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TITLE: The Effect of Large-Scale Tectonic Activity on Rifted Marginal Basin Petroleum Systems

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ABSTRACT BODY:

Abstract Body: The South Atlantic conjugate margins host petroleum systems, which are thoroughly explored on hydrocarbon potential. Sediment fill, source rock characterisation and basin structures are well-investigated. However, questions arise about the vertical movements of these basins that are observed on seismic data, and that cannot be explained by climate changes or basins scale processes. This implies basin uplift and subsidence resulting from large-scale (mantle) tectonic processes. In this study we investigate how mantle plume-induced continental break-up can cause vertical basin movements and what thermal evolution corresponds to this type of tectonic activity. We examine how the thermal changes that result from these tectonic processes influence source rock maturation and hydrocarbon migration.

Firstly, we use a 2D thermo-mechanical code to study the impact of the continental lithosphere's thermo-rheological structure and initial plume position on the thermal evolution of continental rifting and breakup processes. The experiments show that plume material has three possible ways of interfering with a rift centre: a) plume material rises to the centre of the rift, b) plume material arrives partly at the centre of the rift and is partly glued to the base of the lithosphere or c) plume material remains completely below the lithosphere without directly influencing the break-up centre. Accompanying vertical motions have been observed that result directly from these large-scale tectonic processes. Secondly, we extract the heat flow evolution of the three systems, whose respective thermal histories show significant differences. Lastly, we will test the influence of the different thermal evolutions on the marginal basins along the Namibian coast with the use of a petroleum system model. We take into account a detailed evaluation of the sediment fill of the basins and vertical motions as well as the calculated heat flow history. These results are then compared with previous results to determine whether large-scale tectonic processes should be accounted for in basin and/or petroleum system modelling.

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