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TS2P - The Transform Source to Sink Project - 3D Modeling of the Long Term Stratigraphic Evolution of a Transform Margin

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SUMMARY

The thermal and flexural evolution of passive margins are impacted by the (un)loading effects of erosion/ sedimentation processes, which, in turn, affect their relief and sediment accumulation. This complex coupling is recorded by the stratigraphic trend of the associated sedimentary basins, which is controlled by the balance between sediment accumulation, subsidence and eustasy.

Introduction

The thermal and flexural evolution of passive margins are impacted by the (un)loading effects of erosion/sedimentation processes, which, in turn, affect their relief and sediment accumulation. This complex coupling is recorded by the stratigraphic trend of the associated sedimentary basins, which is controlled by the balance between sediment accumulation, subsidence and eustasy.

Our objective is to constrain the relative contribution on the denudation/accumulation history, uplift/subsidence history and long-term stratigraphic trend (shoreline migration), of parameters controlling the mechanical response of the underlying lithosphere and surface processes efficiency. The novel aspect of our approach is to integrate the evolution of both domains in erosion and in sedimentation, using state of the art modeling of the flexure of the lithosphere combined with models of surface process and the thermal evolution of the lithosphere, as well as concepts in sequence stratigraphy.

We used a new numerical model to calculate the surface deflection of a two-dimensional, yet variable thickness, thin elastic plate. It is coupled to a 3D thermal model incorporating the conduction, advection and production terms that allows to compute the thermal subsidence resulting from the stretching-induced perturbation of the isotherms (assuming that the effective elastic thickness is controlled by the depth to a given isotherm) and to a diffusion surface processes model.

We investigated numerically the post-rift long-term evolution (100 Myr) of a non-cyindrical passive margins based on a stretching geometry derived from the present-day geometry of the Western Africa Transform Margin to predict denudation and sediment accumulation patterns and a stratigraphic architecture which we compare to observations: estimations of denudation based on geomorphic markers: 3D maps of well dated successive alteration paleo-surfaces, sedimentation accumulation histories and stratigrahic charts compiled at the scale of the whole west African margin.