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Iceland plume and its magmatic manifestations: LIP-Dornröschen in the North Atlantic

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The North Atlantic region is a prime example of the interaction between plate tectonic movements and thermal instabilities in the Earth's mantle. The opening of the Labrador Sea/Baffin Bay and the North Atlantic, the widespread volcanism and the localized uplift of the topography in Greenland and the North Atlantic are traditionally attributed to the thermal effect of the Iceland mantle plume. However, several prominent features of the region – the temporal synchrony of magmatism and break-up events, the symmetrical configuration of the Greenland-Iceland-Faroe Ridge, and the diachronous domal uplift of the North Atlantic rifted margins – have inspired alternative, "non-plume" views. According to these, the North Atlantic Igneous Province (NAIP) and Iceland magmatism originate from plate tectonic processes sourced in the shallow upper mantle, at odds with the unequivocal presence of deep-seated low-velocity seismic anomalies beneath Iceland and the isotopic signatures of plume-derived melts in Cenozoic magmatic units.

We resolve apparent contradictions in the observations and reconstructions and reconcile end-member concepts of the Late Mesozoic-Cenozoic evolution of the North Atlantic realm. We show that simultaneous Paleocene (~62-58 Ma) magmatism in Western Greenland/Baffin Island and the British Isles, which together form the NAIP, is driven by two processes accidently coinciding in time: 1) the propagation of the Labrador Sea/Baffin Bay spreading axis has overlapped with the ~100-80 Ma dated segment of the Iceland hotspot track near the West Greenland margin, while 2) the actual tail of the Iceland plume has reached the eastern continental margin of Greenland, allowing a horizontal flow of hot plume material along corridors of relatively thinned lithosphere towards Southern Scandinavia and Scotland/Ireland. In this framework, the subsequent formation of the symmetrical Greenland-Iceland-Faroe Ridge can be coherently explained by the continuous supply of hot plume material through an established channel between Eastern Greenland and the British Isles. In contrast to the Scotland/Ireland region, the South Norway continental lithosphere remains too thick to enable localized uplift of the topography and melting immediately after plume lobe emplacement at ~60 Ma. Therefore, the development of topographic domes in Southern Scandinavia only started ~30 Myr later in the Oligocene as a consequence of increasing ridge-push compression that built up during the opening of the Norwegian-Greenland Sea.

The evolution of the North Atlantic region shows that a thermal anomaly that has been hidden below a thick lithosphere for tens of Myr without signs of excessive magmatism can be re-

initialized (or “re-awakened”) by the lateral propagation of spreading ridges or by the tapping of its source beneath thinner segments of the overlying lithosphere due to horizontal plate movements. We dub this type of Large Igneous Province (LIP) as *LIP-Dornröschen* (*LIP-Sleeping Beauty*). We hypothesise that the term *LIP-Dornröschen* may be applicable to a broad family of LIPs, including Precambrian and oceanic LIPs. This means that the interpretation of the timing of LIP formation from the perspective of mantle dynamics should be treated with caution, as there may be delays between the timing of upwelling in the mantle and detectable magmatic manifestations at or near the Earth’s surface.