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Unravelling the influence of orogenic inheritance on the architecture and tectonic evolution of hyper-extended rift systems

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The aim of this starting PhD thesis is to determine under what conditions inheritance produced by former orogens influences subsequent rifting, and to unravel the influence of inherited structures and heterogeneities on the architecture and tectonic evolution of hyper-extended rift systems. To complete this task, we map along the Central and North Atlantic margin 1) rift domains; 2) age of the major rift events; and 3) key structure and heterogeneities inherited from the Caledonian and Variscan orogens. We will then study these data in the light of minimal numerical modelling experiments and use them as a basis for designing more comprehensive numerical models for the North Atlantic rifting.

In order to map the Atlantic margins, we use gravity, magnetic data, seismic reflection and refraction to identify the necking zone and the continentward limit of the oceanic domain. This allows us to define the proximal domain where continental crust is not or barely thinned on one side, the unequivocal oceanic domain on the other side, and the hyper-extended domain between them. Within the hyper-extended domain, we rely on seismic data (refraction and reflection) to distinguish the area where the crust and the mantle are decoupled from the area where they are coupled, and to identify potential zones with mantle exhumation and/or magmatic additions. Previous studies mapped these domains along Iberia-Newfoundland and Bay of Biscay. The objective of this PhD is to extend this mapping further to the North, along the Irish, UK and Norwegian margins, into domains with polyphase rifting and magmatic additions.

One of the goals of this work is to highlight potential correlations between first-order changes in the architecture and/or magmatic evolution of the Atlantic margin and first-order structures and heterogeneities inherited from the Caledonian and/or Variscan orogens. We also aim to assess the importance of inheritance in structuring and controlling the evolution of hyper-extended magma-rich versus magma-poor rift systems.

We present our three preliminary maps, displaying 1) rifts structural domains; 2) the age of necking; and 3) the major Caledonian and Variscan inherited features in Western Europe. We also give insight into the numerical experiments we intend to run.