

## **From mantle dynamics to continental rifting, shelf evolution and basin subsidence**

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The evolution of Earth's topography is ultimately driven by plate tectonics and mantle dynamics, and understanding of these processes requires knowledge of deep Earth structure. The memory of past processes is kept in the sedimentary record and topographic evolution, as well as in physical properties and heterogeneity of the crystalline crust and upper mantle. Therefore, to understand topographic evolution, including the evolution of sedimentary basins and passive margins, we need to know the properties of the lithosphere and the underlying mantle. Laboratory experiments show that the different physical properties of rocks are interlinked, and often not with a unique or linear relation. Because different geophysical techniques are sensitive to different types of physical rock parameters, we apply multi-technique studies, including application of a variety of remote sensing geophysical and numerical modelling methods.

Sedimentary basins can form in all types of plate boundaries and the plate interiors, and they are affected by processes in the whole lithosphere plate and by mantle dynamic processes. Rifting is a major process involved in the formation of sedimentary basins. Traditionally this process has been understood in terms of either active or passive processes, i.e. as the result of mantle dynamics or plate tectonics. Today we know that reality is an interplay between the two and, depending on this interplay, the evolution of continental rifts takes different evolutionary paths: Into ocean opening and formation of continental shelves or into rift failure with formation of intracontinental basins.

The most common model for basin evolution is the McKenzie stretching model, which relies on the beta-factor that determines the stretching and thermal history of the rift zone, and thereby its hydrocarbon potential. However, recent research has shown that this parameter is often underestimated, e.g. at the Baikal and Dniepr-Donetsk rift zones. One should further keep in mind, that stretching-related basin evolution also depends on pre-existing structure. Our analysis of depositional systems around the North Atlantic margins has further been applied to determination of the uplift and erosional history of the surrounding onshore areas.

Other basin types include intracratonic basins, which often are understood in terms of mantle dynamics, but our recent research indicates that metamorphic processes may play a major role for the subsidence, e.g. in the West Siberian Basin. Even compression within continents may potentially create wide, deep basins by lithospheric buckling, e.g. the North German Basin. Also back-arc basins in subduction systems may be major basin forming regions, but their role is presently not well understood.

I will show examples from the structure and evolution of rift zones and wide continental sedimentary basins, and also discuss some new findings regarding the origin of intra-continental basins.