Basin migration: an integrated numerical/analogue modelling approach addressing lithosphere thermal state.

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Changes in temperatures in the lithosphere coeval to, or post extension trigger strength variations in the lithosphere.

We investigate with numerical modeling the effect of these variations on basin migration.

Under very slow extension rates, lithosphere temperature decreases during rifting. This results in an increase in its strength at the locus of the original basin, where the lithosphere will eventually become stronger than the surrounding one. With ongoing extension, the basin shall then migrate.

Two phases of lithosphere extension, separated by a long period of tectonic quiescence will have the same effect. The tectonically quiet period is characterized by cooling of the initial basin and strengthening of the underlying lithosphere. During the second phase of extension, the locus of strain migrates toward weaker lithosphere.

Our models are successfully showing how temperature variations trigger basin migration. However, they predict spatial and time migration that may be larger than observed in nature.

We therefore investigate with analogue modeling, how rheological layering of the lithosphere constraint strain repartition and basin migration.
Models are constructed using 3 or 4 layers of alternating sand and silicone putties representing the brittle and ductile layers of the crust and mantle respectively.

We show how the thermal state of the mantle ie. absence/presence of a brittle upper mantle controls the width of the crustal deformed domain.

We show how the thermal state of the crust ie. absence/presence of a lower ductile crust control basin migration.