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New results from a 3D seismic academic dataset across the west Galicia margin

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The west Galicia margin (western Spain) is a magma-poor margin and has limited sedimentary cover, providing ideal conditions to study the processes of continental extension and break-up through seismic imaging. The margin is characterised by hyper-extended continental crust, well defined rotated faults blocks with associated syn-kinematic sedimentary wedges, and exhumed serpentinized continental mantle. Faulted blocks overlie a bright reflection, the S reflector, generally interpreted as both a detachment and the crust-mantle boundary. But open questions remain concerning the role of the S detachment in extension leading to breakup.

To study further the S reflection and its role in continental breakup, a new 3D high-resolution multi-channel seismic dataset has been acquired over the Galicia margin during summer 2013. It consists in 800 inlines and 5000 crosslines distributed on a ∼680 km2 areal. This 3D dataset is thus the largest academic one of its kind. It extends across the edge of the continental crust and captures the 3D nature of extension and break-up of the northern Atlantic continental margins.

Here we present some results from our interpretations of the 3D volume, which allow various horizons, including the base of the post-rift sedimentary cover, the top basement and the S reflector, to be mapped out in 3D. These maps provide 3D views of the margin structure and also reveal the texture of each horizon. We also focus on the internal structure of some of the faulted blocks through interpretation of the crustal normal faults. The main normal faults are generally connected downward on the S reflector, revealing strong interactions between crustal thinning and the S. The half-grabens and the fault blocks are dominantly N-S oriented, but the crustal structures vary both along strike and cross strike. We particularly observe an intriguingly NW-SE trend, highlighted by a pronounced low within the crest of the fault blocks. We also observe this trend from corrugations at the top of the S reflector that we relate to the slip direction during the rifting. The orientation of the corrugations changes moving oceanward, suggesting more complex directions of extension and thinning mechanisms than expected. This reveals the complex three-dimensional architecture of the margin and demonstrates the important role of the S during the extension and the complex nature of the rifting processes across the margin.