**Preferential development of extension-orthogonal basins in oblique continental rifts**

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Deformation occurs on a wide range of scales in the Earth's lithosphere. On the largest scale, oblique deformation where slip vectors are not precisely orthogonal to plate boundaries is an inevitable consequence of relative plate motion on a spherical surface (McKenzie and Jackson, 1983). In tectonic environments where oblique extension dominates three-dimensional deformation inevitably develops and drives complex strain partitioning in the lithosphere. Understanding the preferred orientations and relative timing of the geologic structures formed during oblique rifting is critical to study passive margins development and remains an active research topic.

We use a high-resolution three-dimensional thermo-mechanical numerical model with a free-surface (May et al., 2015), to investigate the relative timing and distribution of geologic structures during oblique rift development in the continental lithosphere. The obliquity of the rift is prescribed in the models using a wide oblique heterogeneous weak zone allowing intra-rift shear zones to form freely.

We show that strain localisation and the evolution of the deformation pattern in oblique rifts promotes the development of complex transtensional systems in which extension-orthogonal shear zones play a critical role. Comparison with observations from natural oblique continental rift and passive margins confirms the importance of extension-orthogonal shears in accommodating pre-breakup extension.

## References:

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McKenzie, D., and Jackson, J., 1983, The relationship between strain rates, crustal thickening, paleomagnetism, finite strain and fault movements within a deforming zone: Earth and Planetary Science Letters, v. 65, p. 182–202.