MODELLING RIFTING SEQUENCE STRATIGRAPHY COUPLED WITH SURFACE PROCESS AND THERMO-MECHANICAL MODELLING

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Rift settings preserve high-fidelity records of their depositional history in response to multiple processes, such as climate change that significantly influences the sediment input, and tectonic deformation which contributes to accommodation generation or consuming. Integrated studies of geomorphology, thermochronology, analog experiments and numerical modelling improved our understanding of the rifting processes and associated structural evolution. However, the interplay between climate change, sediment transport from eroding highland to rift basins and rift-related deformation is poorly understood.

We present a forward numerical scheme that couples surface process with thermo-mechanical modelling on a rift setting. In the coupling numerical framework, a 2D (potentially 3D) lithospheric scale model is set up. The erosion, sediment transport and deposition are controlled by surface processes with the boundary conditions of climate force (precipitation) and erosion coefficient. The resulting sediment volumes are transferred to the thermo-mechanical system, which has significant effect of crustal deformation. The produced tectonic uplift or subsidence then contributes to the change of surface topography and thus the sediment routing. We focus on investigating the climatic controls on source dynamics, sediment transport, and the deposition in both marine and nonmarine environments. We then quantify the influence of sediment accumulation on crustal deformation and rift evolution. The resulting stratigraphic architecture will be analyzed through evolving stratal stacking patterns and shoreline trajectories to explore the feedbacks between erosion/deposition patterns and the rift structural. We will then apply our modelling to typical rifting examples such as East Africa rift system.