



The North Atlantic and African plate margins of Europe dynamically linked by Paleocene intraplate deformation

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Intra-plate basin inversion structures in Europe formed initially by transverse shortening and erosion of the central parts of Palaeozoic and Mesozoic sediment filled rifts and troughs in response to compressional pulses during the Late Cretaceous, particularly during the Campanian and Maastrichtian. At the beginning of the Late Danian (approx. 62 Ma), however, a sudden release of in-plane compression explains a change of style in the evolution of European inversion structures from transverse shortening to flexural relaxation, as can be demonstrated from detailed stratigraphic relationships along the Sorgenfrei-Tornquist Zone and elsewhere. At the same time, there was an outbreak of volcanism in the North Atlantic that has been generally interpreted in terms of arrival of the proto-Icelandic mantle plume under southwest Greenland. Major sinistral strike-slip motions developed on the proto-North Atlantic plate boundary at the same time, during a short period of suspended relative convergence of Europe and Africa. We have analysed the possible effects of these plate boundary events on the flexural state of the European lithosphere by calculating stress propagation on an elastic spherical shell and using the flexure equations of an elastic plate. The results of the model investigations demonstrates that significant intra-plate stresses within Europe, not related to the hypothesised mantle plume, existed prior to proto-North Atlantic rupture and that these stresses were relaxed at 62 Ma. We suggest that the pre-rupture tectonic stresses were large enough to have been dominantly or solely responsible for precipitating continental break-up in the North Atlantic region, without the necessity of invoking the Iceland plume as a driving mechanism. The rupture, and the intra-plate stress relaxation it allows, is consistent with the suspension in rela-

tive Africa-Europe convergence through the left-lateral northeastern release of Europe from the Laurentian-Greenland craton. Such an interpretation, which satisfies the observed age and tectonic style constraints, differs fundamentally from previous ones, in which the cessation of convergence between Europe and Africa has been argued to lead to an increase of compression within the European plate.