Continent-Ocean Boundaries...The End of the Line?

Lucia Perez Diaz[1], Graeme Eagles[2], and Nicola Scarselli[1]

[1]Earth Sciences, Royal Holloway University of London, Egham, United Kingdom.
[2]Alfred Wegener Institute, Bremerhaven, Germany.

ABSTRACT

The idea of a simple linear boundary between continental and oceanic crust is widely recognised as an oversimplification. Despite this, such boundaries continue to be mapped because of their perceived utility in palinspastic and plate kinematic reconstructions. To examine whether this perception is justified, we map more than 150 published continent ocean boundary estimates for extended margins globally. The maps show that the location of the continent ocean boundary is rarely consistently estimated within the ~10—100 km observational uncertainty that might be expected of the geophysical data used for doing so, and that the geographical range of estimates exceeds the width of single-study continent ocean transition zones. Instead, the global average disagreement between sets of three or more estimates is 167 km, and for the most part comes from interpretations published over the last decade. We interpret this to indicate an extra component of uncertainty that is related to authors' understanding of the range of features that are interpretable at extended margins under the constraints of currently available data and models of continental plate divergence. We go on to discuss the consequences of this uncertainty with examples from the literature and from the South Atlantic ocean. We conclude that a precise continent ocean boundary concept with locational uncertainty defined from the ensembles is of limited value for palinspastic reconstructions because the restoration process tends to bunch the ensemble within a region that is (i) of similar width to the observational uncertainties associated with continent ocean boundary estimates, (ii) narrower than the regions of uncertainty about rotated features implied by the propagation of uncertainties from plate rotation parameters, and (iii) coincident, within all the above uncertainties, with the more-easily mapped continental shelf gravity anomaly. Secondly, we conclude that estimated continent ocean boundaries are of limited use in developing or testing plate kinematic reconstructions because (i) reconstructions built using them as markers do not, within uncertainty limits defined from the ensembles, differ greatly from those using more-easily determined bathymetric or gravity anomaly contours, and (ii) because it is impossible to segment and date them with useful precision to use as markers of the edges of rigid oceanic lithosphere outside of the constraints of a pre-existing plate kinematic model.