How conjugate margins enhance our understanding of lithospheric processes while reducing risk in frontier exploration

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The availability of high fidelity reflection seismic data has transformed our understanding of passive continental margins over the past decade. Through integrating the interpretation and restoration of such seismic profiles with potential fields modelling we develop a better understanding of the geodynamic processes that drive lithospheric stretching from rifting through to margin basin formation. Furthermore, by considering these observations in the context of plate reconstructions, we can use conjugate margin restorations to constrain plate modelling and as a predictive tool for understanding the hydrocarbon systems that may be present within them.

In this study, we apply these techniques on both volcanic and non-volcanic margins and illustrate it with a series of examples from the South Atlantic, Somalia, and Bay of Biscay. Regardless of the margin type the key question is how to characterize the margin architecture. How this architecture is manifested on each of the conjugate margins plays a critical role on the development of plate reconstructions and how we understand the evolving associated basins.

In volcanic margins, central to the reconstruction is which magmatic margin model is applied, and at which point new crust is formed. This has significant impact on the heat-flow and subsidence of the conjugate sections. On non-volcanic margins many of these questions have been considered, in particular on the archetypal Iberia–Newfoundland conjugate system. In this study, we take existing models of this conjugate system and consider how applicable they are to two other examples of non-volcanic, highly extended margins. On the Somalian margin, conjugate studies require a complex three-plate reconstruction, but provide valuable insights into along-margin variations and the nature of the upper and lower plates. In contrast, the Bay of Biscay basin remains rather enigmatic especially in the context of the Iberia–Newfoundland margin but provides insights into the importance of integrating such sections into a plate reconstruction and the complexity that exists at the point of continental breakup.

Having evaluated these examples we then consider the impact that these conjugate margin studies, and the associated reconstructions, have on the petroleum systems that are intimately linked to the rift and drift stage of basin development.

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