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Numerical modelling investigating 3D oblique margins structure in mountain building

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Geophysical imaging of magma-poor rifted margin structure show that hyper-extended domains, between the necking zone and the exhumed lithospheric mantle, represent 70 to 200 km. When inverted as a result of collision, these domains form the internal parts of mountain belts. In this study, we investigate how the structure and the laterally changing nature of rifted margins (structure, temperature) contribute to the temporal and spatial localization of deformation observed in mountain belts. To do so, we performed 3D high-resolution numerical models involving the formation of oblique passive margins before switching the velocity boundary conditions from extensive to compressive. We also coupled the thermo-mechanical computing with a simple 2D surface diffusion to model large scale erosion-sedimentation processes. On the one hand, we study how the initial conditions influence the obliquity, evolution, and final structure of the margin, the basins and thermal anomaly distribution. On the other hand, we investigate how these rifting inherited characteristics influence the evolution of the following mountain belt. The numerical models were performed with pTatin3D a parallel implementation of the finite element method, which employs an Arbitrary Lagrangian Eulerian discretization, together with the material point method.

This study is included to the Orogen research project, a tripartite partnership between academy and industry (Total, BRGM, CNRS). The High Performance Computing has been performed on Pangea super-computer (Total SA).