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How to date rifting thanks to vertical movements?

Roxane Mathey, Julia Autin, Gianreto Manatschal, Daniel Sauter, Pauline Chenin, and Duncan Erratt
ITES - Institut Terre Environnement Strasbourg, France (r.mathey@unistra.fr)

Syn-rift sequences, breakup unconformities and magnetic anomalies have been widely used to date rifting. However, it is generally accepted that rift systems are diachronous, both along dip and strike, and that the rifting processes are complex and difficult to date, in particular at magma-poor rifted margins. Therefore, new approaches need to be developed to date rifting. In our study we use the stratigraphic record of vertical movements to date a specific rift event and its propagation. In this work, we focus on two origins of uplift during rifting. First, the necking process, which corresponds to onset of localized deformation and significant differential crustal thinning over 4 to 14 my. Necking may result in a characteristic, fast and short-lived uplift limited to the future distal margin, followed by its fast subsidence (Chenin et al., 2018). Second, dynamic topography, which refers to a large wavelength (from 1,000 to 4,500 km) and fast (35 to 400 $m.Ma^{-1}$) uplift (Jones et al., 2012), due to convection/heterogeneities within the asthenospheric mantle, not necessarily linked to rifting. In our study, we use the example of the widely studied Late Jurassic to Early Cretaceous southern North-Atlantic magma-poor rift system, forming the present-day West Iberian margin, its conjugate the Newfoundland margin, and the Bay of Biscay rifted margin. Thanks to the specific and characteristic fingerprints of each of the two types of vertical movements, they can be used to date rifting in an absolute and relative way. The necking signal dates a distinct event at a rift-segment scale, allowing to date the along strike diachronous evolution of the rift system. In contrast, the dynamic topography uplift occurs over a very wide area and is linked to simultaneous uplift and well-defined erosional unconformities that are time equivalent to a sudden increase in sedimentation rates offshore. Then, dynamic topography events occurring during rift propagation, could be considered as isochrons across a large area, allowing for along strike time correlations

Our preliminary results show a northward propagation of necking, which is consistent with the northward propagation of continental breakup already documented along the Iberian/Newfoundland conjugated margins. Secondly, we identify a dynamic topography event. Indeed, a Barremian to Aptian/Albian event can be defined by a large-scale uplift (e.g., Massif Central, Provence (France) and Southern England) that occurs at the same time of an increase in sedimentation rates and a change in seismic facies documented at the distal margins in the southern North Atlantic. The identification of these two types of events thanks to geological fingerprints and their relatively short duration, allows us to date rifting in the Iberian-Bay of Biscay system. While vertical movements associated with necking allow us to directly date the onset of crustal thinning and rift localisation, dynamic topography does not date a particular rift moment,

but allows us to define an isochronous event that can be used for along strike time correlations and thus, for relative dating within propagating rift systems.