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The Continent-Ocean transition across the Galicia margin: First observations from the Galicia 3D volume

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The west Galicia margin has been at the forefront 2D models of breakup subsequently applied to other margins. In summer 2013, a 3D multi-channel seismic dataset was acquired over the Galicia margin with the aim to revisit the margin from a 3D perspective and understand processes of continental extension and break-up through seismic imaging. The volume has been processed through to prestack time migration, followed by depth conversion using velocities extracted from new velocity models based on wide-angle data.
Our first interpretations have shown that the most recent block-bounding faults detach downward on a bright reflector, the S reflector, corresponding to a rooted detachment fault and locally the crust-mantle boundary. The 3D topographic and amplitude maps of the S reveal a series of slip surface "corrugations" whose orientation changes oceanward from E-W to ESE-WNW and that we relate to the slip direction during the rifting.

We now focus our investigations on the distal part of the S, just east of the Peridotite Ridge, a ridge of exhumed serpentinized mantle. While the S is mainly a continuous surface beneath the continental crust, it suddenly loses its reflectivity oceanward nearby the eastern flank of the ridge. It is likely that the S stops abruptly because it has been offset for almost 1 STWTT by some landward-dipping faults associated with the development of the ridge. This configuration is particularly defendable in the north of the dataset. The implication would be that in this area, the S is shallow and lies below very thin or inexistent basement, thus providing an ideal target for ODP drilling. Alternatively, the S could be intensively segmented by small-offset, but abundant, west-dipping normal faults that root downward on a persistent landward dipping fault that bounds the eastern flank of the ridge. Such a dissection of the S could also explain its lack of reflectivity nearby the ridge; similar reduced reflectivity is locally observed in other parts of the 3D volume in the vicinity of the faults that bound the continental crustal blocks. The implication would be that the S is still located at depth below intensively broken slices of crust and stops against the eastern flank of the Peridotite Ridge.

Both cases show that rifting to break-up was a complex and time-variant 3D process that involved several generations of faulting, including late potential landward-dipping structures that controlled the development of the peridotite ridge.