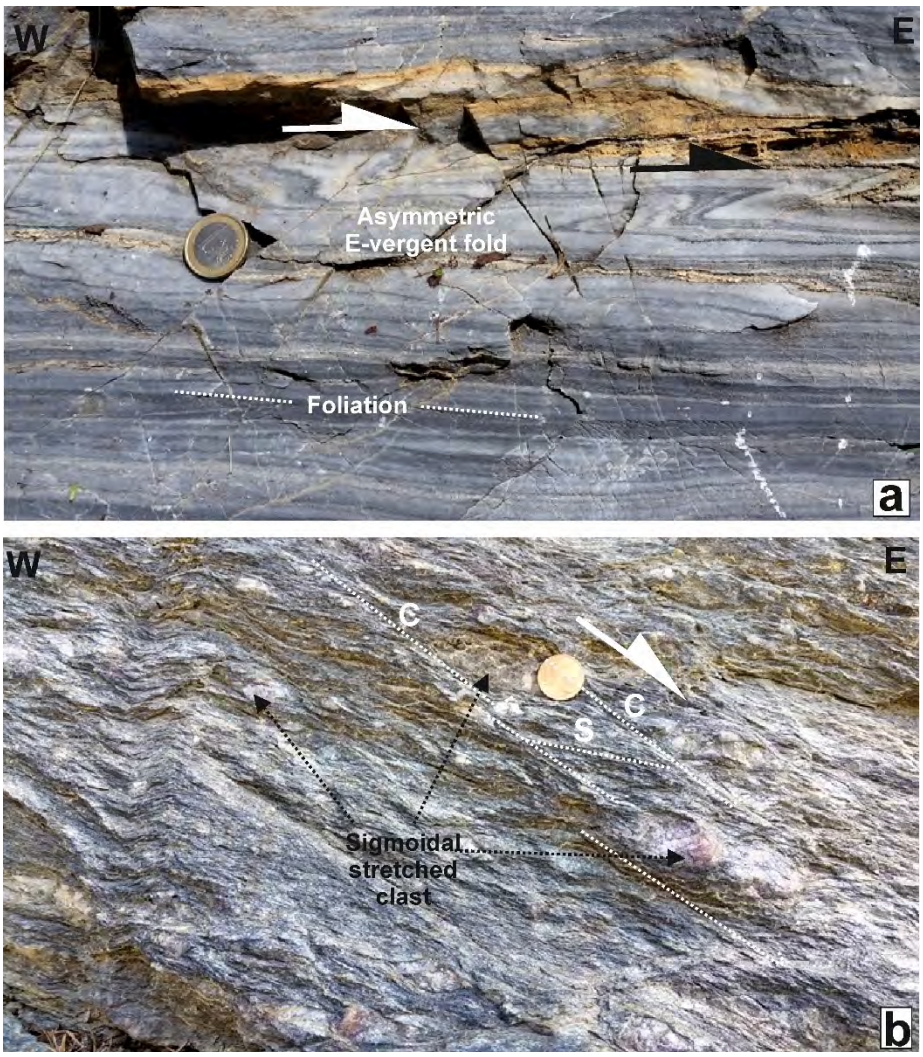
Conventionally, along northern margins of the Gurktal Nappe Complex, two major nappes are distinguished, the Murau and Stolzalpe Nappes with their Lower Paleozoic successions, both in low grade metamorphic conditions. As a peculiar feature, a Permomesozoic unit is intercalated in between (THURNER, 1958). Recent mapping suggest that this unit has its own phyllonitic basement and an entirely overturned Permomesozoic cover succession. Consequently, a separate tectonic unit is postulated, the Rinegg Nappe (termed after a village at the western slope of the Stolzalpe, where this cover is widely exposed).

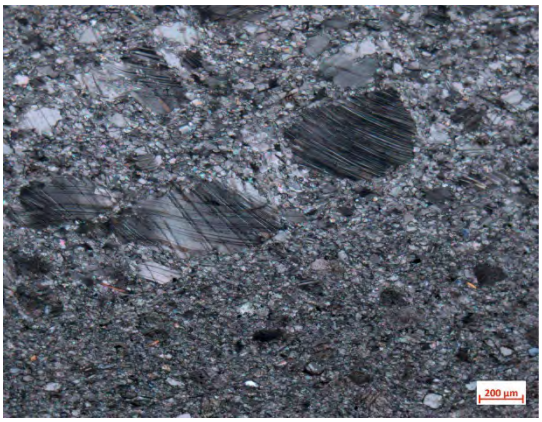
In this study, we investigated the structure, microfabrics and textures of all three units, the Murau, Rinegg and Stolzalpe Nappes north of Murau. Because of the mostly low-grade metamorphic conditions of the Permomesozoic cover and some age dating results from the wider area, the last metamorphic imprint is early Late Cretaceous in age and most synmetamorphic ductile structures must therefore be early Late Cretaceous in age as well. The Murau Nappe shows a large-scale isoclinal fault with an associated axial plane foliation and superimposed ductile shear fabrics with a subhorizontal foliation and a subhorizontal ESE–WNW-trending stretching lineation. The overlying Rinegg Nappe bears similarly oriented shear structures as well as the Stolzalpe Nappe at top. The Rinegg Nappe exposes an overturned lithostratigraphy (basement and Permian Verrucano Formation on top overlying Permian to Lower Triassic



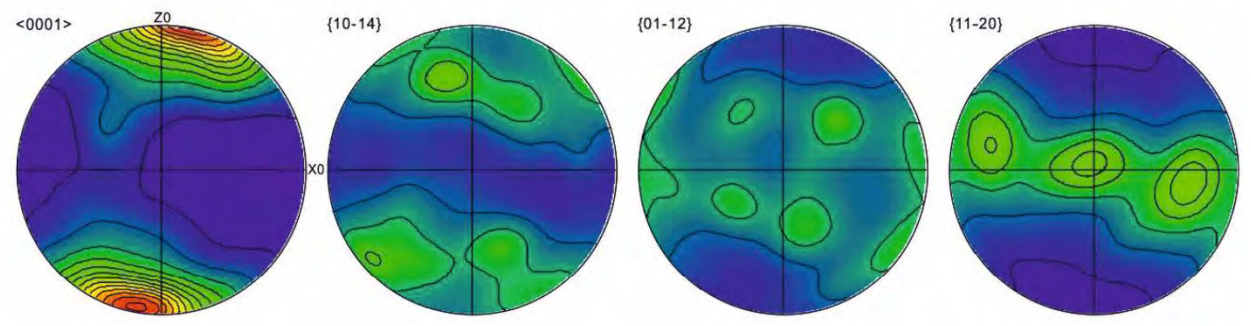
Text-Fig. 1: Top ESE ductile and semiductile shear from the southern Stolzalpe (a) Calcitic Murau marble (Murau Nappe) showing top E-vergent asymmetric folds. (b) Paraconglomerate of the Permian Alpine Verrucano Formation with S-C fabric and asymmetric, sigmoidal clasts showing ca. ESE-directed ductile shear. Note also some reddish vein quartz clasts representative for the Alpine Verrucano Formation.

sandstones and Anisian rauwacke). Even the Stolzalpe Nappe is overturned according the overturned conodont-bearing Devonian strata (NEUBAUER, 1980). In all three units, we distinguish three regional deformation phases:

Deformation phase D_1 includes ductile thrust fabrics with a foliation S_1 and stretching lineation L_1. Subhorizontal isoclinal folds indicate vertical thinning. This Deformation phase led to nappe stacking and carried the Rinegg and Stolzalpe Nappes onto the Murau Nappes. Because of the overturned succession, we suggest that these units represent Helvetic-style fold nappes. These structures are overprinted by often wide-spaced foliation S_2 and a stretching lineation L_2 of **deformation phase D_2** and hitherto undocumented top ESE-shear is commonly observed (Text-Fig. 1). The associated microfabrics of calcite marble document deformation within very-low-grade metamorphism (Text-Fig. 2) and consistently, top ESE-shear (Text-Fig. 3). The combined foliation S_1/S_2 is folded and kilometer-scaled open ESE–WNW-trending upright folds are observed (**deformation phase D_3**). D_1 is assigned to pre-Gosau early Late Cretaceous times, D_2 to Late Cretaceous times due to ESE-directed collapse of the orogenic wedge, which was also associated with formation of Late Cretaceous Gosau basins (e.g., the Krappfeld basin). D_3 has likely an Oligocene age based on regional considerations of the wider Gurktal Nappe area (e.g. NEUBAUER et al., 2018). This phase resulted in some NNE–SSW shortening of the entire Gurktal Nappe Complex.



Text-Fig. 2: Very low-grade metamorphic late-stage calcite microfabrics of a representative sample (MU-50B) of calcitic Murau marble with some small dolomite grains. Note wide range of grain-sizes and undulose twinned calcite grains indicating missing recrystallization after deformation within very low-grade metamorphic conditions.



Text-Fig. 3: Electron back-scattered diffraction pattern of calcite (<0001>) (left pattern) showing asymmetry to the right (= ESE) and top ESE shear (sample MU-50B).

References

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