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Analysing the deformation width of transtensional rifted margins

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Rifted continental margins show variations between a few hundred to almost 1000 km in their conjugated widths from the relatively undisturbed continent to the oceanic crust. For example, rifting in the Gulf of Aden led to deformation widths of less than 200 km, whereas during the Late Jurassic separation between Iberia and Newfoundland led to deformation width more than 800 km. The movement direction was oblique to the rift trend (65°) for the Gulf of Aden, and more or less orthogonal for Iberia-Newfoundland with a rifting obliquity less than 10°. It is tempting to relate the observed variation in margin widths to differences in rifting obliquity. Also analogue and numerical modelling results suggest that the deformation width of rifted margins may have a relationship to their obliquity of divergence with narrower margins for higher obliquity. We here test this by analysing the obliquity and rift width for 25 transtensional conjugate rifted margin segments in the Atlantic and Indian Oceans.

We use the plate reconstruction software GPlates (www.gplates.org) for different plate rotation models to estimate the direction and magnitude of rifting from the initial phases of continental rifting until breakup. Our rifted margin deformation width corresponds to the distance between the onshore maximum topography and the offshore limit where the continental crust is thinner than approximately 10 km. For narrow rifted margins, the offshore limit usually corresponds to the Continent-Ocean Boundary, here defined as the last identified continental crust, while for hyper-extended rifted margins, such as the Norwegian margin, we consider the 10 km thick continental crust limit. The maximum topography limit is determined using the global relief model ETOPO1 (Amante and Eakins, 2009).

From our analysis of the 25 transtensional rifted margin, we find a weak positive correlation between the obliquity of rifting and deformation width. Highly oblique margins are narrower than orthogonal margins, as expected from analogue models. This correlation may imply that the required force for breakup is less for oblique margins, which has been argued for on the basis of numerical models.