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Crustal structure of the Hatton Basin (North Atlantic) from a wide-angle seismic experiment

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The HAtton DEep Seismic (HADES) project was designed to investigate the crustal and sedimentary architecture of the Hatton Basin and Hatton Continental Margin in the North Atlantic, west of Ireland. The region contains a number of large, deep-water sedimentary basins developed in response to multi-phase rifting that preceded the onset of seafloor spreading in the North Atlantic in Early Cenozoic times. The Hatton Basin is located on the volcanic continental passive margin and it has been suggested that it suffered extension in the Late Jurassic followed by thermal effects during the Cenozoic related to the underplated igneous body at the Continental/Oceanic Boundary. However, the Hatton Basin area remains relatively unexplored and is poorly understood. The presence of Palaeogene lavas and intrusive rocks acts as an acoustic layer masking the underlying geology, and limits severely the penetration of near-vertical seismic reflection energy. In 2002 the HADES experiment was carried out in the Hatton region and provided an exceptionally large amount of wide-angle seismic data along the axis of the basin. 100 ocean bottom seismometers (OBS) were deployed over a NE-SW trending profile, with a spacing of about 3 km and with airgun shots fired at about 130 m intervals. This type of acquisition allows us to record energy at longer offsets with dense coverage and improves the image of the crustal velocity structure. A two-step tomographic approach was applied to these data. First, we applied a first-arrival traveltime inversion to define a background velocity model (the refracted waves are used to determine a large-scale velocity model). When the final model was obtained, a checkerboard test was made to assess the resolution scale that can be reached by this tomographic inversion method. This model was then used as an input model to define the Moho interface using a forward modeling method and pro-

nounced PmP reflections. The model resolves considerable details in the sedimentary and crustal layers that can be correlated with variations in the gravity and magnetic fields. Two prominent structural highs are imaged and several sedimentary depocentres, interpreted as sedimentary sub-basins, are also imaged. The model will be used in an integrated study with recently acquired seismic reflection data to better constrain the sedimentary sequence in the Hatton Basin and finally to understand the development and structure of the basin and its relationship to the Hatton Continental Margin. This project is funded by the Geological Survey of Ireland and the Irish Petroleum Infrastructure Programme.