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Uncertainties in breakup markers along the Iberian Newfoundland margin: The need for a new North Atlantic plate model

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The Iberian-Newfoundland conjugate margins are one of the most extensively studied non-volcanic rifted margins in the world. In recent years, researchers have focused their efforts at better understanding the earliest stages of continental rifting, often relying heavily on the identification of so-called “break-up features” imaged in seismic profiles or interpreted from potential field data. Along the Iberian-Newfoundland margins, widely used break-up markers include interpretations of old magnetic anomalies from the M-Series, as well as the J-anomaly, believed to mark the occurrence and spatial extent of first oceanic lithosphere. However, uncertainties in the location and interpretation of these features have led to discrepancies between modelled depictions of the palaeopositions of Iberia and Newfoundland during the early Cretaceous as well as the timing of first seafloor spreading between the two.

Using new seismic data from the Southern Newfoundland Basin (SNB) we are able to illustrate the unsuitability of “break-up” features along the Iberian – Newfoundland Margin for plate kinematic reconstructions. Our data shows that basement associated with the younger M-Series magnetic anomalies is comprised of exhumed mantle and magmatic additions, and most likely represents transitional domains and not true oceanic lithosphere. Magmatic activity in the SNB as early as M4 times (128 Ma), and the presence of SDR packages onlapping onto basement faults suggest that, at this time, plate divergence was still being accommodated by tectonic faulting. Therefore, young M-series anomalies (including the J-anomaly) are not suitable basis on which to reconstruct plate positions during the early stages of continental separation.

We instead follow an alternative modelling approach, not reliant on the identification of extended continental margin features, to robustly constrain North Atlantic tectonics pre-M0 (~121 Ma) times. We do this by using seafloor spreading data and a statistically robust inversion method as the basis for a number of purpose built two-plate models for Africa, Iberia, Eurasia, Greenland and North America, with quantified uncertainties. Together, these models will provide an invaluable framework within to study the evolution of the extended continental margins immediately prior to and during continental separation.