MANTLE PLUME TEMPERATURE VARIATIONS IMMEDIATELY FOLLOWING CONTINENTAL BREAKUP OF THE NORTHERN NORTH ATLANTIC

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The amount of melt generated by mantle decompression beneath an oceanic spreading centre and hence the oceanic crustal thickness is controlled primarily by the temperature of the mantle. By measuring the thickness of the oceanic crust formed immediately after breakup of the northern North Atlantic we are able to deduce the elevated mantle temperatures caused by the presence of the Iceland Mantle Plume. Crustal thickness variations are caused by temporal variations in the mantle plume temperature: at the present Reykjanes Ridge spreading centre the plume temperature pulses on a 3-5 Myr timescale with temperature variations of c.30K.

We show results from the oceanic end of the Hatton-Rockall iSIMM (integrated Seismic Imaging and Modelling of Margins) project, where for this study, 40 OBS (Ocean Bottom Seismometers) were deployed across the oceanic crust of the Iceland Basin adjacent to the rifted margin. The OBS were deployed perpendicular to the margin extending 160km oceanwards from the continent-ocean boundary at Hatton bank and along a 90km strike line. OBS spacing was 10km across the oceanic crust with a denser spacing of 4km adjacent to the margin. The profile spans magnetic anomalies 19-24 (42-54 Ma) with the strike line parallel and coincident with magnetic anomaly 20 (44Ma). This OBS array was shot into using a 6000 cu inch, low frequency, broadband airgun source designed to optimise seismic penetration at large-offsets. Magnetics, bathymetry and gravity data were acquired as well as conventional seismic reflection data using a 3km multichannel streamer (MCS).

Processing of MCS reflection data has allowed accurate determination of the veloc-

ity structure of the sediments covering the igneous oceanic layers. Combined with modelling of the wide-angle OBS data this has allowed the crustal thickness to be measured across the oceanic crust. This represents the first 14Myr of formation of the northern North Atlantic from breakup to mature seafloor spreading. Mantle plume temperature variations during this period would cause rapid changes in uplift of the north-west European margin and probably controls much of the Tertiary sedimentation patterns west of Britain.

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