

Wilson Cycle Tectonics: East Greenland-Norway closure and opening

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It was not until Wilson's (1966) classic paper *Did the Atlantic close and then re-open?* that plate tectonic processes were understood to have been operating before Pangea. Wilson's succession of rifting, crustal subsidence and ocean opening, subduction initiation and ocean closure, and finally continent-continent collision was dubbed the 'Wilson Cycle' by Kevin Burke. The 'Wilson Cycle' concept also spurred an intensive search for older supercontinents. Baltica became isolated after the break-up of the Rodinia supercontinent and its Late Precambrian separation from Laurentia (Greenland) through the opening of the Iapetus Ocean, and continued so until the latest Ordovician and Silurian, when Baltica first collided with Avalonia and then more forcefully with Laurentia to shape Laurussia during the Scandian part of the Caledonide Orogeny. The Scandian orogenic event was marked by oblique collision and deep subduction of Baltican crust beneath Laurentia. The Iapetus Suture ran through the UK, probably beneath the transition between the platform/inner parts of the Vøring Basin, and continued into the Barents Sea Region and then into the High Arctic.

Since the Late Palaeozoic, and directly linked to the break-up of Pangea, the Norwegian continental shelf experienced multi-phase rifting, culminating in the separation of Greenland and Norway and the formation of the Northeast Atlantic Ocean in the Early Tertiary. Continental break-up may be guided by pre-existing rheological heterogeneities due to repeated weakening of continental margins through previous 'Wilson Cycles'. In the North Atlantic realm, prolonged post-Caledonian extension and sedimentary basin formation exploited lithospheric heterogeneities inherited from a previous 'Wilson Cycle', but Early Eocene break-up chose locations and directions unrelated to the previous evolution. Perhaps the only candidate example of how final break-up used a pre-existing rheological heterogeneity is the Charlie Gibbs Fracture Zone that formed along the Iapetus Suture, the site of a former NW dipping subduction zone of Silurian age. Final break-up in the North Atlantic, however, occurred shortly after a massive episode of volcanism and large igneous province formation (North Atlantic Igneous Province) as in many examples world-wide.

Opening of the NE Atlantic took place at three interconnected ridges: Reykjanes, Ægir and Mohns. An important change in seafloor spreading occurred with the abandoning of the Ægir Ridge system in the Oligocene when the Reykjanes Ridge propagated north and west of Jan Mayen (the Kolbeinsey Ridge). Jan Mayen separated from Greenland, the Ægir ridge became extinct, and the Kolbeinsey Ridge became well developed along the western margin of Jan Mayen. The presence of Precambrian zircons in the Öräfajökull volcano in SE Iceland indicate that the young Öräfajökull basalts assimilated underlying continental crust; we consider continental crust remnants beneath SE Iceland as an extension of the Jan Mayen microcontinent.