Geophysical Research Abstracts
Vol. 15, EGU2013-2515, 2013
EGU General Assembly 2013

Pangea formation and break-up

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The Palaeozoic was dominated by the great continent Gondwana. Other continents included Laurentia and Baltica that fused (together with Avalonia), forming Laurussia after the closure of the Iapetus Ocean, making the second largest continental entity in the Silurian. By the Carboniferous at around 320 Ma, Gondwana and Laurussia amalgamated, forming Pangea that was surrounded by the Panthalassa and Paleotethys Oceans. Pangea did not include all continental crust. For example, the South and North China Blocks were not part of Pangea at any given time and also during the Early Permian phase of Pangea assembly, the Neotethys opened, and Cimmerian terranes drifted away from the NE Gondwana margin while the Paleotethys was being subducted beneath Eurasia. An additional, unresolved question is whether Siberia was fully joined to Pangea before the eruption of the Siberian Traps (251 Ma).

Practically all Permian Pangea reconstructions using palaeomagnetic data result in considerable overlap between Laurussia and Gondwana, as both are straddling the equator, and thus Gondwana must be moved sideways to avoid this overlap, and at a younger time displaced dextrally to achieve the well established starting point for Pangea break-up in the Jurassic. Octupole contributions can eliminate this overlap, but just by changing the internal fits within Laurussia and correcting all detrital sedimentary poles for inclination shallowing using a use a benchmark flattening (f) value of 0.6 (unless previously corrected using either the inclination–elongation method or anisotropy of magnetic susceptibility information) lead to an almost perfect Pangea-A type fit.

Pangea break-up profoundly changed our planet, and the most important phase of break-up started when the Central Atlantic Ocean opened (ca. 195 Ma). Perhaps not coincidentally, the region where the Atlantic spreading started was preceded by the emplacement of the Central Atlantic Magmatic Province, one of the largest large igneous provinces (LIPs). Also the Early Permian opening of the Neotethys was preceded by a LIP, the Panjal Traps at around 285 Ma. Pangea was centred above the African large low shear velocity province (LLSVP) at the core-mantle boundary. The African LLSVP has been stable for at least 300 Myrs. Its edges, the plume generation zones, are favourable sites for the initiation of large plumes rising through the mantle and causing extensive upper mantle melting and eruption of LIPs that contributed to the break-up of Pangea.