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The Central European Permian Basins; Rheological and structural controls on basin history and on inter-basin connectivity

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We analyse the relative importance of the major crustal-scale fault zones and crustal architecture in controlling basin formation, deformation and the structural connections between basins. The North and South Permian Basins of Central Europe are usually defined by the extend of Rotliegend sedimentary and volcanic units and not by a common tectonic origin or development. Instead, the sub-basins that together form the Permian Basins are each controlled by different structural and/or rheological controls that are inherited from Early Paleozoïc and older geodynamic processes, they are even located in different crustal/lithospheric domains. The North Permian basin is located on Baltic crust that was thinned during Late Proterozoïc - Early Paleozoïc times. South of the Thor suture, the South Permian basin and its sub-basins are located on Avalonian crust (Southern North Sea and North German Basins) and on the transition of East European cratonic and Avalonian crust (Polish Through).
The size of crustal domains and of the faults that govern basin formation requires a regional-scale to assess their impact on basins and sub-basins. In the case of the Permian Basins this encompasses East Avalonia and surroundings, roughly speaking the area north of the Variscan Rheïc suture, east of the Atlantic and southwest of the Teisseyre-Tornquist line. This approach sheds light on the effects of long lived differences in crustal fabric which are responsible for spatial heterogeneity in stress and strain magnitudes and zonations of fracturing, burial history and temperature history. The focus on understanding the geomechanical control of large crustal-scale fault structures will provide the constraints and geometrical and compositional input for local models of stress and strain.
Considering their fundamentally different structural and rheological controls, the Permian (sub)basins have a remarkably common history of subsidence and inversion, suggesting a more or less continuous link between them. Post-Variscan, Late Carboniferous-Early Permian wrench tectonics is the oldest and main identified cause for regional basin formation in Central Europe. This relatively short-lived tectonic regime cannot explain the observed common history of subsidence of the Permian Basins during the 200 My that followed. Our analysis demonstrates that transfer faults that both follow and cross rheological transitions and inherited fault zones continued to be active after the early Permian. We therefore suggests that crustal-scale transfer faults may be the missing link that explains the common subsidence history of basins with a fundamentally different crustal architecture and structural history.