Modelling Continental Margin Extension Using Combined Rigid/Deformable Plate Tectonic Reconstructions

Adriasola Munoz, Alberto [1]; Glover, Claire [1]; Harris, Jim [1]; Goodrich, Mike [1]; Hudson, Lynne [1]; Ady, Bridget [2] (1) Fugro Robertson Limited, Llandudno, United Kingdom. (2) GeoArctic Canada, Calgary, AB, Canada.

Plate tectonic reconstructions are essential for placing geological information in its correct spatial context, understanding depositional environments, defining basin dimensions and evolution, and serve as a basis for palaeogeographic mapping e.g. for palaeo-climate modelling. A well-known problem with traditional 'rigid' plate reconstructions is overlap and underfit of plates when restored in their pre-drift assemblages. To address these challenges, a new high-resolution palaeogeographic plate reconstruction model has been developed for the Mesozoic and Cenozoic that restores the extensional deformation produced at continental margins.

Continent-ocean boundaries (COB) have been redefined by utilising gradient changes in gravity anomalies, crustal thickness depth to Moho, differences in gravity signature over continental, transitional and oceanic crust, and observing fracture zones in oceanic crust. The relative motions between major plates are determined by matching fractures and magnetic anomalies of similar age in oceanic basins. The relative plate motions of minor plates are calculated by Euler Pole addition in a global circuit, with central Africa at the uppermost position of the plate motion chain. For modelling extension on a global tectonic scale, beta factors have been calculated from the overlap of stretched conjugate passive margins over the relevant geological time span. To remove the deformation effects produced by overlap in the reconstructions, an ArcMap™ extension has been developed (PLATE WIZARD™). This program creates displacement vector maps that allow restoration of the plate margins by 'warping' the mapped extended regions. The program also allows the restoration of the geometries of geo-referenced datasets that intersect with the plate margins defined by the model.

To date, a consistent global plate tectonic model has been achieved, that incorporates stretching factors and scales deformation for the Cenozoic and Mesozoic. It is noted, however, that by resolving deformation geometries to pre-drift positions, the imprint of earlier rifting, strike slip and collisional histories are more clearly defined. This allows areas with a multi-phase tectonic history to be accurately modelled within a dynamic global framework.