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Deformable plate tectonic models of Mesozoic continental breakup and transform system development in East Africa

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Significant poly-phase deformation occurs in adjacent continental domains prior to, simultaneously with, and after continental breakup. Constraining this deformation is essential for understanding the regional development and the mechanisms driving and controlling rifting and breakup. Here, we primarily use published constraints to construct deformable plate tectonic models for the East African conjugate margins of Madagascar and Somalia/Kenya/Tanzania using GPlates, an open source plate tectonic modelling environment. The aim of this work is to test both the capability of the GPlates deformable modelling approach and the published model inputs, including time and location of necking zones and earliest oceanic crust. The results demonstrate that inclusion of independent micro-continental fragments (e.g. Comoros microcontinent and the Bur region in Somalia) and locally defined limits of continental crust, generally produce results more akin to observations. The results also allude towards a complex poly-phase progression of rifting that led to the formation of continental fragments surrounding the Western Somali Basin. These deformation episodes are likely linked to changes in plate kinematics and had significant consequences for the age and crustal nature of the Somali margin. Finally, we suggest that the extreme compressional deformation observed offshore Madagascar and Mozambique along the Davie Ridge is also the result of Mesozoic plate motions.