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Symmetry during the syn- and post-rift evolution of extensional back-arc basins: the role of inherited orogenic structures

Attila Balazs (1), Evgueni Burov (2), Liviu Matenco (1), Katharina Vogt (1), Thomas Francois (1,2), and Sierd Cloetingh (1)

(1) Utrecht University, Faculty of Geosciences, Utrecht, The Netherlands, a.balazs@uu.nl, (2) Université Pierre et Marie Curie, Institut des Sciences de la Terre de Paris, France

Rheological heterogeneities in the lithosphere have first order control on the topographical expression of tectonic processes. Pre-existing orogenic suture zones localize extensional deformation resulting in asymmetric basins. Such crustal geometries are often in contrast with the more symmetric regional lithospheric structure observed beneath extensional basins. We study such (a)symmetries and their controlling parameters by conducting a series of 2D thermo-mechanical numerical experiments of the extension of an overthickened, hot lithosphere that contains a weakness zone. The modelling shows that syn-rift subsidence is low to moderate creating asymmetric half grabens where extension migrates in space and time, grouped in an overall symmetrical appearance on a larger scale. The initial lithospheric mantle asymmetry is attenuated by the lateral heat conduction and further dynamic evolution of the thermal anomaly during the "post-rift" phase, resulting in differential vertical movements of the crust including additional 2-3 km subsidence in the basin centre. The modelling shows that the initial crustal and lithospheric thicknesses, rate of extension and surface processes strongly control the thermo-mechanical evolution of the extensional system. The numerical modelling yields new insights into the mechanics of coupling between near-surface kinematics and the evolution of deep lithospheric structure in the Pannonian back-arc basin of Central Europe.