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Imaging Through Igneous Rock on the Faroese Shelf

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Massive magmatism occurred on the North Atlantic margins when the continents broke apart in the presence of the Iceland mantle plume. The magmatism resulted primarily from interaction between the Iceland mantle plume and the rifting continents. The igneous rocks were emplaced as extrusive lava flows, as sills and as intrusions in the lower crust. I discuss the challenges they pose to seismic imaging, and the advances we have made in imaging through the basalts and into the underplated lower crust. I show results from two recent seismic experiments undertaken across the Faroes Shelf and continental margin: The Faroes Large Aperture Research Experiment (FLARE), which used two ship techniques to record data to maximum offsets of 38,000 metres; and the integrated Seismic Imaging and Modelling of Margins (iSIMM) profiles shot in 2002 which recorded spectacular data using a 12,000 metre, 4000 channel Q-streamer with a 48-gun array, together with long-range data to beyond 140 kilometres using 85 four-component ocean bottom seismometers deployed along the same profile.

Combination of normal incidence and wide-angle seismic data, together with use of sources tuned to the low frequencies required for intra- and sub-basalt penetration enable us to see structure both within and below the basalts. I discuss the processing and imaging strategies we have developed, show examples from two contrasting environments with extrusive igneous rocks, one on the rifted Atlantic continental margin and the other on the flank of the Faroe-Shetland Trough, and discuss their geological interpretation.

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