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# Kinematics and timing of deformation at the front of the Alpine-Carpathian wedge

# (Waschberg-Zdanice Unit, Austria-Czech Republic)

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The Waschberg Unit is located in Lower Austria and southern Moravia in the transition zone between the Eastern Alps and the Carpathians. It contains the outermost nappes of the Alpine-Carpathian orogenic wedge that were emplaced on top of the European continental margin. Seismic mapping in industrial 2D and 3D seismic datasets reveals complex deformation of both the autochthonous European foreland and the thrust nappes. High stratigraphic resolution constrains the timing of activation of faults in the foreland and the allochthon very accurately for the time window between the Eggenburgian (20.5 Ma) and Lower Badenian stage ($\sim$ 16.0 Ma). Within this time interval we identify several distinct phases of foreland deformation, which probably are related to stress coupling across the floor thrust of the wedge, and deformation within the allochthon

Seismic mapping and structural field data establish the following deformation features: (1) Deformation of the European foreland in front of the Waschberg-Zdanice fold-thrust units. Structures include the sinistral reactivation of Variscan strike-slip faults such as the Diendorf fault system, and extensional basins formed at releasing bends of such faults during the Eggenburgian ($\sim$ 20 Ma). (2) Inversion of Jurassic half-

grabens in the European basement leading to folding of the overlying foreland basin strata. Inversion occurred in two distinct periods dated by Eggenburgian-Ottnangian ($\sim$ 18 Ma) and Karpatian ($\sim$17 Ma) growth strata. During the intervening period the fault was inactive. Karpatian inversion is characterized by blind thrusting and the formation of a growth trishear fold. (3) Out-of-sequence thrusting of surface-breaking faults cutting the growth strata panel in the backlimb of the growth trishear fold. The direction of Upper Karpatian ($\sim$ 16.5 Ma) fold-thrusting is very well constrained the 3D geometry of structures mapped in seismic and by numerous outcrop data including fault slip data from Karpatian sediments. Accordingly, thrusting was directed towards NW. Outcrop data, however, prove an overprinting event of NNE-directed fold-thrust shortening. (4) The termination of fold-thrusting is dated by the formation of extensional basins on top of the allochthon. Normal-slip reactivation of the former thrust faults led to the evolution of half-grabens and listric normal faults. Extension is dated by growth strata of Badenian to Pannonian age ($\sim$ 16.0 to 10 Ma). Outcrop and seismic data indicate that probably all of the listed deformations occurred contemporaneously with sinistral strike-slip faulting along NNE-to NE-striking wrench faults.