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Seismic velocity structure of the Hatton Bank volcanic continental margin from wide-angle refraction data

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The Hatton Bank continental margin is a typical example of the volcanic margins present in the northern North Atlantic where voluminous magmatism occurred at the time of continental break-up. The upper crust exhibits characteristically large volumes of extruded lava imaged as seaward-dipping reflectors, which have proved problematic for seismic imaging of the deeper crustal structure. The integrated Seismic Imaging and Modelling of Margins (iSIMM) project recorded profiles in 2002 designed to map specifically the poorly constrained lower crustal structure of the Hatton Bank continental margin. Eighty-nine four-component ocean-bottom seismometers (OBS) were deployed along transects running across and parallel to the margin including a dip line extending from the stretched continental crust of the Hatton Basin into the fully oceanic crust of the Iceland Basin and a strike line above the region of thickest extrusive and intruded igneous rock on Hatton Bank. The seismic profiling was optimised for recording strong arrivals at large offsets using a broadband low-frequency source with a 104 l airgun array towed at 20 m depth. The combination of wide-angle profiling and the low-frequency source allowed coherent signal to be recorded at offsets of up to 140 km, where seismic energy penetrated the extruded basalt and sampled the underlying crust and upper mantle. First arrival traveltime tomography of the refraction data has determined seismic velocity structure across and along the continent-ocean transition. This improved estimate of crustal structure of the margin will improve constraints on the intrusive and extrusive igneous components produced during continental break-up in the early Tertiary and further our understanding of the formation and evolution of the Hatton Bank volcanic continental margin.