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Plate tectonic modeling of multi-rifting events in the NE Atlantic

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The rifted margins of the NE Atlantic are among the most extensively studied regions in the world thanks to the extensive geological and geophysical data available for this area. Despite this extensive research, uncertainties remain regarding the timing and mechanisms of rifting. Key questions include the volume of magma, recognized as underplated layer in the lower crust, the precise position of the Jan Mayen Microcontinent, and the extent of rifting that preceded the final opening of the NE Atlantic in the Paleogene. These uncertainties have significant implications for plate reconstruction models.

In this contribution, we combine interpreted seismic stratigraphy with plate rotations to define a new plate reconstruction model of the study area, spanning from mid-Permian to early Eocene. Stretching and pre-drift extension for individual rifting events are derived from a set of conjugate crustal transects evenly distributed along the NE conjugate margins, allowing to identify “restored” position of the continent-ocean boundaries (COB) back in time. Using an optimization approach, we derive Euler Poles that best-fit fixed and rotated restored COBs of the Eurasian and North American plates. Our approach incorporates uncertainties in COB location and the amount of magma added to the lower crust.

First results indicate a tighter pre-break-up fit between Greenland and Eurasia than previously suggested, implying that earlier models underestimated stretching. Implementing the obtained Euler Poles to plate reconstruction software GPlates highlights the four distinct rifting events. Our new plate reconstruction model offers improved insights into passive margins affected by multiple rifting events and can inform further studies on paleogeography, rift dynamics and break-up kinematics in the NE Atlantic region.