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Are there syn-rift sediments in the Ocean-Continent Transitions of magma poor rifted margins?

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Geophysical surveys and deep sea drilling in the distal Iberia margin resulted in new models for continental break-up. These models support the idea that the architecture and tectonic evolution of the Ocean-Continent-Transition (OCT) is controlled by a transition from upwards to downward concave faults, an interpretation which is also supported by numerical modelling and observations in ancient margins exposed in collisional orogens. Although considerable research is currently done on the identification and explanation of such downward concave faults, much less is known on how these faults can control the depositional architecture of the sediments in the OCT. The observed across-strike change of the fault geometry from upward to downward concave faults and the discovery of tectono-sedimentary breccias overlying highs composed of exhumed mantle rocks in the OCT leads to two major questions: Are there syn-rift sediments in the OCT, and based on what criteria can they be identified?

In order to answer these questions we inspected numerous seismic lines (CAM, Sonne, LG12) from the Southern Iberia Abyssal Plain (40˚-41˚N, 11˚-13˚W) and mapped seismic formations and reflection geometries in the basement and sedimentary cover. This study enabled us to describe the 3D sedimentary architecture in the OCT and to define its relation to basement structures. Of particular interest is the distribution of the lowermost formation overlying the basement in the OCT. This formation shows tilted reflector sequences thickening into the footwall in the northwest whereas similar structures are not observed towards the south and in the adjacent basins further continentwards. These observations clearly indicate the existence of growth structures in the OCT and suggest a migration of the tectonic activity in the OCT towards the northwest. Correlation of this formation with the DSDP Site 398 further east, and

with the seismic descriptions of Mauffret and Montadert (1988) further to the north, suggests a Valanginian-Hauterivian to late Aptian age. Continental break-up, here defined as onset of seafloor spreading leading to the formation of a localized spreading centre resulting in the formation of unambiguous magnetic anomalies, has been defined to occur in the Southern Iberia Abyssal Plain at around 126Ma time (Barremian, M3 magnetic anomaly, Whitmarsh and Miles, 1995). That means that this seismic formation is formed by sediments that have been deposited slightly before, during and after continental break-up. Therefore, they cannot be called in the strict sense "syn-rift". Our observations suggest that deformation in the OCT continues also after onset of seafloor spreading, which is also in line with the occurrence of the tectono-sedimentary breccias on the highs in the OCT. Thus, although growth structures can be observed in OCT of magma-poor rifted margins, their age can be younger than continental break-up. Therefore the concept of syn-rift sediments has to be used with care within OCT of magma-poor rifted margins.

References:

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