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Where, when and how, does the continental crust thin in a hyper-extended rifted margin: insights from the Iberia margin.

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Recent studies of deep water rifted margins using refraction and reflection seismic data show that the continental crust is in most cases much thinner than initially predicted. The extreme thinning of the crust to less than 10 km can be imaged over tens to hundreds of kilometres at most present-day rifted margins. This new discovery is not explained by the classical rift models and leads to the questions: Where and when did the crust really thin during rifting and what are the mechanisms that may explain the extreme crustal thinning of the continental crust? A number of processes have already been proposed to explain the thinning of the crust, including polyphase rifting, sequential rifting and crustal flow. To try to bring new constrains on where, when and how the crust is thinning during rifting, we focused to the Iberia rifted margin because of the abundance of drill hole, refraction and reflection seismic data. Moreover, the absence of salt along the distal part of this margin does not obscure the imaging of the basement structures and the subordinate magmatic overprint does not modify the thickness of the extended crust. In our presentation we describe and compare two sections: a first one across the Galicia Bank in the north and a second through the Iberia Abyssal Plain further to the south. These two sections provide crucial observations that enable to discuss where, when and how the crust thinned along this margin. Our results show that extreme crustal thinning occurred in two steps. During a first stage, which corresponds to the thinning from 30 to about 10 km, thinning along the northern section is distributed whereas it is localized along the southern section. During the second step, which corresponds to the thinning of the crust from about 10 to 0 km deformation is localized along both sections. ODP drill hole data enable to determine the age of the first thinning from 30 to about 10 km as Late Jurassic, and the final thinning to zero as Latest Jurassic to Early Cretaceous (Tithonian to Valanginian). Based on our observations we suggest that thinning of the crust from 30 to about 10 km seems to be mainly controlled by crustal structure and rheology, both of which are dependent on inheritance, while the thinning from about 10 to 0 km occurs after the complete embrittlement of the crust and is therefore much less dependent on the initial structure of the margin.