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Influence of break-up obliquity on the sedimentation of rift margins.

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When continents break apart, extensional tectonic activity leads to the formation of basins with several kilometres of sediments. Most numerical models of rifting assume simple orthogonal extension, while new studies show that more than 70% of global rifts on Earth exceeded an obliquity of 20 degrees (Brune et al. 2014; 2016, Dewey et al., 1998). Despite these observations, very few attempts have been made to model and quantify the effect of different styles of oblique extension on the erosion, transport, and deposition of syn-rift sediments.

We use a new numerical simulation package that couples lithospheric-scale thermo-mechanical models (http://www.underworldcode.org/) with surface process models (https://github.com/badlands-model) for unravelling the effect of rift obliquity on the distribution of facies and the evolution of stratigraphic architecture in syn-rift deposits.

We simulate three million years of evolution for a narrow rift with a range of Earth-like rift obliquities. These models show that rifting obliquity induces an asymmetry on the margin sedimentation rates, which is two to three times higher in one of the margins. The margin with thicker sediments contains an important proportion of scattered deposits of deep and deltaic environments, while the conjugate margin contains less sediments of interconnected shallow marine depositional environments. These 4D models take into account the two-way influence of sedimentation on crustal/lithospheric deformation enable better prediction of the formation, preservation, and economic significance of sediments related to rift evolution.