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Anomalous tectonic subsidence in intraplate basins

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Broad intraplate basins often show a component of anomalous tectonic subsidence that is usually vaguely attributed to heterogenous basement (”accretionary crust”) and which does not conform to the current understanding of rift basin evolution. In order to resolve the driving force and geodynamic framework for these long-term depositional regions, we have been analysing a global set of more than 250 basins using various remotely-sensed geophysical data sets and a relational geospatial database. The available crustal structure data have been used to compute differential extension factor and anomalous subsidence grids to investigate the role of the basin age.

By integrating our crustal structure data into the EarthByte/Torsvik plate tectonic model and a global mantle convection framework we have been able to analyse the long-term influence of dynamic topography on intra-continental basin evolution. In our study we show that most of the typical intracontinental basins experience a downward “mantle-drag” over the last 100 Ma, resulting in increasing negative dynamic topography and thus the creation of additional sediment accomodation space, which can not be detected with conventional basin modelling tools. Periods of basin inversion may also be linked to major changes in the dynamic topography gradient. Our results clearly indicate that the effects of mantle convection need to be considered in regional basin modelling studies.