



## **A hot, top-down model for the formation of the North Atlantic Igneous Province and the Iceland hot spot**

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The Greenland-Iceland-Faroe Ridge (GIFR) is an area that has been magmatically hyperactive since the formation of the North Atlantic Igneous Province at  $\sim 55$  Ma. The magmatic crustal thickness and its compositions is different from the average oceanic crust in a way that possibly requires elevated temperature and enriched composition of the mantle melt source. A popular explanation for this involves the convective rise of hot plumes, often postulated to originate at the lower mantle with a different temperature and composition than the upper mantle. However, since the GIFR initiated just where the embryonic North Atlantic rift crossed older Caledonian sutures, alternative “top-down” models have been proposed, opposing a “bottom-up” model in which an emerging deep mantle plume would exactly coincide with the location of lithospheric weaknesses. Here, we present a new top-down physical model where lithospheric extension led to delamination of a dense quasi-stable mantle lithosphere and lower crust. The delaminated material sank into the lower mantle and caused a plume-like return flow of hot and primordial material that reached the North Atlantic rift system and caused enhanced melt productivity. Our model predicts melt volumes that are of similar magnitude as those observed in the North Atlantic, and explains why Iceland remains magmatically active at present.