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Linking mantle convection and intraplate basin evolution: a way to decipher anomalous subsidence?

C. Heine, R. D. Müller

EarthByte Group, School of Geosciences, The University of Sydney, NSW 2006, Australia (christian@geosci.usyd.edu.au / +61 2 93510184)

Large intraplate sedimentary basins have often been depocentres over long geological times without showing obvious signs of active rifting / extension in the structural record. Furthermore, these basins also often show a component of anomalous tectonic subsidence which has so far only been attributed to specific crustal properties of "accretionary crust" (e.g. very heterogenous basement) or major crustal lineaments in the basin substrate. So far, the driving forces for this anomalous subsidence remain enigmatic. In order to investigate the evolution of intraplate basins, we have analysed more than 250 basins using crustal structure data (e.g. CRUST2), and computed anomalous total tectonic subsidence grids.

Integrating these results in a global mantle convection and plate tectonic framework, we have investigated the time-dependant effect of dynamic topography within intraplate basins for the last 150 Ma. Our results show, that, since the dispersal of Gondwana, many of these basins show a trend of increasing negative dynamic topography over at least the last 100 Ma and thus the creation of additional sediment accomodation space, which is not detectable using conventional basin modelling tools. We present case studies of basins where it is possible to link periods of accelerated subsidence and/or uplift to mantle dynamics. The results cleary illustrate that the effects of mantle dynamics need to be considered in regional basin modelling studies.