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Orogenic structural inheritance and rifted passive margin formation

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Structural inheritance is related to mechanical weaknesses in the lithosphere due to previous tectonic events, e.g. rifting, subduction and collision. The North and South Atlantic rifted passive margins that formed during the breakup of Western Gondwana are parallel to older structures such as the Caledonide and the Brasiliano-Pan-African orogenic belts. In the South Atlantic, 'old' mantle lithospheric fabric resulting from crystallographic preferred orientation of olivine is suggested to play a role during rifted margin formation [1]. Magnetometric and gravimetric mapping of onshore structures in the Camamu and Almada basins suggest that extensional faults are controlled by two different directions of inherited older Brasiliano structures in the upper lithosphere [2]. In the South Atlantic Campos Basin, 3D seismic data indicate that inherited basement structures provide a first order control on basin structure [3].

Here we investigate the role structural inheritance on the formation of rifted passive margins with high resolution 2D thermo-mechanical numerical experiments. The numerical domain is 1200 km long and 600 km deep and represents the lithosphere and the sublithospheric mantle. Model experiments were carried out by creating self consistent orogenic inheritance where a first phase of orogen formation is followed by extension. We focus in particular on the role of varying amounts of orogenic shortening, crustal rheology, contrasting styles of orogen formation on rifted margin style, and the time delay between orogeny and subsequent rifted passive formation. Model results are compared to contrasting structural styles of rifted passive margin formation as observed in the South Atlantic continental margins.

References:

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