Geophysical Research Abstracts, Vol. 9, 07090, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-07090

Investigating the transition from rifting to spreading on magma-poor margins using basement and Moho topography

Donna J. Shillington (1), Harm J.A. Van Avendonk (2), Timothy A. Minshull (1)

1. National Oceanography Centre, University of Southampton, Southampton, UK
2. University of Texas, Institute for Geophysics, Austin, TX, USA

(djshill@noc.soton.ac.uk / Phone: +44 2380596614)

The processes accompanying the transition from rifting to spreading on magma-poor margins remain poorly understood and controversial. Investigations of magma-poor margins by drilling and geophysical data acquisition often reveal the presence of exposed serpentinite ridges on the outward portions of these margins, most notably on the Newfoundland-Iberia margins (e.g., ODP Legs 103, 149,173 and 210). Petrological studies indicate that the mantlerocks recovered from peridotite ridges on the Newfoundland-Iberia conjugate margins have “inherited” properties, and thus differ from “normal” abyssal peridotites exposed at slow-spreading mid-ocean ridges. Seafloor spreading anomalies seaward of these ridges on Newfoundland and Iberia imply slow to ultra-slow seafloor spreading followed magma-poor rifting. This idea is also supported by thin crust, faulting and basement topography observed in seismic reflection and refraction data on the Newfoundland margin. However, it remains unclear how and where the transition from exposure of subcontinental mantle to slow/ultra-slow seafloor spreading occurs and what processes facilitate this transition.

In this presentation, we examine variations in basement and Moho topography and crustal thickness on the seaward portion of the Newfoundland margin using the dataset acquired during the SCREECH (Studies of Continental Rifting and Extension on the Eastern Canadian SHelf) program in July-August 2000. These data are ideally suited for such a study because seismic lines continue $\sim$70 km seaward of the first widely-recognized seafloor spreading anomaly, M0. Studies of slow and ultra-slow spreading

mid-ocean ridges (e.g., by Cannat and coauthors) suggest that the correlation between basement and Moho topography can be an indication of the importance of magmatism versus faulting in accommodating plate separation. Correlated basement and Moho topography implies that faulting may have been more important in accommodating plate separation, while anti-correlated basement and Moho topography implies magmatic addition was important. Other factors might also contribute to this relationship, such as the strength of the lithosphere and the distribution of serpentinization. Additionally, the symmetry of basement ridges, seismic reflection attributes and seismic velocity structure can also assist in assessing the relative contributions of faulting versus magmatic addition. On SCREECH Line 2, there appears to be a transition from fault-dominated topography around and seaward of ODP Site 1277 to basement with mixed contributions from both faulting and magmatism seaward of M0. This is manifested by lateral variations in the seismic velocity structure of the basement and in the relationship between basement and Moho topography. These observations imply that magmatism gradually increased and became more important in crustal construction further seaward. We also compare our results to those from other datasets off the Newfoundland and Iberia margins as well as datasets from other magma-limited margins to understand if a similar transition takes place in these locations.