Looking at the LAB from above – what can we learn from 3D lithosphere-scale models of sedimentary basins?

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To understand the present day structure and the mechanisms of subsidence of basins in different tectonic settings we assess first-order heterogeneities in the sediments, crust and upper mantle. Thus we explore how far a good knowledge of the sedimentary and upper crustal configuration can provide constraints for the deeper parts of the system and how far the preserved record of deposits holds the key to unravel margin history. The present-day geometry and distribution of physical properties within the upper and middle crust is integrated into data-based, 2D and 3D structural models, which, in turn, provide the base for the analysis of the deeper crust and the lithospheric mantle. Different configurations of the deeper lithosphere can be tested against two independent observables: gravity and temperature, using isostatic, 3D gravity and 3D thermal modelling.

First results from the Norwegian passive volcanic margin indicate that the oceanic lithospheric mantle is less dense than the continental lithospheric mantle, that this is mainly due to thermal effects and that the transition between continental and oceanic lithosphere thickness is sharp. Furthermore, the thickness of the young oceanic lithosphere in the North Atlantic is smaller than predicted by plate cooling models but consistent with seismologically derived estimates. We also find that the oceanic LAB strongly influences the shallow thermal field of the margin. How far this holds also for older oceanic lithosphere is currently tested at the conjugate South Atlantic margins offshore South Africa and Argentina.

A second set of studies is focused on the lithosphere structure of intracontinental basins that have developed above a puzzle of crustal blocks amalgamated in several orogenies.