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Seismic imaging of multiple ancient buried landscapes on the fringes of the North Atlantic Ocean

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A 56 million year regional unconformity within the Faroe-Shetland basin, which is located on the northern edge of the NW European continental shelf, has previously been identified and mapped. This surface represents a buried terrestrial landscape that has a recoverable fluvial drainage network. Transient uplift and subaerial exposure has been attributed to a laterally flowing radial pulse of hot material emanating from the Icelandic plume. There is independent evidence from the oceanic basin to the north that the temperature structure of this plume has fluctuated on timescales of 3 to 8 million years. Here, we have extensively remapped this transient landscape, as well as a suite of younger surfaces on calibrated three-dimensional seismic reflection surveys. These multiple ephemeral landscapes have very similar channelized erosional and dendritic drainage networks. Lignite and coal beds within well logs corresponding to these unconformities, confirming transient sub-aerial conditions. Once converted to depth, flattened and decompacted, each of these paleo-landscapes equate to a minimum tectonic uplift of O(200) m. Drainage patterns have then been inverted to determine a history of regional uplift. Transient mantle convection, as either multiple pulses or a single non-uniform pulse, is the likely cause of these uplift events. These unique landscapes provide a valuable insight in to dynamics of mantle plume activity and help to constrain the character of radial flow within the asthenospheric channel.