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Northern N. Atlantic rifted margin crustal thickness and OCT location from satellite gravity inversion incorporating a lithosphere thermal gravity anomaly correction

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Satellite gravity anomaly data (Sandwell & Smith 1997) and bathymetry data (GEBCO 2003) have been inverted to predict Moho depth and crustal thickness at rifted continental margins for the northern N. Atlantic using a methodology which incorporates a correction for the lithosphere thermal gravity anomaly (Hurst & Kusznir 2005, Chappell & Kusznir 2007). The gravity inversion is carried out in 3D in the spectral domain using the scheme of Oldenburg (1974). The lithosphere thermal gravity anomaly is the large negative component of the free air anomaly arising from hot low-density oceanic and rifted continental margin lithosphere. The correction for the lithosphere thermal gravity anomaly is applied iteratively within the inversion scheme using the lithosphere model of McKenzie (1978) to calculate the present day lithosphere temperature field. The lithosphere thermal model for oceanic lithosphere is calculated using thinning factor (1-1/â) = 1 and isochron ages (Muller et al. 1997) for thermal re-equilibration time, and for rifted continental margin lithosphere using breakup age and thinning factors derived from crustal thickness obtained from gravity inversion at rifted continental margins. The method has been adapted to estimate the location of the ocean-continent transition at rifted margins independently of the isochron dataset (Chappell & Kusznir 2007). Where accurate sediment thickness estimates exist, a gravity anomaly correction for sediment thickness may be applied which allows Moho depth predicted by the gravity inversion method to be calibrated against wide-angle seismic estimates. The gravity inversion methodology incorporating a lithosphere thermal gravity anomaly correction has been used to predict Moho

depth and crustal thickness for the iSIMM and SIGMA III profiles on the Hatton Bank and Southeast Greenland margins (Smith et al. 2005; Hopper et al. 2003); gravity and seismic estimates of Moho depth compare well. By using appropriate break-up ages for each region to condition the lithosphere thermal model, we use gravity inversion to produce maps of the maximum bound of crustal thickness and the minimum thinning factor for the northern N. Atlantic. Independent estimates of the ocean-continent transition location have also been made for the northern N. Atlantic using a modified form of the gravity inversion method (Chappell & Kusznir 2007). The maps of crustal thickness and thinning factor determined by gravity inversion incorporating a lithosphere thermal gravity anomaly correction have implications for the structure and formation of the Labrador Sea and the Rockall Trough. This work forms part of the NERC Margins iSIMM project. iSIMM investigators are from Liverpool and Cambridge Universities, Badley Geoscience & Schlumberger Cambridge Research supported by the NERC, the DTI, AGIP UK, BP, Amerada Hess, Anadarko, Conoco-Phillips, Shell, Statoil and WesternGeco.