Recent studies have combined surface field data, subsurface data from seismic surveys, earthquake analysis (especially distribution of clusters) with 3D modeling. The objective is to construct a kinematically consistant 3D-model that will help orient and constrain hydrocarbon and deep geothermal energy exploration as well as seismic hazard analysis.

Aspects of the pre-Alpine and Alpine tectonic evolution of the Gurktal Extensional Allochthon, Eastern Alps: Constraints from structural studies and $^{40}Ar/^{39}Ar$ white mica ages

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The nature and extent of Alpine thrusting of the Gurktal nappe complex represents one of the most controversial topics of Austrian geology. New structural and white mica $^{40}Ar/^{39}Ar$ ages from the Gurktal nappe complex, Eastern Alps, indicate ESE-directed distributed shear mainly leading to the present-day juxtaposition of the deeper Murau nappe overprinted in higher greenschist metamorphic conditions during the Cretaceous, to the higher, nearly unmetamorphic Stolzalpe nappe. The boundary in between represents, therefore, a ductile low-angle normal fault and the unmetamorphic Stolzalpe nappe the main body of a Late Cretaceous extensional allochthon. The distributed extensional shear system along the western margin of the Gurktal nappe complex overprinted nappe stacking structures and operated from initial ductile via semi-ductile and finally to brittle conditions within the same kinematic framework. A plateau age of 89.0 ± 0.6 Ma was found for newly grown white mica in the basal Lower Triassic Stangalm Quartzite exposed at the base of the Mesozoic cover succession on the Bundschuh basement. For the first time, a plateau age of 85.78 ± 0.33 Ma demonstrates the pervasive Late Cretaceous metamorphic overprint on the Murau nappe in the footwall of the regional, ESE-directed ductile detachment fault. This age is interpreted to date cooling after the throughout recrystallization of rocks composing the Murau nappe.

Furthermore, a post-Variscan angular unconformity below the Lower Triassic Stangalm Quartzites (PISTOTNIK, 1976) proves the preservation of style and orientation of Variscan structures in the Bundschuh basement unit. Essentially, an open N-trending fold is unconformably overlain by the above mentioned Lower Triassic Stangalm Quartzite. The basement micaschist displays three stages of deformation. Deformation stage D1 relates to the formation of a penetrative foliation within amphibolite facies conditions as pseudomorphs after staurolite testify. The second deformation stage D2 is represented by formation of E-W-trending isoclinal folds similar as in the wider surroundings. The isoclinal folds are again refolded in open, N-trending folds, representing deformation stage D3. This fold is discordantly cut and overlain by the Stangalm Quartzite. These relationships argue for a Variscan age of the dominant metamorphism within amphibolite facies conditions.

The pre-Alpine deformational structures at this angular unconformity indicate Variscan N–S shortening as the most dominant structure. This is in line with reports suggesting Variscan ca. SSW-directed SSW–NNE shortening at the famous angular unconformity between Devonian limestones and the Permian Prebichl Fm. at the structural base of the Northern Calcareous Alps (NEUBAUER, 1989). Together, these structures indicate ca. N–S resp. NNE–SSW Variscan shortening within present-day coordinates. However, this must be confirmed by further regional investigations.

NEUBAUER, F. (1989): Late Variscan structures of the Eastern Greywacke Zone (Eastern Alps). - Neues Jahrbuch für Geologie und Paläontologie Monatshefte, 1989/7: 425–432.

PISTOTNIK, J. (1976): Ein Transgressionskontakt des Stangalm-Mesozoikums (Gurktaler Alpen, Kärnten/Österreich). - Carinthia II, 166/86: 127–131.