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Facies, stratal and stacking patterns of syn-rift sequences along present-day and fossil hyperextended rifted margins

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Research on the formation and evolution of deep-water rifted margins has undergone a major paradigm shift in recent years. An increasing number of studies of present-day and fossil rifted margins allows us to identify and characterize the architecture of hyperextended rifted margins. However, at present, little is known about the depositional environments, sedimentary facies and stacking and stratal patterns in syn-rift sequences within these domains. In this context, characterizing and understanding the spatial and temporal evolution of the stratal and stacking patterns is a new challenge.

The syn-rift sequence at rifted margins is deposited during the initial stages of stretching to the onset of oceanic accretion and comprises pre-, syn- and post-kinematic deposits along the margin. A difficulty arises from the fact that the observed stratigraphic geometries and facies relationships result from the complex interplay between sediment supply and creation of accommodation, which in turn are controlled by regional synchronous events (i.e. crustal necking and onset of seafloor spreading) and diachronous events (i.e. migration of deformation during rifting, lags in sediment input to the distal margin). These parameters are poorly constrained in hyperextended rift systems. Indeed, the complex structural evolution of hyperextended systems include an evolution from initially distributed to localized extension (i.e. necking) and the development of poly-phase in-sequence and/or out of sequence extensional faulting associated with mantle exhumation and magmatic activity. This multiphase structural evolution can generate complex accommodation patterns over a highly structured top basement but can only be recognized if there is sufficient sediment input to record the events.

In our presentation, we show preliminary results for fossil Alpine Tethys margins exposed in the Alps and seismic examples of the present-day deep water rifted margins offshore Australian-Antarctica, East India and Iberia-Newfoundland. We discuss the parameters controlling the syn-rift depositional sequence and provide a conceptual framework to correlate the deposits with the rifted domains. Our observationally driven approach combines fieldwork with seismic interpretations. The ultimate aim of this work is the identification of correlative surfaces and unconformities, separating genetically-related packages observed within different rift domains along hyperextended rifted margins.