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When and how does continental break-up occur at the Iberia margin: constraints from mapping the 3D distribution of syn-tectonic sedimentary units.

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It is now generally accepted that, at magma-poor rifted margins, continental break-up is ill defined and that the transition between continental and oceanic crusts is formed by a Zone of Exhumed Continental Mantle (ZECM). Geophysical and geological investigations indicated that the ZECM grades into oceanic crust, which makes that neither location nor timing of continental break-up can be defined. In order to investigate when and how continental break-up occurred, we studied the distribution of syn-tectonic sediments in the Ocean Continent Transition of the Iberia margin. Assuming that the transition from rifting to seafloor spreading coincides with the irreversible localization of deformation within a stable and spatially well-defined spreading centre, the syn-tectonic sediments should not be expected to be found over oceanic crust. However, our investigation shows surprising results and clearly indicates that sediments bear important information on the temporal and spatial evolution of continental break-up. Based on the mapping of drilled sediment and basement units across the Iberia Abyssal Plain we were able to define two deformation events that are separated by the accretion of first oceanic crust recorded by the first unequivocal magnetic anomalies (M3 128Ma, M0 125Ma) and by the formation of MOR basalts (clasts sampled at the ODP Sites 897, 899 and 1277).

The first Tithonian-Barremian (145-128Ma) phase overprinted an already thinned crust. This phase is characterized by a migration of tectonic activity oceanwards and a change of the deformation mechanisms parallel as well as normal to the margin, from classical fault bounded half-grabens to the east and north, to zones of mantle exhumed by downward concave faults to the south and west respectively. This phase terminated with the accretion of more than 170km of exhumed mantle, at rates of about 1cm/yr,

from Hauterivian to Barremian (137-128Ma) and resulted in a complex architecture of the OCTs.

The second deformation event, dated as late-Aptian, was distributed over at least 200 km of previously exhumed mantle and embryonic oceanic crust. Extension was accommodated by high-angle faults and was related to the emplacement of alkaline magma. Although short-lived, this event may account for the observed highs in the OCTs and may explain the occurrence of Aptian sediments at their tops. That means that, in contrast to what we expected, distributed deformation can be still wide-spread after formation of the first magnetic anomalies, i.e. after the onset of first oceanic crust accretion. The reason for this delocalization of deformation is not clearly understood. However, it seems that it is contemporaneous with a large alkaline magmatic event that affected Iberia and Newfoundland margins. These preliminary results demonstrate that the transition between continental extension and oceanic accretion is more complex than previously thought. It does not correspond to a spatial or temporal well defined boundary.