Geophysical Research Abstracts
Vol. 16, EGU2014-1189-1, 2014
EGU General Assembly 2014

Origin of the Atlantic: Meso-Caenozoic basin subsidence with superimposed Alpine age wrench deformation.

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Pervasive shear deformation, random distribution of so-called micro-continents, numerous cases of problematic crustal thickness variation and the common observation of metamorphic and old continental rocks within the ocean basins – even along mid-ocean ridges – are among most pressing issues in global geology today. It seems reasonable to conclude that the thin-crusted oceanic tracts represent attenuated continental crust having subsequently been turned into broad tectono-topographic belts. As there is no factual evidence that deep sea depressions, to any extent, existed prior to the middle-late Cretaceous, the main oceanic deformation phase apparently dates from the Alpine climax.

During the Mesozoic, planetary degassing led to advanced sub-crustal delamination, isostatic basin subsidence – for which the developing margins formed along one of the fundamental, ubiquitous orthogonal fracture systems, and the associated internal mass reorganization led to events of acceleration of planetary spin. These changes in Earth rotation gave rise to latitude-dependent inertial drags of the planetary lithosphere. In the Atlantic region, this Alpine lithospheric torsion produced moderate reshaping of the pre-late Cretaceous outline of the ocean – from an original configuration with parallel opposing margins to the present southward fanning-out shapes of the North and South Atlantic.

In concert with the moderate reshaping of the Atlantic basins, the Alpine lithospheric torsion included also 1) moderate in situ rotations of the adjoining continents and 2) break-up of the Mid-Atlantic rift; the associated 'mid'-ocean topographic ridge is thought to date from the late Neogene - concurrent with the rise of continental mountain chains. During the Alpine wrenching of the outer brittle shell, the present curvilinear shape of many prominent trans-Atlantic fracture zones was established. Also the adjacent continental masses underwent moderate internal deformation. All in all, tectonic discontinuities along the evolving continental margins were either minimal or non-existent. Hence, despite the inertial lithospheric deformation, producing moderate overall continental rotations and oceanic crustal deformation, many on-land tectonic structures still maintain their natural continuation into adjacent deep sea basins.