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Continental hyperextension, mantle exhumation and thin oceanic crust at the continent-ocean transition, West Iberia: new insights from wide-angle seismic

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Anomalously thin oceanic crust and expanses of exhumed and serpentinised mantle material at magma-poor rift margins are now a globally observed phenomena that characterizes the seaward limit of the continent-ocean transition. Hyperextension of continental crust at the Deep Galicia rifted margin in the North Atlantic has been accommodated by the rotation of continental fault blocks, which are underlain by the S-reflector, an interpreted detachment fault, along which exhumed and serpentinized mantle peridotite is observed. West of these features, the enigmatic Peridotite Ridge has been suggested to delimit the seaward extent of the continent-ocean transition. An outstanding question at this margin is where oceanic crust begins, with little existing data to constrain this boundary and a lack of clear seafloor spreading magnetic anomalies. Here we present results from a 160-km-long wide-angle seismic profile (WE-1). Forward modelling and travel time tomography models of the crustal compressional velocity structure reveal highly thinned and rotated crustal blocks overlying the S-reflector, which correlates with the 6.0 – 7.0 kms^{-1} velocity contours, corresponding to peridotite serpentinization of 60 – 30 %, respectively. West of the Peridotite Ridge we observe a basement layer which is 2.8 - 3.5 km thick in which velocities increase smoothly and rapidly from $\sim$4.6 kms^{-1} to 7.3 - 7.6 kms^{-1},with an average velocity gradient of 1.00 s^{-1}. Below this, velocities slowly increase toward typical mantle velocities. Such a downward increase into mantle velocities is interpreted as decreasing serpentinization of mantle material with depth. However, sparse Moho reflections indicate the onset of an anomalously thin oceanic crust, which increases in thickness from $\sim$0.5 km to $\sim$1.5 km over a distance of 35 km, seaward.