Full-fit reconstruction of the central Atlantic

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Numerous plate reconstructions for the Central Atlantic have been proposed over the past half century. While these reconstructions use observable features to refit the North American plate with the African plate, few studies incorporate vertical crustal deformation or crustal thinning into their plate models, employing simplistic layer geometries and properties that limit deformation estimates. To improve upon this approach, a six-layer 3D crustal model of the Central Atlantic margins was built using potential fields to estimate depth to Moho and crustal thickness. Using these results, a new, full-fit plate reconstruction model of the Central Atlantic is presented, in which present day extended continental crust is restored to prerift thicknesses and geometries.

The 3D crustal model for the North American margin shows Triassic rift basin connectivity along strike. The 3D crustal model for the African margin shows that crustal thinning continues landward all the way to the Mauritanides mountain belt. Our results shift previously proposed limits of crustal deformation landward by ~350 km on the African margin, and ~150 km on the North American margin. Based on reconstruction overlaps and gaps between the two plates, magmatic and/or amagmatic histories can be estimated. Sections of the margin characterized by reconstruction overlap suggest magmatic activity during formation. Conversely, gaps along the reconstructed margins suggest mantle exhumation. Our 3D method provides a context for examining great lengths of conjugate margin development, from rift to drift. Specifically, our 3D method provides a framework for further studies in the Central Atlantic; examples might be the East Coast Magnetic Anomaly and the amagmatic Newfoundland margin.

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