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The influence of salt on the geometry and the extent of thrust sheets – a series of cross sections in the Eastern Northern Calcareous Alps (Austria)

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The initial thickness and the spatial distribution of autochthonous salt may not only influence sedimentation and segmentation into facies belts in the early stages of salt evacuation and halokinesis, but fundamentally controls the structural style and the geometries of thrust sheets during later shortening and rejuvenation of early salt structures. The Northern Calcareous Alps (NCA) salt-detached fold-and-thrust belt developed during two main stages of shortening: during the Middle Jurassic to Early Cretaceous closure of the Meliata ocean, the NCA units were detached from their basement in a foreland position on the lower plate, and later on during continent-continent collision between Adria and Europe from Eocene times onward were part of the upper plate. The Permo-Mesozoic sedimentary succession involved in the fold-and-thrust belt is dominated by thick non-metamorphic Triassic to Jurassic platform carbonates, underlain by a Permian-Triassic layered evaporitic sequence (i.e. Haselgebirge and Reichenhall Fms.) and covered by mid Cretaceous to Miocene synorogenic deposits.
Based on detailed field work, seismic and well data, a series of cross sections across the NCA from the Weyer Arc to the Vienna Basin subcrop is presented. We show that structural style varies significantly along strike, yet shortening values remain in a comparatively narrow range. Parts of this fold-and-thrust belt are characterized by large panels of overturned stratigraphy and frequent steep fault contacts that can repeat but also omit significant parts of the stratigraphic sequence. Abrupt changes in stratigraphic thickness and limited lateral extent of individual thrust sheets characterize the rather non-cylindrical structural style along strike. Large strike-slip faults previously described for the area commonly exhibit remnants of the Permian–Triassic evaporites and synorogenic strata, with nearby overturned panels, and separate thick Middle to Late Triassic platforms. This structural suite suggests that some of these large strike-slip faults most likely were salt ridges bounding minibasins that became squeezed, secondarily welded, and reactivated as thrust welds during regional shortening. In contrast, certain areas with thrust sheets extending over several tens of kilometers along strike do show remarkably cylindrical structures with little thickness variations, less abrupt facies changes, and a lack of steeply dipping fault contacts. We attribute lateral changes in structural style to variations in the primary thickness of the salt, the localization of mini-basins and the distribution of thick carbonate platforms before the system became a salt-detached fold-and-thrust belt.