EGU2020-5092
https://doi.org/10.5194/egusphere-egu2020-5092
EGU General Assembly 2020

3D fault network development at the Galicia magma-poor margin, North-Atlantic

Derren Cresswell[1], **Gaël Lymer**[2,3], and Tim Reston[1]

[1]University of Birmingham, Geosystems Research Group, Birmingham, United Kingdom
[2]Fault Analysis Group, UCD School of Earth Sciences, University College Dublin, Belfield, Ireland
[3]iCRAG (Irish Centre for Research in Applied Geosciences), School of Earth Sciences, University College Dublin, Belfield, Ireland

We investigate the structures of hyper-extended continental crust and the 3D nature of the development of syn-rift fault networks at the Galicia margin, West of Spain, based on observations from a 3D multi-channel seismic reflection dataset acquired in 2013. This seismic volume provides, for the first time, 3D high-resolution imaging of a fault network geometry above a detachment fault (The "S reflector") in the distal setting of a continental margin. The Galicia margin is sediment-starved, magma-poor and salt-free, thus providing optimal observations of the structures through seismic data.

We use the 3D data to observe the geometries of the faults, to analyse the fault heaves at different levels of the litho-stratigraphic sequence (i.e. at the top of the crystalline basement, at the top of the pre-rift/early syn-rift sediments and at the top of the syn-kinematic sediments), and to make a stratigraphic analysis to constrain the dynamics and the kinematics of fault activity within the successive half-grabens.

Our 3D interpretations demonstrate that the continental crust thins to zero during the rifting by the simultaneous development of initially individual fault planes, which progressively link with adjacent faults to form a network of active faults. The linked roots of the faults altogether form the surface of the S at depth, and allow the oceanward propagation of the detachment fault during the rifting. The faults throughout the network remained active and progressively rotated with further extension, until their deactivation when they acquired an angle of ~30°. Whereupon, a new network of active, initially isolated, faults developed and linked one step (~10 km) oceanward. The system repeats until the break-up of the continental crust, resulting in the progressive focussing of the locus of the extension toward the ocean, where the continental crust is the thinnest.

Given the similitude of the features observed at the Galicia margin with other magma poor continental margins, we expect that most margins worldwide might have formed following similar processes, thus representing a paradigm shift in the global understanding of late fault network development at rifted margins during continental break-up.