



Kinematic Coupling in the Miocene at the leading edge of the Alpine-Carpathian wedge (Waschberg-Zdanice Unit, Austria-Czech Republic)

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Previous studies conducted in the framework of the project KARPATIAN TECTONICS on the front of the Alpine-Carpathian wedge based on industrial 2D and 3D seismic datasets, borehole and outcrop data have confirmed and characterized the complex deformation of both the autochthonous European foreland and the thrust nappes at the transition zone between the Eastern Alps and the Carpathians. The focus on the timing and exact sequence of thrusting within the nappe pile is further refined by detailed mapping of tectonic elements in 3D seismic volumes. Interpretation focuses on the central part of the Waschberg-Zdanice Unit in Lower Austria near the border to the Czech Republic.

The timing of Lower Miocene fault activation is accurately constrained by a high stratigraphic resolution within the time between the Eggenburgian (20.5 Ma) and Lower Badenian stage (~ 16.0 Ma). We identify several distinct phases of in-sequence thrusting at the leading edge of the orogen, as well as cross-cutting relationships indicating out-of sequence thrusting in the hinterland. This sequence of deformations is related to stress coupling across the floor thrust of the wedge, and deformation within the allochthon.

As a first stage the European foreland is deformed in front of the Waschberg-Zdanice fold-thrust units, including sinistral reactivation Variscan strike-slip faults such as the Diendorf fault system concurrent with thrusting in the Molasse Unit. There, extensional basins form at releasing bends of such faults during the Eggenburgian (~ 20 Ma). Thin-skinned thrusting in the frontal parts of the Alpine-Carpathian nappes occur in at least two distinct stages dated by Eggenburgian-Ottangian (~ 18 Ma) and Karpatian (~17 Ma) growth strata. Ottangian (~ 18 Ma) blind thrusting is dated by growth strata overlying a growth trishear fold. Out-of-sequence thrusts of surface-breaking faults cutting the growth strata panel in the backlimb of the growth trishear fold are active in the early Badenian. Such thrusts occur in both, the Waschberg-Zdanice Unit and the allochthonous Alpine-Carpathian units (Penninic Flysch nappes and Northern Calcareous Alps) in the area of the present Vienna Basin. Directions of thrusting and fault kinematics are very well constrained by 3D seismic mapping and visualization as well as by outcrop data.

Part of the Lower Miocene thrusts are reactivated as normal faults leading to the formation of half-grabens and listric normal faults bounding Neogene basins with Badenian to Pannonian fill. Thus, the termination of thrusting is dated by subsequent extension starting in the Badenian to Pannonian as dated by growth strata (Middle to Upper Miocene, ~ 16.0 to 10 Ma).