Geophysical Research Abstracts
Vol. 20, EGU2018-9827, 2018
EGU General Assembly 2018

Deep crustal structures in the northern North Sea rift: observations from new 3-D seismic reflection data

Thilo Wrona (1), Haakon Fossen (1), Robert L. Gawthorpe (1), Christopher A-L. Jackson (2), Rebecca E. Bell (2), Craig Magee (2), Jan Inge Faleide (3), and Marit Stokke Bauck (3)

(1) Department of Earth Science, University of Bergen, Allégaten 41, 5007 Bergen, Norway (thilo.wrona@uib.no), (2) Basins Research Group (BRG), Department of Earth Science and Engineering, Imperial College, Prince Consort Road, London, SW7 2BP, UK, (3) Department of Geosciences, University of Oslo, P.O. Box 1047 Blindern, N-0316 Oslo, Norway

Structure, composition and rheology of the lower crust are crucial factors controlling the style of rifting and continental break up. Our understanding of the lower crust has long been limited by the seismic resolution of conventional 2-D reflection profiles. New broadband 3-D seismic reflection data from the northern North Sea allow us to study the extent, geometry and orientation of these deep crustal structures in unprecedented detail. The wide frequency range and extensive coverage of this data provide high-resolution, three-dimensional images of deep crustal structures. These images allow us to map an isolated, high-amplitude seismic reflection over an area of more than 1500 km2. This reflection shows positive polarity and tuning effects, indicating that it originates from a thin (<200 m), high velocity body. Moreover, the reflection crosscuts other reflections presumably arising from the host rocks. 3-D mapping of the reflection reveals a series of saucer-shaped geometries as well as distinct vertical steps and amplitude anomalies typical for magmatic intrusions. While alternative interpretations for lower crustal reflectivity, such as ductile shear zones could show some of these features (e.g. tuning effects, cross-cutting host rocks), shear zones are typically mapped as kilometre-thick packages of multiple, subparallel reflections. Understanding whether this reflection originates from magmatism or deformation is important, as either of these processes can significantly alter the strength of the lower crust controlling the style of rifting.