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Influence of margin segmentation and anomalous volcanism upon the break-up of the Hatton Bank rifted margin, west of the UK

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The Hatton Bank margin, flanking the Iceland Basin is a widely cited example of a volcanic rifted margin. Prior to this study insights into the break-up history of the margin have been limited to profiles in the north and south, yet whilst valuable, the along margin tectono-magmatic variability has not been revealed. Over 5660 line km of high quality reflection seismic profiles with supplementary multibeam bathymetry were collected to support the UK's claim to Hatton region under the United Nations Convention on Law of the Sea (UNCLOS).

Integration of this new data with existing profiles, allowed the margin to be divided into three segments, each of which are flanked by oceanic crust with a smooth upper surface and internal dipping reflectors. The southernmost segment is characterised by a series of inner and outer seaward dipping reflector (SDR) packages, which are separated by an outer high feature. The outer SDR are truncated by Endymion Spur, a chain of steep sided, late stage volcanic cones linked with necks. The central sector has no inner SDR package and is characterised by the presence of a highly intruded continental block, the Hatton Bank Block (HBB). The northern sector is adjacent to Lousy Bank, with a wider region of SDR recognised than to the south and a high amount of volcanic cones imaged.

The variations in the distribution of the SDR's along the margin, the presence of the HBB and Endymion Spur all suggest that the break-up process was not uniform alongstrike. The division of the margin into three sectors reveals that structural segmentation played an important role in producing the variations along the margin. Break-up initiated in the south and progressed north producing the SDR packages

witnessed, when the HBB was encountered the focus of break-up moved seaward of the block. The northern sector was closer to the Iceland Hotspot and hence a greater amount of volcanism is encountered. The smooth oceanic basement also indicates a high thermal flux leading to high melt production and subsidence rates forming the dipping reflectors. Shortly after break-up the eruption of Endymion Spur occurred. The nature of the magma erupted is unknown but from the steepness of the cones, it is inferred to be viscous and considering the setting, mostly likely a tholeiitic cumulate.

A possible trigger for the Endymion Spur is the passage of a pulse of hotter than normal asthenospheric material along the margin, which interacted with lower crustal material to produce melt to feed the volcanic centres. Enhanced asthenospheric heat flow has been invoked to explain the V-shaped ridges along the present day Reykjanes Ridge and it is probable that the Endymion Spur represents previous such pulses along the margin/spreading axis. The location of the enhanced volcanism is itself controlled by crustal segmentation, with the Endymion Spur limited to the southern sector. The crustal thickness in this sector is approx. 2 to 3 km thinner than that found in the central segment, in which Endymion Spur is absent. The role of the segmentation along the margin has influenced the break-up style (presence or absence of SDR) and also the location and nature of post break-up volcanism.